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UAE Vice President, Prime Minister and Ruler of Dubai



ISTA 2010

**The 23rd Annual Congress of the
International Society
for Technology in Arthroplasty**

**"Arthroplasty Growth and Its Technology:
Reaching the Developing World"**

PROGRAMME BOOK

October 6-9, 2010

**Intercontinental Hotel - Festival City,
Dubai, United Arab Emirates**



ISTA 2010



Convened under the auspicious of esteemed endorsers:

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ISTA 2010



Welcome word from the organizers



It's an honor for me to welcome you personally to Dubai and to the 23rd World Congress of International Society for Technology in Arthroplasty (ISTA).

ISTA Conference is being held for the first time in the Middle East and Dubai has been given the opportunity to host such a prestigious event considering the tremendous contribution made by Dubai towards the health sector.

The Conference becomes more significant as it is held under the patronage of His Highness Sheikh Mohammed Bin Rashid Al Maktoum, UAE Vice President, Prime Minister and Ruler of Dubai.

We have formulated an exceptionally inspiring, and very challenging scientific program. The program is complemented by very prominent speakers from all over the world who will generously share their expertise in Arthroplasty. In addition, the Organizing Committee has created a very appealing social program, and we sincerely hope you will enjoy it, and your stay here with us in Dubai.

I would like to thank the Local and international Committee Members for their devotion through the course of planning. Also, for being available unflinchingly to support this extraordinary event.

I wish every one of you a pleasant and a memorable stay in Dubai. If you require any assistance during the conference, I and my committee members will be delighted to assist you.

Sam Tarabichi, MD

Host and Program Chair ISTA 2010



ISTA 2010



Special Thank You

ISTA's Board of Directors extends a special "Thank you" to the following individuals and the Invite Speakers for their work in supporting and organizing the ISTA 2010 Congress in Dubai. The Congress would not have been as successful without their hard work and involvement.

Host & Programme Chair	:	Samih Tarabichi, MD
Programme Chair	:	John Hollingdale, MD
Programme Director	:	Hani Haider, Ph.D., USA
Secretary General	:	Robert M. Streicher, Ph.D.
Guest speaker	:	Stephen Sosebee Founder & President Palestine Children's Relief Fund (PCRF)

Lifetime Achievement Award Winner: Professor Robin Ling OBE, FRC

Dr. Ibrahim Gado, UAE	Scott A. Banks, Ph.D. , USA
Dr. Rashid Al Shaeel, UAE	Joseph Fetto, M.D., USA
Dr. Arun Mullaji, INDIA	Claude Rieker, PhD, Switzerland
Prof. Assem Tantawy, UAE	Won Yong Shon, M.D. South Korea
Dr. Saeed Al Thani, UAE	Raj Sinha, M.D., Ph.D. USA
Dr. Eissa Al Hemrani, UAE	Mike Tuke, United Kingdom
Dr. Eltayeb Nasser, UAE	Shinro Takai, M.D., Ph.D., Japan
Dr. Justin P. Cobb, UK	
Dr. Mohammad Razi, IRAN	
Dr. Nilen Shah, INDIA	
Dr. Robin Strachan, UK	
Dr. Cho Woo Shin, KOREA	
Dr. Tim Briggs, UK	
Dr. Sam Nasser, USA	



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John Hollingdale, M.D., UK, Programme Chair

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Scott A. Banks, Ph.D., USA



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Invited Speakers

Jean Noel Argenson

Marseille, France

Andrea Baldini

Florence, Italy

Tim Briggs

London, UK

Timour El-Husseini

Cairo, Egypt

Hani Haider

Omaha, NE, USA

Riyaz Jinnah

Winston-Salem, NC, USA

Wolfgang Klauser

Hamburg, Germany

Richard Komistek

Knoxville, TN, USA

Derek McMinn

Birmingham, London

Arun Mullaji

Mumbai, India

Sam Tarabichi

Dubai, UAE

Nico Verdonschot

Nijmegen, The Netherlands

Kelly Vince

Whangrei, New Zealand

Mahmoud Elsebaie

Cairo, Egypt



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Programme at a glance

Thursday, October 7, 2010

Session A	Session B
7:25 - 7:30 Opening remarks: John Hollingdale	7:25 - 7:30 Opening remarks: Sam Tarabichi
7:30 - 8:30 Session A1: Alternate Bearings in THA 1	7:30 - 8:30 Session B1: Computer Navigation in TKA
8:30 - 9:30 Session A2: Alternate Bearings in THA 2	8:30 - 9:30 Session B2: Knee Arthroplasty in the Indian Sub Continent
9:30 - 10:20 Session A3: Bearing Mobility Issues	9:30 - 10:20 Session B3: Cartilage Repair/ Regeneration
10:20 - 10:25 Coffee break / Posters / Exhibitors	10:20 - 10:25 Coffee break / Posters / Exhibitors
10:25 - 10:45 Opening Ceremony	10:25 - 10:45 Opening Ceremony
10:45 - 11:10 Invited talk: Large headed Bearings for Conservative Hip Arthroplasty - What is the future?	10:45 - 11:00 Invited talk: Articular Cartilage Repair - Now and the Future
11:10 - 12:00 Session A4: Hip Resurfacing Moderator.	11:00 - 11:30 Session B4: Ethnic and Gender Issues in TKR.

Session A	Session B
12:00 - 13:30 Bayer Healthcare Presentation Lunch	11:30 - 12:00 Hap Paul Award Paper: A Novel Technique of Patient Specific Templating for Total Knee Arthroplasty: Laboratory Validation
13:30 - 14:00 Invited talk: Hip Arthroplasty in Egypt: Challenges of Pathology and Sociologoeconomics	12:15 - 13:30 Smith and Nephew Presentation Lunch
14:00 - 14:50 Session A5: Hip Mechanics	13:30 - 14:20 Session B5: Computer Navigation in TKR 1
14:50 - 15:40 Session A6: Hip Miscellaneous	14:20 - 15:10 Session B6: Computer Navigation in TKR 2
15:40 - 16:10 Session A7: Hip 2	15:10 - 16:00 Session B7: Robotic Knee Surgery
16:10 - 16:30 Coffee break/Posters/Exhibitors	16:00 - 16:20 Coffee break/Posters/Exhibitors
16:30 - 17:30 Session A8: Periprosthetic Fractures in THA	16:20 - 16:50 Invited talk: Revision TKA - Now More Durable than Primaries
17:30 - 18:10 Session A9: Arthroplasty Outcomes	16:50 - 17:50 Session B8: Management of Complications in TKA

Friday, October 8, 2010

Session A	Session B
7:30 - 8:00 Invited talk: The Status of Finite Element Analyses of Orthopaedic Implants	7:30 - 8:40 Session B9: Complications in Arthroplasty
8:00 - 8:40 Session A10: Bearings and Tribology	
8:40 - 9:40 Session A11: Knee Arthroplasty in the Middle East	8:40 - 10:00 Session B10: Navigation and Robotics in Arthroplasty
9:40 - 10:00 Coffee break/Posters/Exhibitors	
10:00 - 10:20 Invited talk: Friction of Various Hip Replacement Materials and Designs Captured During Testing on Hip Simulators	10:00 - 10:20 Coffee break/Posters/Exhibitors
10:20 - 11:10 Session A12: Materials	10:20 - 11:00 Invited talk: Customizing the Solution in Knee Arthroplasty
11:10 - 12:00 Session A13: Alternate Bearing Materials in Arthroplasty	11:00 - 12:00 Session B11: Knee Mechanics

Session A	Session B
12:00 - 13:30 Zimmer Presentation Lunch.	12:00 - 13:30 Sanofi Aventis Presentation Lunch
13:30 - 14:00 Invited talk: Hinged Knee Arthroplasty in Revision Knee Surgery - Still up to Date?	13:30 - 14:20 Session B12: Shoulder Arthroplasty
14:00 - 15:00 Session A14: Complication Management	14:20 - 14:50 Invited talk: Mechanical Analysis of the Hip; Kinematics, Kinetics, Sound and Vibration
15:00 - 16:10 Session A15: Alternate Bearings 2	14:50 - 15:20 Session B13: Imaging Technology
	15:20 - 16:10 Session B14: Hip Resurfacing
16:10 - 16:30 Coffee break/Posters/Exhibitors	16:10 - 16:30 Coffee break/Posters/Exhibitors
16:30 - 17:30 Session A16: Computer Navigation in THA	16:30 - 17:40 Session B15: MIS Techniques in TKA



Saturday, October 9, 2010

Session A	Session B
7:45 - 8:15	7:45 - 9:00
Invited talk: Bespoke Knees: The Value of CAS	Session B16: Performance and Survivorship in Arthroplasty
8:15 - 9:10	
Session A17: Knee Mechanics	
9:10 - 10:00	9:00 - 9:40
Session A18: Complication Management	Session B17: Novel techniques in Arthroplasty
	9:40 - 10:10
	Invited talk: Robotics and Navigation in Orthopaedic Surgery
10:00 - 10:20	10:10 - 10:30
Coffee break/Posters/Exhibitors	Coffee break/Posters/Exhibitors
10:20 - 11:15	10:30 - 11:15
Session A19: Miscellaneous Arthroplasty	Session B18: Pot Pourri!
11:15 - 11:50	11:15 - 12:00
Session A20: Knee Arthritis: Early Intervention	Session B19: Hip Mechanics

Session A	Session B
11:50 - 13:20	12:00 - 13:30
Novartis Presentation Lunch	Boehringer Ingelheim Presentation Lunch
13:20 - 13:50	13:30 - 14:30
Invited talk: The Unique Features of the Asian Knee	Session B20: Hip Arthroplasty
13:50 - 14:40	
Session A21: Knee Arthroplasty	14:30 - 15:00
	Invited talk: New Concepts in Revision TKA
14:40 - 15:20	15:00 - 15:40
Session A22: Tribology and Biomechanics in Arthroplasty	Session B21: Innovation in Hip Arthroplasty
15:20 - 15:40	15:40 - 16:00
TKA in Paralytic Knee	Coffee break/Posters/Exhibitors
15:40 - 16:00	
Coffee break/Posters/Exhibitors	
16:00 - 17:00	16:00 - 17:00
Session A23: Knee Mechanics	Session B22: Arthroplasty- Getting it Right!
17:00 - 17:10	17:00 - 17:10
Closing remarks and end of conference.	Closing remarks and end of conference.



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CME Accreditation

Accreditation: This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of William Beaumont Hospital and the International Society for Technology in Arthroplasty (ISTA). William Beaumont Hospital is accredited by the ACCME to provide continuing medical education for physicians. William Beaumont Hospital designates this educational activity for a maximum of 24.5 hours.

Physicians should only claim credit commensurate with the extent of their participation in the activity.

Disclosure Statement: All speakers and planners have been asked to disclose any relevant financial relationships with commercial interests and a summary of this information will be made available at the time of the meeting.

Target Audience

The programme has been designed for orthopaedic surgeons and orthopaedic researchers involved in developing new techniques and procedures in arthroplasty.

Educational Objectives

- Objective 1: Identify pain mechanisms underlying common presentations of persistent and / or chronic pain to improve diagnosis and treatment.
- Objective 1: Establish treatment expectations with pain patients to improve compliance over course of treatment.
- Objective 3 : Provide counseling for patient with nonmalignant neuropathic pain to improve patient satisfaction in office visit / hospital in patient setting.
- Objective 4 : Evaluate appropriate therapies for patient presenting with chronic pain in order to improve score on 'quality of life' indicators.

Disclaimer

The products, procedures, and opinions presented at this meeting reflect the viewpoint or approach of the presenter only and are not to be attributed to the International Society for Technology in Arthroplasty. We present such materials for informational and educational purposes only. This material is not intended to represent the only, nor necessarily the best methods or procedures appropriate for the medical situations discussed, but rather is intended to present an approach, view, statement, or opinion of the faculty which may be helpful to others who face similar situations.

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ISTA 2010



Programme detailed

Thursday, October 7, 2010

Session - A

7:25 - 7:30

Opening remarks: John Hollingdale

7:30 - 8:00

Session A1: Alternate Bearings in THA 1
Moderator: Hani Haider

Tribological Evaluation of a Spacer Cement Without Hard Radio Contrast Agents
J. Philippe Kretzer; Sebastian Jaeger; Joern Reinders; Eike Jakobowitz; Marc Thomsen; Rudi Bitsch

The Use of a Metal Acetabular Shell With a Polycarbonate-Urethane Liner for Total Hip Reconstruction
Antonio Moroni; Martha Hoque; Giovanni Micera; Fabrizio Sinapi;

Total Hip Arthroplasty in Fused Hips Using Hard Bearing Articulation
Yoon Taek Rim; Park Young Hoon; Cho Nam Young

Ultrafine Grain Refinement of Biomedical Co-29Cr-6Mo Alloy Using Conventional Hot-Compression
Akihiko Chiba; Yungping Lee; Shingo Kurosu; Hiroaki Matsumoto

Wear Testing of Highly Crosslinked UHMWPE Against 36 Mm CoCr and 44 Mm Oxidized Zirconium Femoral Heads
Amit Parikh; Patrick Hill; Vivek Pawar; Mark Morrison

Third Generation Ceramic-on-Ceramic Total Hip Arthroplasty in Patients Younger Than 30 Years With Avascular Necrosis of Femoral Head: A Minimum 4-Year Follow-Up
Yoon Taek Rim; Park Kyung Soon; Park Young Hoon; Cho Nam Young

8:30 - 9:20

Session A2: Alternate Bearings in THA 2
Moderator: Robert Streicher

Results of Metal on Metal Revision Hip Arthroplasty
Inder Gill; Murali Krishnan; Mike Reed; Paul Partington

Synchrotron Xray Spectroscopy Reveals Chemical Form of in-Human Metal-on-Metal Hip Wear Debris : Ultima and Current Generation Hips

Alister Hart; Paul Quinn; John Nolan; Keith Tucker; John Skinner; Jonathan Powell; Ferdinand Lali; Fred Mosselms

Session - B

7:25 - 7:30

Opening remarks: Sam Tarabichi

7:30 - 8:20

Session B1: Computer Navigation in TKA
Moderator: Riyaz Jinnah

Navigated Total Knee Prosthesis Exchange. a Comparative Study With Conventional Technique.
Jean-Yves Jenny; Yann Diesinger

The Role of Selective Femoral Navigation in Restoring the Mechanical Axis Post TKR
Nilen Shah; Abhijit Adsul

Which Steps Do Trainees Find Most Difficult in Performing Knee Replacement?
Sabir Ismaily; Lindsey Turns; Jonathan Gold; Jerry Alexander; Kenneth Mathis; Philip Noble

Influence of Intra-Operative Joint Gaps on Post-Operative Flexion Angle After Cruciate-Retaining Total Knee Arthroplasty With a Navigation System.
Koji Takayama; Seiji Kubo; Tomoyuki Matsumoto; Kazunari Ishida; Ken Sasaki; Takehiko Matsushita; Masahiro Kurosaka; Ryosuke Kuroda

Patient Personalized Instrumentation for TKA; Comparative Study With the Conventional Instrumentation
Michel Bercovy; Luc Kerboull

Navigated, Mobile Bearing Total Knee Prosthesis With Floating Platform and Extended Congruency. a 5-Year Follow-Up Study.
Jean-Yves Jenny; Jean-Yves Schoenahl; Pascal Louis; Yann Diesinger

Modular Total Knee Arthroplasty (TKA) in Cases of Revision and Complicated Primary Cases
Harald Dinges

Stress Testing to Optimise Tibiofemoral and Patellofemoral Dynamics During Computer Assisted Surgical Navigation (Casn).
Robin Strachan

8:20 - 8:30

Panel discussion



Oxinium Versus Metal on Polyethylene: A Prospective Randomized Evaluation of the Penetration Rate at Two-Year Follow-Up.

El Hage Samer; Frederic Zadegan; Jean Pierre Courpied; Michel Mathieu; [Moussa Hamadouche](#)

Is the French Paradox a Reality? Long Term Survival and Migration of the Charnley-Kerboull Cemented Line-to-Line Firas El Masri; Luc Kerboul; Marcel Kerboul; Jean Pierre Courpied; [Moussa Hamadouche](#)

Total Hip Replacement in High Riding DDH, Using Proximal Femoral Neck Shortening Osteotomy, in L Step Cut Fashion
[Ataollah Moshirabadi](#)

Massive Osteolysis Could Not Expand Along Porous Cup Surface With AW-Glass Ceramics Bottom Coating: A Case Report
[Koji Goto](#); Haruhiko Akiyama; Keiichi Kawanabe; Kazutaka So; Takashi Nakamura

9:20 - 09:30

Panel Discussion

9:30 - 10:10

Session A3: Bearing Mobility Issues
Moderator: Scott Banks

Roughness and Surface Polarity of Retrieved Zirconia Femoral Heads Marcel Roy; Leo Whiteside; [Tariq Nayfeh](#); Brian Katerberg

An Independent Analysis of the First Sixteen Mobile Bearing Lateral Unicompartamental Knee Replacements. Is There a Learning Curve?
[Sebastiaan Schelfaut](#)

A Patient Specific Template Technique Improved Femoral Component Alignment in Hip Resurfacing
[Hiroyoshi Iwaki](#); Taku Yoshida; Mitsuhiro Ikebuchi; Yukihide Minoda; Takahiro Iida; Tessyu Ikawa; Hiroaki Nakamura

Post-Cam Kinematics in TKP
[Hendrik Delpont](#); Ward Bartels; Scott A. Banks; Jos Van der Sloten; Johan Bellemans,

A Comparison of Mobile-Bearing Versus Fixed-Bearing Total Knee Arthroplasty
[Seyed Kazemi](#); Hamid Reza Seyyed Hosseinzadeh

10:10 - 10:20

Panel Discussion

10:20 - 10:25

Coffee Break

8:30 - 9:20

Session B2: Knee Arthroplasty in the Indian Sub Continent
Moderator: Arun Mullaji

A 11 to 14 Year Follow-Up Study of the Rotaglide Mobile
[Yasuo Kunugiza](#); Tetsuya Tomita

Effect of Hindfoot Alignment on Mechanical Axis Deviation After Total Knee Arthroplasty in Osteoarthritis
[Arun Mullaji](#); Gautam Shetty

Analysis of Valgus Angle Following Navigation Total Knee Arthroplasty.
[Jai Thilak Kailathuvalapil](#); Binu Sasidharan

Total Knee Arthroplasty After Extra-Articular Deformity for Degenerative Arthritis
[Ashok Rajgopal](#)

Determinants of Limb Alignment After Minimally-Invasive Oxford Medial Unicompartamental Knee Arthroplasty
[Gautam Shetty](#); Arun Mullaji

In Vitro Measurements of the Initial Fixation of the Profix Tibial Baseplate: Conventional Versus "Omega" Stem Antonio Spinarelli; [Silvio Patella](#)

Total Knee Arthroplasty in Ankylosed Knees
[Ashok Rajgopal](#)

Anthropometric Measurements of the Indian Knee for Total Knee Arthroplasty
[Pankaj Mahindra](#); Prof. Mohammad Yamin; Prof. Rajnish Garg; Harpal Singh Selhi; Shekhar Singla

9:20 - 9:30

Panel discussion

9:30 - 10:10

Session B3: Cartilage Repair/Regeneration
Moderator: Tim Briggs

Methods to Determine Indications for Partial Resurfacing in the Knee Including Arthroscopic Cartilage Mapping and Radiographic Analysis
[Robin Strachan](#)

Osteogenic Differentiation of Adult Human Adipose-Derived Stem Cells Is Achieved by Overexpression of the BMP Receptor 1A
[Farhang Raaii](#)



10:25 - 10:45

Opening Ceremony

10:45 - 11:10

Invited Talk: Large headed Bearings for Conservative Hip Arthroplasty
– what is the future?
By Derek McMinn

11:10 - 11:50

Session A4: Hip Resurfacing
Moderator: Alistair Hart

Long Term Outcome in Modern Hip Resurfacing Arthroplasty. a Minimum of 10 Years Follow Up.
Peter Lewis; Kemi Alo; Jag Chakravarthy; Eric Isbister

The Effect of Cementing Technique on Polymerization Heat Generation and Thermal Necrosis in Hip Resurfacing Arthroplasty
Dennis Janssen; Priyanka Srinivasan; Thierry Scheerlinck; Nico Verdonschot

The Fate of Initial Gaps Between the Cup and Acetabular Floor in Resurfacing Hip Arthroplasty
Satoshi Nakasone; Masaki Takao; Takashi Nishii; Takashi Sakai; Nobuo Nakamura; Nobuhiko Sugano

Effectiveness of Patient Matched Hip Resurfacing Femoral Alignment Guide
Jai Thilak Kailathuvalapil, Binu Sasidharan

Total Knee Arthroplasty after Extra-Articular Deformity due Degenerative arthritis Ashok Rajgopal

Determinants of Limb alignment After Minimally-Invasive Oxford Medical Unicompartmental Knee Arthroplasty
Gautam Shetty, Arun Mullaji

In Vitro Measurements of the Initial Fixation of the Profix Tibial Baseplate: Conventional Versus XXXXXXXXXXXX Stem Antonio Spinarelli, Silvio Patella

Anthropometric Measurements of the Indian Knee for Total Knee Arthroplasty
Pankaj Mahindra, Prof. Mohammad Yamin, Prof. Rajnish Garg, Harpal Singh Selhi, Shekhar Singla

11:50 - 12:00

Panel discussion

12:00 - 13:30

Bayer Healthcare Presentation Lunch 2 years of experience with the First Oral Factor Xa Inhibitor Xarelto in Orthopedic Surgery Patrick Mouret
Luncheon tickets available at the Bayer Healthcare session.

New Biodegradable and Biocompatible Synthetic Scaffold for Meniscal Regeneration: Preliminary Clinical Experience

Silvio Patella; Elizaveta Kon; Alessandro Di Martino; Giuseppe Filardo; Stefano Zaffagnini; Luca D’Orazio; Berardo Di Matteo; Maurilio Marcacci

Validation of a Prognostic Classification System for Acetabular Cartilage Lesions

Sujith Konan; Faizal Rayan; Geert Meermans; Johan Witt; Fares S Haddad

10:10 - 10:20

Panel discussion

10:20 - 10:25

Coffee Break

10:25 - 10:45

Opening Ceremony

10:45 - 11:00

Invited talk: articular Cartilage Repair – Now and The Future

By Tim Briggs

11:00 - 11:20

Session B4: Ethnic and Gender Issues in TKR.
Moderator: Sam Tarabichi

Sizing and Suture in TKA: Surgical Implications and Considerations Philippe Van Overschelde

Bicompartmental Arthroplasty as an Ethnic and Gender Solution in Arthroplasty
Emmanuel Thienpont

Gender Differences in Japanese Osteoarthritic Knee Joint Geometry Shinro Takai

Complications After Total Knee Arthroplasty With Anterior-Posterior Glide Low Contact Stress Mobile-Bearing
Bo-Hyun Hwang; Woo-Suk Lee; Kwan-Kyu Park; Ick-Hwan Yang; Chang-Dong Han

11:20 - 11:30

Panel discussion

11:30 - 12:00

Hap Paul Award Paper: A Novel Technique of Patient Specific Templating for Total Knee Arthroplasty: Laboratory Validation
Mahmoud Hafez



13:30 - 14:00

Invited talk: Hip Arthroplasty in Egypt: Challenges of Pathology and Sociogeconomics
Timour El-Husseini

14:00 - 14:40

Session A5: Hip Mechanics
Moderator: Nico Verdonshot

Restoration of Vertical and Horizontal Offset Using Dual Offset Stem in Korean

Yoon Je Cho; Sang Joon Kwak; Young Soo Chun; Kee Hyung Rhyu; Dong Chul Nam; Myung Chul Yoo

Outcome of Ceramic-Ceramic Total Hip Arthroplasty in Patients With Developmental Dysplasia of the Hip
Simon Steppacher; Moritz Tannast; Stephen Murphy

The Cam Impinging Femur Has Multiple Morphologic Abnormalities Philip Noble; Michael Conditt; Matthew Thompson; Molly Usrey; Gregory Stocks

Effect of Cup Abduction and Head Lateral Microseparation on Contact Stress in Ceramic-on-Ceramic THA
Sari-Ali El-Hadi; Todd Stewart; Zongmin Jin; John Fisher

An in-Vitro Long Term Performance Evaluation of a Thin Acetabular Shell With in-Growth Coating
Mayur Thakore; Hoogerhyde Duane; Christina DANjou; Arlen Hanssen; Gregg Schmidig

14:40 - 14:50

Panel discussion

14:50 - 15:30

Session A6: Hip Miscellaneous
Moderator: Joseph Fetto

Modular Tapered Implants for Severe Femoral Bone Loss in Revision Total Hip Arthroplasty.
Cara Cipriano; Nick Brown; Craig Della Valle; Scott Sporer

Sports Ability After Total Hip Replacement for the Hip Dysplasia in Japanese Patients
Naonobu Takahira; Katsufumi Uchiyama; Kensuke Fukushima; Tadashi Kawamura; Mitsuaki Ashihara; Meguru Fujii; Yukiko Kihara; Masumi Yoshimoto; Jun Kitagawa

Revision Total Hip Arthroplasty in Massive Proximal Femoral Bone Loss With Tumor Endoprosthesis
Ayman Bassiony

Short Term Results of Primary THA Using RevelationV2: A Lateral Flare Femoral Component
Satona Murakami; Nobuyuki Watanabe; Hirotaka Iguchi; Shinichi Hasegawa; Kaneaki Tawada; Masahito Yoshida; Nobuhiko Tanaka; Takanobu Otsuka

12:15 - 13:30

Smith and Nephew Presentation Lunch Metal on Metal: The good, the bad and the ugly
Peter Brooks M.D.
Luncheon tickets available at the Smith & Nephew session.

13:30 - 14:10

Session B5: Computer Navigation in TKR 1
Moderator: Andrea Baldini

Decision of the Femoral Component Rotation in TKA With Image- Free Navigation System
Nobuhiro Abe; Takayuki Furumatsu; Yusuke Yokoyama; Naoki Takata; Toshifumi Ozaki

CT and Cine Video X Ray Based Analysis of Alignment and Stability of Computer Navigated and Conventional TKR
Rajeev Kumar Sharma

Alignment in Conventional Versus Computer-Assisted Total Knee Arthroplasty in Obese Patients
Gautam Shetty; Arun Mullaji

Computer Assisted Total Knee Arthroplasty for Significant Tibial Deformities
Ritesh Shah; Lalit Puri; Gregory Strohmeyer

Computer-Assisted Total Knee Arthroplasty in Arthritis With Recurvatum Deformity
Arun Mullaji; Lingaraju AP; Gautam Shetty

Correction of Complex Femoral or Tibial Shaft Deformities During Total Knee Arthroplasty Using Computer Assisted Techniques
Mahmoud Hafez

14:10 - 14:20

Panel discussion

14:20 - 15:00

Session B6: Computer Navigation in TKR 2
Moderator: Shinro Takai

Effect of Total Knee Arthroplasty on Varus Knee Biomechanics During Gait
Ajit Deshmukh; Karl Orishimo; Ian Kremenic; Malachy McHugh; Stephen Nicholas; Jose Rodriguez;

OrthoPilot Navigated Total Knee Replacement- Technical Tips
Ranjan Sachdev

Cadaveric Evaluation of the MAKO Multi Compartmental Knee Kinematics
Gokce Yildirim; Peter Walker; Michael Conditt; Sharon Horowitz; Ivan Madrid



Meliorheostosis of the Hip Joint Treated With Total Hip Replacement Ahsan Sheeraz; Natasha Picardo; Bhupinder Mann; John Skinner

15:30 - 15:40

Panel discussion

15:40 - 16:00

Session A7: Hip 2

Moderator: Daryl D'Lima

Effect of Proximal Stem Surface Roughness on the Initial Mechanical Stability

Ichiro Nakahara; Shunichi Bandoh; Masaki Takao; Takashi Sakai; Takashi Nishii; Nobuhiko Sugano

Conservative Postero-Lateral Approach to Hip. Evaluation of 500 Cases.

Fabrizio Pace; Fabrizio Pace

Improving Cup Positioning Using a Mechanical Navigation Instrument

Simon Steppacher; Jens H Kowal; Stephen Murphy

Hip Arthroscopy and Body Temperature

Dante Parodi; Eduardo Sauthier; Javier Besomi; Carlos Tobar; Juanjose Valderrama

16:00 - 16:10

Panel discussion

16:10 - 16:30

Coffee break/Posters/Exhibitors

16:30 - 17:20

Session A8: Periprosthetic Fractures in THA

Moderator: Wolfgang Klauer

Fixation Methods in the Treatment of Vancouver B1 Periprosthetic Hip Fractures: Our Experience of 69 Cases

Jonathan Phillips; Chris Boulton; Chris Moran; Andrew Manktelow

Periprosthetic Fractures Associated With Press Fit Stems in Revision Total Knee Arthroplasty: Incidence, Risk Factors, and Management. Cara Cipriano; Nick Brown;

Marc Jacofsky; Scott Sporer; Craig Della Valle

Metal on Metal Total Hip Arthroplasty After Fracture of the Acetabulum Mohammed Kamal Asal

Periprosthetic Fractures Around Exeter Stems: A New Injury?

Jonathan Phillips; Chris Boulton; Chris Moran; Andrew Manktelow

Analysis of Outliers in Computer-Assisted Total Knee Arthroplasty

Arun Mullaji; Gautam Shetty

Revision of Femoral Components by Long Stem: Cementless Versus Cemented

Ashraf Elwakeel

Comparing Femoral Component Rotation Using a Force Sensing Device Versus Conventional Methods With Anatomic Landmarks

Stefan Kreuzer; Kevin Leffers

Navigated, Minimal Invasive, Mobile Bearing Unicompartamental

Knee Prosthesis. a 2-Year Follow-Up Study.

Jean-Yves Jenny; Francois Saussac; Pascal Louis; Yann Diesinger

15:00 - 15:10

Panel discussion

15:10 - 15:50

Session B7: Robotic Knee Surgery

Moderator: Harish Parmar

Effect of Cement Technique on Component Position During Robotic- Arm Assisted Unicompartamental Arthroplasty (UKA)

Raj Sinha; Margaret Cutler

In Vivo Validated Subject-Specific Computer Model of Dynamic Squatting After Total Knee Arthroplasty

Hideki Mizu-Uchi; Cesar Flores-Hernandez; Clifford Colwell Jr.; Nikolai Steklov; Shuichi Matsuda; Yukihide Iwamoto; Darryl D'Lima

Early Outcomes of Robotically Guided Bicompartamental Arthroplasty John Velyvis; Thomas Coon; Martin Roche;

Stefan Kreuzer; Sharon Horowitz; Miranda Jamieson; Michael Conditt

Total Knee Arthroplasty Following High Tibial Osteotomy.

Simone Ripanti; Sabina Marin; Giancarlo Romani; Stefano Campi; Andrea Campi

Four Year Outcomes of Robotically Guided UKA

Martin Roche; Sharon Horowitz; Michael Conditt

Predicting Bone Damage and Implant Subsidence After Total Knee Arthroplasty

Darryl D'Lima; Jowene Wong; Shantanu Patil; Cesar Flores- Hernandez; Clifford Colwell Jr.; Nikolai Steklov; Mark Kester



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What Can We Do With Periprosthetic Fractures?
Pavel Zigo; Thomas-Peter Ranke; Susanne Kalich

THA in Sickle Cell Disease Patients
Mojieab Manzary; Fawzi Fahad Alijassir

Complications Associated With Operative Treatment of Peri- Prosthetic Femur Fractures Sustained in the Acute Post-Operative Period Following Primary Total Hip Arthroplasty
Neil Sheth; Nick Brown; Craig Della Valle

The Evidence Based Approach Towards Management of Periprosthetic Fractures Around the Hip.
Bhupinder Mann; Ahsan Sheeraz; Rachel Shaw; Govin Murugachandran; Ratukondla Ravikumar

17:20 - 17:30
Panel discussion

17:30 - 18:00
Session A9: Arthroplasty Outcomes
Moderator: Timour El-Husseini

Integrated Approach for Ortho-Sports Medicine Patient Care Management: A Total Knee Arthroplasty Outcomes Study
Kenneth Bramlett; Dr. Rajan Grover

Pattern of Loosening of Polyethylene Keeled Glenoid Components in Primary Osteo-Arthritis.A Multicenter Study With Follow-Up > 5 Years
Dominique-Francois Gazielly; Gilles Walch; Pascal Boileau

The Royal National Orthopaedic Hospital Experience With Custom Made (CAD/CAM) Total Hip Replacement in Patients With Osteochondrodysplasia
Baljinder Dhinsa; Azal Jalgaonkar; Zuhair Nawaz; Tim Briggs; Sarah Muirhead-Allwood; Richard Carrington; John Skinner; George Bentley; Jonathan Miles

Non Fusion Technology, L TDR vs. Fusion
Zbiggy Brodzinsky

Mid-Term Results of Hi-Tech Knee Cementless Total Knee Arthroplasty : 5 To12 Years Follow-Up
Hajime Yamanaka

18:00 - 18:10
Panel discussion
Adjournment

15:50 - 16:00
Panel discussion

16:00 - 16:20
Coffee break/Posters/Exhibitors

16:20 - 16:50
Invited talk: Revision TKA - Now More Durable than Primaries Kelly Vince

16:50 - 17:40
Session B8: Management of Complications in TKA
Moderator: David Sochart

Rivaroxaban Versus Enoxaparin in the Setting of Elective Hip and Knee Arthroplasty and Their Effects on Bleeding, Thromboembolism and Delayed Wound Healing
Barry Rose; Katia Sindali; Hassan Soueid; Chan Jeer; Deepak Saran

Transfusion Free Bilateral Total Knee Arthroplasty- a Reality ?
Fred Cushner

Surface Treating of Endoprostheses by Stitching-in Silver
Paul Unwin; Martin Pickford; James Shawcross; Gordon Blunn; Steve Cannon; Robert Grimer

Tranexamic Acid in Total Knee Replacements: A Meta-Analysis
Mohamed Sukeik; Sattar Alshryda; Anthony Nargol; James Mason

Treatment of Periprosthetic Osteolysis Using Trabecular Metal in Revision Knee Arthroplasty
Daniel Kendoff; Christian Schmitz; Wolfgang Klausner

Methicillin-Resistant Staphylococcus Aureus in Total Knee Arthroplasty Treated With Revision and Direct Intraarticular Antibiotic Infusion
Leo Whiteside; Michael Peppers; Tariq Nayfeh; Marcel Roy

Extensor Mechanism Allograft Reconstruction in TKA for Ruptures or Ankylosis
Andrea Baldini; Luca Manfredini; Pierpaolo Ceruli Mariani; Bernardo Barbanti

17:40 - 17:50
Panel discussion
Adjournment



Programme detailed

Friday, October 8, 2010

Session - A

7:30 - 8:00

Invited talk: The Status of Finite Element Analyses of Orthopaedic Implants
Nico Verdonshot

8:00 - 8:30

Session A10: Bearings and Tribology
Moderator: Riyaz Jinnah

Highly Crosslinked PE as Alternative Bearing Material for Big Diameter THA
Robert Streicher

Comparison of the Stem Geometries of Lateral Flare Stems Using 3D CAD and FEA -Stems Are Alternative Load Interface Between Pelvis and Femoral Cortex-
Hirota Iguchi; Nobuyuki Watanabe; Nobuhiko Tanaka; Sinn'ichi Hasegawa; Satona Murakami; Kaneaki Tawada; Masahito Yoshida; Gen Kuroyanagi; Atsunori Murase; Takano Otsuka

Metal Bearings in Hip Arthroplasty –“ What Have We Learned?
Chris Whately

Oxinium
Seyedesmaeil Shafiei

Metal Ion Levels and Associated Chromosome Aberrations in Metal-on-Metal Total Hip Arthroplasties
Baljinder Dhinsa; Kieran Gallagher; Zuhair Nawaz; Ben Spiegelberg; Sam Hanna; Stephen Tai; Rob Pollock; Richard Carrington; Steve Cannon; Tim Briggs

8:30 - 8:40

Panel discussion

8:40 - 9:30

Session A11: Knee Arthroplasty in the Middle East
Moderator: Eisa AL Hemrani

Can an Anterior Quadriceps Release Improve Range of Motion in the Stiff Arthritic Knee?
Mohamed Elfekky; Sam Tarabichi

Management of Flexion Deformity in Total Knee Arthroplasty by Recreation of the Posterior Condylar Recess Without Extra-Bone Resection
Mohamed Eid; Wael S.Behairy; Mahmoud A.El-Sebai

Session - B

7:30 - 8:30

Session B9: Complications in Arthroplasty
Moderator: Darryl D'Lima

Eradication of Negative Bone Remodelling Using the C-Stem Polished, Triple-Tapered Femoral Implant
David Sochart; Nargis Chaudhary

Management of Unstable Total Hip Arthroplasty Using a Dual Mobility Cup
Olivier Guyen; Christophe Chevillotte; Julien Wegrzyn; Vincent Pibarot; Jacques Bejui-Hugues; Jean-Paul Carret

Controlled Release of Antibiotics From HA Used in Bone Cement With HA
Hiroyuki Oonishi; Shigekazu Mizokawa; Hironobu Oonishi

Two Stage Revision for Infection in Modular Megaprotheses of the Lower Limb After Resection for Bone Tumour
Pietro Ruggieri; Elisa Pala; Mario Mercuri

Revision Hip Arthroplasty for Type IIIB Femoral Defects Using a Modular, Tapered Femoral Component
Michael Ryan; James Fait; Amir Khan; Glenn Barnes

Usefulness of IBG With X-Changed Rim Mesh for Reconstruction of Large Tibial Bone Defect During TKA Procedure
Seiichi Ono

Outcome of Revision Total Hip Arthroplasty Using the Echelon Revision Stem
James Waddell; Robert Baird; Vasileios Nikolaou; Emil Schemitsch

Constrained Implants for Total Hip Arthroplasty Instability: Analysis of Failures
Olivier Guyen; David Lewallen; Miguel Cabanela

8:30 - 8:40

Panel discussion

8:40 - 9:50

Session B10: Navigation and Robotics in Arthroplasty
Moderator: Michael Conditt

Early Experience With Customized, Patient Specific Unicompartamental and Bicompartamental Knee Arthroplasty
Raj Sinha



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New Concept in Soft Tissue Balancing During Primary Total Knee Arthroplasty
Ataollah Moshirabadi

Constrained Condylar Arthroplasty in Severe Varus Deformity Wael Osman
Full Flexion After Total Knee Using Lps Flex Implant
Ibrahim Gado; Samih Tarabichi

9:30 - 9:40

Panel discussion

9:40 - 10:00

Coffee break/Posters/Exhibitors

10:00 - 10:20

Invited talk: Friction of Various Hip Replacement Materials and Designs Captured During Testing on Hip Simulators Hani Haider

10:20 - 11:00

Session A12: Materials
Moderator: Robert Streicher

ANOVELROUTEforPROCESSINGCo-Cr-MoORTHOPAEDIC ALLOYS

Bhairav Patel; Mohan Edirisinghe; Fawad Inam; Mike Reece; William Bonfield; Jie Huang; Arash Angadji

The Hydroxyapatite Containing Silver Inhibits the Biofilm Formation in a Flow Condition

Yoshiki Ando; Iwao Noda; Hiroshi Miyamoto; Takayuki Akiyama; Takafumi Shimazaki; Yutaka Yonekura; Masaki Miyazaki; Masaaki Mawatari; Takao Hotokebuchi

Long-Term Wear Performance of an Advanced Bearing Knee Technology

Ramprasad Papannagari; Gary Hines; Jeff Sprague; Mark Morrison

11:00 - 11:10

Panel discussion

11:10 - 11:50

Session A13: Alternate Bearing Materials in Arthroplasty
Moderator: Alistair Hart

Modified Minimally Invasive Two-Incision THA Using Large-Diameter Ceramic-on-Ceramic Articulation
Yoon Taek Rim; Park Young Hoon; Cho Nam Young

Deformation and Fracture Behaviors in a Biomedical Co-29Cr-6Mo-0.14N Alloy Analyzed by X-Ray Tomography
Hiroaki Matsumoto; Shingo Kurosu; Akihiko Chiba; Caroline Landron; Damien Fabregue; Eric Maire

Improving Accuracy by Patient Specific Instruments
Emmanuel Thienpont

Demographic Factors and Their Influence Inresult of THA
Firooz Madadi

Comparing Navigated Versus Conventional TKR. Short Term Radiological Result
Eltayeb Nasser

Robotic Assisted Spinal Surgery - 2 Years of Clinical Experience - Gains and Disadvantages.

Alexander Bruskin

Use of Navigation Aids as Additional Training Tool for Orthopaedic Trainees

Sujith Konan; Fahad S Hossain; Fares S Haddad
Periprosthetic Fractures After Hip Arthroplasty
Ashraf Elwakeel

Assessment of Accuracy of Robotic Assisted Unicompartemental Arthroplasty (Makoplasty)

Ali Mofidi; Bu Lou; Michael Conditt; Gary Poehling; Riyaz Jinnah

9:50 - 10:00

Panel discussion

10:00 - 10:20

Coffee break/Posters/Exhibitors

10:20 - 11:00

Invited talk: Customizing the Solution in Knee Arthroplasty
Jean Noel Argenson

11:00 - 11:50

Session B11: Knee Mechanics
Moderator: Nico Verdonshot

Design Rationale and Clinical Evaluation of Total Knee Arthroplasty Reproducing Anatomic Geometry for Asian
Toru Suguro; Keitaro Yamamoto; Yoshiyasu Miyazaki; Takashi Nakamura; Masayuki Sekiguchi; Scott Banks

The Flexion-Extension Axis of the Knee and the Rotational Orientation of Tibial Components

Philip Noble; Sabir Ismaily; Stephen Incavo

The Influence of Pre-Operative Deformity on Intra-Operative Soft Tissue Balance in Posterior-Stabilized Total Knee Arthroplasty

Tomoyuki Matsumoto; Seiji Kubo; Hirotsugu Muratsu; Kazunari Ishida; Koji Takayama; Takehiko Matsushita; Katsumasa Tei; Masahiro Kurosaka; Ryosuke Kuroda



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Minimum 5 Year Results for Modular Metal on Metal THA
Kirk Kindsfater; Christi Terefenko; Chris Bureau; Cindy Sherman

Medial Neck Femoral Fractures: Our Treatment Algorithm and the Use of f.g.l. Memory Shape Stem
Filippo Calderazzi; Michele A. Verdano; Francesca de Caro; Antonio Carolla; Francesco Ceccarelli

Modern Alternative Bearing Total Hip Arthroplasty in Patients Less Than 21 Years Old
Atul Kamath; Neil Sheth; Oladapo Babtunde; Harish Hosalkar; Gwo-Chin Lee; Charles Nelson

Unilateral Fracture of a 4th Generation Alumina Bearing-Ceramic Liner in a Modern Bilateral Total Hip Replacement: A Case Report.
Edwin Su; Pranit Chotai

12:00 - 13:30

Zimmer Presentation Lunch
Luncheon tickets available at the Zimmer session.

13:30 - 14:00

Invited talk: Hinged Knee Arthroplasty in Revision Knee Surgery - Still up to Date?
Wolfgang Klausner

14:00 - 14:50

Session A14: Complication Management
Moderator: Dr. Althani

Aggressive Early Debridement Can Be Successful for Infected Total Hip Arthroplasty
Mohamed Sukeik; F S Haddad

Custom Made Hinged Spacers in Revision Knee Surgery for Patients With Infection, Bone Loss and Instability
Simon Macmull; Will Bartlett; Jonathan Miles; Gordon Blunn; Rob Pollock; Richard Carrington; John Skinner; Steve Cannon; Tim Briggs

Serum and Synovial Fluid Analysis for Diagnosing Periprosthetic Infection in Patients With Inflammatory Arthritis
Cara Cipriano; Nick Brown; Andrew Michael; Mario Moric; Scott Sporer; Craig Della Valle

Revision Total Knee Arthroplasty for Treatment of Supracondylar Fracture of the Femur After Total Knee With Osteoporosis
Masaaki Maruyama

Anchor Like Sutures for Prophylaxis Against Patellar Ligament Rupture During Total Knee Arthroplasty
Wael Osman

Influence of Activity on the Primary Stability of Three Designs of Cementless Tibial Tray
Mark Taylor

Should a Mobile Bearing Wear Less Than a Fixed-Bearing TKR?
the Answer From in Vitro Wear Testing.
Hani Haider; Christian Kaddick

Measurements of Knee Kinematics During TKA Surgery Using Navigation System Correlate With Postoperative Kinematics Tokifumi Majima; Naohiro Sawaguchi; Yasuhiko Kasahara;
Tetsuya Tomita; Kazuomi Sugamoto

Anterior Tibial Cortex Is the Best Landmark for Tibial Component Rotation in Tka
Andrea Baldini; Pierpaolo Ceruli Mariani; Luca Manfredini; Lapo De Luca

11:50 - 12:00

Panel discussion

12:00 - 13:30

Sanofi Aventis Presentation Lunch
An evolving VTE Management: LMWHs and the clinical evidence Luncheon tickets available at the Sanofi Aventis session.
Dr. Hassan Kamaliddin

13:30 - 14:10

Session B12: Shoulder Arthroplasty
Moderator: Rashid Al Shaeel

Swanson-Prosthesis in Bouchard Arthrose: Is Still Indicated?
Khalaf Moussa; Abdull Kader Martini

Glenohumeral Chondrolysis: Causative Factors and Treatment Options
Samer Hasan

Complications and Early Outcomes Following Reverse Shoulder Arthroplasty Using a Prosthesis With a Lateral Center of Rotation Samer Hasan; Cassie M. Fleckenstein

Surface-Contour Based Algorithm for Quantifying Glenohumeral Ligament Length Changes During Function
Hippolite Amadi

Reverse Shoulder Prosthesis With Concentric vs Eccentric Glensphere. a Multicentric Study
Carlo Felice De Biase; Giantony Di Giorgio; Roberto Postacchini



Comparison of Drain Clamp After Bilateral T.K.A.
Firooz Madadi

Directed Air Flow to Reduce Airborne Particulate and Bacterial Contamination in the Surgical Field During Total Hip Arthroplasty Gregory Stocks; Daniel O'Connor; Sean Self; Geoff Marcek; Brandon Thompson

14:50 - 15:00
Panel discussion

15:00 - 16:00
Session A15: Alternate Bearings 2
Moderator: John Hollingdale

Ceramic-on-Metal vs. Ceramic-on-Ceramic. a Hip Simulator Wear Study.
J. Philippe Kretzer; Eike Jakubowitz; Robert Sonntag; Joern Reinders; Chistain Heisel

5-Year Results of a Series of 100 Consecutive Arthroplasties With a Large Diameter Metal-on-Metal Femoral Head Philippe Triclot

Equatorial Fins to Enhance Press Fit of Cementless Cups With Ceramic-on-Ceramic and Met-Met Articulation: Positive Experience With 3 Different Models
Roberto Binazzi; Paolo Dalla Pria; Massimo De Zerbi; Francesco Perdisa

Acetabular Reconstruction Using Reinforcement Ring and Cemented Metal on Metal Cup for Revision Hip Arthroplasty
Under Gill; Murali Krishnan; Mike Reed; Paul Partington

An MRI Classification of Lesions Around Metal-on-Metal Hip Replacements
Alister Hart; Keshthra Satchithananda; Johann Henckel; Justin Cobb; Shiraz Sabah; John Skinner; Adam Mitchell

Incomplete Seating of the Liner With the TriAD Acetabular System
Yasuaki Tamaki; Shunji Nakano; Risa Utsunomiya; Masaru Nakamura; Takashi Chikawa; Tateaki Shimakawa; Akira Minato

An Original Hip Navigation System to Control Leg Lengthening, Offset and Stability Without the Use of the Pelvic Anterior Plane
Olivier Guyen; Vincent Pibarot; Sebastien Martres; Christophe Chevillotte; Jacques Bejui-Hugues; Jean-Paul Carret

14:10 - 14:20
Panel discussion

14:20 - 14:50
Invited talk: Mechanical Analysis of the Hip; Kinematics, Kinetics, Sound and Vibration
Richard Komistek

14:50 - 15:10
Session B13: Imaging Technology
Moderator: Scott Banks

Observation of 3D Image Preoperative Planning in the Operation Theater Using 3-Dimensional Display Without Goggles
Hiroataka Iguchi; Nobuyuki Watanabe; Nobuhiko Tanaka; Sinn'ichi Hasegawa; Satona Murakami; Kaneaki Tawada; Masahito Yoshida; Gen Kuroyanagi; Atsunori Murase; Yasuhiro Nishimori

Precision Phantom Study of a CR and DR Imaging System for Radiostereometric Analysis Using a Novel Spine Pedicle Screw
Martin Petrak; Andreas Burger; Richard Van Der Put; Thomas Turgeon; Eric Bohm

Adjusting Leg Length Discrepancy in Hip Arthroplasty Using Digital Templating System
Mahmoud Hafez

15:10 - 15:20
Panel discussion

15:20 - 16:00
Session B14: Hip Resurfacing
Moderator: Assem Tantawy

The Outcome of the Treatment of Periprosthetic Hip Infection Using a Two Stage Reimplantation Protocol With a Cement Spacer
Hideyuki Tashima

Wear Simulator Studies of a Deflection Compensating Hip Joint
Azad Hussain; Amir Kamali

Hip Implants - Tribological Testing Influenced by Physiological Conditions
Joseph Pamu; Amir Kamali; Jasper Daniel; Azad Hussain; Chenxi Li

Correlation Between Edge Loading and Wear in Hip Implants
Azad Hussain; Katrina Packer; Chenxi Li; Amir Kamali



ISTA 2010



Delta AMC Ceramic Joints in THA : A Monocentric Study of 141 Cases With Minimum 2 Years Follow-Up.

Jean Yves Lazennec; Alexandre Ducat; Alfonso RANGEL; Vicente Gozalbes; Yves CATONNE

16:00 - 16:10

Panel discussion

16:10 - 16:30

Coffee break/Posters/Exhibitors

16:30 - 17:20

Session A16: Computer Navigation in THA

Moderator: Darryl D'Lima

Comparison of Computer Navigated Total Hip Arthroplasty Versus Conventional Total Hip Arthroplasty Utilizing the Direct Anterior Approach

Stefan Kreuzer; Kevin Leffers

Accuracy of Robotically Assisted Acetabular Cup Implantation Lawrence Dorr; Mark Pagnano; Robert Trousdale; Matthew

Thompson; Miranda Jamieson; Michael Conditt

The Accuracy of Cup Position in Total Hip Arthroplasty With CTBased Navigation System

Kazuo Fujiwara; Hirosuke Endo; Yoshiaki Miyake; Toshifumi Ozaki; Shigeru Mitani

Evaluation of the Stem Position of Total Hip Arthroplasty With CT-Based Navigation System

Yoshiaki Miyake; Kazuo Fujiwara; Hirosuke Endo; Toshifumi Ozaki; Shigeru Mitani

Acetabular Component Placement in THR: A New CT-Image- Based Dedicate Software

Attilio Speranza; Barbara Maestri; edoardo monaco; Carmelo D'arrigo; andrea ferretti

The Value of Three-Dimensional Computerised Planning of THA Using Anterior Minimal Invasive Surgery.

Sari-Ali El-Hadi; Raphael Mauprivez; Yves CatonnÃ©

Complex Acetabular Revision Using Computer-Aided Planning for Patient-Specific Implant and Guide.

Hendrik Delpont; Michiel Mulier; Frederik Gelaude; Tim Clijmans

17:20 - 17:30

Panel discussion

Adjournment

Functional Outcome of the Birmingham Hip Resurfacing: 300 Patients With a 2 to 7 Year Follow-Up in a Non-Designer Centre

Erwin Jansegers

16:00 - 16:10

Panel discussion

16:10 - 16:30

Coffee break/Posters/Exhibitors

16:30 - 17:30

Session B15: MIS Techniques in TKA

Moderator: John Hollingdale

Surgical Experience and Results of 1350 Consecutive Mini- Subvastus Knee Arthroplasties

Nilen Shah

Usefulness of New Distal Femoral Cutting Guide for MIS-TKA

Sadafumi Ichinohe; Yoichi Kamei; Seiji Tokunaga; Makoto Suzuki

Combined Anterior Cruciate Ligament Reconstruction and Unicompartamental Knee Arthroplasty

Clara Terzaghi; Alberto Ventura; Enrico Borgo; Walter Albisetti; Giuseppe Mineo

Effect of Arthritis in the Other Compartments on the Outcome After Unicompartamental Arthroplasty (Makoplasty)

Ali Mofidi; Gary Poehling; Jason Lang; Riyaz Jinnah Subvastus Approach, the Only True Mis Approach in Total Knee

Ibrahim Gado; Samih Tarabichi

Prospective Comparison of Total Hip Arthroplasty Performed Using Conventional and Tissue-Preserving Techniques: A Minimum 2-Year Outcome Study

Simon Steppacher; Moritz Tannast; Stephen Murphy

Fatigue and Wear Evaluation of Partial Femoral and Tibial Unicompartamental Cartilage Replacement Knee Components

Hani Haider; Joel Weisenburger; Scott Sherman; Josh Karnes;

17:30 - 17:40

Panel discussion

Adjournment



Programme detailed

Saturday, October 9, 2010

Session - A

7:45 - 8:15

Invited talk: Bespoke Knees: The Value of CAS
Arun Mullaji

8:15 - 9:00

Session A17: Knee Mechanics
Moderator: Arun Mullaji

Calculation of the Forces Acting on the Knee Joint During Ascent From Kneeling

Shunji Hirokawa; Tsutomu Motooka; Takayuki Akiyama; Ryo Morizono; Riki Tanaka; Masaaki Mawatari; Etsuo Horikawa; Takao Hotokebuchi

A Sliding Stem in Revision Total Knee Arthroplasty Provides Stability and Reduces Stress Shielding; a RSA Study Using Impaction Bone Grafting in Synthetic Femora
Huub Meijerink; Corne van Loon; Maarten De Waal Malefijt; Albert van Kampen; Nico Verdonschot

In Vivo Kinematics of Mobile-Bearing Total Knee Arthroplasty Including Polyethylene Insert During Stairs Up and Down

Kunihiko Kawashima; Tetsuya Tomita; Takaharu Yamazaki; Kazuma Futai; Norimasa Shimizu; Masashi Tamaki; Masahiro Kurita; Yasuo Kunugiza; Kazuomi Sugamoto

Kinematic Analysis of Mobile-Bearing Total Knee Arthroplasty Using Image Matching Technique

Katsumasa Tei; Nao Shibanuma; Seiji Kubo; Tomoyuki Matsumoto; Akio Matsumoto; Hiroomi Tateishi; Masahiro Kurosaka; Ryosuke Kuroda

A Large Scale Finite Element Study of an Osseointegrated Cementless Tibial Tray

Francis Galloway; Heiko Seim; Max Kahnt; Prasanth Nair; Peter Worsley; Mark Taylor

In Vivo Tibiofemoral Joint Contact Forces During High Flexion Activities

Stacey Acker; Ines Kutzner; Georg Bergmann; Kevin Deluzio; Urs Wyss

9:00 - 9:10

Panel discussion

9:10 - 9:50

Session A18: Complication Management
Moderator: Andrea Baldini

Session - B

7:45 - 8:50

Session B16: Performance and Survivorship in Arthroplasty
Moderator: Philip Noble

Intra-Operative Gap Measurement and Component Type Selection in Total Knee Arthroplasty, Cruciate Retaining or Posterior Substitute. Ryutaku Kaneyama; Hideaki Shiratsuchi; Kazuhiro Oinuma; Tomonori Nagamine; Yoko Miura; Tatsuya Tamaki; Gun Sha; Takanori Akada

Japanese Success of Deep Knee Flexion in Total Knee Arthroplasty.

Koichi Kanekasu

Outcome Studies in Hip and Knee Arthroplasty: A 14-Year Experience With the OrthoWave Software Suite

Jean-Alain Epinette

10-17 Years Survivorship of CAD-CAM Primary and Revision Hip Stems

Jia Hua; Sarah Muirhead-Allwood; Amir Sandiford; John Skinner; Peter Walker

Morphologic Evaluation of Femoral Condyles With CT Based Three-Dimensional Digital Templating Software.

- Relationship Between the Epicondyle and the Articular Surface in Flexed and Extended Position- Masashi Hirakawa; Makoto Kondo; Kazuhide Tomari; Miyuki Sato; Takashi Itokawa; Nobuhiro Kaku; Shinichi Ikeda; Katsutoshi Hara; Hiroshi Tsumura

In Vivo Kinematics of Rotating Platform Mobile-Bearing Total Knee Arthroplasty

Masahiro Kurita; Tetsuya Tomita; Masakazu Fujii; Takaharu Yamazaki; Yasuo Kunugiza; Kazuma Futai; Kunihiko Kawashima; Norimasa Shimizu; Kazuomi Sugamoto

The Demographic Influence on Oxford Knee Scoring: Fact or Fiction?

Bassel El-Osta; Ali Ghaz; Mark Andrews

Patterns of Osseointegration and Remodeling in Femoral Revision With Bone Loss Using a Modular, Fluted, Tapered Titanium Stem Ajit Deshmukh; Jose Rodriguez; Wolfgang Klauser; Vijay Rasquinha; Philip Lubinus; Chitranjan Ranawat; Ramun Thakur

8:50 - 9:00

Panel discussion



Ceramic Strategy for Cup Revisions: Minimum 3 Years Follow-Up With Alumina Matrix Composite Ball Heads and Sleeves

Jean Yves Lazennec; Patrick Boyer; Alexandre Ducat; Alfonso RANGEL; Vicente Gozalbes; Yves CATONNE

Dual Mobility Acetabular Implants-a Solution for Dislocating Total Hip Prosthesis: Our Early Results
Sabyasachi Ghosh; Bhavik Shah; Hardik Bhansali

Recurrence of Infection After a Two Stage Revision Protocol: Analysis of Risk Factors.
Edoardo Crainz

Catastrophic Rupture of a CLS Spotorno Acetabular Expansion Cup in a Metal-Polyethylene Total Hip Arthroplasty: A Case Report.
Pranit Chotai; Won Yong Shon; Sung Bum Han; Yong Cheol Yoon; Young Hwan Park; Vinaykumar M Siddaraju

Isolated Lateral Ligament Laxity in Primary Total Knee Arthroplasty: Cohort Study of Stemmed Versus Unstemmed Implants
OhSoo Kwon; Atul Kamath; Pramod Voleti; Jonathan Garino

An Efficient Algorithm for Minimizing Perioperative Blood Loss During Minimally Invasive Total Knee Arthroplasty Utilizing Erythropoietin, Epinepherine, a Bipolar Sealer, and a Reinfusion Drain
Fred Cushner

9:50 - 10:00

Panel discussion

10:00 - 10:20

Coffee break/Posters/Exhibitors

10:20 - 11:05

Session A19: Miscellaneous Arthroplasty
Moderator: Shinro Takai

Short Term Results of Mobile Bearing Total Ankle Arthroplasty
Masahiro Tada; Tadashi Okano; Yuko Sugioka; Shigeyuki Wakitani; Hiroaki Nakamura; Tatsuya Koike

Percutaneous Axial Lumbar Interbody Fusion (AxiaLIF): Technical and Clinical Topics of a New Minimally Invasive Lower Spine Fusion Way.
Lorenzo Marzona; Alberto Sancin

Medium Term Results of Total Elbow Replacement; Distrc General Hospital Experience Sherif Elnikety

9:00 - 9:30

Session B17: Novel techniques in Arthroplasty
Moderator: Joseph Fetto

Use of Cemented Metaphyseal Sleeves in Revision TKR With AORI Type 2 and 3 Bone Loss
Prashant Deshmane; Ajit Deshmukh; Kelly Stets; Mathew Hepinstall; Amar Ranawat; Jose Rodriguez; Raman Thakur

Acetabular Reconstruction in Severe Bone Defects Using a New Cup With Iliac Screw: Presentation and Preliminary Results
Giovanni Pignatti; Dante Dallari; Nicola Rani; Cesare Stagni;

Nicolandrea Del Piccolo; Armando Giunti
Parva :A Novel Short Hip Stem
Marco Schiraldi; Carlo Dottino

9:30 - 9:40

Panel discussion

9:40 - 10:10

Invited talk: Robotics and Navigation in Orthopaedic Surgery
Riyaz Jinnah

10:10 - 10:30

Coffee break/Posters/Exhibitors

10:30 - 11:05

Session B18: Pot Pourri!
Moderator: AssemTantawy

Controlled Release of Antibiotics From Beta-TCP Mixed in HA in IBBC as Prevention of Infection in Joint Replacement
Shigekazu Mizokawa; Tomonori Arita; Akira Tachibana; Toshizumi Tanabe; Hironobu Oonishi

A Minimally Invasive Interpretation of the Smith-Petersen Approach: The Anterior Lateral Decubitus Intermuscular (ALDI) Approach.
Serafino Carta; Mattia Fortina; Paolo Ferrata

Bisphosphonate-Associated Subtrochanteric Stress Fractures: An Emerging Epidemic
William Ward; Christina J. Carter

Collomis Stem: A New Short Stem With Meta-Epiphyseal Cancellous Bone Compaction. Evaluation of First 350 Cases.
Rinaldi Giampaolo



Massive Endoprosthetic Replacement for Forearm Tumours: Our Experience at Stanmore

Azal Jalgaonkar; Anita Mohan; Derek Park; Sebastian Dawson- Bowling; Will Aston; Steve Cannon; John Skinner; Tim Briggs

Magnetic Resonance Imaging in the Assessment of Total Ankle Arthroplasty

M Reza Rahim; J. Choi; P. Brydon

11:05 - 11:15

Panel discussion

11:15 - 11:40

Session A20: Knee Arthritis: Early Intervention

Moderator: Harish Parmar

Autologous Chondrocyte Implantation Does Not Prevent the Need for Arthroplasty in Patients With Pre-Existing Osteoarthritis

Baljinder Dhinsa; Zuhair Nawaz; Kieran Gallagher; Richard Carrington; John Skinner; Tim Briggs; George Bentley

TruFit Resorbable Scaffolds: 2 Yr Clinical Good Results Associated to Delayed Biological Incorporation in the Knee

Fabio Valerio Sciarretta

New Nanostructured Biomimetic Scaffold for the Treatment of Osteochondral Defects: Pilot Clinical Study at 3 Years Follow-Up

Silvio Patella; Elizaveta Kon; Giuseppe Filardo; Alessandro Di Martino; Luca D'Orazio; Berardo Di Matteo; Stefano Zaffagnini; Maurilio Marcacci

11:40 - 11:50

Panel discussion

11:50 - 13:20

Novartis Presentation Lunch "Advanced Therapy across the Spectrum of Patients with Osteoporosis" Prof. David M. Reid

Luncheon tickets available at the Novartis session.

13:20 - 13:50

Invited talk: The Unique Features of the Asian Knee Sam Tarabichi

13:50 - 14:30

Session A21: Knee Arthroplasty

Moderator: Robin Strachan

Patellar Tracking Utilizing Two Different Implant Designs for Total Knee Arthroplasty

Raman Thakur; Jose Rodriguez

Different Techniques of Acetabular Reconstruction

Ashraf Elwakeel

A Randomized Prospective Study Comparing the Quality of Surgical Fields Resulting From Automatically Determined Tourniquet Cuff Pressure Versus Surgeon Chosen Tourniquet Cuff Pressure

Mojieb Manzary; Alastair Younger

11:05 - 11:15

Panel discussion

11:15 - 11:50

Session B19: Hip Mechanics

Moderator: David Sochart

The Effect on Radiographic Osseointegration of Geometric Variations in Acetabular Component Design

James Waddell; Max Edwards; Michael Lutz; Oliver Keast-Butler; Benjamin Escott; Emil Schemitsch; Vassilios Nikolaou

Comparison of Abductor Muscle Power and Pain Recovery Between 2-Incision and Mini-Watson Jones Approach

Kazuo Hirakawa; Koji Tsuji

Rotational Acetabular Osteotomy With Femoral Osteotomy in Incongruent Hip - Midterm Result -

Yoon Je Cho; Sang Joon Kwak; Young Soo Chun; Kee Hyung Rhyu; Se Min Lee; Myung Chul Yoo

Management of Severe CDH With THA and Derotating/shortening Osteotomy: Our 20 Years Experience Results

Gianluca Cusma' Guatteri

Multicenter Longitudinal Densitometric Clinical Study on Periprosthetic Osteointegration and Bone Remodelling of Trabecular Titanium

Leo Massari; Alessandro Bistolfi; Pier Paolo Grillo; Araldo Causero; Silvia Burelli; Gaetano Gigliofiorito; Piera Menosso; Giulia Carli; Hans Rudolf Bloch

11:50 - 12:00

Panel discussion

12:00 - 13:30

Boehringer Ingelheim Presentation Lunch Primary Prevention of VTE , Experience with Dabigatran Etexilate Dr Ali Chamseddine

Luncheon tickets available at the Boehringer Ingelheim session

13:30 - 14:20

Session B20: Hip Arthroplasty

Moderator: Wolfgang Klausner



Extramedullary Femoral Reference Without Navigation for Total Knee Arthroplasty. a Multicenter Randomized Clinical Trial

Andrea Baldini; Ettore Sabetta; Vincenzo Madonna; Claudio Zorzi; Paolo Adravanti; Luca Manfredini

Patellar Fracture in TKR With Patellar Resurfacing: The Role of Lateral Facet Prashant Deshmane; Norberto Baez; Vijay Rasquinha; Amar Ranawat; Jose Rodriguez; Raman Thakur

Newer Femoral Component Designs in TKA: Effects on the Conformity of the Patello-Femoral Joint. Pierfrancesco Indelli; Andrea Baldini; Marcucci Massimiliano; Cariello Donatina

Balanced Gap Technology - Tibia and Extension First Harald Dinges; Khalaf Moussa

Functional Relevance of Patellofemoral Thickness Before and After Unicompartmental Patellofemoral Replacement. Ali Mofidi; S Badaja; Mark Holt; Andrew Davies

The Effect of Tourniquet in Total Knee Arthroplasty-a Randomized Controlled Trial Ta-Wei Tai; Chyun-Yu Yang; Chii-Jeng Lin; Kuo-an Lai

14:30 - 14:40

Panel discussion

14:40 - 15:10

Session A22: Tribology and Biomechanics in Arthroplasty Moderator: Philip Noble

Mobile-Bearing Total Knee Arthroplasty for Knee Osteoarthritis Complicated With Permanent Patellar Subluxation

Risa Utsunomiya; Shunji Nakano; Masaru Nakamura; Takashi Chikawa; Tateaki Shimakawa; Akira Minato

In Vitro and in Vivo Analysis of Squeaking Frequencies in Ceramic-on-Ceramic Total Hip Arthroplasty Sari-Ali El-Hadi; Todd Stewart; zonghmin jin; John Fisher

Acoustic Analysis of the Impact Sound in the Press-Fit Implantation of Cementless Acetabular Components Tatsuya Tamaki

Lab-in-a-Knee: Simultaneous Measurement of in Vivo Forces and Kinematics Darryl D'Lima; Clifford Colwell Jr.; Nikolai Steklov; Shantanu Patil

Mid-Term Results of a Cementless Dual Mobility Socket in Primary THA: Concerns With the 3rd Articulation Moussa Hamadouche; Bertrand Bouxin; Herve Arnould

A Hip Replacement Programme in Burkina Faso: Review of 104 Cases Lieven Dossche; Jan Noyez; Wim Bruyneel; Windemi Ouedraogo

Two-Stage Arthroplasty Using Functional Temporary Prosthesis to Treat Infected Arthroplasty and Septic Arthritis of the Hip Ibrahim El-Ganzoury; Ahmed Salem;

A Prospective Randomized Controlled Trial Comparing Three Alternative Bearing Surfaces in Primary Total Hip Arthroplasty James Waddell; Vasileios Nikolaou; Max Edwards; Earl Bogoch; Emil Schemitsch

Fifteen Year Results of Hybrid THA Using a Precoated Femoral Stem: A Single Center Experience. Won Yong Shon; Pranit Chotai; Vinay Kumar Siddaraju

The Squeakiest Hip of All !! Sabyasachi Ghosh; Bhavik Shah

14:20 - 14:30

Panel discussion

14:30 - 15:00

Invited talk: New Concepts in Revision TKA Andrea Baldini

15:00 - 15:30

Session B21: Innovation in Hip Arthroplasty Moderator: Scott Banks

Minimal Invasive (MIS) Posterior Approach in Short Stem Total Hip Arthroplasty-Short Term Results Khalaf Moussa

Short Stems: Thinking in Three Dimensions Joseph Fetto

Accuracy of Femoral Component Alignment Using Specimen Matched Cutting Blocks: An in Vitro Study. Carsten Tibesku; David Mehl; Pius Wong; Bernardo Innocenti; Luc Labey; Abraham Salehi

A Comparative Analysis Between the Surgical and Minimally Invasive Anterior Approach to the Direct Lateral in Total Hip Arthroplasty Stanislao Lado; Francesco Maggi



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Hydroxyapatite Block for Reconstruction of Severe Dysplasia or **Acetabular Bone Defects in Total Hip Arthroplasty- Operative Technique and Clinical Outcome**

Masaaki Maruyama; Keiji Tensho; Shinji Wakabayashi; Kazumi Kitagawa

15:20 – 15:40

TKA in Paralytic Knee- M. Elsebaie

15:40 - 16:00

Coffee break/Posters/Exhibitors

16:00 - 16:50

Session A23: Knee Mechanics
Moderator: Dr. Althani

Progress in Developing a More Clinically Relevant Lubricant for in-Vitro Wear Testing of Total Knee Replacements

Jan-M. Brandt; Kory Charron; Lin Zhao; Steven MacDonald; John Medley

Influence of Patellar Height on Soft Tissue Balance in Total Knee Arthroplasty

Seiji Kubo; Hiroshi Sasaki; Tomoyuki Matsumoto; Hirotsugu Muratsu; Kazunari Ishida; Koji Takayama; Shinya Oka; Katsumasa Tei; Ken Sasaki; Ryosuke Kuroda

Does High-Flexion Total Knee Arthroplasty Promote Early Loosening of the Femoral Component?

Jorrit Zelle; Maarten De Waal Malefijt; Nico Verdonschot

Posterior Condyle Surface Damage on Retrieved Femoral Knee Components

Colin Burnell; Jan-M. Brandt; Martin Petrak; Robert Bourne

The Effect of Greater External Rotation of the Femoral Component as a Result of Gap Ligament Balancing on Patellar Tracking and Flexion Instability in Total Knee Arthroplasty Gary Rasmussen

16:50 - 17:00

Panel discussion

17:00 - 17:10

Closing remarks and end of conference.

15:30 - 15:40

Panel discussion

15:40 - 16:00

Coffee break/Posters/Exhibitors

16:00 - 16:50

Session B22: Arthroplasty- Getting it Right!
Moderator: Rashid Al Shaeel

Total Joint Replacement (De La Caffinire) in Steoarthritits of Trapeziometacarpal Joint Technique and Results
Khalaf Moussa

Prosthetic Reconstruction of the Extremities in Musculoskeletal Oncology: The Experience of the Istituto Rizzoli.

Pietro Ruggieri; Elisa Pala; Mario Mercuri

Survival of the Implants in Primary and Secondary Reconstructions With GMRSÂ® Modular Prostheses for the Lower Limb: Complications, Functional Results and a Comparative Statistical Analysis.

Pietro Ruggieri; Elisa Pala; Andrea Angelini

Accuracy of Cup Center Position, Leg Length, and Offset in Image- Free Hip Navigation System

Fumiaki Inori; Hirotsugu Ohashi; Hirotake You; Yoshiaki Okajima; Kenji Fukunaga; Hideyuki Tashima

Blood Loss and Transfusion Rates With MIS Total Knee Replacement Surgery in a Community Hospital Setting Utilizing Sympony Platelet Gel

Jeffrey F Traina

Nucleoplasty an Innovative Minimally Invasive Methode for Treatment of Lumbar Radicular Pain

Samir Shnayien

An Update of Non-Invasive Extendable Endoprotheses in Paediatric Tumour Surgery - Dual Centre Study.

Kishan Gokaraju; Jonathan Miles; Gordon Blunn; Paul Unwin; Robin Pollock; John Skinner; Roger Tillman; Lee Jeys; Adesegun Abudi; Tim Briggs

16:50 - 17:00

Panel discussion

17:00 - 17:10

Closing remarks and end of conference.



Posters

- 1. Pyoderma Gangrenosum in Revision Total Hip Arthroplasty: Clinical and Histopathological Findings.**
Ariella Zbar; James Mathers; Douglas Sawyer;
- 2. Comparison of Different Modalities of Post Operative Analgesia in Unilateral Total Knee Replacement Patients**
Mohammad Ashik
- 3. Testing High Performance After Knee Arthroplasty: A New Objective Functional Score**
Andrea Baldini; Luca Manfredini; Pierpaolo Ceruli Mariani; Alessandro Pisaneschi
- 4. Flexion-Extension Gaps Configuration in Revision Knee Arthroplasty**
Andrea Baldini; Lorenzo Castellani; Luca Manfredini
- 5. Avascular Necrosis of Femoral Head: Reshaping the Head With Bone Graft**
Dante Parodi; Carlos Tobar; Javier Besomi; Jaime Lopez; Luis Moya; Claudio Mella; Joaquin Lara
- 6. Worse Clinical Prognosis Factors in the Surgical Treatment of Femoroacetabular Impingement**
Dante Parodi; Javier Besomi; Luis Moya; Claudio Mella; Joaquin Lara
- 7. Long-Term RESULTS of WAGNER-TYPE CONICAL STEMS for CEMENTLESS FEMORAL REVISION**
Roberto Binazzi; Alice Bondi; Massimo De Zerbi; Francesco Perdisa
- 8. A Novel Implant Modification for Post-Operative Hip Arthroplasty Stem Anteversion Identification**
George Branovacki; Kamran Sadr; Hassan Baydoun; Michael Redondo; Dana Murphy; Luis Redondo; Sam Chmell
- 9. Intraoperative Evaluation of the Gender Knee**
Harold Cates; Brian Edkin; John Schmidt
- 10. Postural Control Features in Total Hip Replacement Patients**
Chun-Ju Chang; SaiWei Yang; Mel S Lee; Jen-Suh Chern
- 11. Exchanging Polyethylene Liner With Cement Fixation in Well-Fixed Cementless Acetabular Cup**
Yoon Je Cho; Sang Joon Kwak; Young Soo Chun; Kee Hyung Rhyu; Chul Hee Park; Myung Chul Yoo
- 12. Dilute Betadine Lavage Prior to Closure for the Prevention of Acute Postoperative Deep Periprosthetic Joint Infection**
Cara Cipriano; Mario Moric; Craig Della Valle



- 13. Dilute Betadine Lavage Prior to Closure for the Prevention of Acute Postoperative Deep Periprosthetic Joint Infection**
Nick Brown; Cara Cipriano; Craig Della Valle
- 14. A Novel Method to Determine the Lower Limb Mechanical Axis in the Coronal Plane**
Michel Collette; Nicholas Hohl
- 15. The "Sulcus Sign" as a New Clinical Marker of Flexion Instability in Total Knee Replacements**
Jose Rodriguez; Ajit Deshmukh; Prashant Deshmane
- 16. Patterns of Osseointegration and Remodeling in Femoral Revision With Bone Loss Using a Modular, Fluted, Tapered Titanium Stem**
Jose Rodriguez; Ajit Deshmukh; Wolfgang Klauser; Vijay Rasquinha; Philip Lubinus; Chitranjan Ranawat
- 17. Intra-Operative Analysis of the Kinematic Behavior of a Total Knee Replacement by a Navigation System. Initial Experience and Further Development.**
Jean-Yves Jenny; Franz-Peter Firmbach; Yann Diesinger
- 18. Accuracy of CT Based Navigation System for Acetabular Component Placement in Cementless Total Hip Arthroplasty**
Hiroshi Egawa; Natsuo Yasui
- 19. Dysplastic Hip**
Ashraf Elwakeel
- 20. Diagnosis and Prevention of Venous Thromboembolism in Our Hospital**
Taro Fujinaka; Atsushi Funayama; Yoshinari Fujita; Yoshiaki Toyama
- 21. Fondaparinux Prevents DVT, but Not PE in Total Knee Arthroplasty With MDCT Analysis.**
Kenji Fukunaga; Hiroyoshi Iwaki; Yukihide Minoda; Hirotsugu Ohashi; Fumiaki Inori; Yoshiaki Okajima; Hideyuki Tashima
- 22. Accuracy of Acetabular Cup Positioning by Using a New Acetabular Reaming Guide in Total Hip Arthroplasty**
Atsushi Funayama; Kenji Yamaguchi; Masashi Okubo; Taro Fujinaka; Hidenori Shimizu; Riichiro Ichikawa; Shigeru Yanagimoto; Yoshiaki Toyama
- 23. Total Hip Arthroplasty: The Soft Tissue Balancing.**
Olimpio Galasso; Bruno Iannace; Filippo Familiari; Daria Riccelli
- 24. Cell-Based OPG Gene Therapy Reverses Aseptic Knee Implant Loosening in a Mouse Model**
Weiming Gong; Leibo Zhang; Tanghong Jia; Shang-You Yang



25. **PRP or Steroids in Lateral Epicondylitis? RCT With Two Year Follow Up.**
Taco Gosens
26. **In Vivo Measurement of Pennation Angle of the Vastus Lateralis and Medialis Muscles in Knee Arthroplasty**
Tomohiro Goto
27. **What Is the Blood Transfusion Rate Following Revision THA With Major Acetabular Reconstruction?**
Moussa Hamadouche; Loren Bellamy; Merian Osman
28. **Preliminary Clinical Results of Patient Specific Cutting Guides for Total Knee Replacement (TKR)**
Mahmoud Havez
29. **Clinical and Laboratory Validation of a Novel Technique of Patient Specific Templating (Cutting Guides) for Total Knee Replacement**
Mahmoud Havez
30. **Pelvic Flexion / Extension and Its Impact on Functional Acetabular Alignment and Stability Following Total Hip Replacement**
Mahmoud Havez; Branislav Jaramaz
31. **Rapidly Destructive Arthropathy of the Hip (RDAH): Clinical, Radiological and Pathological Evaluation**
Mahmoud Havez; David Nag; Vicky J. Jowett; Frank R. Howell
32. **Evaluation of Mechanical and Wear Properties of Low Temperature Degradation Free Zirconia Toughened Alumina Ceramic for Artificial Joint**
Junji Ikeda; Tekefumi Nakanishi; Fumiaki Miyaji; Yoshinori Sawae; Teruo Murakami
33. **Angiolieomyoma of the knee:Case Series and an Unusual Cause of Knee Pain**
Azal Jalgaonkar; Sunil Dachepalli; Mohammed Farid; Sudhir Rao
34. **2 Years Follow Up for Coflex@ Inter-Spinous Stabilization Device. a Prospective Analysis.**
Tamer Kamal; Sherif Elnikety; Ahmed Hegazy; James Casha
35. **Does CT-Free Navigation in Total Knee Arthroplasty Improve Outcome at Short-Term Follow-Up?**
Taisei Kawamoto; Satoshi Iida; Sakae Sano; Chiho Suzuki
36. **Total Hip Arthroplasty With a Custom-Made Stem Using CT Based Navigation System**
Kenji Kawate; Ikuo Kawahara; Tomoyuki Ueha; Kazuo Takemura; Yasuhito Tanaka



37. **Fluoroscopic Analysis of Advanced Arthritic Knees: In Vivo Comparison of Three-Dimensional Kinematics Between Severe Varus and Valgus Deformity**
Atsushi Kitagawa; Kazunari Ishida; Nobuhiro Tsumura; Tetsuhiro Iguchi
38. **Mid-Term Results of Surgical Repair of Proximal Hamstring Tendon Tears**
Sujith Konan; Fares S Haddad
39. **Distally Locked Long Stem Prosthesis for the Management of Infected Peri Prosthetic Fractures of the Femur**
Sujith Konan; Faizal Rayan; Fares S Haddad
40. **Revision Hip Replacement in 55 Years of Age and Younger.**
Sujith Konan; Fares S Haddad
41. **Validation of a Prognostic Classification System for Acetabular Cartilage Lesions**
Sujith Konan; Faizal Rayan; Geert Meermans; Johan Witt; Fares S Haddad
42. **Porous Metal Surface Fragments Cause Third-Body Wear in PolyurethaneAluminium Oxide Composite Materials in Total Hip Arthroplasty**
J. Philippe Kretzer; Robert Sonntag; Joern Reinders; Eike Jakobowitz
43. **Effect of Joint Laxity on Polyethylene Wear in Total Knee Replacement**
J. Philippe Kretzer; Eike Jakobowitz; Robert Sonntag; Joern Reinders; Chistain Heisel; Marc Thomsen
44. **Development of a Constant Load Dynamic Gap Measurer for Soft Tissue Balancing in Total Knee Arthroplasty**
Dai-Soon Kwak; Yong In; Seung-Ho Han
45. **The Innovative EOS System for the Study of Total Hip Arthroplasty Patients : A Pioneering Experience in 200 Cases**
Jean Yves Lazennec; Marc Antoine ROUSSEAU; Alfonso RANGEL; Vicente GONZALBES; Samir Chabane; Yves CATONNE
46. **Double Acetabular Wall: A Misleading Point for Hip Arthroplasty**
Firooz Madadi
47. **Clinical Results of Reserved v-Shaped High Tibial Corticotomy Wuth Minimally Invasive Surgery Without Internal Fixation Devices**
Firooz Madadi
48. **Full Thickness Defects of Articular Cartilage and Experimental Surgery**
Andrea Fabio Manunta; Francesco Marras; Francesco Pisanu; Lucia Manunta



49. **Incidence of Patella Baja in TKR by Two Methods of Measurement**
Mojieb Manzary; Moh'd Itani
50. **The Influence of Pre-Operative Deformity on Intra-Operative Soft Tissue Balance in Total Knee Arthroplasty**
Tomoyuki Matsumoto; Seiji Kubo; Hirotsugu Muratsu; Kazunari Ishida; Koji Takayama; Shinya Oka; Katsumasa Tei; Takehiko Matsushita; Masahiro Kurosaka; Ryosuke Kuroda
51. **Mobile Bearing TKA Increased the Peri-Prosthetic Bone Mineral Density Around the Femoral Component**
Yukihide Minoda; Hiroyoshi Iwaki; Mitsuhiko Ikebuchi; Taku Yoshida; Fumiaki Inori; Kenji Fukunaga; Takahiro Lida; Tessyu Ikawa; Hiroaki Nakamura
52. **Femoral Head Augmentation With Metal-on-Metal Hip Resurfacing Is Effective for Severe Dysplasia**
Antonio Moroni; Martha Hoque; Giovanni Micera; Riccardo Orsini; Sandro Giannini
53. **Allergic Reaction to Bio Absorbable Screws in ACL Reconstruction , Case Report**
Ataollah Moshirabadi
54. **Change of the Femoral Offset (FO) and CCD Angle After Implantation the Short-Stem Prosthesis in Total Hip Arthroplasty**
Khalaf Moussa
55. **Patient-Specific Mechanical Navigation of Acetabular Component Orientation Based on Conventional Radiography**
William S Murphy; Simon D Steppacher; Jens H Kowal; Stephen Murphy
56. **Outcome of Ceramic-Ceramic Total Hip Arthroplasty in Patients Younger Than 50 Years**
Andrew Murphy; Simon Steppacher; Moritz Tannast; Stephen Murphy
57. **TriLobe TDR Design Promotes Intrinsic Biomechanical Stability and Physiologic Kinematics**
Bao K.N. Nguyen; Jeffery Taylor; Richard Dixon; German Loesener; David Harding; Vaneet Singh; A. Stan Despres; Bill J. Pope
58. **The Impact of Launch Strategies on the Survivorship of New Devices**
Philip Noble
59. **Anteversion Angle of THA With Navigation System Based on the Time Course of the Pelvic Inclination**
Shuhei Osaki; Kazuo Fujiwara; Hirotsuke Endo; Yoshiaki Miyake; Toshifumi Ozaki; Shigeru Mitani



60. **Influence of Impaction Forces of Ceramic Ball Heads on Proper Seating on Metal Stems for Hip Implants**
Thomas Pandorf; Roman Preuss
61. **Influence of Tilting of Ceramic Liners on Their in-Vivo Safety**
Thomas Pandorf
62. **Influence of Impacting Ceramic Inserts on Proper Seating in Acetabular Cups for Hip Implants**
Thomas Pandorf; Roman Preuss; Hendrik Bertmaring
63. **Patient Satisfaction When Completing Hip and Knee Replacement Followup Questionnaires on a Touch-Screen Kiosk in an Orthopaedic Clinic**
Martin Petrak; Ili Slobodian; Thomas Turgeon; Eric Bohm
64. **What Is the Financial Cost of Treating Periprosthetic Hip Fractures?**
Jonathan Phillips; Chris Boulton; Chris Moran; Andrew Manktelow
65. **Periprosthetic Femoral Fractures Around Hip Hemiarthroplasty After Previous Hip Fracture: Demographics, Outcomes and Mortality. a Single Centre Consecutive Series of 57 Patients**
Jonathan Phillips; Chris Boulton; Chris Moran; Andrew Manktelow
66. **The Treatment of 83 Vancouver B2 and B3 Periprosthetic Fractures Around Loose Femoral Implants: Methods and Outcomes**
Jonathan Phillips; Chris Boulton; Chris Moran; Andrew Manktelow
67. **Principles of Revision Total Knee Arthroplasty**
Ashok Rajgopal
68. **Defect Management in Total Knee Arthroplasty**
Ashok Rajgopal
69. **Stem Cells in Orthopaedic and Traumatology: Clinical Results.**
Oraldo Ricci; Massimiliano Fini
70. **Use of Total Femur Prosthesis in Bone Tumor Treatment: The Rizzoli Institute Experience**
Pietro Ruggieri; Elisa Pala; Mario Mercuri
71. **Gap Balancing vs Measured Resection Technique in Computer Assisted Surgery**
Giacomo Sabbioni; Domenico Tigani; Nicola Rani; Nicolandrea Del Piccolo
72. **In Vitro Tests in Order to Evaluate the Effect of a Femoral Stem With an Intertrochanteric Plate**
Rina Sakai; Moritoshi Itoman; Hakuhiro Maezawa; Kiyoshi Mabuchi



73. **Trafermin and Sugar Therapy for Infection and Skin Ulcer After Total Knee Arthroplasty.**
Tomotaro Sato; Atsushi Kaneko; Daihei Kida
74. **Ultra Clean Air Laminar Flow Theatre and Vascular Graft Surgery- Lessons to Be Learnt by the Orthopaedic Team**
Hemant Sharma; Nadine Jones; Dave Bosanquet; Nick Gill; Michael Lewis; Peter Lewis
75. **So Are Sutures Actually Better Than Staples in Prevention of Superficial Wound Infections After Primary Total Hip Replacement?**
Ahsan Sheeraz; Natasha Picardo; Daniel Shaerf; Sarah Muirhead-Allwood; John Skinner
76. **Modified Fulkersons Procedure, Combined With Microfracture for Patello-Femoral Arthritis in the Younger Patient**
Ahsan Sheeraz; Paul Allen
77. **Post-Operative Morbidity and Mortality Associated With Primary Total Knee and Unicompartamental Knee Arthroplasty**
Neil Sheth; Nick Brown; Mario Moric; Keith Berend; Michael Edward Berend
78. **An Algorithmic Approach to the Treatment of Osteolysis Around a Well-Fixed Acetabular Component**
Neil Sheth; Jared Foran; Wayne Paprosky
79. **In Vivo Post-Cam Kinematics of a High Flexion Posterior-Stabilized Total Knee Arthroplasty**
Norimasa Shimizu; Tetsuya Tomita; Kunihiko Kawashima; Takaharu Yamazaki; Yasuo Kunugiza; Masahiro Kurita; Kazuma Futai; Kazuomi Sugamoto
80. **The Use of Fluoroscopy in Screwless Acetabular Cup Fixation With Metal on Metal Total Hip Arthroplasty in Osteoporotic Patients**
Kei Shiramizu; Junji Maeda; Hikaru Saita
81. **Dislocation After Bipolar Hemiarthroplasty in Patients With Neuromuscular Diseases**
Kuen Tak Suh; Jeung Il Kim; Jung Sub Lee; Hyung Joon Cho; Jung Yun Bae; Hong Seok Lee; Dae Woong Kim; Won Ro Park
82. **Tranexamic Acid in Total Hip Replacements: A Meta-Analysis**
Mohamed Sukeik; Sattar Alshryda; F S Haddad; James Mason
83. **Aggressive Early Debridement Can Be Successful for Infected Total Knee Arthroplasty**
Mohamed Sukeik; Mike Dobson; Anna Bridgens; F S Haddad
84. **Comparison of the Mid-Vastus and Median Parapatellar Approaches for Primary Total Knee Arthroplasty: A Meta-Analysis**
Ilhan Alcelik; Mohamed Sukeik; Raymond Pollock; Anand Misra; Ashraf Naguib; Peter Fisser



85. **Surgical Wound Infection as a Performance Indicator in Total Knee Replacement: A Comparison Between Common Definitions**
Mohamed Sukeik; Elizabeth Ashby; Paul Sturch; F S Haddad; APR Wilson
86. **Proposed Aggressive Cleaning and Sterilization Procedure for Orthopaedic Surgical Instruments**
Gregg Schmidig; Mayur Thakore; Yanoso-Scholl, Laura
87. **An in-Vitro Evaluation of the Initial Stability of Cementless Pressfit Hip Stems Using Injectable HA Bone Substitute**
Gregg Schmidig; Mayur Thakore; Laura Yanoso-Scholl
88. **Severe Persistent Synovitis After Cobalt Chromium Total Knee Arthroplasty Requiring Revision Surgery Report of Five Patients**
Raman Thakur; Michael McGraw; Mathais Bostrum; Jose Rodriguez; Michael Parks
89. **Pre Assembled Ceramic Acetabular Liner. Prospective Study About 100 Patients at 2 Years Follow-Up.**
Jerome Tonetti; David Dagrenat; Robert Beya; Louis-Etienne Gayet; Christophe Denis; Thomas Gradel
90. **Conversion of Arthrodesis to Arthroplasty in Hip Joint**
Takuma Yagura; Hirokazu Iida; Takahiko Wada; Naofumi Okamoto; Tomohisa Nakamura
91. **Evaluation of New Developmental Navigation System for Total Knee Arthroplasty**
Yusuke Yokoyama; Nobuhiro Abe; Toshifumi Ozaki
92. **Comparison of Three Different Navigation Systems of Accuracy in Revision Total Hip Arthroplasty**
Taku Yoshida; Hiroyoshi Iwaki; Mitsuhiko Ikebuchi; Yukihide Minoda; Takahiro Lida; Tessyu Ikawa; Hiroaki Nakamura



ISTA 2010



24th ANNUAL CONGRESS

20-23 September, 2011

Theme:
*Bridging the gap between innovation
and evidence-based practice in Arthroplasty*

Location:
*Concert Building, Bruges (Brugge),
Belgium, Europe*

Important deadlines:

Submission of abstracts: **May 15th, 2011**
Submission of full papers for the awards: **May 15th, 2011**
Notification of acceptance of the abstract for the program: **June 15th, 2011**
Discounted early registration: **July 15th, 2011**



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Decision of the Femoral Component Rotation in TKA With Image-Free Navigation System

*Nobuhiro Abe - Okayama University Hospital - Okayama, Japan
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(Purpose)

The complication of patellofemoral compartment was quite often in total knee arthroplasty. One of the important factors in these complications would be the femoral component rotation in TKA. To determine the rotation of the femoral component, the reference of the surgical epicondylar axis (SEA), posterior condylar axis (PCA), AP axis with three dimensional model achieved from computed tomography data were considered. There are some limitations with pre-operative CT-based planning such as radio exposure, cost, time and detection of the depth of cartilage. We evaluate the determination of the femoral component rotation with image-free registration method to compare with three-dimensional template system.

(Material and Methods)

Thirty six knees were evaluated to determine the femoral component rotation. The reference points were marked to measure the PCA (posterior condylar axis), SEA (surgical transepicondylar axis), and APA (anteroposterior axis, Whiteside line) intra-operatively and calculated the angle from PCA to SEA and PCA to APA with Image free navigation system (BrainLAB). Those knees were preoperatively evaluated the angle deviation from SEA to PCA with three dimensional template system. These angle deviations, which suggested the femoral component rotation obtained from preoperative template system, were statistically compared with the femoral rotation angle in clinical situation.

(Results)

The mean angle from PCA to SEA was external rotated 2.7 degrees (SD=1.8 degrees) with the template system. During image-free system in TKA, the mean angle from PCA to SEA was external rotated 2.2 degrees (SD=4.5 degrees), and the mean angle from APA to SEA was 0.5 degrees (SD=4.4 degrees).

(Discussion)

The preoperative 3 dimensional template system showed the small ranges and standard deviations in PCA and SEA even when the residual cartilage of the surface at the femur was not considered to evaluate. Meanwhile, the three reference axes obtained from image free navigation system showed the large amount of deviations and thus the variability in these references was difficult to decide the rotation of the femoral component. Now navigation system provided the appropriate gap balance during knee motion. This gap-navigation technique would be one of the keys to obtain the proper rotation of the component.

In Vivo Tibiofemoral Joint Contact Forces During High Flexion Activities

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Accurate in vivo knee joint contact forces are required for joint simulator protocols and finite element models during the development and testing of total knee replacements (Varadarajan et al., 2008.) More accurate knowledge of knee joint contact forces during high flexion activities may lead to safer high flexion implant designs, better understanding of wear mechanisms, and prevention of complications such as aseptic loosening (Komistek et al., 2005.) High flexion is essential for lifestyle and cultural activities in the developing world, as well as in Western cultures, including ground-level tasks and chores, prayer, leisure, and toileting (Hemmerich et al., 2006.) In vivo tibial loads have been reported while kneeling; but only while the subject was at rest in the kneeling position (Zhao et al., 2007), meaning that the loads were submaximal due to muscle relaxation and thigh-calf contact support. The objective of this study was to report the in vivo loads experienced during high flexion activities and to determine how closely the measured axial joint contact forces can be estimated using a simple, non-invasive model. It provides unique data to better interpret non-invasively determined joint-contact forces, as well as directly measured tiobiofemoral joint contact force data for two subjects.

Two subjects with instrumented tibial implants performed kneeling and deep knee bend activities. Two sets of trials were carried out for each activity. During the first set, an electromagnetic tracking system and two force plates were used to record lower limb kinematics and ground reaction forces under the foot and under the knee when it was on the ground. In the second set, three-dimensional joint contact forces were directly measured in vivo via instrumented tibial implants (Heinlein et al., 2007.) The measured axial joint contact forces were compared to estimates from a non-invasive joint contact force model (Smith et al., 2008.)

The maximum mean axial forces measured during the deep knee bend were 24.2 N/kg at 78.2° flexion (subject A) and 31.1 N/kg at 63.5° flexion (subject B) during the deep knee bend (Figure 1.) During the kneeling activity, the maximum mean axial force measured was 29.8 N/kg at 86.8° flexion (subject B.) While the general shapes of the model-estimated curves were similar to the directly measured curves, the axial joint contact force model underestimated the measured contact forces by 7.0 N/kg on average (Figure 2.) The most likely contributor to this underestimation is the lack of co-contraction in the model.

The study protocol was limited in that data could not be simultaneously collected due to electromagnetic interference between the motion tracking system and the inductively powered instrumented tibial component. Because skin-mounted markers were used, kinematics may be affected by skin motion artefacts. Despite these limitations, this study presents valuable information that will advance the development of high flexion total knee replacements. The

study provides in vivo measurements and non-invasive estimates of joint contact forces during high flexion activities that can be used for joint simulator protocols and finite element modeling.

Figures

[Figure 1](#) [Figure 2](#)

Friday, October 8, 2010, 13:30-14:10

Session B12: Shoulder Arthroplasty

Surface-Contour Based Algorithm for Quantifying Glenohumeral Ligament Length Changes During Function

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Introduction: Advanced medical imaging techniques have allowed the understanding of the patterns of relative bone motions at human joints¹. However, poor imaging contrasts of soft tissues have not allowed the full understanding of various glenohumeral ligaments (GHL) functions during glenohumeral joint (GHJ) manoeuvres. This is presently a significant limitation to research as these structures are said to be responsible for the passive stability of the GHJ². Furthermore, the repairs of GHJ instability often take recourse to these structures³. Earlier studies have presented a model that numerically reconstructs or simulates GHJ motions⁴ and how the locus of bony attachment points of the GHLs on a dynamic GHJ could be numerically tagged and trailed⁵. The aim of this study was to advance these previous findings by developing an algorithm that allows the quantification of GHL lengths at any instantaneous position of the GHJ.

Materials and Method: CT scan of a set of humerus and scapula was reconstructed into two individual surface meshes of interconnected nodes, each node having a unique vectorial identification in space. The two attachment nodes (**a** and **b**) of a GHL were identified on the bones⁵. Least squares geometric sphere was fitted upon the humeral head (HH) and its centre (**c**) and radius (r) quantified⁶. Vectors **a**, **b** and **c** were applied to represent the 'dominant ligament plane' concomitant with the 2D 'dominant plane' of Runciman (1993)⁷. This plane defined the path through which the ligament wrapped on the HH. The point of initial or end of contact of GHL on the HH was defined as the point on HH where a line from **c** intercepts the ligament at 90°. Total GHL length was calculated as the sum of its three segments, namely: (1) Proximal segment – a straight line from its glenoid attachment node to the point of initial contact (2) Wrap segment – an arc of (r) radius of curvature from initial to end contact points (3) Distal segment – a straight line from end contact point to the humeral node of attachment. The wrap segment was further refined by adjusting ligament contacts along this path to the actual surface contour of the HH by integrating all the surface nodes along the path. The

algorithm was tested for short incremental steps of GHJ abduction, flexion, rotation and translations on the Amadi et al's kinematics simulation model⁴.

Results: From plotted graphs of 5 simulated GHL, lengths increased or decreased smoothly as the rotations and translations were increased or decreased at a constant rate, respectively. Some GHJ motion directions resulted in contrasting stretching or folding effects on different ligaments in a mathematically reasonable manner.

Conclusion: This numerical application would allow the quantification of functional loading of each GHL during simulated or reconstructed GHJ motion and hence provide understanding of how the various GHL may be treated during surgical repairs.

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Friday, October 8, 2010, 10:20-11:00

Session A12: Materials

The Hydroxyapatite Containing Silver Inhibits the Biofilm Formation in a Flow Condition

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Bacterial infection related to prosthetic replacement is one of the serious types of complications. Recently, there has been a greater interest in antibacterial biomaterials. In order

to reduce the incidence of replacement-associated infections, we developed a novel coating technology of Hydroxyapatite (HA) containing silver (Ag). We reported the Ag-HA coating showed high antibacterial activity against *E. coli*, *S. aureus* and methicillin-resistant *S. aureus* (MRSA) under static condition. However, human bodies have a circulating body fluid, which is not a static condition. And the growth and the maturation of biofilm, which is said that a common course of persistent infections at a surgical site, are enhanced by the flow of broth in culture environment. Therefore, we evaluated whether the Ag-HA coating inhibits the biofilm formation on its surface or not by a biofilm-forming test under flow condition in this study.

Ag-HA or HA powder was sprayed onto the commercial pure titanium disks using a flame spraying system. The HA coating disks were used as negative control. The biofilm-forming methicillin sensitive *S. aureus* (BF-MSSA; Seattle 1945) strain and the BF-MRSA (UOEH6) strain were used. The pre-culture bacterial suspension (about 10^5 colony forming units; CFU) was inoculated onto the Ag-HA and HA coating disks. After cultivation at 37 °C for 1 h, the disks were rinsed twice with 500 µL sterile PBS (-) to eliminate the non-adherent bacteria. The number of the adherent bacteria on these disks was counted using culture method. After rinsing, the disks were transferred into petri-dish containing Trypto-Soy Broth (TSB) + 0.25% glucose with a stirring bar on the magnetic stirrer and they were cultured at 37°C for 7 days. In the meantime, the stirring bar was spun at 60 rounds per minute. Then, the disks were immersed in a fluorescent reagent to stain the biofilm. Finally, the biofilm on each disk was observed by a fluorescence microscope and the biofilm-covered rate on the surfaces of them was calculated using the NIH image software.

The number of the bacteria on these disks was not so different between Ag-HA and HA coating after rinsing. After biofilm-forming test, the coverage of the biofilm of BF-MSSA was 2.1% and 81.0% on the Ag-HA and HA coatings, respectively. Similarly, in the case of BF-MRSA, it was 7.7% and 72.0% on the Ag-HA and HA coatings, respectively. Though bacteria slightly adhered, biofilm was hardly observed on the Ag-HA coating. The biofilm on the HA coating was extensive and mature. The inhibition effect of biofilm formation on the Ag-HA coating might be ascribed to the antibacterial effect by Ag ions released from the coating. Because Ag ions have a broad spectrum of antibacterial activity against pathogens, including biofilm forming bacteria, they inhibited the biofilm formation on the Ag-HA coating by killing adherent bacteria. Even in a flow condition, it was suggested that the AgHA shows the antibacterial activity, though the conditions in this work are different from those in living body.

Thursday, October 7, 2010, 16:30-17:20

Session A8: Periprosthetic Fractures in THA

Metal on Metal Total Hip Arthroplasty After Fracture of the Acetabulum

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Fracture of the acetabulum can lead to degenerative arthritis of the hip, avascular necrosis of the femoral head, or both. Total hip arthroplasty is a common form of surgical treatment when significant joint changes and pain are present.

Ten patients with fracture acetabulum were treated in this study using metal on metal total hip arthroplasty. The initial fracture was posterior wall fracture in one patient, posterior column fracture in one patient, transverse fracture in 2 patients, fracture dislocation in 3 patients and fracture posterior wall and column in 3 patients. The indications of arthroplasty were secondary osteoarthritis after internal fixation or after conservative management or collapse of the femoral head. Arthroplasty was done after an average period of 1.8 years (range from 1 to 4 years).

After a follow up period ranged from 3 to 7 years with a mean of 4.6 years, the Harris hip score was improved from a mean of 51 (range 20 to 65) to a mean of 92.5 (range 90 to 95). Infection occurred in one case and two stages revision was done. Another case developed loosening of the acetabular component and was revised using cementless cup fixed with screws and bone graft.

Metal on metal THR after acetabular fracture are relatively uncomplicated and lead to a good outcome despite the difficulties faced during the procedure.

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Outcome of Revision Total Hip Arthroplasty Using the Echelon Revision Stem

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To review prospectively collected data on patients undergoing femoral revision arthroplasty for failed cemented or cementless primary stems.

Materials & Methods:

All patients undergoing primary and revision joint replacement surgery at our institution are prospectively entered into a database which includes history and physical examination, radiology, WOMAC and SF-36 scores. These investigations are repeated 3 months, 6 months, 1 year and yearly thereafter at each patient visit.

This database identified all patients undergoing femoral revision arthroplasty over the last 10 years.

Results:

There were a total of 231 patients with 248 revision procedures performed. There were 127 female and 104 male patients and the mean age at the time of revision surgery was 69.4 years. Twenty-two of these patients had had at least one prior revision operation on the index hip. Thirty hips were treated with a cemented Echelon stem and 218 treated with a cementless Echelon stem. Of the 248 hips 14 patients were lost to follow-up (14 hips) and 9 patients (9 hips) are deceased. The average follow-up was 5.9 years.

Of the 225 hips remaining in the follow-up series there was a single case of aseptic loosening confirmed radiologically. Twenty-one hips were diagnosed with infection (9.3%); 6 of those patients had had at least one prior revision procedure and 4 additional patients had a prior diagnosis of infection. Therefore, 10 of the 21 hips were either definitely or probably infected at the time of their revision operation on which we are reporting. Nine patients (4%) had multiple dislocations post-operatively. These were patients who had undergone multiple revisions or whose primary revision operation was for instability. An additional 18 patients (8%) had a single dislocation treated by closed reduction requiring no further treatment.

There were 6 hips with intra-operative fracture requiring immediate re-revision plus fracture fixation and a further 12 hips (5.3%) who sustained a peri-prosthetic fracture some time after their revision procedure.

Despite the number of complications the majority of patients required no further surgical treatment. Eleven hips (4.8%) required re-revision of the femoral component. Therefore the overall survival rate at 5.9 years of the Echelon revision stem was 95.2%.

Discussion:

Femoral revision total hip arthroplasty is a difficult operation with uncertain outcome. All series recognize a significant complication rate primarily as a consequence of infection, instability or intra-operative or peri-operative fractures secondary to poor bone quality.

Our experience with the Echelon revision stem demonstrates excellent incorporation of the implant with a negligible rate of re-revision for failure of bone ingrowth; the other complications are consistent with those reported in other series.

Conclusions:

Although the complication rate in this group of patients is high only 4.8% of the hips required re-revision of the femoral component. Of significance was the lack of re-revision necessitated by aseptic loosening of this revision stem

Newer Femoral Component Designs in TKA: Effects on the Conformity of the Patello-Femoral Joint.

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Newer Femoral Component Designs in TKA: Effects on the Conformity of the Patello-Femoral Joint.

Different femoral designs in TKA have shown multiple effects on the conformity of the patello-femoral joint. Historically, this anatomical relationship may interfere with clinical results. The objective of this study was to compare the reproducibility of a correct patello-femoral conformity in patients underwent TKA utilizing modern femoral implants.

MATERIALS AND METHODS: We performed 50 consecutives TKA in fifty patients affected by knee arthritis utilizing the PFC Sigma System (De Puy, Warsaw, USA) with a new femoral design, having a prolonged anterior flange and a “smoother” throclea. The surgical procedure was performed utilizing the Sigma HP instrumentation to allow 3 degrees of external rotation of the femoral component and the “balanced gaps technique” was chosen. All patellae were replaced. All patients were evaluated preoperatively and at six months follow-up both clinically with the Knee society Score as well as radiografically: standing 30x90 cm. view, Merchant view, standard lateral view and a CT-scan with two millimeters cuts (Berger Protocol) at 20 degrees of flexion were all done. Particular attention was paid to the following CT measurements: patellar tilt, patellar conformity angle, patellar lateralization, femoral component external-rotation in relation to the patellar sitting. Statistical analysis was performed utilizing the t-test e the Wilcoxon test ($p < .05$).

RESULTS: Any patient was dropped from the study group. Femoral component positioning in relationship to the trans-epicondilar axis showed at follow-up an external rotation of $2.74^\circ (\pm 2.10^\circ)$ respect to a preoperative value of $5.7^\circ (\pm 1.80^\circ)$. Average patellar conformity angle was at follow-up 12.5 (range, $-2.5^\circ - 28.2^\circ$) respect to an average preoperative value of 10.3° (range, 1.5 – 25.6). Average patellar tilt at follow-up was $2.8^\circ (\pm 7.5^\circ)$ respect to a preoperative average value of $18.5^\circ (\pm 8.5^\circ)$. Average lateralization index was at follow-up 2.7 mm (range, -3.4 – 7.1 mm) respect to a preoperative value of 12.2 mm (± 4.8 mm).

CONCLUSION: This study highlighted that a correct utilization of a modern instrumentation and a femoral design with softer edges and a prolonged femoral groove allow for a correct reproducibility of the patello-femoral conformity. TC scan is a reliable method to evaluate the patella-femoral compartment after TKA.

Extensor Mechanism Allograft Reconstruction in TKA for Ruptures or Ankylosis

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Extensor mechanism disruption in total knee arthroplasty (TKA) occurs infrequently but often requires surgical intervention. We compared two cohorts undergoing extensor mechanism allograft reconstruction, one group had an extensor mechanism rupture, and the other had a recurrent ankylosed knee. Thirteen consecutive patients with extensor mechanism disruption or ankylosis after TKA were treated. Two different types of extensor mechanism allografts were used: quadriceps tendon-patella-patella tendon-tibial tubercle, and Achilles tendon allograft (Fig1). Demographic factors, diagnosis at extensor failure, Knee Society clinical rating scores, radiographs, and patient satisfaction were recorded. The average time from extensor mechanism disruption to surgery was 6.6 months (range, 1-24 months). At a mean followup of 24 months (range, 6-46 months), all patients were community ambulators. None of the patients showed a postoperative extensor lag. Average postoperative maximum flexion was 97° (90-115°) for the ruptured group and 80° (75-90) for the ankylosed group. All patients thought their functional status had improved, and 87% were satisfied with the results of the allograft reconstruction (Fig 2, 3, 4, 5). One patient had allograft failure due to recurrent infection after re-revision for sepsis. The total extensor mechanism allograft and Achilles tendon allograft both were successful in the treatment of the failed extensor mechanism and showed promising results for the treatment of the ankylosed knee.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#) [Figure 5](#)

Extramedullary Femoral Reference Without Navigation for Total Knee Arthroplasty. a Multicenter Randomized Clinical Trial

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The aim of tissue sparing surgery in total knee arthroplasty is to reduce surgical invasivity to the entire knee joint. Surgical invasion should not be limited only toward soft tissues but also toward bone. The classic technique for total knee arthroplasty implies intramedullary canal invasion for proper femoral component positioning. This phase is associated to fat embolism, activation of coagulation, and occult bleeding from the reamed canal. The purpose of our study was to validate a new extramedullary device which relies on templated data.

Two-hundred patients in four different orthopaedics centres were randomized to undergo primary total knee arthroplasty either using standard intramedullary femoral instruments (IM group) or using a new extramedullary device (EM group). A new set of instruments was developed to control the sagittal and coronal plane of the distal femoral resection. The extramedullary instrument was calibrated referencing to templated data obtained from the preoperative long-limb radiograph (Fig 1, 2). Varus-valgus orientation of the resection were established by moving the two paddles according to templated data. An L-shaped sliding tool (5 centimetres long) over the anterior cortex controls the flexion-extension parameter of the resection and is intended to allow a cut flush with the anterior cortex at 0° of angulation with the distal aspect of the femoral diaphysis on the sagittal plane

Femoral component coronal alignment was within $0\pm 3^\circ$ of the mechanical axis in 86% of the IM group and 88% of the EM group. Sagittal alignment of the femoral component was $0\pm 3^\circ$ in 80% of the IM group and 94% of the EM group. There was no difference in the average operative time between the two groups. The EM group showed a trend toward less postoperative blood loss

Extramedullary reference with careful preoperative templating can be safely utilized during total knee arthroplasty.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#) [Figure 5](#) [Figure 6](#) [Figure 7](#) [Figure 8](#)

[Figure 9](#)

Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

Anterior Tibial Cortex Is the Best Landmark for Tibial Component Rotation in Tka

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The anterior curve of the tibial plateau cortex represents a reliable and reproducible landmark which may help aligning the tibial component with the femoral component and the extensor mechanism

Few studies analyzed the tibial component rotational alignment during total knee arthroplasty. Malrotation can affect both patello-femoral and tibio-femoral postoperative function. We evaluated the rotational relationship between femur and tibia, and we investigated which tibial landmark consistently matches the rotation of the femoral epicondylar axis in full extension (Fig 1).

Axial magnetic resonance images of 124 normal knees (statistical power $1 - \beta = 0.8$) were analyzed separately by three authors. Scanograms were obtained with the knee in full extension and with the long axis of the foot (second metatarsal bone) aligned on the neutral sagittal plane. The surgical epicondylar axis was drawn and projected over the proximal tibia and tibial tuberosity slices. Multiple anatomical tibial rotational landmarks were drawn and symmetric tibial component digital templates of different sizes were aligned according to each landmark. Alignment of the virtual tibial components was then compared to that of the projected femoral epicondylar axis (Fig 2). The best antero-posterior line to achieve rotational matching between the components was drawn on the proximal tibia slice of each patient.

Results of rotation (positive = external rotation, negative = internal) relative to the epicondylar axis were (Fig 3): (a) Medial third-to the middle third of the tibial tubercle $1.2^\circ \pm 5.7$, (b) Akagi's line (centre of the posterior cruciate ligament tibial insertion to the most medial part of the tibial tubercle) $-11.5^\circ \pm 6.5$, (c) The anterior curved tibial plateau cortex (curve-on-curve matching between the tibial template and the anterior cortex) $1.0^\circ \pm 2.9$. Intraclass correlation coefficient resulted 0.923, 0.881, and 0.949 for the Akagi's line, Middle third of tibial tubercle, and the curve-on-curve reference respectively.

The anterior curve of the tibial plateau cortex represents a reliable and reproducible landmark which may help aligning the tibial component with the femoral component and the extensor mechanism (Fig 4, 5).

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#) [Figure 5](#)

Thursday, October 7, 2010, 14:50-15:30

Session A6: Hip Miscellaneous

Revision Total Hip Arthroplasty in Massive Proximal Femoral Bone Loss With Tumor Endoprosthesis

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Background:

Revision THA presents significant challenges for the surgeon when the proximal femur is deficient or mechanically unreliable. The aim of this study is to assess the clinical and functional results of the use of tumor endoprosthesis to reconstruct the proximal femur when there is massive bone loss.

Patients and Methods:

A prospective study was conducted involving 10 cases. The follow up of the cases ranged from 12 months to 30 months with a mean period of an average of 23 months. The indications for

revision surgery were aseptic loosening in 9 cases and septic loosening in one case Harris hip score was used for pre and postoperative clinical evaluation of the patients

Results:

At the latest follow up the Harris Hip scores improved from a preoperative average of 16 (range, 3-47), to a postoperative average of 75.6 (range, 66-94). The complications that we encountered in the study included one case of superficial wound infection, another case developed sciatic nerve palsy postoperatively. No other complications were reported.

Conclusion:

Revision hip replacement in proximally compromised femurs presents a significant surgical challenge. When there is massive proximal femoral bone loss proximal fitting revision stems do not achieve adequate fixation hence the use of tumor prosthesis is indicated.

Thursday, October 7, 2010, 7:30-8:20

Session B1: Computer Navigation in TKA

Patient Personalized Instrumentation for TKA; Comparative Study With the Conventional Instrumentation

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We present a new technique for TKA implantation which utilizes patient-specific femoral and tibial positioning guides developed from MRI to offer an individualized approach to total knee replacement.

This is a prospective non controlled study which aims to analyse the precision of this technique, its advantages and inconvenients in comparison with the conventional instrumented technique.

Material

The MRI provides a consistent three-dimensional data set of the patient's anatomy which allows for 3D axis identification.

The ideal position and sizing is performed by the surgeon on this 3D model and the patient specific guides are manufactured in advance in order to reproduce the bone cuts corresponding to this positioning and implant size. There are no intramedullary nor extramedullary instruments during the surgery .

Method :

We compared 20 patients operated with this technique with 20 patients operated with the

conventional technique.

The hypothesis was a difference $< 2^\circ$ between the 2 techniques

The measured parameters were :

HKS, HKA, tibial slope, femoral rotation on CT

Duration , bleeding, pain on VAS and morphine consumption, active flexion, KSS, Oxford score , recovery of independant walking and delay of return to home.

Both groups were identical for gender, age, BMI, etiology, comorbidities, pain and rehabilitation protocols.

Results :

There were no significant differences on HKA, HKS angles, femoral rotation, active flexion, pain, length of hospital stay.

The surgery with the patient specific instruments was 10 minutes shorter than the conventional one($p < 0,05$) and the bleeding was inferior with a ratio of 1/3 ($p=0,02$).

There were no complications with this technique and the use of the conventional guides were never necessary with the patient specific instrumentation.

Discussion and Conclusion

The patient specific instrumentation for TKA has a precision identical to that of the conventional technique, including for femoral rotation and ligament balance.

The advantages of this method are :

Reduced per and post operative bleeding

Shortening of the operative procedure

It is reproducible, including for less experimented surgeons and allows teaching and assistance in a lower technological institution.

The number of implant sizes is much inferior (2/9) just as the quantity of instruments to be sterilised.

These advantages induce a cost reduction which could be inferior to the price of the procedure.

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Title: Hip Arthroscopy and Body Temperature

Introduction: Hypothermia is the drop in body temperature under 35°C (95°F), It has implications in immunological function and healing process, increasing the infection and the cardiovascular risk. During hip arthroscopy patients are exposed to several risk factors that may lead to hypothermia.

Objective: to determinate if there are hypothermia and which are the factors contributing to hypothermia during hip arthroscopy.

Methods and materials: we developed an prospective observational analytical study in a cohort group of patients that went to a hip arthroscopy, all operated by a single surgeon for treatment of femoroacetabular impingement, all were done under general anesthesia in supine position , with vair hugher warmer body air convection system always in 43.3°C; and we registered central body temperature (esophagical) during the entire procedure, we also recorded operation room temperature, volume (liters) and temperature of the saline solution used for the arthroscopy, age of the patient, body mass index (BMI), arterial tension, pump pressure, and surgical time. We analyzed the results with STATA 10.0 statistical software.

Results: we performed 12 cases, 30 years old in average (14 – 46), BMI 24.0 in average (18.7 – 30.4), and hypothermia was founded in 16% (2/12) of cases. There are a direct assosiation between hypothermia and operating time over 120 minutes (p <0,001) (fig.1). Despite the rest of the parameters we didn't find any other correlation.

Conclusion: Hypothermia is present in 16,67% of the patients, during hip arthroscopy for the treatment of femoroacetabular impingement, are group is small but we demonstrated a direct correlation between operating time and hypothermia, further studys with larger groups should be performer to identify the correlations and risk factors for hypothermia in these patients.

Figures

[Figure 1](#)

Equatorial Fins to Enhance Press Fit of Cementless Cups With Ceramic-on-Ceramic and Met-Met Articulation: Positive Experience With 3 Different Models

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The present clinico-radiographical study evaluated the long term performance of a Ti-Al-V alloy cementless modular press-fit cups (FitekTM) having, on the outer surface, an oriented multilayer titanium mesh (SulmeshTM) with 65% tridimensional porosity and 2 fins applied to the outer surface. Fins were initially designed for anti-rotatory purposes but showed to give an excellent initial mechanical stability. Thus, in the following years, we have designed 2 other cups having 8 fins and ceramic insert. In this paper we compare the design and the results obtained with these 3 cups.

We have reviewed the first 100 consecutive FITEK cups implanted in 92 patients with an average FU of 9,7 years (range 9-11 years). Results were evaluated with the Harris score. We had 86 Excellent, 10 Good, 2 Fair and 2 Poor. In this series we always used 28 mm heads.

Dysplastic patients showed inferior results compared to arthritics patients in different parameters, as pain, limp, ROM ($p < 0.05$), putting socks and shoes ($p < 0.05$).

Radiographically, our cups were implanted in a fairly horizontal position (36.5° an average).

At the last FU radiolucent lines were present in 14 % of the cases, never progressive.

In no case we found a change of position of the cup, and in this series no revision was necessary.

Between 2005 and 2008 we have implanted 140 consecutive Delta Fins cups with ceramic-on-ceramic articulation. The fins of this cup have a trapezoidal shape, with HA coating. The cup has an interference of 2 mm. The Delta ceramic insert allows the use of 32 or 36 mm heads.

Clinico-radiographical results were very good. One cup needed to be revised for aseptic loosening consecutive to a surgical error (undersizing)

The H.M.S. cup is made of Porous Titanium with 8 fins having a triangular section, in order to increase their penetration into cortical bone. The ceramic insert allows even larger ceramic insert (32, 36 and 40). Preliminary clinico-radiographical results were excellent, with complete initial mechanical stability and great ROM due to the large ceramic heads.

The presence of fins on the outer surface of cementless cups enhances primary stability and fixation and the use of large ceramic heads improves ROM and subjective patients satisfaction.

Integrated Approach for Ortho-Sports Medicine Patient Care Management: A Total Knee Arthroplasty Outcomes Study

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Purpose: Introduce an Integrated Approach for Orthopedic-Sports Medicine Practice and Patient Care Management that:

• Is built around effective and efficient surgical techniques, and patient care management processes

• Integrates Operations and Service Excellence best practices with patient care management processes

• Integrates orthopedic care delivery between outpatient clinic, pre-surgery, surgery, inpatient, (acute care) and post acute care settings

• Delivers exceptional clinical, patient satisfaction and financial outcomes as validated by independent national healthcare benchmarking organization

• Helps position Ortho-Sports medicine services for strategic growth

• Is replicable to develop Ortho-Sports Medicine Centers of Excellence

Presentation illustrates the 'Ten Elements' approach to implement the Ortho-Sports Medicine Centers of Excellence and demonstrate the effectiveness of the approach with an outcomes study from over 1000 total knee arthroplasty (TKA) procedures. During the presentation, the speakers would share the key clinical, patient satisfaction, and financial outcomes achieved by the implementation of the best practices defined in our 'Ten Elements' approach. All performance data elements are collected, validated and analyzed by an independent third party, national healthcare benchmarking company.

During the presentation Dr. Bramlett would elaborate on the surgical protocol, and the key differentiating steps in procedure technique from traditional approach that significantly enhances procedure effectiveness, efficiency and lowers the patient complication rate as demonstrated by benchmarking data. Speakers would further present the key elements of Total Knee Arthroplasty procedure that focus on patient education, patient participation in pre-surgical weight loss and pre-rehabilitation program, anesthesia approach, avoiding tourniquet use and deep vein thrombosis (DVT) risk reduction, early post operative patient ambulation and weight bearing, and post operative patient management approach. On average the ortho-sports medicine clinical of Alabama TKA patients are discharged from the hospital in 2.6 days, and experience 65 percent less complications than expected for a similar patient population and assume early control of their independent functionality.

Progress in Developing a More Clinically Relevant Lubricant for in-Vitro Wear Testing of Total Knee Replacements

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There is no universal consensus on the protein constituent fractions, serum osmolality, addition of hyaluronate (HA) and microbial growth inhibitors for lubricants used in knee implant wear testing. The present study obtained clinical data on osteoarthritic synovial fluid (SF) composition, compared it with current lubricants and proposed a more clinically relevant lubricant.

SF was drawn from 20 patients with osteoarthritis. The protein constituent fractions and osmolality were determined. Knee simulator (AMTI) wear tests for a total of 11.5 million cycles were conducted on gas-plasma sterilized polyethylene (PE) inserts (AMK, GUR 1050; DePuy Orthopedics, Warsaw, IN) with 3 calf sera of different protein sub-constituents: alpha (ACS), newborn (NCS) and bovine (BCS). The effects of osmolality and hyaluronic acid (HA) on PE wear were also assessed. In addition, electrophoresis, protein degradation, microbial contamination and protein shear were determined.

The protein constituent fractions for NCS and BCS were largely different from SF; ACS was closest to SF. The wear rate was different between all three calf sera ($p < 0.05$). Increased protein degradation was associated with higher wear rate ($p < 0.05$) and increased albumin-alpha-1 globulin concentration with lower wear rate ($p < 0.05$). Diluting ACS with distilled water resulted in non-clinical osmolality levels with increased the wear ($p < 0.05$). ACS diluted with buffered-saline and HA was associated with a higher wear rate ($p < 0.05$) and using antibiotics rather than sodium azide eradicated microbial contamination and gave reduced wear rate ($p < 0.05$). The wear rate increased with increased protein shear ($p < 0.05$).

The most clinically relevant lubricant was ACS diluted with buffered-saline + HA + antibiotics to closely mimic the in-vivo boundary lubrication conditions. Similarities in surface pitting and roughness between simulator tested and retrieved femoral components were found. In support, the in-vitro linear penetration of the femoral component into PE inserts with the more clinically relevant lubricant was 0.06mm/Mc which matched the recently reported in vivo linear penetration of 0.06mm/year for the same type of implant [Collier et al., JBJS 90-7, 2008].

Posterior Condyle Surface Damage on Retrieved Femoral Knee Components

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Wear of the polyethylene (PE) insert in total knee replacements can lead to wear-particle and fluid-pressure induced osteolysis. One major factor affecting the wear behaviour of the PE insert in-vivo is the surface characteristics of the articulating femoral components.

Contemporary femoral components available in Canada are either made of cast Cobalt Chromium (CoCr) alloy or have an oxidized zirconium surface (Oxinium). The latter type of femoral components have shown to have increased abrasive wear resistance and increased surface wettability, thus leading to reduced PE wear in-vitro compared with conventional cast CoCr components. Although surface damage has been reported on femoral components in general, there have been no reports in the literature as to what extent the recommended operating techniques affect the surface tribology of either type of femoral component.

Twenty-two retrieved total knee replacements were identified with profound surface damage on the posterior aspect of the femoral condyles. The femoral components were of three different knee systems: five retrievals from the NexGen® total knee system (Zimmer Inc., Warsaw, IN), twelve retrievals from the Genesis II® total knee system (CoCr alloy or Oxinium; Smith & Nephew Inc., Memphis, TN), and five retrievals from the Duracon® total knee system (Stryker Inc., Mahwah, NJ). Reasons for revision were all non-wear-related and included aseptic loosening in two cases, painful flexion instability, and chronic infection. All retrieved femoral components showed evidence of surface damage on the condyles, at an average of 99° flexion (range, 43° – 135° flexion). Titanium (Ti) alloy transfer and abrasive surface damage were evident on all retrieved CoCr alloy femoral components that came in contact with Ti alloy tibial trays. Surface damage on the retrieved Oxinium femoral components was gouging, associated with the removal and cracking of the oxide and exposure of the zirconium alloy substrate material. CoCr alloy femoral components that had unintended contact with CoCr alloy tibial trays also showed evidence of gouging and abrasive wear.

All femoral components showed severe surface damage in the posterior aspect of the condyles. The femoral surface was heavily scratched and the oxidized zirconium coating surface appeared removed. The surface analysis suggested that the surface damage most likely occurred during the time of initial implantation. In particular, it appeared that the femoral condyles were resting on the posterior aspect of the tibial tray in flexion, thus scratching the femoral components. Such scratches could potentially lead to accelerated PE insert wear and reduced implant longevity, thus making expensive revisions surgery necessary. The authors strongly suggest a revision of the current operating techniques recommended by the implant manufacturer to prevent this type of surface damage from occurring.

Non Fusion Technology, L TDR vs. Fusion

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The paper describes various surgical techniques and devices for: nucleus pulposus replacement and total lumbar disc arthroplasty/L TDR, as well as other dynamic-system preservation motion stabilization/fixation without fusion techniques (ISS-ILS, DF/semirigid (based on screw & rods)) vs. fusion.

Coverage includes indications and contraindications, surgical approaches, and the latest constructs and clinical trial results.

Robotic Assisted Spinal Surgery - 2 Years of Clinical Experience - Gains and Disadvantages.

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Introduction: Our clinic has started to use MAZOR's Spine-Assist® robotic device in routine spinal surgery practice since 2006. The use of this system is diverse and now applicable for Vertebroplasty, Biopsy procedures and different techniques of Spinal fusion. During this time our clinic performed near 150 robotic assisted surgeries.

Amongst its benefits the system allows the reduction of the duration of fluoroscopic exposure in the OR, better accuracy due to computerized assisted planning and navigation, avoidance of human caused complications and a less traumatic procedure for the patient. On the other hand, the duration of the procedure is prolonged, the wound is subdued to a longer exposure in cases of the open surgery, and the operational cost is higher and requires a good trained medical staff.

Materials and Methods: In the last 2 years we have performed 56 robotic assisted Vertebroplasty procedures (research group). At the same time we have performed 44 non assisted Vertebroplasty procedures. There was a significant difference in the fluoroscopic time

and subsequent exposure time to radiation between the groups: in the research group we used only an average of 3 seconds of staff fluoroscopic exposure (an average of 5 fluoroscopic images) compared to an average of 11 seconds of exposure (an average of 24 fluoroscopic images). Furthermore, we have successfully inserted more than 400 pedical screws with less than 1mm accuracy from planning, out of which only 8 were misplaced. Subsequently we have also performed 16 biopsies, which were effective as CT based biopsies.

The average duration of a surgical procedure without the use of the system in 1 level fusion was 82 min. With the use of the system the average time was 106 min. The operational cost with the use of the system was about 1,000 € more expensive. Furthermore, the use of the system required performing of an additional CT scan with 1 mm slices, which caused an additional exposure to patient radiation.

Results: Robotic assisted spinal surgery is a new and safe approach aiming to dramatically shorten the duration of fluoroscopic exposure of the staff and surgeon thus reducing the exposure to radiogenic dose. This novel procedure, promotes a better accuracy with regard to Vertebroplasty, Spinal fusion, insertion of Pedical Screws and also for biopsies procedures. We continue to broaden the usage of the robotic assisted device to other fields of spinal surgery and to general orthopaedic surgery. However, we have to resolve some issues such as cost, operation time and less fluoroscopic exposure for the patient.

Friday, October 8, 2010, 11:10-11:50

Session A13: Alternate Bearing Materials in Arthroplasty

Medial Neck Femoral Fractures: Our Treatment Algorithm and the Use of f.g.l. Memory Shape Stem

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Undisplaced or minimal displaced medial neck femoral fractures are treated with canulated screws either in young or in elderly patients with good functional capacity, without severe comorbidity and cognitive impairment. We also perform this procedure in patients with very low daily activities and affected by severe comorbidity, with the aim to reduce pain. We reserve total hip replacement in middle-advanced age, with good level of functional activity and adequate bone-stock. We use bipolar hemiarthroplasty in patients that need early mobilization for the presence of comorbidities that could worsen. We prefer cemented bipolar hemiarthroplasty, as it gives an optimal primary stability, without press-fit. We prefer to utilize bipolar hemiarthroplasty with memory shape stem F.G.L. (Fig.1) in high risk patients (ASA classification). In fact the use of cement prolongs duration of surgery and is associated with higher perioperative mortality from cardiopulmonary complications. This stem in its metaphyseal region has 10 tabs, made of a Nitinol alloy (Ni-Ti). The feature of this alloy is to enlarge when brought to a certain temperature. When F.G.L. stem is maintained at 4° - 7° C

the Nitinol ® tabs are in the “restrained” configuration. Just at the time of surgery procedure, the stem is taken out of the refrigerator and inserted into the femoral diaphysis. At corporeal temperature, the Nitinol tabs enlarge, compressing the metaphyseal cancellous femoral region and give an immediate primary stability. We report clinical and radiological results of 15 patients (mean follow-up: 8 months) that underwent surgical procedure of bipolar hemiarthroplasty with F.G.L. stem in our department from March 2008 to December 2009. We had no perioperative complications and the results overlapped those of patients that underwent standard cemented bipolar hemiarthroplasty. The advantage of the use of F.G.L. stem is that it allows an immediate primary stability without searching an extreme press-fit. The disadvantage is the higher cost respect a standard cemented bipolar hemiarthroplasty. Therefore its use should be limited to those patients in which the surgery time must be contained for severe comorbidity, or in patients in which specific cardio-pulmonary complaints make dangerous the use of cement.

Figures

Saturday, October 9, 2010, 10:30-11:05

Session B18: Pot Pourri!

A Minimally Invasive Interpretation of the Smith-Petersen Approach: The Anterior Lateral Decubitus Intermuscular (ALDI) Approach.

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Background: The increasing desire to protect the periarticular structures led the need of a Tissue Sparing Surgery. The accesses most widely used are the direct-lateral approach and the postero-lateral one, both with patient in lateral decubitus. Aim: This accesses require however an incision of tendons and muscles even in their minimally invasive technique, so we looked for an approach that would wholly protect the periarticular structures and allow us not to revise our experience in patient positioning, preparation of the operating field and surgeon's position during surgery. Our intent was to leave the acquired knowledge unchanged and to preserve unaltered the anatomical landmarks that we had previously identified and consolidated for the correct positioning of the components. Methods: We have used this approach in more than 180 cases of primary hip arthroplasty. Clinical control includes: Oxford Hip Score, VAS and X-Ray. Results: OHS mean:44, range 37-48. On X-Ray no signs of components migration, radioucent lines or osteolysis. We didn't have dislocations or other complications. Discussion: The only approach that safeguard really the periarticular structures is the anterior one (Smith-Petersen), which actually is performed placing the patient in supine decubitus, with obvious difficulties in preparing the operating field and a complete change of the anatomical landmarks. We have combined the advantages of the anterior access with the ones linked to the lateral decubitus. The rewards of this new approach are: easiest preparation of the operating field, no special bed or supports are required, the inferior limb can be easily moved, it is a real tissue sparing approach, good acetabular exposition, surgeon placed traditionally on the posterior side

of the patient during the acetabular time. Conclusion: We have encoded all the steps of this approach that we have called the Anterior Lateral Decubitus Intermuscular (ALDI) approach.

Thursday, October 7, 2010, 8:00-8:50

Session A1: Alternate Bearings in THA 1

Ultrafine Grain Refinement of Biomedical Co-29Cr-6Mo Alloy Using Conventional Hot-Compression

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Co-Cr-Mo alloys are widely used for biomedical implant materials such as artificial hip and knee joints owing to their excellent corrosion and wear resistance as well as higher strengthening properties. However, the alloys exhibits sever brittle nature under an as-cast condition. It is generally recognized that refinement of the grain size of the metallic materials by means of hot-forging processes is an effective methodology to strengthen the alloy. Dynamic recrystallization (DRX) is an effective metallurgical process for grain refinement during hot deformation. However, there are few studies on the hot deformation behavior of Co-Cr-Mo alloy, especially grain refinement through DRX. In the present study, DRX and grain refinement during hot deformation of Co-29Cr-6Mo alloy has been investigated under various conditions such as deformation temperature and strain rate.

Although at strain of 5% hot deformed microstructure maintains the original grains, the grain size decreases with increasing the strain and exhibits the average grain size of approximately $2\mu\text{m}$ at strain of 60%. Ultra fine grained microstructure with the grain size of approximately $0.5\mu\text{m}$ was obtained under deformation at a 1323 K at a strain rate of 0.1s^{-1} . The original grains are broken up into different grains due to the new boundary formation not only near the initial boundaries but also in the interior of the grains at large strain. This grain fragmentation without bulging in the course of hot deformation is associated with considerably low stacking fault energy (SFE) of the Co-29Cr-6Mo alloy even at the deformation temperatures.

Rotational Acetabular Osteotomy With Femoral Osteotomy in Incongruent Hip - Midterm Result -

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Purpose: To evaluate the clinical and radiologic midterm results of rotational acetabular osteotomy (RAO) in incongruent hip joints.

Material and Methods: A consecutive series of 15 hips in 14 patients who underwent RAO in incongruent hip joint were evaluated at an average follow-up of 52.3 months (range from 36 to 101 months). The average age at operation was 27 years (range from 12 to 38 years) old. The preoperative diagnoses were developmental dysplasia in 4 hips, sequelae of Legg-Calvé-Perthes disease in 8 hips, and multiple epiphyseal dysplasia in 3 hips. The RAO procedures were combined with a femoral valgus osteotomy in 10 hips, advance osteotomy of greater trochanter in 4 hips, derotational osteotomy in 2 hips. Clinically, Harris hip score, range of motion, leg length discrepancy(LLD) and hip joint pain were evaluated. Radiological changes of anterior and lateral center-edge(CE) angle, acetabular roof angle, acetabular head index(AHI), ratio of body weight moment arm to abductor moment arm, and a progression of osteoarthritis were analyzed.

Results: The Harris hip score has been improved from average from 67.5 points preoperatively to 97.6 points postoperatively. There have been no significant changes in the range of motion. The anterior CE angle increased from an average of 9.0° (-19.7 18.6 $^{\circ}$) to 32.5° (22.6 39.1 $^{\circ}$), the lateral CE angle from 7.6° (-12.1 14.1 $^{\circ}$) to 31.7° (26.5 37.8 $^{\circ}$) and the AHI from 61%(33 73%) to 86%(65 100%). The average ratio of body weight moment arm to abductor moment arm was changed 1.88 to 1.49. There was no case showing progression of osteoarthritis. None of the patients experienced revision surgery.

Conclusion: The conventional salvage operation, such as Chiari osteotomy, has been recommended in incongruent hip. However, if we can expect to have a congruency after RAO with/without any femoral osteotomies, it would be a hopeful procedure for the incongruent joints by enhancing acetabular coverage, taking joint surface with normal articular cartilage, increasing abductor moment arm with additional improvement in LLD.

Key Words: Incongruent hip, Rotational acetabular osteotomy, Valgus osteotomy.

Restoration of Vertical and Horizontal Offset Using Dual Offset Stem in Korean

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Purpose: The ultimate goal in total hip arthroplasty is not only to relieve the pain but also to restore original hip joint biomechanics. The average femoral neck-shaft angle(FNSA) in Korean tend to have more varus pattern. Since most of conventional femoral stems have relatively high, single, fixed neck shaft angle, it's not easy to restore vertical and horizontal offset exactly especially in Korean people. This study demonstrates the advantages of dual offset(especially high-offset) stem for restoring original biomechanics of hip joint during the total hip arthroplasty in Korean.

Materials and Methods: 180 hips of 155 patients who underwent total hip arthroplasty using one of the standard(132°) or extended(127°) offset Accolade cementless stems were evaluated retrospectively. Offset of stem was chosen according to the patient's own FNSA in preoperative templating. In a morphometric study, neck-shaft angle of proximal femur, vertical offset and horizontal offset, abductor moment arm were measured on preoperative and postoperative both hip AP radiographs and the differences and correlation of each parameters, between operated hip and original non-operated hip which had no deformity (preoperative ipsilateral or postoperative contralateral hip), were analyzed.

Results: The standard stems were used in 34 hips and extended offset stems were used in 146 hips. The FNSA of non-operated hip was an average of 129.8° (127.2° - 135.8°) in standard group and mean 125.4° (122.7° - 129.9°) in extended offset group. The FNSA of operated hip was an average of 131.6° and 127.1° in each group. In the statistical analysis, there was no significant difference of mean horizontal and abductor moment arm between operated hip and non-operated hip in both groups and the restoration of horizontal offset and abductor moment arm showed($p=0.217$, $p=0.093$) significant positive correlation($R=0.870$, $R=0.851$) to the original value. However, vertical offset was increased an average of 1.4mm in operated hip and there was statistical significance. Restoration of vertical offset showed positive correlation to original value ($R=0.845$).

Conclusion: Dual- or multi-offset stem, especially extended offset stem can provide easy restoration of hip biomechanics and soft tissue tension without significant alteration of leg length especially in Korean with more varus femoral neck compared to Caucasian. Precise radiographic measurements of original hip and application of proper-offset stem should be taken in order to restore ideal hip biomechanics successfully and easily. A use of a proper offset stem can afford to enhance joint stability and implant longevity by improving soft-tissue tension and reducing resultant force, and it will guarantee a successful results after total hip arthroplasty in the aspect of function and longevity.

Keywords : Total hip arthroplasty, Hip biomechanics, Dual offset, Accolade, Korean

Catastrophic Rupture of a CLS Spotorno Acetabular Expansion Cup in a Metal-Polyethylene Total Hip Arthroplasty: A Case Report.

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Abstract:

CLS Spotorno expansion acetabular cup is in use since 1984 for uncemented Metal-Polyethylene (PE) total hip arthroplasties (THA). Metal-PE articulations are notoriously known to wear and lead to failure of THA. However, catastrophic breakage of expansion acetabular cup is rare. Our 74-year-old male who was diagnosed with bilateral osteonecrosis of femoral head, underwent bilateral THA using CLS Spotorno metal expansion acetabular cups (Protek, AG, Bern) in 1991. He had irregular follow-up since then. In 2005, he presented with right hip pain and inability to walk without support. Anteroposterior (AP) hip radiographs established the diagnosis of catastrophic failure of right THA secondary to severe liner wear and acetabular osteolysis. Patient chose to postpone the revision surgery and opted for wheel chair ambulation. He presented 4 years later, when the right hip pain became unbearable. Anteroposterior as well as lateral hip radiographs showed worsening of cup breakage with superolateral migration of metal femoral head. Pelvic CT scans confirmed severe acetabular osteolysis in DeLee and Charnley's Zone 1, 2 & 3 with secondary loss of bony support to the expansion cup [Fig. 1]. A revision THA was strongly advised. However, patient sought for a pain-free rather than a fully ambulatory right hip and decided against a second THA. We performed resection arthroplasty of right hip with bone cement loading, respecting patient's decision. Intra-operatively, the metal femoral head was lying in the huge osteolytic defect in the roof of acetabulum. The 3 cranial wings of metal expansion shell were broken with corresponding wear of the cranial pole of polyethylene liner [Fig. 2]. We were able to gratify patient's expectations and patient is able to ambulate with the aid of one crutch at latest follow-up. However, it is clearly evident that a timely and regular follow-up would have identified the initial PE wear and secondary osteolysis. Additionally, it can avoid extensive procedures like a revision THA or resection arthroplasty by allowing simple procedures like modular PE liner and the femoral head exchange. A comprehensive review of literature for catastrophic acetabular component breakage revealed 10 such cases, although with different cup designs. To the best of our knowledge, this is the first case of CLS expansion cup breakage for metal-PE articulation. Majority of these cases have a presence of extensive liner wear and pelvic osteolysis along with a post-operative irregular follow up. This case stresses on importance of regular follow-up even after many years of index THA to identify early PE wear and prevent secondary catastrophic complications.

Friday, October 8, 2010, 11:10-11:50

Session A13: Alternate Bearing Materials in Arthroplasty

Unilateral Fracture of a 4th Generation Alumina Bearing-Ceramic Liner in a Modern Bilateral Total Hip Replacement: A Case Report.

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Introduction:

Alumina Ceramic liners are increasingly used in patients undergoing Total Hip Replacement (THR). The rate of fracture of ceramic liner is decreasing with improved manufacturing techniques from 1st to 3rd generation alumina-ceramic liners. We report the first case of a fracture of a modern, 4th generation alumina bearing ceramic liner, which incorporates a metal sheath to help avoid fracture. Our case is a 60 years old female presenting two years and three months after a bilateral total hip replacement using Stryker Trident cup, securfit stem and alumina on alumina bearing ceramic liner. Ceramic liners are commonly used, especially in young patients because of their excellent biocompatibility, low wear rate and superior tribology. Although fracture of ceramic liner is a less common complication of modern total hip arthroplasty, it is a major concern with the use of ceramic on ceramic THR, the reason being brittleness of ceramic. Cases of 3rd generation ceramic liner fracture have been reported which might be associated with impingement due to excessive anteversion of the socket in Asian patients who habitually squat. Habitual squatting, sitting cross legged and kneeling were not characteristic of this case.

Methods:

The patient presented with complains of mechanical grinding in left hip. She also reported a past history of clicking sound from left hip on extension of left hip and long stride gait. There was no history of trauma or fall. On examination she had a nonantalgic gait and left hip had audible and palpable crepitations. The range of motion on left hip was intact with no subluxation. Right hip was symptom free and examination did not detect any abnormalities.

Evaluation & Results:

Radiographs of left hip revealed eccentric positioning of the head [Fig. 1] within the socket and excessive anteversion of the socket, which likely caused edge-loading in extension, leading to catastrophic failure in form of fracture of ceramic liner on left hip. She was treated with revision surgery using polyethylene liner with metal head. Intra-operative findings confirmed the ceramic liner fracture [Fig. 2] and revealed impingement of the metal neck against the metal

rim of the liner.

Discussion & Conclusion:

Although ceramic on ceramic hips have excellent wear properties, it is subject to fracture due to its brittle nature. This can lead to catastrophic failure with edge loading. In this case, the alumina-ceramic liner fractured; despite of being surrounded by a metal rim to prevent fracture. It fractured at the anterior edge, which is where it was loaded in extension. We believe that careful attention must be paid not only to inclination, but version of the socket, so as to avoid this complication. Other factors which might lead to such complication are obesity, high activity level, improper manufacturing techniques for ceramic liners and entrapment and impingement of a micromm sized foreign body between ceramic liner and prosthetic head which initiates wear.

Figures

[Figure 1](#) [Figure 2](#)

Thursday, October 7, 2010, 14:50-15:30

Session A6: Hip Miscellaneous

Modular Tapered Implants for Severe Femoral Bone Loss in Revision Total Hip Arthroplasty.

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Introduction: Modular tapered implants have been suggested as the optimal treatment in patients with severe femoral bone loss undergoing revision total hip arthroplasty (THA). The purpose of this study is to describe minimum 2 year follow up of patients treated with modular tapered prostheses for Paprosky type IIIB and IV femoral bone loss in revision THA.

Methods: 44 Consecutive patients with Paprosky type IIIB (23) or IV (21) femurs undergoing revision total hip arthroplasty to cementless modular tapered prostheses were studied. Harris Hip Scores were obtained prior to revision on all patients except those presenting with acute implant failure or periprosthetic fracture. 10 Patients were deceased within 2 years of surgery; the remaining 18 were followed for an average of 42 months (range 25-69 months). Clinical outcomes were measured using the Harris Hip Score, and radiographs were assessed for signs of stem loosening or subsidence >4mm.

Results: No further revisions were required in patients who were deceased within 2 years. In those with >2 year follow up, there were 4 additional revisions: 1 for infection, 2 for instability, and 1 for periprosthetic fracture. In patients with surviving implants, the mean Harris Hip Score improved from 33 (range 11-49) pre-operatively to 77 (range 55-100), and there was no radiographic evidence of loosening or subsidence at time of final follow up.

Conclusions: These outcomes support the use of modular tapered implants as a safe and effective option for revision arthroplasty of type IIIB and IV femurs.

Thursday, October 7, 2010, 16:30-17:20

Session A8: Periprosthetic Fractures in THA

Periprosthetic Fractures Associated With Press Fit Stems in Revision Total Knee Arthroplasty: Incidence, Risk Factors, and Management.

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Introduction: When using press-fit stems in revision total knee arthroplasty (TKA), diaphyseal engagement optimizes stability. Attempts to maximize press fit may lead to periprosthetic fracture; however, the literature offers no guidance regarding the prevalence or management of this complication. The purpose of this study is to report the incidence, risk factors, and outcomes of these fractures.

Methods: 634 Stemmed implants (307 femoral and 327 tibial) from 413 consecutive revision TKAs were reviewed. Immediate and 6 week post-operative radiographs were examined. Patient age, gender, stem length, diameter, and offset were evaluated as potential risk factors for fracture occurrence using a paired t-test for continuous and a chi-square analysis for categorical variables.

Results: 15 Periprosthetic fractures (2.4%) were identified including two femoral (0.65%) and 13 tibial (4.0%). 10 Fractures were non-displaced, 3 had cortical displacement <2mm, and 2 were displaced >2mm. 1 Femur fracture was recognized and fixed intra-operatively with cables. 11 patients with non or minimally displaced fractures were allowed to bear weight as tolerated and 2 were protected for 2 weeks. 1 Displaced fracture was braced for 3 months, while the other was casted for concomitant extensor allograft reconstruction. All fractures showed radiographic evidence of healing and all patients were able to painlessly bear weight within 6 months. There was no evidence of implant migration at a mean of 15 months (range 3-47 months). 1 Patient developed recurrent infection at 10 months; no other complications were identified. With the sample size available for study, no significant differences in age ($p=0.09$), implant parameters ($p=0.06-0.85$) or gender ($p=0.37$) were detected between the fracture and non-fracture groups.

Conclusions: Periprosthetic fractures occurred in approximately 2.4% of press-fit stems in

revision TKA, more commonly in the tibia than femur. All fractures were managed non-operatively without complication or loss of prosthetic fixation.

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Serum and Synovial Fluid Analysis for Diagnosing Periprosthetic Infection in Patients With Inflammatory Arthritis

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Introduction: Serum erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), and synovial fluid white blood cell (WBC) count and differential are effective in diagnosing periprosthetic joint infection (PPJI); however their utility in patients with inflammatory arthritis is unknown. The purpose of this study is to determine the utility of these tests in patients with inflammatory arthritis.

Methods: 934 Consecutive revision hip and knee arthroplasties were prospectively evaluated for PPJI. 202 Cases were excluded due to acute post-operative or hematogenous infection. 690 Patients had non-inflammatory and 42 had inflammatory arthritis. Receiver operating characteristic (ROC) curves were used to establish optimal ESR, CRP, WBC, and % neutrophil values for diagnosis of PPJI, and the area under the curve (AUC) was calculated to determine the overall accuracy.

Results: The optimal thresholds for predicting PPJI were ESR 30mm/hr, CRP 17mg/L, WBC 2667, and differential 75% neutrophils in inflammatory arthritis, and ESR 32mm/hr, CRP 15mg/L, WBC 4000, and 78% neutrophils in non-inflammatory arthritis. The efficacy of these tests was similar in both populations (AUC for inflammatory ESR=86.2%, CRP=86.2%, WBC=93.8, 93.6% neutrophils; AUC for non-inflammatory ESR=85.2%, CRP=90.2%, WBC=94.5, 95% neutrophils); there was no significant difference between groups (ESR $p = 0.861$, CRP $p = 0.549$, WBC $p = 0.8315$, % neutrophils $p = 0.7021$). The rate of PPJI was significantly higher in patients with inflammatory (33.3%) than non-inflammatory (18.8%) arthritis (p -value=0.013).

Conclusions: These results suggest that the ESR and CRP are useful in diagnosing PPJI in patients with inflammatory as well as non-inflammatory arthritis with similar optimal cut-off values.

Four Year Outcomes of Robotically Guided UKA

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Introduction:

Clinical outcomes of UKA procedures are sensitive to malalignment of the components, and thus show significant variability in the literature. A new robotic procedure addresses isolated medial compartment osteoarthritis with the classic indications of UKA. Using precision planning through patient specific 3D modeling and reconstruction, a robotic arm gives the surgeon control of resurfacing the knee joint, allowing for consistent precision according to the previously chosen plan. Through the precise preparation of bone surfaces and inter-component alignment, this procedure is designed to significantly increase accuracy and decrease malalignment, thus increasing post-operative physical and function outcomes. This paper evaluates four year clinical outcomes of this novel surgical procedure.

Methods:

The first seventy-three (42 male, 31 female) patients (average age: 71 ±10yrs) to receive a robotically assisted UKA enrolled in an IRB approved outcomes registry. Eleven patients were four years post operative and sixty-two patients were three years post operative at the time of the study. The average follow ups were 45 months and 35 months, respectively (range: 30 to 47 months). The tibial component for all patients was an all-poly inlay design.

Results:

At one, two, three and four year follow up, all patients showed significant improvements, compared to pre-operative values, in range of motion ($p < 0.05$), Knee Society Knee ($p < 0.001$) and Function ($p < 0.001$) scores, sf-12 PCS scores ($p < 0.001$). Two patients have been revised, for a four year clinical failure rate of 2.34% at an average follow-up of 37 months. Both revisions were due to loosening of the tibial component and occurred at 23.6 and 17.5 months, respectively, after the index procedure. The first was revised to a TKA. The second patient (age 50, BMI 27.2) was revised to a unicompartmental onlay tibial component at 17.5 months after presenting with weight bearing pain in the medial compartment. Upon explantation of the inlay component, the surgeon observed perfect cement-to-bone integration and noted that the failure was due to debonding of the undersurface of the poly to the cement. Optimal alignment of the femur to the tibia remained intact and the patient showed no signs of progressing OA disease. The bone preserving nature of the original inlay tibial component preparation allowed the surgeon to convert the patient to an onlay component with minimal bone resection instead of conversion to a TKA. A cement channel has been added to the inlay design to improve cement fixation effectiveness. In addition, the undersurface of the tibial component has since been removed and replaced with a dovetail channel to improve lift-off resistance of the tibial inlay. This new design has shown to be 10 times stronger in laboratory push out tests.

Conclusions:

This initial series of robotically guided UKA implantations provided significant improvement in the post-operative function of patients in every functional measurement with only two revisions to date, likely for improper patient selection. The introduction of new procedures and technologies in medicine is routinely fraught with issues associated with learning curves and unanticipated pitfalls. Because the explicit objectives of this novel technology are to optimize surgical procedures to provide more safe and more reliable outcomes, these favorable results provide the potential for significant improvements in orthopedic surgery.

Saturday, October 9, 2010, 9:10-9:50

Session A18: Complication Management

Recurrence of Infection After a Two Stage Revision Protocol: Analysis of Risk Factors.

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ABSTRACT: Two-stage revision is the gold standard in treatment of TKA infection. Several risk factor as the type of microbial flora, presence of general and local comorbidity and the type of therapeutic protocol may influence the success rate of treatment. The aim of our study is to assess the impact of these factor on prognosis in two-stage revision in chronic periprosthetic knee infection. We treated 38 knees in 37 patients, with an overall recurrence of 23,5% (9 recurrences). Our series analisys shows that associated diseases can affect the final result, with recurrence of infection in 12% of patients with one risk factor and in 33% of patients with association of comorbidity , wherass any infection occurred if less than three comorbidity were present. We also detect a statistically significative higher rate of recurrence in presence of local risk factor and in infection sustained by methicillin-resistant germs or with poly-microbial flora. Presence of these factors significantly affect prognosis and should be taken into serious consideration in the decision process leading to appropriate treatment.

Saturday, October 9, 2010, 9:10-9:50

Session A18: Complication Management

An Efficient Algorithm for Minimizing Perioperative Blood Loss During

Minimally Invasive Total Knee Arthroplasty Utilizing Erythropoietin, Epinephrine, a Bipolar Sealer, and a Reinfusion Drain

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Blood loss during the perioperative period of total joint arthroplasty has been well described in the literature. Despite numerous advances, allogeneic transfusion rates are still reported as high as 50%. Often the literature focuses on one area or mechanism of blood loss prevention but this article focuses on a multimodal approach to blood loss prevention including preoperative optimization, intraoperative technique, and postoperative management. Hemoglobin drop and transfusion rates were retrospectively reviewed for 134 control patients undergoing total knee arthroplasty (TKA) in three groups. Group 1 included low risk patients (Hb >14 g/dl), Group 2 included intermediate risk patients (Hb 13-14 g/dl) utilizing reinfusion drain and preoperative autologous blood donation, and Group 3 included high risk (Hgb <13) patients treated with preoperative erythropoietin (EPO). These controls were then compared to two groups of patients undergoing minimally invasive total knee arthroplasty (MIS TKA). Group 4 included 20 consecutive patients undergoing MIS TKA with intraoperative injection of lidocaine and epinephrine along the arthrotomy site. Group 5 included 22 consecutive patients treated with similar technique plus the additional intraoperative use of a bipolar sealer device. The combined utilization of MIS TKA, epinephrine, and bipolar sealer minimized hemoglobin drop (2.74 (Std Dev 0.77) vs 3.29 (SD 1.05) g/dl, $p=0.01$) and total blood transfusions (0.05 (SD 0.21) vs 0.86 (SD 0.63) units, $p<0.01$) compared with the traditional TKA approach for high risk patients using reinfusion drain and preoperative autologous donation (Group 2). This series demonstrates how a busy knee practice minimizes hemoglobin drop and transfusion requirements with preoperative optimization of high risk patients utilizing EPO, minimally invasive technique, intraoperative hemostasis obtained with epinephering injection, use of a bipolar sealer, and postoperative management with a reinfusion drain.

Thursday, October 7, 2010, 16:50-17:40

Session B8: Management of Complications in TKA

Transfusion Free Bilateral Total Knee Arthroplasty- a Reality ?

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Introduction- The purpose of this study was to determine the efficacy of a Multi-modal Blood Conservation protocol that involves pre-operative autologous blood donations (2 units) in conjunction with Erythropoietin supplementation as well as intra-operative conservation modalities.

Methods - A retrospective review of 104 patients with simultaneous bilateral total knee arthroplasty done between 2006-2009 was performed. Patients donated two units of blood, 4 weeks prior to surgery and also received Erythropoietin injections(40 k units 3weeks,2 weeks and 1 week prior to surgery). Intra- operative Blood Management included symptom-based transfusions, blood salvage devices, local epinephrine injections and fibrin spray. Pre-donation blood levels , peri-operative hemoglobin and hematocrit levels along with transfusion records were assessed.

Results- The mean pre-donation hemoglobin was 13.1 g/dL. After 2 units of autologous blood donation and procrit injection, the mean hemoglobin was 13.0 g/dL. The mean hemoglobin dropped to a nadir of 9.8 g/dL on postoperative day 3. The mean drop in hemoglobin from preadmission testing was 3.3g/dl. Overall, 28 % patients required autologous blood transfusion and no patients required allogeneic transfusion if the protocol was followed. 6 patients (5.8%) did require allogeneic transfusions but all 6 were protocol violations and did not follow the proposed treatment regiment.

Conclusion- This multi-modal protocol was effective in not only avoiding allogeneic transfusions following Bilateral TKA but also resulted in high blood levels at the time of discharge. This protocol was effective in eliminating allogeneic transfusions and maintaining blood levels.

Saturday, October 9, 2010, 11:15-11:50

Session B19: Hip Mechanics

Management of Severe CDH With THA and Derotating/shortening Osteotomy: Our 20 Years Experience Results

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Introduction: The anatomic abnormalities associated with the dysplastic hip increase the complexity of hip arthroplasty, in addition previous femoral osteotomy can deformate proximal femur. Despite the fact that uncemented cup and stems are specifically designed for dysplasia to recover the true acetabular region in Crowe IV and sometimes Crowe III additional surgical procedure are required. Purpose of the study is to verify surgical procedures and explore reconstruction options on severe hip dysplasia.

Materials and methods: In last 25 years, 2308 arthroplasties were performed in dysplastic hips (565 cases had a previous femoral osteotomy). In 128 cases was required a correction of femoral side deformity: in 64 cases was performed a greater trochanter osteotomy (in 12 of these a proximal femoral shortening was associated), 55 cases were treated by a shortening subtrochanteric osteotomy (that allows corrections in any plane) and in 9 cases was performed a distal femur osteotomy.

Discussion: Long-term results in these patients are steadily inferior to those obtained in general population (70% survival rate at 15 years). On femoral side early failures reflect learning curve

and are due to insufficient fixation of osteotomies. Despite this, the more promising outcomes are concerning shortening sub-trochanteric osteotomy with uncemented stem but only early and mid-term data are available.

Thursday, October 7, 2010, 15:10-15:50

Session B7: Robotic Knee Surgery

Predicting Bone Damage and Implant Subsidence After Total Knee Arthroplasty

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Introduction

Aligning the tibial tray is a critical step in total knee arthroplasty (TKA). Malalignment, (especially in varus) has been associated with failure and revision surgery. While the link between varus malalignment and failure has been attributed to increased medial compartmental loading and generation of shear stress, quantitative biomechanical evidence to directly support this mechanism is incomplete. We therefore constructed and validated a finite element model of knee arthroplasty to test the hypothesis that varus malalignment of the tibial tray would increase the risk of tray subsidence.

Methods

Cadaver Testing: Fresh human knees (N = 4) were CT scanned and implanted with TKA cruciate-retaining tibial tray (Triathlon CR, Stryker Orthopaedics, New Jersey). The specimens were subjected to ISO-recommended knee wear simulation loading for up to 100,000 cycles. Micromotion sensors were mounted between the tray and underlying bone to measure micromotion. In two of the specimens, the application of vertical load was shifted medially to generate a load distribution ratio of 55:45 (medial:lateral) to represent neutral varus-valgus alignment. In the remaining two specimens, a load distribution ratio of 75:25 was generated to represent varus alignment.

Finite element analysis: qCT scans of the tested knees were segmented using MIMICS (Materialise, Belgium). Material properties of bone were spatially assigned after converting bone density to elastic modulus. A finite element model of the tibia implanted with a tibial tray was constructed (Abaqus 6.8, Simulia, Dassault Systèmes). Boundary conditions were applied to simulate experimental mounting conditions and the tray was subjected to a single load cycle representing that applied during cadaver loading.

Results

The two cadaver specimens tested at 55:45 medial:lateral (M:L) force distribution survived the 100,000 cycle test, while both cadaver specimens tested at 75:25 M:L force distribution failed. The finite element model generated distinct differences in compressive strain distribution patterns in the proximal tibia. A threshold of 2000 microstrain was used for fatigue damage in bone under cyclic loading. Both specimens loaded under 75:25 M:L distribution demonstrated substantially larger cortical bone volumes in the proximal tibial cortex that were greater than this fatigue threshold.

Discussion & Conclusion

We validated a finite element model of tibial loading after TKA. Local compressive strains directly correlated with subsidence and failure in cadaver testing. A significantly greater volume of proximal tibial cortical bone was compressed to a strain greater than the fatigue threshold in the varus alignment group, indicating an increased risk for fatigue damage. This model is extremely valuable in studying the effect of surgical alignment, loading, and activity on damage to proximal bone. Emerging techniques that customize tibial tray placement to the individual patient's pre-arthritis alignment run counter to the traditional recommendations for coronal alignment to the mechanical axis of the knee. A method that determines the risk of bone damage in a patient-specific manner can provide the surgeon with a safe range for component alignment and may even be applicable in preoperative planning.

Saturday, October 9, 2010, 14:50-15:20

Session A22: Tribology and Biomechanics in Arthroplasty

Lab-in-a-Knee: Simultaneous Measurement of in Vivo Forces and Kinematics

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Background: While in vivo kinematics and forces in the knee have been studied extensively, these are typically measured during controlled activities conducted in an artificial laboratory environment and often do not reflect the natural day-to-day activities of typical patients. We have developed a novel algorithm that together with our electronic tibial component provide unsupervised simultaneous dynamic 3-D kinematics and forces in patients.

Methods: An inverse finite element approach was used to compute knee kinematics from in vivo measured knee forces. In vitro pilot testing indicated that the accuracy of the algorithm was acceptable for all degrees of freedom except knee flexion angle. We therefore mounted an electrogoniometer on a knee sleeve to monitor knee flexion while simultaneously recording knee forces. A finite element model was constructed for each subject. The femur was flexed using the measured knee flexion angle and brought into contact with the fixed tibial insert using the three-component contact force vector applied as boundary conditions to the femoral component, which was free to translate in all directions. The relative femorotibial adduction-abduction and axial rotation were varied using an optimization program (iSIGHT, Simulia, Providence, RI) to minimize the difference between the resultant moments output by the model and the experimentally measured moments. Maximum absolute error was less than 1 mm in anteroposterior and mediolateral translation and was 1.2° for axial rotation and varus-valgus angulation. This accuracy is comparable to that reported for fluoroscopically measured kinematics. We miniaturized the external hardware and developed a wearable data acquisition system to monitor knee forces and kinematics outside the laboratory.

Results: Knee forces were monitored in three subjects during unsupervised outdoor walking. The terrain included level ground, varying grade slopes, hiking trails, and hiking off-trail. In general knee forces were higher than those measured in the laboratory (2.2 xBW). Peak knee forces were highest (>3 xBW) when hiking up and down a 10° slope. One subject tripped and recorded over 5 x bodyweight.

Conclusions: This method of obtaining combined kinematics and forces with minimal external hardware greatly increases our ability for capturing true kinematics and forces. Unsupervised activities outside the laboratory generated significantly different forces compared to in-laboratory measurements. Clinically relevant data can be obtained for preclinical testing of prostheses as well as for advising patients regarding postoperative rehabilitation and activities.

We are now able to continuously monitor data over extended periods of time (days or weeks) and to record naturally occurring events (in contrast to choreographed activity). Since we compute tibiofemoral contact as part of the algorithm to determine the kinematics, the forces and kinematics are already integrated with contact analysis. These data can be used as input into damage and wear models to predict failure or for validation of biomechanical models of the knee, which predict knee forces and kinematics. Continuously monitoring in vivo knee forces and kinematics under daily conditions will identify weaknesses and potential areas of failure in current designs and will provide direction into enhancing the function and durability of total knee arthroplasty.

In Vivo Validated Subject-Specific Computer Model of Dynamic Squatting After Total Knee Arthroplasty

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INTRODUCTION

Knee contact force during activities after total knee arthroplasty (TKA) is very important, since it directly affects component wear and implant loosening. While several computational models have predicted knee contact force, the reports vary widely based on the type of modeling approach and the assumptions made in the model. The knee is a complex joint, with three compartments of which stability is governed primarily by soft tissues. Multiple muscles control knee motion with antagonistic co-contraction and redundant actions, which adds to the difficulty of accurate dynamic modeling. For accurate clinically relevant predictions a subject-specific approach is necessary to account for inter-patient variability.

METHODS

Data were collected from 3 patients who received custom TKA tibial prostheses instrumented with force transducers and a telemetry system. Knee contact forces were measured during squatting, which was performed up to a knee flexion angle that was possible without discomfort (range, 80–120°). Skin marker-based video motion analysis was used to record knee kinematics. Preoperative CT scans were reconstructed to extract tibiofemoral bone geometry using MIMICS (Materialise, Belgium). Subject-specific musculoskeletal models of dynamic squatting were generated in a commercial software program (LifeMOD, LifeModeler, USA). Contact was modeled between tibiofemoral and patellofemoral articular surfaces and between the quadriceps and trochlear groove to simulate tendon wrapping. Knee ligaments were modeled with nonlinear springs: the attachments of these ligaments were adjusted to subject-specific anatomic landmarks and material properties were assigned from published reports.

RESULTS

Total measured peak ground reaction force was 0.9–1.1 xBW (times of bodyweight) and measured peak knee contact force was 2.2 (\pm 0.2) xBW during squatting. Model predicted peak tibiofemoral contact forces were within the cycle-to-cycle variations for each subject. Model predicted peak patellofemoral contact forces were 0.9–1.1 xBW and peak quadriceps forces were 1.3–1.6 xBW. Mean peak ligament tensions were 55.5 ± 8.8 N for the MCL and 47.1 ± 10.4 N for the LCL.

DISCUSSION

Small differences between predicted and measured forces were likely due to the complexity of the squatting activity, the inherent error in skin marker-based motion capture, and the fact that muscle force was computed from muscle shortening history. Trunk flexion significantly affected the contact force, especially at higher knee flexion angles. Trunk flexion reduced the external flexion moment at the knee leading to reduced quadriceps force and therefore reduced tibiofemoral contact force.

Peak patellofemoral contact forces and quadriceps muscle forces were also lower than previously reported. Although others have reported on hamstring muscle activity during the squat, hamstring forces were low in our models in qualitative agreement with the EMG data that we recorded during squatting. The lack of significant hamstring activity may explain the lower net tibiofemoral contact forces. This model would be very useful tool to predict the effect of surgical techniques on contact forces. Such a model could be used for implant design development to enhance knee function and to predict forces generated during other activities.

Friday, October 8, 2010, 13:30-14:10

Session B12: Shoulder Arthroplasty

Reverse Shoulder Prosthesis With Concentric vs Eccentric Glenosphere. a Multicentric Study

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Background : One of the main concern about reverse shoulder arthroplasty for the treatment of rotator cuff deficiency is scapular notching that is still an unsolved issue for this particular prosthesis. The purpose of this multicentric retrospective study is to compare two different concept of reverse prosthesis, one with a concentric glenosphere and the other one with a new eccentric glenosphere design that aim to minimize scapular notching.

Methods: From 2004 to 2009 67 patients were treated with a SMR reverse shoulder prosthesis (LIMA) with either concentric (figure 2) or eccentric glenosphere (figure 1). We selected for the study patients with criteria as much homogeneous as possible by the age and pathology . We then included for the study 25 patients (Group 1) with a concentric glenosphere and 21 (Group 2) with a eccentric glenosphere. All baseplates of concentric glenospheres were implanted with the most inferior aspect of baseplate that matched with the inferior glenoid ream, so that the glenosphere extended 4 mm beyond the glenoid inferiorly in order to minimize scapular notching. Every patient were followed clinically (Constant and Murley Score [C.S.] and Simple Shoulder test [S.S.T.]) and radiographically (notching, loosening and mechanical failure) with a minimum follow-up of 24 months. We also evaluated at the final follow-up psna (prosthesis-scapular neck angle), pgrd (peg glenoid rim distance) and DBSNG (distance between scapular neck and glenosphere).

Results: At two years of follow up R.O.M. increased significantly in both groups especially in those with a eccentric glenosphere. Notably in patients with an eccentric glenosphere elevation improved from 66° to 148° and abduction from 60° to 115° while in those with a concentric glenosphere improved from 78° to 122° and 71° to 98° respectively for elevation and abduction. Outcomes for external-rotation and internal-rotation were very similar in both groups. 14 (56%) patients among those with a concentric glenosphere had scapular notching while we didn't have any notch in those with eccentric glenosphere even though we didn't find any significant different between the two groups in term of clinical outcomes and patient's satisfaction. The average C.S. increased from 38% to 69% in those with concentric SMR and from 30% to 74% in the other group. At the final follow-up PSNA, DBSNG and PGRD were respectively 88°, 3,2mm and 18,2 mm in group 1, while they were 92°, 4,3 mm and 21,2 mm in the group 2.

Conclusions: Putting concentric glenosphere more inferiorly reduce the incidence of scapular notching but it doesn't solve the problem whereas, at medium follow-up, the new eccentric

design seems to solved completely this issue. This study sustains PSNA, DBSNG, PGRD as reliable measures to predict scapular notching. Besides eccentric SMR glenosphere seems to increase R.O.M. mostly in flexion, abduction and adduction.

Figures

[Figure 1](#) [Figure 2](#)

Thursday, October 7, 2010, 10:20-11:00

Session A3: Bearing Mobility Issues

Post-Cam Kinematics in TKP

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In general TKA can be divided into two distinct groups : cruciate retaining and cruciate substituting. The cam and post of the latter system is in fact a mechanical substitution of the intricate posterior cruciate ligament. In our previous work we and many other investigators have focused on the movement of the femoral component relative to the tibial tray. Little information is available about the relative movement between the cam part of the femoral component and the post of the tibial insert. In this study we determine the distance and the changes in distance between the cam of the femoral component and the tibial post during extension, flexion at 90° and full flexion. The secondary purpose is to analyse possible differences between FBPS and MBPS TKA.

Methods :

12 subjects' knees were imaged using fluoroscopy from extension over 90° to maximum kneeling flexion. The images were digitized. The 3-dimensional (3D) position and orientation of the implant components were determined using model-based shape-matching techniques, manual matching, and image-space optimization routines. The implant surface model was projected onto the geometry-corrected image, and its 3D pose was iteratively adjusted to match its silhouette with the silhouette of the subject's TKA components. The results of this shapematching process have standard errors of approximately 0.5° to 1.0° for rotations and 0.5 mm to 1.0 mm for translations in the sagittal plane. Joint kinematics were determined from the 3D pose of each TKA component using the 3-1-2 Cardan angle convention. This process resulted in a distance map of the femoral and tibial surfaces, from which the minimum separations were determined for the purpose of this study between cam and post (fig1.).

Separation distances between the tibial polyethylene (PE) insert's post and the femoral

prosthesis component have been calculated in three steps. First, the surface models of all three components as well as their position and orientation were extracted from the data files produced by the fluoroscopic kinematic analysis. Next, a set of 12 points were located on the post of each tibial insert (fig2.). Finally, for each point, the distance to the femoral component was quantified. For each step in this process, custom MATLAB[®] (The MathWorks[™] Inc., Natick, MA, USA) programs were used.

For each of the 12 points on the post, a line was constructed through the point and parallel to the outward-facing local surface normal of the post. The resulting set of lines was then intersected with the femoral component model. Intersection points where lines ran “out of” the femoral component, detected by a positive dot product of the femoral component surface normal with the post surface normal (used to define the line), were discarded.

Finally, the distances between the 12 points on the post and the intersection points on each line were calculated. For each line, the smallest distance was retained as a measure of the separation between insert and femoral component. Where a line did not intersect the femoral component, the corresponding separation distance was set to infinity.

In each position, distances are measured at 6 pairs of points. Two indices of asymmetry are analysed:

- 1) The absolute difference between both measurements within a pair. Perfect symmetry is present when this absolute difference equals zero.
- 2) The proportion of pairs where one of both measurements equals infinity. Indeed, this situation refers to the presence of ‘extreme’ asymmetry.

A linear model for repeated measures is used to analyse the absolute differences as a function of the between-subjects factor condition (mobile bearing or fixed bearing) and the within-subject factors position (4 levels) and pair (6 levels). More specifically, a direct likelihood approach is adopted using a compound symmetric covariance matrix.

Results :

There is a significant difference in absolute difference between the fixed and mobile bearing condition ($p=0.046$). On average, the absolute difference is higher in the fixed bearing condition, 1.75 (95% CI: 1.39;2.11) vs 1.20 (95% CI:0.78;1.62). (fig2.).

Conclusion:

The separation distances between post and cam show less asymmetry in the Rotating platform TKA, meaning less or no contact between the post and cam surfaces which are possible sources of wear.

Complex Acetabular Revision Using Computer-Aided Planning for Patient-Specific Implant and Guide.

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The number of joint revision surgeries is rising, and the complexity of the cases is increasing. In 58% of the revision cases, the acetabular component has to be revised. For these indications, literature decision schemes [Paprosky 2005] point at custom pre-shaped implants. Any standard device would prove either unfeasible during surgery or inadequate in the short term. Studies show that custom-made triflanged implants can be a durable solution with good clinical results. However, the number of cases reported is few confirming that the device is not in widespread use.

Case Report

A patient, female 50 yrs old, diagnosed having a pseudotumor after Resurfacing Arthroplasty for osteo-arthritis of the left hip joint. The revision also failed after 1 y and she developed a pelvic discontinuity . X-ray and Ct scans were taken and sent to a specialized implant manufacturer [Mobelife, Leuven, Belgium]. The novel process of patient-specific implant design comprises three highly automated steps.

In the first step, advanced 3D image processing presented the bony structures and implant components. Analysis showed that anterior column was missing, while the posterior column was degraded and fractured. The acetabular defect was diagnosed being Paprosky 3B. The former acetabular component migrated in posterolateral direction resulting in luxation of the joint. The reconstruction proposal showed the missing bone stock and anatomical joint location.

In the second step, a triflanged custom acetabular metal backing implant was proposed. The bone defect (35ml) is filled with a patient-specific porous structure which is rigidly connected to a solid patient-specific plate. The proposed implant shape is determined taking into account surgical window and surrounding soft tissues. Cup orientation is anatomically analyzed for inclination and anteversion. A cemented liner fixation was preferred (Biomet Advantage 48mm). Screw positions and lengths are pre-operatively planned depending on bone quality, and transferred into surgery using jig guiding technology (Materialise NV, Leuven, Belgium) .

In the third step, the implant design was evaluated in a fully patient-specific manner in dedicated engineering (FEA) software. Using the novel automated CT-based methodology, patient-specific bone quality and thickness, as well as individualised muscle attachments and muscle and joint forces were included in the evaluation.

Implants and jig were produced with Additive Manufacturing techniques under ISO 13485 certification, using respectively Selective Laser Melting (SLM) techniques [Kruth 2005] in medical grade Ti6Al4V material, and the Selective Laser Sintering technique using medical grade epoxy monomer. The parts were cleaned ultrasonically, and quality control was performed by optical scanning [Atos2 scanning device, GOM Intl. AG, Wilden, Switzerland]. Sterilization is performed in the hospital.

CONCLUSION

A unique combination of advanced 3D planning, patient-specific designed and evaluated implants and drill guides is presented. This paper illustrates, by means of a clinical case, the

novel tools and devices that are able to turn reconstruction of complex acetabular deficiencies into a reliable procedure.

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Saturday, October 9, 2010, 9:00-9:30

Session B17: Novel techniques in Arthroplasty

Use of Cemented Metaphyseal Sleeves in Revision TKR With AORI Type 2 and 3 Bone Loss

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Introduction: Fixation remains a challenge in Revision TKR. Irregular and cavitory bone loss may preclude proper metaphyseal cementation and pressurization. Metaphyseal sleeves have been proposed to improve the inherent rotational stability of the implant bone interface. The goal of this study was to assess the effect of the use of metaphyseal sleeves on the quality of the cement fixation achieved.

Methods: Fifty consecutive revision TKRs for AORI type 2 and 3 bone loss between January 2005 through January 2008 with average 2 years follow up were assessed retrospectively. Twelve patients were excluded for inadequate follow up. Nineteen patients with 26 cemented metaphyseal sleeves (15 tibiae and 11 femora) formed group 1 and 19 patients with 36 revision components (without metaphyseal sleeves) served as control (group 2). Patients were assessed clinically with knee society scores (KSS) and radiographically by quality of metaphyseal cement mantle and radiolucent lines (RLL). Groups were matched for pre-op bone loss and

length of follow-up.

Results: The presence of uniform cement mantle was 100% in group 1 as opposed to only 70% (25 out of 36) in group 2. Incidence of metaphyseal RLL was 3.8% (1 out of 26 components) in group 1; as opposed to 16.7% (6 out of 36 components) in group 2. The average postoperative knee society and function score in group 1 was 90 and 80 and in group 2 was 88 and 81 respectively at final follow-up.

Conclusion: Cemented metaphyseal sleeves along with press fit stems provided reproducible cement mantle with minimal radiolucencies when compared to similar cases in whom only stems were used. This minimal incidence of RLLs at 2 years possibly has potential for better survivorship over the long term.

Saturday, October 9, 2010, 14:00-14:40

Session A21: Knee Arthroplasty

Patellar Fracture in TKR With Patellar Resurfacing: The Role of Lateral Facet

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Introduction: Mechanical integrity of patella can be weakened by the technique of removing the articulating surface. The senior author developed the technique of maintaining subchondral bone of the lateral patellar facet in early 1980s. Though laboratory studies have demonstrated deleterious effect of excessive resection of patella on the strains in the remaining bone under load; clinical studies have not shown the importance of strong subchondral bone of lateral facet to have an effect on patellar fracture prevalence. We present the results of our patellar resection technique preserving the subchondral bone of lateral facet.

Methods: 393 TKRs were performed between 1989 and 1996 using cruciate substituting modular knee with recessed femoral trochlear groove and congruent patello-femoral articulation. 45 patients with 48 knees died and 37 patients with 41 knees were lost to follow-up. Three hundred and four knees were followed for an average 10 years (range 5 -16 years). Patellar surface was resected with an oscillating saw without the use of cutting guide. The medial facet and most of the articular cartilage of the lateral facet was resected, while preserving the subchondral bone of lateral facet. An all-polyethylene implant with single peg was used in most cases.

Results: There have been two fractures in the cohort with prevalence of 0.66%. Eight TKRs were revised for synovitis and osteolysis. Patellar osteolysis was found in 4 of these cases, with loosening of 3 of these patellae, and 1 patellar fracture. Two patellar implants had global radiolucencies and were considered loose. The average knee score in unrevised knees improved

from 48.6 to 92.2, while functional scores improved from 50 to 81.1

Conclusion: We believe that maintaining this anatomic landmark allows for preserved patellar strength, and in association with a femoral component with a recessed trochlear groove, has resulted in our low patellar fracture rate in primary TKR and revision cases for patellar osteolysis.

Thursday, October 7, 2010, 17:30-18:00

Session A9: Arthroplasty Outcomes

The Royal National Orthopaedic Hospital Experience With Custom Made (CADCAM) Total Hip Replacement in Patients With Osteochondrodysplasia

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Patients with osteochondrodysplasia frequently require Total Hip Arthroplasty at a younger age, as a result of early degenerative disease of the hip joint. The outcome of Modular Total Hip Arthroplasty in this group of patients has been reported previously. In this retrospective study we evaluated the outcome of custom made (CADCAM) Total Hip Arthroplasty in patients with osteochondrodysplasia.

Between 1974 and 2009, twenty one CADCAM Total Hip Arthroplasty procedures were performed in fourteen patients in our institution. There were eight female and six male patients, with the mean age at time of surgery of 40.95 years (20 to 78). The patients were followed up clinically and with the Harris hip score for a mean of 7.12 years (0.5 to 17 years).

Four of the twenty-one hips (23.8%) required revision surgery at a mean of 11.54 years (6.5 to 17 years); one required it for aseptic loosening of the femoral component; one required complete revision of the acetabular component ; one required exchange of acetabular liner; and one was for symptomatic non-union of a lesser trochanter avulsion.

This study shows encouraging clinical outcomes of custom made (CADCAM) Total Hip Arthroplasty in patients with osteochondrodysplasia,

Autologous Chondrocyte Implantation Does Not Prevent the Need for Arthroplasty in Patients With Pre-Existing Osteoarthritis

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Purpose:

The rate of arthroplasty or osteotomy in patients who had undergone autologous chondrocyte implantation (ACI) for osteochondral defects in the knee was determined. Furthermore, we investigated whether any radiographic evidence of osteoarthritis (OA) prior to ACI was associated with poorer outcome following surgery.

Methods:

We retrospectively reviewed the medical notes and radiographs of 236 patients (mean age 34.9) who underwent ACI from 1998 to 2005 at our institution. Knee function was assessed according to the Modified Cincinnati Score (MCS) pre-operatively and at a mean of 64.3 months postoperatively (range 12 – 130). Radiographic changes were graded according to the Stanmore grading system.

Results:

Patients were divided into 2 groups; Group A were patients with no evidence of OA (n=72) and Group B were patients with OA (n=164). In group A, two patients required total knee replacement (TKR) or unicompartmental knee replacement (UKR) and 3 required high tibial osteotomy (overall revision rate 6.9%). In group B, 34 patients required patello-femoral replacement, or UKR or TKR and 17 patients required osteotomy (overall revision rate 31.1%). This difference was significant ($p < 0.01$). At latest follow up, the mean MCS was significantly higher in Group A (72.5 versus 51.8, $p < 0.01$).

Conclusions:

Patients with early radiographic evidence of OA are unlikely to gain maximum benefit from ACI. The results suggest that ACI does not prevent patients from progressing in their arthritic process and hence requiring joint replacement.

Metal Ion Levels and Associated Chromosome Aberrations in Metal-on-Metal Total Hip Arthroplasties

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The aim of this study is to investigate whether Metal-on-Metal (MoM) implants result in more chromosome aberrations and increased blood metal ions post-operatively when compared to Metal-on-Polyethylene (MoP) implants.

Metal-on-metal arthroplasties are being inserted in increasing numbers of younger patients due to the increased durability and reduced requirement for revision in these implants. Recent studies have raised many concerns over possible genotoxicity of MoM implants.

This is a prospective study of patients who have undergone elective total hip replacement, they were selected and then randomised into two groups. Group A received a MoP implant and group B received a MoM implant. Patients are reviewed pre-operatively (control group), at 3 months, 6 months, 1 year and 2 years post-operatively. On each occasion blood tests are taken to quantify metal ion levels (chromium, cobalt, titanium, nickel and vanadium) using HR-ICPMS method and chromosome aberrations in T lymphocytes using 24 colour fluorescent in situ hybridisation (FISH).

53 patients have been recruited to date. 24 of whom had MoP prosthesis and 29 a MoM. 37 of these have had their one year follow-up with blood analysis and 14 have had 2 year follow up. Cobalt and chromium concentration increased during the first 6 months in both MoM and MoP groups, in the MoM group the chromium levels were twice that of MoP group and 12x that of the preoperative samples. Chromosome aberrations occurred in both groups. At 6 months both the MoM and MoP groups showed increase frequency of aneuploidy aberrations with further increases after one year. Structural damage in the form of translocations occurred in the MoM group after one year, but not in the MoP group, by two years there was a profound increase in translocations

Preliminary results of this study show that the levels of chromium and cobalt are significantly higher in the MoM group compared to the MoP group. This corresponds to increases in chromosome aberrations in the groups with increases in structural chromosome damage after two years.

Navigated, Mobile Bearing Total Knee Prosthesis With Floating Platform and Extended Congruency. a 5-Year Follow-Up Study.

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INTRODUCTION: Computer-aided systems have been developed recently in order to improve the precision of implantation of a total knee replacement (TKR). Several authors demonstrated that the accuracy of implantation of TKR was higher with the help of a navigation system in comparison to the conventional, manual technique. Theoretically, the clinical results and the survival rates should be improved. Our team was one of the first all over the world which decided to use routinely a navigation system for TKR.

Prostheses designed with a mobile bearing polyethylene component allow an increased congruence between femoral and tibial gliding surface, and should decrease the risk of long-term polyethylene wear. We designed a prosthetic system with one of the highest congruence on the current market. These prostheses might be technically more demanding than more conventional designs, and involve specific complications like bearing luxation. Navigation systems might be helpful in this was as well.

In the present study, we wanted to test clinically the theoretic advantages of these three specific points of our system (navigated implantation, mobile bearing and increased congruence) with a five-year clinical and radiological follow-up.

MATERIAL AND METHODS: 128 patients were operated on at our Department with this TKR system between 2000, and were contacted for a five-year clinical and radiological follow-up. The clinical and functional results were evaluated according to the Knee Society Scoring System (KSS). The subjective results were analyzed with the Oxford Knee Score. The accuracy of implantation was assessed on post-operative long leg antero-posterior and lateral X-rays. The survival rate after 5 years was calculated according to the Kaplan-Meier technique.

RESULTS: The mean clinical score was 87 points (maximum of 100 points). The mean pain score was 43 points (maximum of 50 points). The mean flexion angle was 118°, and 33% of the patients were able to reach 130° of knee flexion or more. The mean functional score was 70 points (maximum of 100). The mean Oxford Score was 23 points (best score = 12 points, worst score = 60 points).

An optimal correction of the coronal leg axis (less than 3° off the neutral axis) was obtained in 87% of the cases. 67% of the cases had an optimal implantation of both tibial and femoral implants on both coronal and sagittal planes.

The Kaplan-Meier survival rate was 97.4% after 5 years.

DISCUSSION: The present study confirmed the efficiency of the navigation system used on the accuracy of implantation. The clinical and functional results after 5 years were at least as good as those published after conventional implantation of uncongruent prostheses. The survival rate was comparable as well to the already accepted gold standards. We observed no complication directly related to the new prosthetic system. The mean flexion angle was better than the results we observed with the previously used fixed bearing system. The question of the polyethylene wear could not be assessed because of the too short follow-up period. An additional follow-up study is planned after 5 more years.

Thursday, October 7, 2010, 14:20-15:00

Session B6: Computer Navigation in TKR 2

Navigated, Minimal Invasive, Mobile Bearing Unicompartmental Knee Prosthesis. a 2-Year Follow-Up Study.

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INTRODUCTION: Computer-aided systems have been developed recently in order to improve the precision of implantation of a total knee replacement (TKR). Several authors demonstrated that the accuracy of implantation of an unicompartmental knee replacement (UKR) was also improved.

Minimal invasive techniques have been developed to decrease the surgical trauma related to the prosthesis implantation. The benefits of minimal-incision surgery might include less surgical dissection, less blood loss and pain, an earlier return to function, a smaller scar, and subsequently lower costs. However, there might be a concern about the potential of minimal invasive techniques for a loss of accuracy. Navigation might help to compensate for these difficulties.

Mobile bearing prostheses have been developed to decrease the risk of polyethylene wear. The benefits might be a better survival and less bone loss during revisions. However, these prostheses are technically more demanding, and involve the specific risk of bearing luxation. Again, navigation might help to compensate for these difficulties.

MATERIAL AND METHODS: We wanted to combine the theoretical advantages of the three different techniques by developing a navigated, minimal invasive, mobile bearing unicompartmental knee prosthesis. 160 patients have been operated on at our institution with

this system. The 81 patients with more than 2 year follow-up have been re-examined. Complications have been recorded. The clinical results have been analyzed according to the Knee Society Scoring System. The subjective results have been analyzed with the Oxford Knee Questionnaire. The accuracy of implantation has been analyzed on post-operative antero-posterior and lateral long leg X-rays. The 2-year survival rate has been calculated.

RESULTS: We observed 8 complications related to the implant or the operative technique : 2 cases of meniscus instability (1 revision to TKR, 1 bearing exchange); 2 cases of tibia loosening (revised to TKR), 2 cases of femoral loosening (revised to TKR), 1 case of lateral disease progression (revised to TKR), 1 case of unexplained pain syndrome (revised to TKR).

The mean Knee Score was 93 points, 44% had the maximum of 100 points, and only 10% have less than 85 points. The mean pain score was 48 points/50. The mean flexion angle was 128°, and 60% had at least 130° of knee flexion. The mean Function Score was 97 points, 84% have the maximum of 100 points, and only 5% had less than 85 points. The mean Oxford Knee Questionnaire score was 19 points (best result: 12 points, worst result: 60 points).

Expected limb axis correction was obtained in 77% of the cases. 62% of the cases had an optimally implanted prosthesis for all studied criteria. The 2-year survival rate was 97%.

DISCUSSION: Most of the revision cases were related to technical difficulties during the development phase. Fixation of the implant has been improved, and some imprecise steps of the software have been corrected. Since these changes occurred, no severe early complication related to implant or software has been observed. The current implant is considered reliable, and the current minimal invasive navigated technique is considered reliable as well.

Figures

[Figure 1](#)

Thursday, October 7, 2010, 7:30-8:20

Session B1: Computer Navigation in TKA

Navigated Total Knee Prosthesis Exchange. a Comparative Study With Conventional Technique.

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INTRODUCTION: Revision total knee replacement (TKR) is a challenging procedure,

especially because most of the standard bony and ligamentous landmarks used during primary TKR are lost due to the index implantation. However, as for primary TKR, restoration of the joint line, adequate limb axis correction and ligamentous stability are considered critical for the short- and long- term outcome of revision TKR. Navigation system might address this issue.

MATERIAL AND METHODS: We are using an image-free system (ORTHOPILOT TM, AESCULAP, FRG) for routine implantation of primary TKR. The standard software was used for revision TKR. Registration of anatomic and cinematic data was performed with the index implant left in place. The components were then removed. New bone cuts as necessary were performed under the control of the navigation system. The system did not allow navigation for intra-medullary stem extensions and any bone filling which may have been required. This technique was used for 37 patients. The accuracy of implantation was assessed by measuring following angles on the post-operative long-leg radiographs: mechanical femoro-tibial angle, coronal orientation of the femoral component in comparison to the mechanical femoral axis, coronal orientation of the tibial component in comparison to the mechanical tibial axis, sagittal orientation of the tibial component in comparison to the proximal posterior tibial cortex.

Individual analysis was performed as follows: one point was given for each fulfilled item, giving a maximal accuracy note of 4 points. Prosthesis implantation was considered as satisfactory when the accuracy note was 4 (all fulfilled items). The rate of globally satisfactory implanted prostheses and the rate of prostheses implanted within the desired range for each criterion were recorded. The results of the 37 navigated revision TKR were compared to 26 cases of revision TKR performed with conventional intramedullary guiding systems.

RESULTS: We observed a significant improvement of all radiological items by navigated cases. Limb alignment was restored in 82% of the navigated cases and 74% of the conventional cases. The coronal orientation of the femoral component was acceptable in 85% of the navigated cases and 76% of the conventional cases. The coronal orientation of the tibial component was acceptable in 95% of the navigated cases and 89% of the conventional cases. The sagittal orientation of the tibial component was acceptable in 77% of the navigated cases and 66% of the conventional cases. Overall, 50% of the implants were oriented satisfactorily for the four criteria for navigated cases, and only 40% for conventional cases.

DISCUSSION: The navigation system enables reaching the implantation goals for implant position in the large majority of cases, with a rate similar to that obtained for primary TKA. The rate of optimally implanted prosthesis was significantly higher with navigation than with conventional technique. The navigation system is a useful aid for these often difficult operations, where the visual information is often misleading.

Figures

[Figure 1](#) [Figure 2](#)

Balanced Gap Technology - Tibia and Extension First

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Total knee arthroplasty belongs today to one of the standard operation in orthopaedic surgery. During the last years the number of the total knee arthroplasty has dramatically increased. The prognosis for the future have shown also an increasing tendence. The Swedish Register Study and others showed that the results after total knee replacement not almost dependant on the design of the prothesis . More important are patient selection ,operation technique and the postoperative therapy.

The goals of modern knee replacement surgery are restoring mechanical alignment , preserving of the joint line , balancing ligament with a well balanced extension and flexion gap to reach maximum stability and movement. Bone resection is the simple part of a total knee operation . Ligament balancing with equal extention and flexion gap represents a major chalange for the surgeon which may consequently affect the stability both in extention and flexion. Stability of total knee arthroplasty is dependant on correct and percise rotation of the femoral component. Femoral component malrotation has been associated with numerous adverse sequelae, including patellofemoral and tibiofemoral instability ,knee pain, arthrofibrosis,and abnormal knee kinematics. A great number of early revision today are due to malrotation of the femoral component.

Multiple differing surgical techniques are currently utilized to perform TKA.

1-femur first (measured resection)

2-tibia first (gap balancing)

In the classic femur first technique the excision of the bone done indepentaly after one another followed by ligament balancing in flextion and extension. There are 4 bony landmarks deciding the rotational position of the femur. The epicondylar line ,whiteside line, the dorsal condyles and anetroir-posterior axis. All these landmarks are associated with problems and failure to define exactly these bony landmarks intraoperatively. This may lead not seldom to malrotation of the femural component ,consequently instability,limitation of function and increased wear.

In the tibia first technique excision of the femur especially for flexion done dependant on the excision of the tibia. This carried out using a tensor. With using this technique the rotation of the femur will be oriented mainly at the ligament balancing espcialy in flexion . Flexion instability and patellae maltacking will be avoided.

We present our preferrd tibia first technique using a new tensor system . With this system it is possible to reach a well balanced extension and flextion gap. A 3° release is only needed in special cases. The rotation position of the femur depend primerly on the released soft tissue in extension. Also an exact reconstruction of the dorsal offset as well as an exact anterior or posterior referencing can be guaranteed with the instruments by infinitely variable ap movement..The use of bony landmarks also possible.

we think our new tensor present a step forwards in understanding the biomechanics of the

knee and offer a new development of the instruments used in knee replacement. This could be useful especially in cases of revision.

Thursday, October 7, 2010, 7:30-8:20

Session B1: Computer Navigation in TKA

Modular Total Knee Arthroplasty (TKA) in Cases of Revision and Complicated Primary Cases

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Today TKA belongs to a standard care in orthopaedics and traumatology. The number of the annual implantations has clearly increased during the last years and also in the future an increasing rate to be expected.

Also the number of Revision TKA and the treatment of complicated pathologies in the primary care will increase in the same way.

Therefore the requirements of the surgeon rised as well as a suitable and accurate systems will be needed. Beside revision cases, traumatic-, post-traumatic- and RA-patients demonstrate partly distinctive bone and ligamentous pathologies.

Beside the primary implant components and instrumentation-systems, modern knee systems must include also modular revision systems compatible with the primary systems to be able to carry out complicated primary as well as light to moderately severe recision cases. Besides, also the possibility should be able to change within the system (with constant bone-cuttings) on higher degrees of the constrain.

With the TC-Primary and TC-Revision system fulfils the above mentioned criteria so that nearly every situation can be handled.

We present our experience using this system in cases of revisions, traumatic, post-traumatic and RA-cases The handling of bone and ligamentous defects will be demonstrated. In particular the possibility the use of the TC-Revision also in primary TKA as P a so named "extension primary system" will be emphasized.

By the Modularity and compatibility of the TC-Primary and TC-Revision systems, the use of

Wedges and Stems as well as the possibility of the different degrees of the constrain a knee family permits us to treat complicated primary as well as mild to moderate revision cases.

Saturday, October 9, 2010, 13:30-14:20

Session B20: Hip Arthroplasty

A Hip Replacement Program in Burkina Faso: Review of 104 Cases

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We report on our experience of a THR program set up in Ouagadougou, Burkina Faso (BF). As THR is not performed on a regular basis in this country, we had to start it up completely. We work in BF during a 2 weeks period in December each year. We do this in coöperation with a local surgeon who makes a preselection of THR candidates in advance. This surgeon is trained by us to do the necessary follow up and can contact us all year round in case of specific problems. From 2004 until 2009 we performed 104 operations; these consisted of 98 THR, 2 bipolar hip replacements and 4 revisions. 3 of these revisions were of hip replacements performed by us; 1 revision was of a THR performed in France. Mean age at operation was 48,4 years. All operations were performed by an anterolateral approach with use of cemented implants. Reason for operation was degenerative arthritis in 31 (29,8%), AVN in 39 (37,5%), fracture in 30 (28,9%). Fractures were more than several months old in most cases. Reason for the revision operations was aseptic loosening in 3 cases and periprosthetic fracture in 1.

For every operation, technical problems were recorded, if applicable. These problems were not necessarily complications. We recorded 50 technical problems in 31 patients. 73 operations (70,2%) were performed without any note of technical problem. Most frequently recorded problems were important shortening of the leg (6), very narrow femoral canal (6), difficult reduction (5), peroperative femoral fracture (4-excluding trochanter maior fracture), extensive fibrosis (4), blocked femoral canal (3).

Flexible reamers were used in 5 cases.

There were 2 peri-operative deaths: one patient died after a postoperative sickle cell crisis with hemolysis. One patient developed a pulmonary embolism. Both patients were Hb SC.

We recorded 21 complications in 16 patients. The majority were osseous complications. These were 4 femoral fractures of which 3 had clinical repercussion, 4 trochanteric fractures without any clinical repercussion and 4 peroperative perforations of the femoral canal, all without postoperative clinical repercussion. Other complications were infection (2), paralysis of femoral nerve (1), burn injury by diathermia plate (1), postoperative hemolysis (1), pulmonary embolism (1) and dislocation (2). One infection and dislocation was found in the same patient.

This was the patient with revision of a initial THR performed in France.

The indications for THR in BF differ significantly from the indications we find in Belgium. We also find the average case in BF more challenging. During the years we have developed specific strategies and schemes based on our experience and the technical problems encountered during the operations.

Specific tips and tricks regarding patient selection, technique and equipment will be presented. This can be a good opportunity to learn from our experience for anyone who wants to set up a similar program.

Thursday, October 7, 2010, 14:00-14:40

Session A5: Hip Mechanics

An in-Vitro Long Term Performance Evaluation of a Thin Acetabular Shell With in-Growth Coating

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Revision total hip replacements are likely to have higher complication rates than primary procedures due to the poor quality of the original bone. This may be constrained to achieve adequate fixation strength to prevent future "aseptic loosening" [1]. A thin, slightly flexible, acetabular component with a three dimensional, titanium foam in-growth surface has been developed to compensate for inferior bone quality and decreased contact area between the host bone and implant by better distributing loads across the remaining acetabulum in a revision situation. This is assumed to result in more uniform bone apposition to the implant by minimizing stress concentrations at the implant/bone contact points that may be associated with a thicker, stiffer acetabular component, resulting in improved implant performance.[2] To assemble the liner to the shell, the use of PMMA bone cement is recommended at the interface between the polyethylene insert and the acetabular shell as a locking mechanism configuration may not be ideal due to the flexibility in the shell [3].

The purpose of this study was to quantify the mechanical integrity of a thin acetabular shell with a cemented liner in a laboratory bench-top total hip revision condition. Two-point loading in an unsupported cavity was created in a polyurethane foam block to mimic the contact of the anterior and posterior columns in an acetabulum with superior and inferior defects. This simulates the deformation in an acetabular shell when loaded anatomically [4]. The application has been extended to evaluate the fatigue performance of the Titanium metal foam Revision Non-Modular Shell Sequentially Cross Linked PE All-Poly Inserts and its influence on liner fixation.

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Figures

Friday, October 8, 2010, 8:40-9:30

Session A11: Knee Arthroplasty in the Middle East

Management of Flexion Deformity in Total Knee Arthroplasty by Recreation of the Posterior Condylar Recess Without Extra-Bone Resection

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The purpose of this study is to investigate the feasibility of surgical correction of moderate flexion deformity during total knee arthroplasty by recreating the posterior condylar recess following certain sequence of surgical principles without extra-resection of bone from the distal femur or proximal tibia. The hypothesized surgical protocol was applied in 52 consecutive primary TKAs with moderate flexion deformity. Preoperative and residual postoperative flexion deformity was recorded. Intraoperatively, extension and flexion gap widths were recorded before and after surgical correction. Fixed flexion deformity has improved from a preoperative mean value of 24.8 ± 6.4 to a postoperative residual value of 3.2 ± 1.8 (p value < 0.001). Extension and flexion gap widths have increased by a mean value of 3.8 ± 0.4 mm and 4.1 ± 0.7 mm respectively (p value < 0.005). There was no significant difference between the changes in the extension and flexion gaps. The original flexion/extension gap width mismatch (3.2 ± 0.5 mm) was compensated for by an upsized femoral component. The statistically significant changes has demonstrated the efficiency of the hypothesized surgical protocol for management of flexion deformity during TKA added to the benefits of bone conservation for future revision surgery, preservation of surface area for collateral attachments, and establishment of the joint line at the correct level.

Saturday, October 9, 2010, 13:30-14:20

Session B20: Hip Arthroplasty

Two-Stage Arthroplasty Using Functional Temporary Prosthesis to Treat Infected Arthroplasty and Septic Arthritis of the Hip

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TWO-STAGE ARTHROPLASTY USING FUNCTIONAL TEMPORARY PROSTHESIS TO TREAT INFECTED ARTHROPLASTY AND SEPTIC ARTHRITIS OF THE HIP

A modified technique

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Abstract

Two-stage revision arthroplasty is the gold standard for treatment of infection after total hip Arthroplasty and end stage septic arthritis of the hip. In the first stage we used a modified technique to insert an inexpensive modular femoral component coated with antibiotic-impregnated polymethylmethacrylate articulating with a polyethylene liner. The construct was used in 8 patients with infected arthroplasty, and 6 patients with septic arthritis of the hip. Two patients were excluded (no second stage). Of the remaining 12 patients, only one patient had persistent infection after the first stage; 11 patients received a successful re-implantation at the second-stage. The technique provide a construct that can be used safely and successfully in the awaiting period between the two stages of revision arthroplasty. **Key words:** functional temporary prosthesis, infection, arthroplasty, two-stage, septic hip

Introduction

Sepsis after total hip arthroplasty (THA) is a potentially devastating complication that may result in major morbidity for the patient and adversely affecting the functional outcome. Further operations are usually required to control the sepsis which, despite the best efforts, can ultimately end in a disfiguring result. Different treatment strategies that have been employed to clear infection and leave the patient with a functioning joint include: Antibiotic treatment alone resulting in resolution of infection (rarely achieved); prolonged suppressive antibiotics without removing the components (useful in the generally infirm with well-fixed components, highly sensitive organisms, and no systemic sepsis [1]); surgical debridement with retention of the original prosthesis (in early infection); one-stage exchange arthroplasty; two-stage exchange with or without a temporary spacer.

Sepsis in the adult native hip is an uncommon problem that has an increased incidence in the elderly and immune-compromised population with chronic diseases, with haematogenous spread is the most common route of infection. Patients with diabetes mellitus, cirrhosis, end-stage renal disease, systemic lupus erythematosus, (SLE), rheumatoid arthritis have abnormal white blood cell (WBC) response, decreased complement and antibody function, and immune system dysfunction. Patients with local articular disorders like osteoarthritis, avascular necrosis (AVN), previous trauma have alteration of the normal joint environment interrupting the exchange process of nutrients and waste, increase in synovial permeability allowing bacterial invasion. Pyogenic arthritis and sepsis in an arthritic joint can pose difficult management problems since the risk of infection after total hip arthroplasty is very high. Treatment modalities for patients with end-stage septic arthritis include: debridement and fusion, resection

arthroplasty, and reconstruction with a total joint arthroplasty after resolution of the infection in a two-stage procedure.

In this study, we introduce a modified technique of two-stage arthroplasty for the management of patients with infected hip arthroplasty, and end stage septic arthritis of the hip.

Materials and Methods

A prospective study was conducted using the construct resulting from this modified technique. Data about each patient was documented and recorded onto case report forms. Data included patient's demographic data, medical history, index operation diagnoses, Harris Hip Score (HHS) before first stage, postoperative courses, HHS after second stage. Patients were included in the prospective study population if they met the following criteria: (1) end stage arthritis with hip infection was confirmed or suspected; (2) the patient had infection following total hip replacement, or hemiarthroplasty. Diagnosis of infection was suspected through patient's medical history, risk factors for infection, and whether there were wound complications in the postoperative period following the index operation in arthroplasty cases, clinical examination for discharging sinuses, laboratory investigations including elevated white blood cell count, ESR, C-reactive protein (CRP). Hip aspiration was performed under sterile condition prior to the first stage surgery at least 4 weeks after cessation of all antibiotic therapy for culture and cytological analysis with WBC over 25,000 and a differential count of over 25% polymorphonuclear leukocytes, low glucose and high protein levels is highly suggestive of infection[2].

Patient is positioned in the true lateral position. Direct lateral approach was used in all cases. In infected arthroplasty cases the cemented femoral stem was loose and removed with minimal or no difficulty; the difficulty mostly came with cement removal due to strong interdigitation at the bone-cement interface. Cement is then removed antegrade and completed with "scaphoid osteotomy technique", where a carefully planned osteotomy of the anterolateral cortex of the femur is performed starting at the site of the distal plug and extending for 8cm proximal with rounded corners to minimize stress raisers to remove distal plug and the remaining cement. At the completion of the procedure, the osteotomy is fixed with cerclage wires. The acetabular components were easier to remove. Meticulous debridement and intraoperative tissue biopsy is taken (at least 3 specimens from each side) then follows the removal of the components. The temporary functional hip prosthesis consists of a standard polyethylene liner, and an

inexpensive modular femoral component or the removed femoral implant, which is autoclaved. We use trials of the acetabular component to dictate the size of the acetabulum. On the femoral side, we use trials for spacer G (TECRES S.P.A.), of which only 3 sizes are available (Fig 1), to dictate the size that best fits into the femoral canal diameter, which is equivalent to the planned stem diameter together with its cement mantle.

Fig.1 Trials for spacer G (TECRES S.P.A.)

After determining the size of acetabulum (eg 54mm), we use the acetabular reamer tray of the same size (54mm) as a mold and a sterile sofratol sheet is used to line reamer tray, antibiotic-impregnated polymethylmethacrylate is then mixed and applied in the doughy phase in the tray reamer which is lined with sofratol, and definite polyethylene liner (the smallest diameter that matches 28mm head) is inserted in the tray reamer till polymerization is completed to get in-vitro cemented polyethylene construct (Fig 2)

Fig. 2 steps of constructing in vitro cemented acetabular component A. use of the acetabular reamer tray as a mold after dictating size of the acetabulum and a sterile sofratol sheet is used to line reamer tray; B. antibiotic-impregnated polymethylmethacrylate is then mixed and applied in the doughy phase in the tray reamer; C, D. definite polyethylene liner (the smallest diameter that matches 28mm head) is inserted in the tray reamer till polymerization is completed; E & F in-vitro cemented polyethylene construct that matches the size of acetabulum

For the femoral component: the stem of the trial spacer G, that mimics the femoral canal diameter, is wrapped entirely with Vaseline paper found within the sterile sofratol pack, and polymethylmethacrylate is applied over the trial spacer stem, till polymerization is completed and the trial spacer is then extracted to get a polymethylmethacrylate mold for the femoral canal diameter (Fig 3).

Fig. 3 Cement mold for the femoral component A, B - the stem of the trial spacer G, that mimics the femoral canal diameter, is wrapped entirely with Vaseline paper; C- polymethylmethacrylate is applied over the trial spacer stem, till polymerization is completed; D, E- the trial spacer is then extracted to get a polymethylmethacrylate mold for the femoral canal diameter

The smallest definite femoral stem is then cemented with antibiotic-impregnated polymethylmethacrylate within the mold which is lined from the inside with Vaseline paper. After polymerization, the outer mold is peeled from around the cemented stem which now has a cement mantle that fits into the femoral canal diameter (Fig 4)

Fig 4 A-D Femoral stem construct A. Femoral stem & mold; B. the smallest definite femoral stem is then cemented with antibiotic-impregnated polymethylmethacrylate within the mold which is lined from the inside with Vaseline paper; C. After

polymerization, the outer mold is peeled from around the cemented stem; D. combined femoral stem with its cement mantle that match the femoral canal diameter.

The final construct is cemented in place with antibiotic-impregnated polymethylmethacrylate and inserted during the late stages of polymerization to minimize osseous interdigitation to facilitate later removal in the second stage. As regards the femoral component, cementation is limited to the proximal 3cm of the femoral canal. Modular head that achieves stability is then applied. Extramedullary rod formed of K-wire with antibiotic-impregnated polymethylmethacrylate cured around is inserted sub-muscular to provide elution of antibiotic extramedullary, followed by closure in layers (Fig 5)

Fig 5 A. acetabular component after cementation; B. Femoral component insertion with cementation limited to the proximal 3 cm of the femoral canal; C. extramedullary K-wire with antibiotic-impregnated polymethylmethacrylate investing it

In septic hip arthritis the same technique is used after osteotomy of the neck and debridement of the infected and devitalized tissues.

In the first stage, all necrotic and devitalised tissues are removed, and the functional temporary prosthesis is inserted using the technique described. Tissue biopsy (5-6 specimens from acetabulum and femur) are collected and sent for culture. Extended cultures for 2 weeks is our protocol to approve the results of culture with infection best predicted when three or more of the intraoperative cultures show growth of a consistent microorganism [3]. Even if we thought that the positive growth on culture was a contaminant, as is the case when only one of five culture specimens is positive, we counted the case as a confirmed infection. This approach was taken to ensure the safety of the procedure.

During the interval period between the two stages: patient is allowed to mobilize and ambulate partial weight-bearing with frame the day after surgery, intravenous antibiotics are administered for a minimum of 6 weeks, combined with oral rifampicin. The patient is followed clinically and radiologically; provided wound healing and inflammatory mediators (ESR and C-RP) levels are satisfactory, antibiotics discontinued and second stage performed. Numerous intraoperative samples are obtained for microbiological analysis during the second stage. A

successful treatment outcome was defined as implantation of a total hip prosthesis at the time of the second-stage operation with no growth of a microorganism on any culture specimen obtained from the operative site during the second-stage surgery and no reoperations resulting from a recurrent or persistent infection of the affected hip during the follow up at a minimum of one month postoperatively (Fig 6).

Fig. 6 Serial radiographs for the procedure A. Anteroposterior view of 62 years old male patient with infected hemiarthroplasty; B. after first stage with the functional temporary prosthesis in place & extramedullary rod formed of K-wire with antibiotic-impregnated polymethylmethacrylate investing it; C. 6 months after second stage revision

Results

These functional temporary hip arthroplasties have been inserted by this modified technique since June 2006. The construct was used in fourteen consecutive patients (9 men and 5 women) with a mean age of 49.7 years (Table 1); 8 patients with infected arthroplasty (6 patients with infected THA, and 2 patients with infected hemiarthroplasty) and 6 patients with adult native joint septic arthritis of the hip.

Table 1 Demographic data

Gender			Age		
	N	Percent	Mean age	Minimum	maximum
Male	9	64.3	44.7	34.2	65
Female	5	35.7	54.8	22	59
Total	14	100.0	49.7	22	65

Two patients were excluded from the study (no second stage). Of the remaining twelve patients, only one patient had persistent infection after the first stage; eleven patients received a successful re-implantation at the second-stage, and were followed for a mean of 18 months (range 3 months to 33 months).

The diagnoses at the index operation in cases with infected arthroplasty are shown in Table 2

Table 2 Index operation diagnoses

Diagnosis	N	percent
Osteoarthritis	5	62.5
Fracture	2	25
Avascular necrosis	1	12.5
Total	8	100

All the fourteen patients showed positive growth on extended cultures of intraoperative specimens taken during the first-stage. *Staphylococcus aureus* was the most frequent infecting organism found in 8 patients (72.72%) of 11 patients with positive preoperative culture specimens; and in 10 patients (71.42%) of 14 patients with positive intraoperative culture specimens. *Staphylococcus epidermis* was the second most common pathogen found in 3 patients (21.4%) of 14 patients with positive intraoperative culture specimens and polymicrobial in one patient (7.14%) (Table 3)

Table 3 Pathogens confirmed after first stage

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Pathogen	N	Percent
Staphylococcus aureus	10	71.42
Staphylococcus epidermis	3	21.4
Others (polymicrobial)	1	7.14

We add 2 g of vancomycin powder for each bag of antibiotic-impregnated polymethylmethacrylate (40 g). In all patients, one bag is used to make acetabular construct, and another to form the cement mantle around the femoral stem, and finally a third bag to cement the components to bone.

One of twelve cases showed persistent infection (pathogen was polymicrobial) and required another second stage debridement with re-insertion of another temporary construct followed by intravenous antibiotics and later implantation of permanent prosthesis after 6 months interval at third stage. No other complications occurred after the first stage (Table 4)

Table 4 Complications that occurred during and after the first-stage operation

	First stage Intraoperative/postoperative complications
Description	N
Persistent/recurrent deep infection	1
Bone fractures (intra-operative)	0

Dislocation/Subluxation	0
Bone fractures (post-operative)	0
Wound Healing (Dehiscence, Skin Necrosis, Superficial Infection)	0
Femoral perforation	0
Component Insertion Difficulty	0
Component loosening	0
Cement fracture	0
Pain	0
Acetabular Perforation	0

Overall, the patients expressed satisfaction with the temporary prostheses. They functioned with relative ease during the “waiting period”. The mean time between the first and second-stage procedures was 10.5 weeks (range, 6 weeks to 6 months).

At the second-stage operation, all eleven patients received a cementless femoral and acetabular

component as their permanent prosthesis. The case with persistent infection after the first stage had successful second stage debridement and successful implantation of permanent prosthesis at third stage 6 months later. Two patients did not have a second-stage operation for implantation of the permanent prosthesis and retained the temporary prosthesis. Following the definition for successful treatment outcomes, 11 of 12 patients were treated successfully, with an overall success rate of 91.6%. No patient had clinical, laboratory, or radiographic evidence of infection at the final follow-up. Nine of eleven patients (81.81%) had an improvement of Harris hip score of at least 30 points.

Discussion

Many surgical strategies have been described in an attempt to treat infected hip arthroplasty and end stage septic arthritis of the hip, with two-stage arthroplasty considered to be the treatment of choice and more widely practiced than one-stage arthroplasty in most centres. After removal of prosthetic components and thorough debridement carried in the first stage, the surgeon is left with choice between leaving the joint space empty, or, much better, inserting antibiotic-loaded spacer whether static or functional .

Static spacers, like antibiotic impregnated cement-coated rush pin or intramedullary nail, antibiotic-impregnated cement beads have the theoretical advantage of increased antibiotic elution due to their large surface area, yet these spacers have the disadvantages of: skeletal traction being required for 2-3 weeks postoperatively till muscle scaring takes place, with resulting muscle shortening; pain; joint instability; limited mobility; bone surface degradation through bone-on-bone contact or by toggling and abrasion by the static cement spacer [4].

On the contrary, functional articulating spacers have the advantages of maintaining soft tissue tension, providing sufficient stability, preventing muscle contracture, and allowing the patient to ambulate partial weight-bearing the day after surgery. Many varieties have been described, like PROSTALAC device available in a single size (42mm outer diameter, 32mm inner diameter with a snap-fit design) and femoral component with several molds differing in size, femoral offset, neck length, and stem length [5]; spacer G (TECRES S.P.A.) which is constructed entirely from gentamicin-loaded cement available in 3 sizes.

In this study, we presented a modified technique to form a custom-made articulating spacer with antibiotic elution through the antibiotic-impregnated cement used in both components of the construct. The technique gives versatility in forming a construct with different sizes that can match different sizes of acetabula and femoral canals to a great extent. This match between the spacer and bone anatomy is of ultimate importance to prevent toggling of the spacer within bone and consequently decrease bone resorption during the interval period, and at the same time

maintain motion at the joint. From the economic point of view, the construct is much cheaper than PROSTALAC and preformed spacers like spacer G. Success rate using the technique used in this study was 91.6% which is comparable to results of Garvin et al [6] (92.7%), compare favourably with results of Tsukayama et al [7] (85.3%), and inferior to Younger et al [8] (95%).

Infection after total hip arthroplasty or hemiarthroplasty is a major complication that threatens the functional outcome, leading to major morbidity for the patient, and can ultimately end in a dysfunctional result even amputation. Sepsis in adult native hip with end stage arthritis represents another big challenge for orthopaedic surgeon. Multiple operations are usually required to control the sepsis, with increase costs and economic burden on the health services. Two-stage arthroplasty is considered to be the gold standard for management of such cases. Meticulous surgical debridement during first stage combined with insertion of the functional spacer as described in the technique, followed by appropriate intravenous antibiotics then carefully planned re-implantation of the permanent prosthesis result in high success rate. While static spacers result in limited mobility and arthrofibrosis which makes re-implantation difficult, the preformed articulating spacers like PROSTALAC and spacer G allow mobility and provide stability but are expensive. The modified technique described in this study provide a functional temporary spacer formed of inexpensive femoral component or the autoclaved extracted stem articulating with polyethylene acetabular liner with high versatility to match bony anatomy preventing bone resorption that may, potentially, result if static spacers are used. The construct allow range of movement, weight bearing, with low cost as a joint-preserving spacer in the awaiting period between the two stages in management of infected hip arthroplasty and septic arthritis of the hip

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Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#) [Figure 5](#) [Figure 6](#)

Effect of Cup Abduction and Head Lateral Microseparation on Contact Stress in Ceramic-on-Ceramic THA

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Background: High cup abduction angles generate increased contact stresses, higher wear rates and increased revision rates. However, there is no reported study about the influence of cup abduction on stresses under head lateralisation conditions for ceramic-on-Ceramic THA.

Material and method: A finite elements model of a ceramic-on-ceramic THA was developed in order to predict the contact area and the contact pressure, first under an ideal regime and then under lateralised conditions. A 32 mm head diameter with a 30 microns radial clearance was used. The cup was positioned with a 0°anteversion angle and the abduction angle was varied from 45° to 90°. The medial-lateral lateralisation was varied from 0 to 500 microns. A load of 2500 N was applied through the head center.

Results: For 45° abduction angle, edge loading appeared above a medial-lateral separation of 30 µm. Complete edge loading was obtained above 60 µm medial-lateral separation. For 45 degrees inclination angle, as the lateralisation increased, the maximal contact pressure increased from 66 MPa and converged to an asymptotic value of 205 MPa. A higher inclination angle resulted in a higher maximum contact pressure. However, this increase in contact pressure induced by higher inclination angle, became negligible as the lateral separation increased

Discussion Both inclination angle and lateral displacement induced a large increase in the stresses in Ceramic-on-Ceramic THA. Edge loading appeared for a small lateralisation. The influence of acetabular inclination angle became negligible for a lateral displacement above 240 µm, as the stresses reached an asymptotic value.

Figures

[Figure 1](#) [Figure 2](#)

In Vitro and in Vivo Analysis of Squeaking Frequencies in Ceramic-on-Ceramic Total Hip Arthroplasty

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INTRODUCTION:

Squeaking after total hip replacement has been reported in up to 10% of patients. Some authors proposed that sound emissions from squeaking hips result from resonance of one or other or both of the metal parts and not the bearing surfaces. There is no reported in vitro study about the squeaking frequencies under lubricated regime. The goal of the study was to reproduce the squeaking in vitro under lubricated conditions, and to compare the in vitro frequencies to in vivo frequencies determined in a group of squeaking patients. The frequencies may help determining the responsible part of the noise.

METHODS: Four patients, who underwent THR with a Ceramic-on-Ceramic THR (Trident®, Stryker®) presented a squeaking noise. The noise was recorded and analysed with acoustic software (FMaster®). In-vitro 3 alumina ceramic (BioloX Forte Ceramtec®) 32 mm diameter (Ceramconcept®) components were tested using a PROSIM® hip friction simulator. The cup was positioned with a 75° abduction angle in order to achieve edge loading conditions. The backing and the cup liner were cut with a diamond saw, in order to avoid neck-head impingement and dislocation in case of high cup abduction angles (Figure1). The head was articulated $\pm 10^\circ$ at 1 Hz with a load of 2.5kN for a duration of 300 cycles. The motion was along the edge. Tests were conducted under lubricated conditions with 25% bovine serum without and with the addition of a 3rd body alumina ceramic particle (200 μ m thickness and 2 mm length). Before hand, engineering blue was used in order to analyze the contact area and to determine whether edge loading was achieved.

RESULTS: Edge loading was obtained. In-vitro, no squeaking occurred under edge loading conditions. However, with the addition of an alumina ceramic 3rd body particle in the contact region squeaking was obtained at the beginning of the tests and stopped after ~20 seconds (dominant frequency 2.6 kHz). In-vivo, recordings had a dominant frequency ranging between 2.2 and 2.4 kHz.

DISCUSSION: For the first time, squeaking was reproduced in vitro under lubricated conditions. In-vitro noises followed edge loading and 3rd body particles and despite, the severe conditions, squeaking was intermittent and difficult to reproduce. However, squeaking is probably more difficult to reproduce because the cup was cut and the head was fixed in the simulator, preventing vibration to occur. Squeaking noises of a similar frequency were recorded in-vitro and in-vivo. The lower frequency of squeaking recorded in-vivo, demonstrates a potential damping effect of the soft tissues. Therefore, the squeaking in the patients was probably related to the bearing surfaces and modified lubrication conditions that may be due to edge loading. Varnum et al reported recently (3) that all the revised squeaking patients had a neck-cup impingement with metal 3rd body particles. These metallic wear particles may generate squeaking as shown in vitro. However, a larger cohort of squeaking patients is needed to confirm these results.

Figures

[Figure 1](#)

Friday, October 8, 2010, 16:30-17:20

Session A16: Computer Navigation in THA

The Value of Three-Dimensional Computerised Planning of THA Using Anterior Minimal Invasive Surgery.

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Background

A high precision of three-dimensional (3D) computerised planning of THA was recently reported. However, there is no comparative study analysing the value of 3D planning comparatively to the planning made on X-rays using 2D templates

Material and method

A prospective comparative randomised study was carried out from 2008 to 2009, and included 2 groups of 32 patients who underwent THA for primary osteoarthritis. One surgeon performed all the procedures using a direct anterior approach. In one group, the planning was made on calibrated X-Rays using 2D templates. In the other group, a 3D planning was performed based on CT-scan using the Hip-Plan software. Post operatively, the final hip anatomy was analysed on X-Rays for the 2D group and on CT-scan for the 3D group.

Results

In the 3D group, the duration of the surgical procedure was 18% shorter and the bleeding was 34% lower. The prediction rate of the stem and the cup sizes were respectively of 100% and 97% in the 3D group. In the 2D group, these rates were 43%. When combining both components, the prediction rate was 97% in the 3D group and 16% in the 2D group. The center of rotation, the femoral off-set and the length were restored with a twice higher precision in the 3D group

Discussion

This higher precision was probably due to the accurate analysis of the hip anatomy, the problems that may be encountered were detected before surgery. Clinical benefits for the patients were also proved. This technique is now our gold standard procedure.

Figures

[Figure 1](#) [Figure 2](#)

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

The Demographic Influence on Oxford Knee Scoring: Fact or Fiction?

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Introduction:

The Oxford Knee Score is a well validated, commonly used scoring system. Previous studies have suggested that the score is influenced by demographic differences between patients in particular the functional component more than the pain and clinical components. The aim of this study was to further assess this using a large number of patients.

Methods:

The pre, 3 months and 12 months post-surgical Oxford Knee Scores were collected from 1492 patients from five distinct demographic locations undergoing total knee arthroplasty over twelve years under the care of 8 different consultants. A total of 735 patients had complete data sets. The scores were then analysed to test whether age, postcode, sex or consultant in charge had any significant effects on the outcome.

Results:

No significant difference in outcome was found between the five locations used in the study. This was also the case when different consultants were compared however when the results are adjusted for age there was a significant difference ($p=0.019$). In this study female patients had higher scores at both 3 and 12 months (significance $p=0.011$ and 0.044 respectively). Age of patient was also found to be of borderline significance when determining the post-operative scores.

Conclusion:

This large patient sample study shows that the Oxford Knee Score in post-operative patients is not as heavily influenced by demography as previously suggested. The results show that patients who are older and/or male will have better outcomes from knee arthroplasty. Individual surgeons do not significantly affect the outcome although some surgeons may have better results when age of patient is taken into account. Lastly, post code and life style has no significant influence on the outcome neither should be taken for any consideration for surgery.

Saturday, October 9, 2010, 10:20-11:05

Session A19: Miscellaneous Arthroplasty

Medium Term Results of Total Elbow Replacement; District General Hospital Experience

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In this study we reviewed all Total Elbow Replacements (TER) done in our hospital over eight years period (1997 – 2005), 21 patients (16 females, 5 males) were available for follow up and four were lost (two died and two moved out of the region) with average age of 65 years (range 44 – 77), all procedures were done by two upper limb surgeons (CHB & RGW). 16 patients (14 females, 2 males) had the procedure for Rheumatoid Arthritis and 5 patients (3 males, 2 females) undergone the procedure for post-traumatic arthritis.

The average follow up was 61 months (range 12 – 120 months), the Mayo Clinic performance index, the DASH scores and activities of daily living (adopted from Secec Elbow Score) assessment tools were used. In addition, all patients were assessed for loosening using standard AP and lateral radiographs. Sixteen patients had Souter-Starthclyde prosthesis whilst three had Kudo and two had Conrad-Moorey prosthesis.

All procedures were done through dorsal approach and all were cemented, the ulnar nerve was not transposed in any of the cases. The average elbow extension lag was 27 degrees (range 15 – 35) with flexion up to 130 degrees (range 110 – 140). Supination was 65 degrees (range 15 – 90) and pronation was 77 (range 55 – 90). The average DASH score was 51.3 (range 19 – 95), the Mayo elbow score was 82 (range 55 – 100) and the average Activities of daily living Secec Score was 17 (range 10 – 20).

There were four complications, three ulnar nerve paresis which recovered and one wound complication which needed a flap cover. Two needed revision surgery, one for a periprosthetic fracture and one for loosening. Two patients showed radiological signs of loosening but were asymptomatic. The survival rate with revision as the end point is 95% for aseptic loosening and 90% for any other reason.

Our study proves TER has good medium term results with good functional outcome and high patient satisfaction rate.

Periprosthetic Fractures After Hip Arthroplasty

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Between 2002 and 2009, 15 patients with periprosthetic fractures of the femur and the acetabulum either intraoperative or perioperative fractures were treated.

The intraoperative femoral fracture was treated by cerclage and longer stems with excellent results, the postoperative femoral fracture was treated by cable plate systems or revision arthroplasty without the use of cortical strut allograft, all the cases are treated according to Vancouver classification.

There are two cases of intraoperative acetabular fractures, the first one was treated by block autograft and cemented cup, the other one treated by multihole cementless cup as internal plating.

The postoperative acetabular fractures are spontaneous fractures due to osteolysis and treated by impaction or allograft with metal support either by rings or meshes.

Revision of Femoral Components by Long Stem: Cementless Versus Cemented

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Between 2001 and 2010, 120 cases of femoral revisions were done, these cases were treated by one of the following three techniques; the first one is revision by long stem cemented, the second is revision by long stem cementless with the use of oscar system through endofemoral application and the third is revision by long stem cementless via Wagner osteotomy, one of these patients was treated by long stem cemented as primary treatment due to proximal femoral deficiency.

All of the long stem revisions were treated without the use of strut cortical allograft as this type of graft is not available in Egypt.

The choice of the implant depends on the type of the primary prosthesis, bone quality, proximal femoral deficiency and the technique of removal.

Saturday, October 9, 2010, 10:30-11:05

Session B18: Pot Pourri!

Different Techniques of Acetabular Reconstruction

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40 patients affected by primary and secondary acetabular bone stock defect that were operated using cemented and cementless hip replacement.

Bone defect was classified according to American Academy of orthopaedic surgery, different types of bone graft techniques and metal reinforcement were used.

Geometrical position of the acetabular component, cup integration, hip center and graft interposition were assessed, 95% of the cups were in the desired position with graft incorporation and remodeled with one case of partial sciatic affection, most of reconstructions in primary hips were done with cementless cups but most of reconstructions in defects following loosening were treated by cemented cups.

The results depend on the stability of the graft, cementing technique as well as cup position.

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

Outcome Studies in Hip and Knee Arthroplasty: A 14-Year Experience With the OrthoWave Software Suite

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This Outcome Studies Software suite has been designed and carried out by Surgeons for Surgeons in order to provide the Orthopaedic Community with a valuable tool devoted to the

computerized clinical follow-up of Joint Arthroplasty, named OrthoWave™. The development of the OrthoWave™ suite, since 1996, has got involved clinical studies coordinators, software engineers, orthopaedic surgeons, and statisticians.

One underlying theme regarding Health Care has and always will be constant: the need to understand if our treatments actually work. Providing answers makes not only scientific sense but pragmatic and economic sense as well. In such a way, Evaluation in Joint Arthroplasty has become a master word in the realm of Orthopaedic Surgery, which thus gets many actors involved, be they Surgeons, Scientific Societies, Health Department Authorities, Journal Editors, and Orthopaedic Devices Manufacturer.

While bearing in mind that more than a million of Hip and Knee replacements are worldly performed annually and there are thousands of devices and device combinations in use to achieve arthroplasties, these replacement procedures have to be properly evaluated as a very challenging procedure. An outcomes study software needs to allow for easy and user friendly collection of clinical data and related images, while preserving privacy of patients and their personal data. This software must then provide consistent statistical and survivorship analyzes in the very long run. The OrthoWave™ software has been widely used worldly, and currently features the on-line Version 6, now available as a web-based secured "cloud computing" computer system. The so called "regular databases" can be linked to additional "scientific databases" and "monitored databases" able to set up together a very consistent and efficient global system.

Roughly speaking, OrthoWave addresses (1) data collection of Surgeons themselves, able to self evaluate their surgeries while owning their own data, (2) Local Registries, involving groups of Surgeons, to analyze, report and publish clinical series in the Literature, (3) Brand Registries, for tracking upon large multicenter studies at an early stage any problem that might occur with any given implant, (4) Clinical Affairs Departments in Industry, (5) and finally enables potential automatic links to National and International Joint Registries.

This OrthoWave software has thus permitted a "fine tuning" of clinical results, radiographic findings, survival rates and real assessment of quality of life, helping to determine in large databases studies if implant composition or joint replacement features can be associated with decreased need for repeat surgery, and to outline best methodological approaches to the assessment of failures in arthroplasty, in terms of functioning, quality of life and long-term disability.

All along these 14 years of continuous use of this OrthoWave software suite, we have tried to help it to be more and more efficient and user friendly. The current on-line web-based version now meets our expectation, and is flexible enough to adapt itself to future needs and better treatments for patients.

Short Stems: Thinking in Three Dimensions

*Joseph Fetto - NYU Hospital for Joint Disease - New York, USA

Non-cemented components have traditionally employed several possible features, among them a stem

and/or collar, to achieve proper alignment and initial implant stability within the proximal femoral cavity.

The advent of MIS has stimulated an interest in reducing the dimensions of implants, specifically stem length,

in order to facilitate introduction and implantation of the component. The consequence of this trend appears to be

an increase in early aseptic failure, of some components, due to loosening and migration. Several important

questions have arisen.

1. What are the direction of the deforming forces about a hip during daily activities?
2. What design features should a short stem implant exhibit so as to provide optimum stability against these forces?
3. Is having a stem an absolute requirement of a femoral component?
4. What is the minimum "safe" length a stem must have?
5. How can proper short stem alignment be optimized? Is intra-operative x-ray exposure necessary?

This presentation will discuss the computer modelling, laboratory testing and clinical outcomes of various

component designs; and make suggestions concerning directions for future investigations.

Figures

Friday, October 8, 2010, 16:30-17:20

Session A16: Computer Navigation in THA

The Accuracy of Cup Position in Total Hip Arthroplasty With CT-Based Navigation System

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(Objectives) Few reports were shown about the position of the cup in total hip arthroplasty (THA) with CT-based navigation system. We use minimally invasive surgery (MIS) technique when we perform cementless THA and the correct settings of cups are sometimes difficult in MIS. So we use CT-based navigation system for put implants with correct angles and positions. We evaluated the depth of cup which was shown on intra-operative navigation system.

(Materials and Methods) We treated 30 hips in 29 patients (1 male and 28 females) by navigated THA. 21 osteoarthritis hips, 6 rheumatoid arthritis hips and 3 idiopathic osteonecrosis hips were performed THA with VectorVision Hip 2.5.1 navigation system (BrainLAB). Implants were AMS HA cups and PerFix stems (Japan Medical Materials, Osaka). Appropriate angles and positions of cups were decided on the 3D model of pelvis before operation. According to the preoperative planning, we put the implants with navigation system. We correct the pelvic inclination angle and measured the depth of cups with 3D template software.

(Results) The average distance from the surface of the cup to the edge of medial wall of pelvis was 3.4mm (0.0-8.0mm) on the axial plane which include the center of femoral head on postoperative CT. The average distance from the surface of the cup to the edge of medial wall of pelvis was 6.4mm (1.5-15.0mm) on intraoperative navigation. The average error was 2.9mm (0.0-9.0mm). The cup positions of post operative CT were deeper than that of intraoperative navigation in twenty six hips (86%).

(Conclusions) The shallow setting of cups caused the instability of cups. Deep setting caused damage of acetabular fossa. The positions of cups on the navigation system tend to be shown shallower than actual positions, so we should take care of deeper setting.

Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Subvastus Approach, the Only True Mis Approach in Total Knee

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INTRODUCTION:

The majority of papers covering MIS total knee describe a surgical approach where the quads tendon is violated. This presentation describes a modified subvastus approach using MIS technique. The results are compared to the regular subvastus approach.

MATERIAL AND METHODS

423 total knee replacements were performed through MIS subvastus approach from November 2002 to February 2004. All cases were performed by the same surgeon. The subvastus approach was modified to allow more quads excursion so the surgery can be performed without dislocating the patella. The data was processed at University of Dundee. The results were compared to the results of 361 cases of standard subvastus approach performed by the same surgeon.

RESULTS:

The average skin incision for the MIS group was 10.2 CM. as compared to 18.4 to the standard subvastus. There was no significant difference in the blood loss between the two groups. The progress with rehabilitation was the same in both groups as well. Hospital stay was also the same

DISCUSSION:

Kanasaki et al. (ISTA 2002) has shown that patients who had subvastus approach were able to regain the ability to do a straight leg raising faster than the standard parapateller incision. The results in this paper confirm the same showing that the ability of patients to rehabilitate is not related only to the size of the incision. Having relatively small incisions help in shorten hospital stay but did not make any difference in blood loss.

CONCLUSION:

The subvastus approach is the only true quad sparing approach and it can be performed through 10 cm. incision safely even in heavy patients with severe knee deformity

Friday, October 8, 2010, 8:40-9:30

Session A11: Knee Arthroplasty in the Middle East

Full Flexion After Total Knee Using Lps Flex Implant

Ibrahim Gado - American Hospital - Dubai, UAE

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INTRODUCTION

The majority of implants available in the market today were designed to allow for a flexion up to 130 degree angle. The LPS Mobile Flex was designed to accommodate deep flexion, up to

160 degree angle. The purpose of this study is to evaluate the clinical result of the LPS Mobile Flex knee.

MATERIALS AND METHODS

From January 1999 to February 200, 1043 (one thousand and forty three) surgeries were performed on patients treated for advanced osteoarthritis. All the surgeries were carried out by the same surgeon. The majority of the patients had bilateral total knee replacements simultaneously. Mobile and fixed implants were used. Pre-operative ranges of motion were documented on lateral x-ray. Patients were considered to have full flexion if they were able to flex the knee to at least 140 degree and sit on the ground with calf touching thigh for at least one minute. Data were processed at University of Dundee

RESULTS

67% obtained full flexion as defined above. The majority of the cases with full flexion had full movement pre-operatively; except for 63 cases. Average range of motion was much better than University of Dundee data base. Complications included; 2 cases of peroneal nerve palsy, three of dislocation, and two of infection, a case of rupture of MCL ligament, a case of intra-operative tibial plateau fracture, 2 of supracondylar femur fracture and 4 patella clunk

CONCLUSION

The LPS Flex Implant had a similar complication rate to those reported by other series. There was no complication that could be specifically attributed to deep flexion. However it should be stressed that this exceptional result has to do mainly with careful patient selection.

Friday, October 8, 2010, 8:40-9:30

Session A11: Knee Arthroplasty in the Middle East

Clinical Experience With Mobile Lps Flex Implant

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INTRODUCTION

The majority of implants available in the market today were designed to allow for a flexion up to 130 degree angle. The LPS Mobile Flex was designed to accommodate deep flexion, up to 160 degree angle. The purpose of this study is to evaluate the clinical result of the LPS Mobile Flex knee.

MATERIALS AND METHODS

From January 1999 to February 2002, 318 surgeries were performed on patients treated for advanced osteoporosis. All the surgeries were carried out by the same surgeon. The majority of the patients had bilateral total knee replacements simultaneously. Pre-operative ranges of motion were documented on lateral x-ray. Patients were considered to have full flexion if they were able to fix the knee to at least 140 degree angle sit on the ground with calf touching thigh for at least one minute.

RESULTS

68% obtained full flexion as defined above. The majority of the cases with full flexion had full movement pre-operatively, except for 12 cases. Some complications were reported. There were 2 cases of peroneal nerve palsy, one of dislocation, and one of infection. There was also a case of rupture of MCL ligament, a case of intra-operative tibial plateau fracture and one of supracondylar femur fracture. No revision was performed. There were no patella complications.

CONCLUSION

The LPS Flex Implant had a similar complication rate to those reported by other series. There was no complication that could be specifically attributed to deep flexion. Surprisingly, there were no patella complications and the implant, in general, had an excellent clinical outcome as far as mobility. However, it should be stressed that this exceptional result has to do mainly with careful patient selection.

Saturday, October 9, 2010, 8:15-9:00

Session A17: Knee Mechanics

A Large Scale Finite Element Study of an Osseointegrated Cementless Tibial Tray

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Introduction

The number of total knee joint replacements has increased dramatically, from 28,000 in 2004 to

over 73,000 in 2008 in the UK. This increase in procedures means that there is a need to assess the performance of an implant design in the general population. For younger, more active patients, cementless tibial fixation is an attractive alternative means of fixation and has been used for over 30 years. However, the clinical results with cementless fixation have been variable, with reports of extensive radiolucent lines, rapid early migration and aseptic loosening [1]. This study investigates the inter-patient variability of bone strain at the implant-bone interface of 130 implanted tibias over a full gait cycle.

Methods

A large scale FE study of a full gait cycle was performed on 130 tibias implanted with a cementless tibia tray (PFC Sigma, DePuy Inc, USA). A population of tibias was generated from a statistical shape and intensity (SSI) model [2].

The tibia tray was automatically positioned and implanted using ZIBAmira (Zuse Institute Berlin, Germany). Cutting and implanting were performed using Boolean operations on the meshed surfaces of the tibia and implant. After generation of a volume mesh from the resulting surface, the bone modulus was mapped onto the new mesh.

The FE models were processed in Abaqus (SIMULIA, RI, USA). Associated force data (axial, anterior-posterior and medial-lateral forces and flexion-extension, varus-valgus and internal-external moments) was sampled from a statistical model of the gait cycle derived from musculoskeletal modelling of 20 elderly healthy subjects. Patient weight was estimated using the length of the tibia and a BMI sampled from NHANES data.

Loads were applied to four groups of nodes on the tibia tray (anterior, posterior, medial and, lateral) for 51 steps in the gait cycle. The bone and implant were assumed to be bonded, simulating the osseointegrated condition.

Results

The equivalent strain was computed for each element in the model. The peak strain in each element over all the gait cycle was found. The mean strain, for all implanted tibias, at the bone-implant interface was found to be 477 microstrain, with a 95th percentile of 1370 microstrain. The maximum and minimum mean interface strains of each individual tibia were 1243 microstrain and 221 microstrain respectively. A one-way ANOVA test was carried out to see if there was any significant difference of mean strain levels between implant sizes. No significant difference was shown between the implant sizes and mean strain ($p = 0.37$).

Discussion

There is a large variability of the mean strain within the population, a range of 1000 microstrain. The implant size does not appear to influence the mean strain of the population. With a large scale study, it is possible to investigate the effect of other factors which might influence the strain field at the contact interface, such as modulus, bone shape, or loading.

Acknowledgements

This project is funded by EPSRC and DePuy.

References

- [1] Bassett R., 1997, J. Arthro.
- [2] Bryan et al., 2009, Med. Eng. & Phys.

Pattern of Loosening of Polyethylene Keeled Glenoid Components in Primary Osteo-Arthritis.A Multicenter Study With Follow-Up > 5 Years

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INTRODUCTION- THE AIM OF THIS STUDY WAS TO ANALYSE THE LONG-TERM RADIOLOGICAL CHANGES FOLLOWING TSA IN ORDER TO BETTER UNDERSTAND THE MECHANISMS RESPONSIBLE FOR LOOSENING.

MATERIAL AND METHODS- BETWEEN 1991 AND 2003, IN 10 EUROPEAN CENTERS,611 SHOULDER ARTHROPLASTIES WERE PERFORMED FOR PRIMARY OSTEOARTHRITIS USING A THIRD GENERATION ANATOMIC PROSTHESIS WITH A CEMENTED ALL-POLYETHYLENE KEELED GLENOID COMPONENT.FULL RADIOGRAPHIC AND CLINICAL FOLLOW-UP GREATER THAN 5 YEARS WAS AVAILABLE FOR 518 SHOULDERS.kAPLAN-MEIER SURVIVORSHIP ANALYSIS WAS PERFORMED WITH GLENOID REVISION FOR LOOSENING AND RADIOLOGICAL LOOSENING AS END POINTS;CLINICAL OUTCOME WAS ASSESSED WITH THE CONSTANT SCORE,PATIENT SATISFACTION SCORE,SUBJECTIVE SHOULDER VALUE AND RANGE OF MOVEMENT

RESULTS- AFTER A MEAN FOLLOW-UP OF 103,6 MONTHS (61-209 MONTHS),THE CONSTANT SCORE IMPROVED SIGNIFICANTLY(P<0,0001) FROM 30,1 POINTS PRE-OPERATIVELY TO 65,2 POINTS AT LATEST FOLLOW-UP.THE ACTIVE ANTERIOR ELEVATION INCREASED FROM 91,5 TO 138,1 DEGREES (P<0,0001),AND ACTIVE EXTERNAL ROTATION INCREASED FROM 7,9 TO 33,2 DEGREES (P<0,0001). 90,3% OF PATIENTS WERE EITHER VERY SATISFIED OR SATISFIED WITH THEIR OUTCOME AND THE AVERAGE SSV WAS 77,1%.RADIOLOGICAL LOOSENING WAS FOUND IN 166 CASES(32%).THREE PATTERN OF GLENOID COMPONENT MIGATION WERE OBSERVED IN 136 CASES:SUPERIOR TILTING (10%) ,POSTERIOR TILTING(6,3%), AND A SUBSIDENCE (7,9%) OF THE GLENOID COMPONENT.DIFFERENT RISK FACTORS WERE STATISTICALLY ASSOCIATED WITH THE MIGRATION OF THE GLENOID COMPONENT(P<0,001):PROXIMAL MIGRATION OF THE HUMERAL HEAD,EXCESSIVE REAMING OF THE GLENOID,TYPE OF GLENOID PREPARATION FOR THE KEEL(I.E.CURETTAGE TECHNIQUE DESCRIBED BY NEER IN 1972 VERSUS CANCELLOUS COMPACTION TECNIQUE DESCRIBED BY GAZIELLY IN 2003).SURVIVORSHIP WITH THE END-POINT BEING GLENOID REVISION FOR LOOSENING WAS 99,8% AT 5 YEARS,95,9% AT 10 YEARS, AND 77,5% AT 15 YEARS. **CONCLUSION-** TO REDUCE RISK OF LOOSENING OF THE GLENOID COMPONENT,WE RECOMMAND CONSIDERATION OF THE FOLLOWING:OPTIMIZATION OF THE DESIGN AND SIZE OF THE IMPLANT,LIMIT THE AMOUNT OF REAMING SO AS TO NOT SACRIFICE THE SUBCHONDRAL GLENOID BONE,AND PREPARE THE GLENOID WITH CANCELLOUS COMPACTION RATHER THAN CURETTAGE TECHNIQUE.

Dual Mobility Acetabular Implants-a Solution for Dislocating Total Hip Prosthesis: Our Early Results

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Introduction

Revision surgery is generally recommended for recurrent dislocation following Total hip arthroplasty (THA). However, dislocation following revision THA continues to remain a problem with further dislocation rates upto 28% quoted in literature.

We present early results of one of the largest series in U.K. using dual mobility cemented acetabular cup for recurrent hip dislocation.

Methods

We retrospectively evaluated 40 patients where revision of hip replacement was performed using cemented dual mobility acetabular prosthesis for recurrent dislocations from March 2006 till August 2009 at our district general hospital by a single surgeon (senior author). The series comprised of 13 men and 27 females with average age of 73.4 years (49-92). The mean follow-up period was 23 months. (36 months –6 months).

All the hips that were revised had 3 or more dislocations, some them more than 10 times. The cause of dislocation was multifactorial in majority of cases including acetabular component malpositioning mainly due to loosening and wear .A cemented dual mobility cup was used in all cases. In six cases the femoral stem was also revised.

Results

At mean follow up of 26 months none of the revised THA had dislocated nor did they have any features of instability. No patients were lost for follow up. Clinically and radiologically there were no features of loosening of the acetabular component.

Discussion

The dual mobility cup appears to be a reliable method in treatment for recurrent total hip dislocations. Although our early results are encouraging with no loosening of acetabular components a further evaluation at longer follow- up is recommended.

Saturday, October 9, 2010, 13:30-14:20

Session B20: Hip Arthroplasty

The Squeakiest Hip of All !!

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Introduction-A 68 year old female patient underwent a left total hip replacement for primary osteoarthritis in March 2004. She was referred back by her GP 5 years as she was struggling with mobility and felt there were mice in her hip. It was squeaking so loudly that it could be heard at a distance of 25 metres. There was no history of any falls or dislocation in the last 5 years. The implant used was an Exeter/ABG ceramic total hip prosthesis with Palacos cement. This lady's discomfort in her hip had been always there. She never described herself as being satisfied with the THR. However, her discomfort had worsened terribly over the last year.

On examination-The slightest movement around her hip caused her severe pain. Tremendous squeaking could be heard when she was made to walk. She had significant limb length discrepancy of 2.5cms. The radiographs revealed that she had probably broken the ceramic head as pieces could be seen around the neck area.

On table-When the hip was exposed through standard lateral approach it was found that the ceramic head was intact. There was a large amount of blackish debris around the entire area and the shell of the ABG cup had a huge defect in it. It was a startling revelation as it was initially thought that the ceramic head was broken. Revision surgery was carried out with a C stem total hip prosthesis with an orthodynamic socket.

Discussion-Ceramic bearing surfaces have been introduced to reduce friction and prevent bone loss. There has been a problem with squeaky hips following ceramic implant insertion. However there has been no report of cup wear and an intact ceramic head till date in literature. To our knowledge this is the first case being reported and the images are quite startling.

Saturday, October 9, 2010, 10:30-11:05

Session B18: Pot Pourri!

Collomis Stem: A New Short Stem With Meta-Epiphyseal Cancellous Bone

Compaction. Evaluation of First 350 Cases.

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Collo MIS is a new short stem created to achieve minimal metaepiphyseal invasiveness, to respect the joint physiology, to get optimal primary stability and osteointegration.

This stem needs a subcapital osteotomy to respect and preserve the physiologic anteversion of the femoral neck; the technique provide compactation of the cancellous bone of the greater trochanter using just compactors and not rasps during the femur preparation and the stem has to match the calcar curvature to get the right position.

This stem has been designed with a lateral wedge to ensure a great primary stability in the femoral neck.

Since November 2008 at Niguarda Hospital we have implanted 350 prosthesis in cooperation with Frankfurt Hospital.

Patients age varies form 26 to 80 years old with a mean age of 61 y.o.

This stem has to be implanted in patients with good bone quality to achieve the compactation of the cancellous bone.

We have operated patients affected mostly by coarthritis and just in few cases by dysplasia (Crowe 1); contraindications are represented by a CCD angle less than 120° and more than 140° because of the stem morphology, severe osteoporosis, dymorphism, and dysplasia (Crowe 2,3,4).

We have evaluated the offset and CCD angle pre and post op that resulted mostly increased after surgery (average CCD angle $+6,15^{\circ}$, offset $+ 5.95$ mm).

In the post-op we normally give partial weight bearing after 1 day and the full weight bearing after 20 days.

The mean HSS score before surgery was of 57.5 points and after 1 year of 98 points.

The complications we have found in these study were: 11 cases of dysmetrias less than 1 cm, 6 cases of neck fissuration. No infection, mobilization, neck impingemen, subsidence, radiolucency have been evaluated.

Thursday, October 7, 2010, 9:00-9:50

Session A2: Alternate Bearings in THA 2

Results of Metal on Metal Revision Hip Arthroplasty

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Introduction:

The aim of this study is to report the results of Revision hip arthroplasty using large diameter, metal on metal bearing implants- minimum 2 year follow up.

Methods:

A single centre retrospective study was performed of 22 consecutive patients who underwent acetabular revision surgery using metal on metal bearing implants between 2004 and 2007. Birmingham hip resurfacing (BHR) cup was used in all patients - monoblock, uncemented, without additional screws in 16 cases and cemented within reinforcement or reconstruction ring in 6 cases.

Femoral revisions were carried out as necessary.

Results:

There were 16 men and 6 women with a mean age of 71 years (51-83). Revision surgery was performed for aseptic loosening in 10, infected primary hip arthroplasty in 8, infected Hemiarthroplasty in 1 and Peri-prosthetic fracture with loosening in 3 patients. A 2-stage revision was performed for all infected hips.

One patient died and the remaining 21 patients had clinical and radiological assessment at a mean 35 months (24-60). The mean Harris hip score was 75 (23-98) with 50% good to excellent results.

Only 1 patient had further revision to a proximal femoral replacement and constrained cup in 2 stages for recurrent infection at 24 months.

There were 2 recurrent infections (both revised for septic loosening) and 1 non-union of trochanteric osteotomy.

There were no dislocations in the group. No radiological loosening of implants or metal ion complications have been seen at last follow up.

Conclusions:

We believe this is the first reported series on the use of large diameter metal on metal bearing surfaces for revision hip arthroplasty. Our series shows satisfactory short to medium term results in this complex group of patients with no component loosening, despite monoblock cups and no dislocations.

Acetabular Reconstruction Using Reinforcement Ring and Cemented Metal on Metal Cup for Revision Hip Arthroplasty

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Introduction:

To report the short to medium term results of acetabular reconstruction using reinforcement/reconstruction ring, morcellised femoral head allograft and cemented metal on metal cup.

Methods:

Single centre retrospective study of 6 consecutive patients who underwent acetabular reconstruction for revision hip surgery.

The acetabulum was reconstructed using morcellised femoral head allograft and reinforcement or reconstruction ring fixed with screws. The Birmingham cup – designed for cementless fixation, was *cemented* into the ring in all cases. The uncemented Echelon stem with metal on metal modular head was used for reconstructing the femur.

Data from our previous in-vitro study had shown good pull out strength of a cemented Birmingham cup.

Results:

There were 2 men and 4 women with a mean age of 75 years(57-83). Revision was performed for aseptic loosening in 2, septic loosening in 2 and peri-prosthetic fracture with loosening in 2 patients.

All patients were reviewed clinically and radiographically at a mean of 36 months follow-up(range 24 - 42 months).

Revision was not necessary in any patient for failure of acetabular or femoral fixation. However, 1 patient had revision to a proximal femoral replacement and constrained cup for recurrent infection and osteomyelitis at 24 months. This patient was excluded from the final analysis.

The mean Harris hip score at last follow up was 79(range 70-89).

Radiographic analysis revealed good graft incorporation and no signs of loosening or cup/ring migration.

No dislocations or metal ion problems were recorded in this series.

Conclusions:

To the best of our knowledge, this is the first series using cemented metal on metal cups within a reinforcement / reconstruction ring for revision hip arthroplasty. Excellent cemented fixation of the cup, manufactured for cementless fixation, was obtained at surgery with no evidence of loosening, and no dislocations at minimum 24 months follow up.

Saturday, October 9, 2010, 16:00-16:50

Session B22: Arthroplasty- Getting it Right!

An Update of Non-Invasive Extendable Endoprostheses in Paediatric Tumour Surgery - Dual Centre Study.

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Non-invasive expandable prostheses for limb salvage tumour surgery were first used in 2002. These implants allow ongoing lengthening of the operated limb to maintain limb-length equality and function while avoiding unnecessary repeat surgeries and the phenomenon of anniversary operations.

A large series of skeletally immature patients have been treated with these implants at the two leading orthopaedic oncology centres in England (Royal National Orthopaedic Hospital, Stanmore, and Royal Orthopaedic Hospital, Birmingham).

An up to date review of these patients has been made, documenting the relevant diagnoses, sites of tumour and types of implant used. 87 patients were assessed, with an age range of 5 to 17 years and follow up range of up to 88 months.

Primary diagnosis was osteosarcoma, followed by Ewing's sarcoma. We implanted distal femoral, proximal femoral, total femoral and proximal tibial prostheses. All implants involving the knee joint used a rotating hinge knee. 6 implants reached maximum length and were revised. 8 implants had issues with lengthening but only 4 of these were identified as being due to failure of the lengthening mechanism and were revised successfully. Deep infection was limited to 5% of patients.

Overall satisfaction was high with the patients avoiding operative lengthening and tolerating the non-invasive lengthenings well. Combined with satisfactory survivorship and functional

outcome, we commend its use in the immature population of long bone tumour cases.

Thursday, October 7, 2010, 9:00-9:50

Session A2: Alternate Bearings in THA 2

Massive Osteolysis Could Not Expand Along Porous Cup Surface With AW-Glass Ceramics Bottom Coating: A Case Report

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One cementless cup which had porous outer surface with Apatite-Wollastonite glass ceramic (AWGC) coating, was revised 13 years after primary THA because of massive osteolysis expanded to medial iliac wall along the screws. While many retrieved studies of hydroxyapatite-coated cup have been reported, there has been no report on the retrieved cup with AWGC coating. The purpose of this study was to describe this rare case in detail, confirm the bone ingrowth to the porous cup, and discuss on the effectiveness of porous surface with AWGC coating.

Case

The patient was a 64 old woman and complained of chronic mild pain around her left groin region. X-ray examination revealed that osteolysis had been expanding around the screws and extended proximally. The revision surgery was performed for the massive osteolysis through Hardinge antero-lateral approach. The retrieved implants included a cementless cup made of titanium alloy (QPOC cup, Japan Medical Materials Inc.(JMM) Osaka, Japan), the outer surface of which was plasma-sprayed with titanium for porous formation and coated with AWGC in the deep layer. It was found that the polyethylene liner was destructed partially in the supero-lateral portion, but the cup was well fixed to the bone. The bone-attached area was found to be dispersed over the porous surface of the hemispherical cup. Histological examination revealed that matured bony tissue intruded into the porous surface of the cup, and contacted to bone directly, which was also demonstrated in the back-scattered electron image. It was also demonstrated that there were residual silicon (Si) rich regions on the porous surface by the SEM-EDX analysis, which indicated that constituents of AWGC still remained on the surface. On the other hand, the results of elementary analyses in the Si rich regions varied among the sections, which probably indicated that the extent of degradation and absorption of AWGC varied among the sections.

AWGC was one of the bioactive ceramics and reported to have an ability to bond to bone earlier than hydroxyapatite (HA). In the present case, though massive osteolysis occurred with aggressive wear, it did not expand on the porous surface, and rather progressed along the smooth surface of the screws. Considering that there are many clinical studies reporting poor clinical results of HA-coated smooth cups, bioactive ceramic coating may function well and

bring superior clinical results when combined with porous coated substrate. In our study, though the cause of massive polyethylene wear and intrapelvic giant osteolysis could not be revealed, the porous cup with AW-GC bottom coating was well fixed and gained bone-ingrowth at the porous surface under osteolytic conditions, which may demonstrate the long-term durability of this surface treatment.

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Management of Unstable Total Hip Arthroplasty Using a Dual Mobility Cup

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Julien Wegrzyn - Edouard Herriot Hospital - LYON, FRANCE

Vincent Pibarot - Edouard Herriot Hospital - LYON, FRANCE

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Introduction:

Reoperations to manage unstable total hip arthroplasty are reported with a high failure rate. The dual mobility cup (figure 1) (mobile polyethylene component between the prosthetic head and the outer metal shell) is a useful option in such cases. The purpose of this retrospective study was to assess the clinical and radiologic features associated with the dual mobility cup.

Materials and Methods:

Fifty one unstable total hip arthroplasties (32 females, 19 males) were revised using a dual mobility socket at our institution between March 2000 and February 2005.

Mean age at reoperation was 67 year old (range, 35 to 98). The outcome of the revision procedure was assessed using the Harris Hip Score, and complications were determined by detailed review of the patient's records. Anteroposterior and lateral radiographs of the involved joint were reviewed to assess the position of the prosthesis and to look for osteolysis and signs of loosening of the implant.

Results:

Mean follow-up was 4 years (range, 2 to 6.7). At last review 4 patients had died and one was lost to follow up. Postoperatively there was a significant improvement of the Harris Hip Score. Fifty patients (98%) had no further episodes of dislocation. There were 3 revisions for deep infection, and 2 for dissociation of the bipolar component. No cup required a revision for aseptic loosening. No radiolucent lines around the components and no osteolysis were observed at latest follow up.

Conclusion:

The dual mobility cup is a highly effective option to manage unstable total hip arthroplasty. Unlike constrained devices, such components provide encouraging radiologic results regarding the potential for loosening and osteolysis. Longer follow up is needed to confirm these results.

Figures

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Constrained Implants for Total Hip Arthroplasty Instability: Analysis of Failures

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Introduction:

Recurrent instability after total hip arthroplasty remains a serious and somewhat frequent problem. Constrained implants have proven effective to manage instability. This has led to a liberal utilization of these devices. However, sporadic mechanical failures have been reported. This report analyzes the failures of a single constrained device at our institution.

Materials and Methods:

Forty-three constrained implants (Stryker Constrained Liner™) in 34 patients were revised out of total 390 similar implants performed at our institution. There were 24 females and 10 males. Constrained implant was inserted at the first revision in 6 hips and after an average of three surgeries (1-6) in 37 hips. Seven different methods of constrained liner fixation were observed. Eight different theoretical failure mechanisms were identified: six are mechanical device failures at each of the implant interfaces, infection and catastrophic polyethylene wear being the other two.

Results:

Average time to failure was 28.4 months (1-78). Several failure mechanisms were operating in most cases. The predominant mechanism was infection in 12 (28%), type I (failure of fixation to

bone) in 11 (26%), type II (failure of mechanism holding the liner to shell) in 6 (14%), type III (failure of the bipolar holding mechanism) in one (2%), type IV (dislocation of bipolar) in 9 (21%), type V (dislocation of femoral prosthetic head from bipolar) in 3 (7%), and in 1 hip we could not identify the failure mechanism; There were no instances found of type VI failure (disengagement of the prosthetic head from trunion) or catastrophic polyethylene wear.

Conclusion:

Constrained tripolar implants are complex devices with multiple interfaces. We have shown multiple mechanisms of failure of these devices. Avoiding technical errors can reduce the number of failures. However, judiciously restricting their use to salvage situations seems warranted.

Friday, October 8, 2010, 15:00-16:00

Session A15: Alternate Bearings 2

An Original Hip Navigation System to Control Leg Lengthening, Offset and Stability Without the Use of the Pelvic Anterior Plane

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Introduction:

Despite improvements in prosthesis design, the clinical outcome of total hip arthroplasty still has 10% failure rate after 10 years. Component malpositioning can lead to instability, impingement, excessive wear and loosening. Computer-assisted procedures are expected to improve the accuracy of component positioning, and therefore the long-term outcome. We present an original hip navigation system that allows controlling leg lengthening, offset and stability without the use of the pelvic anterior plane.

Material and Methods:

Because the reliability of the pelvic anterior plane (Lewinnek plane) remains discussed, we present a computer-assisted hip replacement using a functional femoral reference plane. Direction and depth of the acetabular reaming and progression of the femoral rasp are calculated by a sophisticated algorithm, as well as the components' final position, in order to control leg lengthening and offset. In addition, the ROM to impingement (and therefore the stability) is continuously displayed relative to the position of the components. Simple graphical and numerical data in addition to virtual instruments displayed on the screen aid the surgeon during the entire procedure.

Results:

We report cases of hip replacements performed using the subscribed navigation system in patients with preoperative leg length discrepancy and abnormal hip morphology to emphasize the value of navigation in such cases.

Conclusion:

The subscribed navigation system allows accurate positioning of the components during total hip arthroplasty and enables the surgeon to control leg lengthening, offset and stability. Therefore, improved long term outcome can be expected. Longer clinical follow-up is required to confirm this assumption.

Friday, October 8, 2010, 14:50-15:10

Session B13: Imaging Technology

Adjusting Leg Length Discrepancy in Hip Arthroplasty Using Digital Templating System

*Mahmoud Hafez - October 6th - Cairo, Egypt

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Digital templating was used in 50 patients who underwent THA using Merge Ortho software, Cedara. Clinical examination was performed first, to measure leg lengths and account for pelvic obliquity and flexion deformity. Good quality digital radiographs were obtained with anteroposterior and lateral views extending beyond the tip of the femoral component and the cement restrictor. A coin was placed on the ASIS to help in determining radiological magnification

Digital radiographs were saved in DICOM format and imported to EndoMap software system.

A 6-step technique was used for templating as follows:

1. **Radiographic assessment;** looking at the quality of bone, amount of bone stock, dysplasia, osteophytes, and other abnormalities
2. **Correction of magnification;** following the specific instructions of the software, by measuring the diameter of the coin on the digital radiograph.
3. **Measuring leg length discrepancy;** the software system automatically calculated the leg length discrepancy, even in the presence of pelvic obliquity (Figure1).
4. **Templating acetabular component;** the desired cup was selected from the implant library after identifying important landmarks. The size and position was modified to fit the acetabulum and to restore the center of rotation of the hip, considering minimal bone removal and sufficient bone coverage laterally.
5. **Templating femoral component;** the size and position of the desired stem was adjusted to fit the femoral canal, different offsets were compared to find the best match for the patient's original offset.

Correction of leg length discrepancy and measuring length of neck resection; the height of the femoral stem was adjusted to correct any leg length discrepancy by placing the center of the head above the center of the cup by the same length of discrepancy. Then the level of the neck resection was marked at the level of the stem collar and the femoral neck cut was measured by a digital ruler from the tip of the lesser trochanter to the mark of neck resection. In case of leg length discrepancy, the height of the femoral neck cut was adjusted accordingly to compensate for the leg length discrepancy. For example, if the affected leg is 20 mm short, place the centre of the head 20 mm above the centre of the cup.

Intraoperatively, the surgeon performed the femoral neck osteotomy at the level determined by preoperative templating. Postoperatively, the leg length was measured and compared to the preoperative leg length. Preoperatively, the leg length discrepancy ranged from 5 to 30 mm. In all cases, the leg was short on the side of THR (ipsilateral). Leg length discrepancy was adjusted in all THR cases. Postoperatively, the accuracy of the correction was found to be within 5 millimeters i.e. less than 5mm of shortening or lengthening). Intraoperatively, the level of femoral neck cut ranged from 1 to 44 mm.

Digital templating is useful in adjusting leg length discrepancy. In addition, there were other benefits such as predication of femoral and acetabular implant sizes, restoration of normal hip centre, and optimization of femoral offset.

Thursday, October 7, 2010, 13:30-14:10

Session B5: Computer Navigation in TKR 1

Correction of Complex Femoral or Tibial Shaft Deformities During Total Knee Arthroplasty Using Computer Assisted Techniques

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Introduction

There is a controversy with regard to the treatment of osteoarthritis (OA) of the knee in patients with considerable deformities of the femoral or tibial shafts. Some surgeons prefer to correct the deformity while performing TKA at the level of the knee joint. However, this technique requires accurate planning and execution of the planned cuts. In addition, the use of intramedullary guides in such cases may not be possible or desirable and may lead to complications. There is a strong indication for using navigation in such cases.

Methods

The navigation technique was used in both laboratory and clinical setting, First, we compared between navigational and conventional techniques in performing TKA in 24 plastic knee specimens (Sawbones, Sweden) that have osteoarthritic changes and complex tibial or femoral deformities. A demo kit for conventional instrumentation of posterior stabilised TKA (Scorpio, Stryker) was used for 12 cases and an image-free navigation system (Stryker) was used for a corresponding 12 cases. There were 4 different deformities; severe mid-shaft tibial varus, severe distal third femoral valgus, complex deformity distal femur and deformity following a revision TKA. The surgical procedures were performed by 3 arthroplasty surgeons, each surgeon operated on 8 knee specimens (4 knees in each arm of the study with 4 different deformities).

Deformities were corrected at the level of the knee joint during TKA without prior osteotomies. For conventional techniques, surgeons used a combination of both intramedullary and extramedullary guides. Postoperative long leg radiographs were used to assess coronal alignment. Second, we used the same navigational technique clinically to perform TKA in patients with extra-articular deformities.

Results

Using both navigational and conventional techniques, it was possible to indirectly correct shaft deformities by adjusting the inclination of bone cuts at the level of the knee joint. The amount of bone cutting at distal femur and proximal tibia were variable depending on the location and direction of the deformity. There was no compromise of collateral ligaments or patellar tendons in both techniques. However, the accuracy of restoring normal alignment was better in navigational techniques. The results of the clinical cases are still in progress waiting analysis of a longer term follow up.

Discussion

Navigational techniques eliminated the use of both intramedullary and extramedullary guides. The improved accuracy with navigational techniques led to better alignment that can improve functional and survival outcome of similar cases of TKA in real patients.

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Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

Should a Mobile Bearing Wear Less Than a Fixed-Bearing TKR? the Answer From in Vitro Wear Testing.

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Some mobile bearing knee replacement designs have shown truly excellent long-term clinical results. The higher laxity of a mobile bearing helps reduce the shear forces and torques transmitted to the prosthesis-bone interface, and this could only help reduce the risk of loosening. Some argue that self-alignment of a mobile bearing rotationally can produce more central patellar tracking. However, the most commonly assumed benefit of mobile bearings is the reduction in contact stress, which is typically expected to reduce fatigue and wear. In a rotating platform TKR for example, wear is also expected to be less because the rolling/sliding

motion is separated from the transverse rotational motion onto two separate articulating surfaces, thus less cross-paths and less wear. Such expectations may have dominated the thinking and perhaps even clouded the expectations of TKR wear test engineers. Such wear reduction however has not really been categorically proven clinically.

This paper combines in-vitro wear results from two separate laboratories, one in Nebraska USA and one in Germany. These two (industrially unattached labs) possess between them a very large set of in-vitro wear testing results across the widest variety of fixed and mobile bearing TKR designs. Fortunately, the wear testing methodology using the force-control regime used in the two labs was largely similar, and was highly consistent within each lab. The fixed and the mobile bearings were subjected to the exact same force fields, allowing their Anterior-Posterior translation and internal-external rotation kinematics to vary based on the individual TKR design.

Tens of implant designs have been tested, both fixed and mobile, in total (bycondylar) form and unicompartmental, of various sizes. Some mobile bearings had rotating platforms and some were rotating-translating. Some of the tests specifically compared mobile to fixed bearing tibial components using identical femoral components. Between both labs, and across all tests, no statistically significant difference resulted in wear between fixed and mobile bearings. Yet, such differences did clearly feature with known superior bearing materials (for wear) and other favored design features. Also, generally, the force-control test methodology has proven highly discriminatory in its simulation and measurement of wear as a potential clinical failure mode.

The take home message to test engineers is to expect the wear of both mobile and fixed bearings to depend more on the detailed design and materials of the TKR than on the mobility of the bearing. The results of this study re-confirm the need for wear testing to be performed prior to any clinical use on all implant designs, despite seemingly similar predicates or success of some mobile bearings.

Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Fatigue and Wear Evaluation of Partial Femoral and Tibial Unicompartmental Cartilage Replacement Knee Components

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- - ,

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Unicompartmental knee replacement components have gained favor because they replace only the most damaged areas of articular cartilage and the less invasive operation results in a faster patient recovery than traditional TKR. Additionally, they can provide a solution when a full TKR is not yet needed. However, the wear magnitude of such implants is not well understood, primarily due the variation in design and the difficulty of testing them in knee simulators designed to test full TKRs. Modern innovative partial cartilage replacement knee components which are typically even smaller and more bone conservative than unicompartmental implants, are even less common in testing with added challenges. This study investigates the fatigue characteristics of partial cartilage replacement knee components, and the wear of the UHMWPE bearing of a new, truly less invasive unicompartmental design by Arthrex Inc./Florida.

Fatigue testing was performed on MTS 858 MiniBionix machines. Two 12mm diameter UHMWPE tibial components were cemented into jigs at 0° posterior slope and were axially loaded at 2Hz for 10 million cycles (Mc) with a sinusoidal profile peaking at 60% of 8 average human bodyweights (3800N) and a load ratio R of 0.1. Two femoral components were tested with the same load profile at 10Hz for 10 million loading cycles (Mc). The femoral components were mounted at 15° flexion and only the anterior half of the implant was supported, replicating a worst-case scenario where fixation had failed on the posterior half of the implant. This resulted in a large bending moment when force was applied that would fatigue the femoral implant. Following the fatigue test, two full wear simulation tests were conducted on four 12mm and four 20mm unicompartmental components on a four-station Instron-Stanmore force-control knee simulator. The spring-based system to simulate soft-tissue restraining forces and torques was adapted to operate the machine in a displacement control mode to achieve the motions of the medial compartment based on ISO 14243-3. The specimens were lubricated with bovine serum (20g/L protein, 37°C) and the simulator was operated at 1Hz. Liquid absorption was corrected through passive-soak-control bearing inserts. The tibial specimens were cleaned and weighed at standard intervals with the usual ISO test protocols.

After 10Mc of fatigue testing, both tibial components had deformed by some flattening out but were able to sustain the full load without failure and displayed average stiffness (over the whole 10Mc) of $27,600 \pm 1,180$ N/mm. Neither partially supported femoral component failed, and the femorals displayed average stiffness (over 10Mc) of $37,500 \pm 3,280$ N/mm. After 5Mc of wear testing, the 12mm tibial components displayed a wear rate of 4.56 ± 1.45 mg/Mc while the larger 20mm size wore at a lower 2.80 ± 0.39 mg/Mc.

The results from the fatigue test suggest that this unicompartmental cartilage replacement design will not fail under simple axial loading, even under the extreme case where the tibial implant is receiving the entire share of the load, and the femoral component is only partially supported. In the clinical application, of course some load-sharing with the native unworn cartilage would occur, reducing the stresses on the implant. The results from the wear test showed very low wear for tibial components of this design, lower than many successful TKRs. The larger size tibial components wore less likely due to reduced contact stress. Based on the results of this test, an implant of this type could be a viable option prior to TKR.

Is the French Paradox a Reality? Long Term Survival and Migration of the Charnley-Kerboull Cemented Line-to-Line

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Introduction: The purpose of this study was to evaluate the in vivo migration patterns of a polished femoral component cemented line-to-line using EBRA –FCA.

Methods: The series included 164 primary consecutive THAs performed in 155 patients with a mean age of 63.8 years. A single prosthesis was used combining an all-polyethylene socket and a 22.2 mm femoral head. The monoblock double tapered femoral component made of 316-L stainless steel had a highly polished surface (Ra 0.04 micron) and a quadrangular section (Kerboull® MKIII, Stryker). The femoral preparation included removal of diaphyseal cancellous bone to obtain primary rotational stability of the stem prior to the line-to-line cementation. Stem subsidence was evaluated using EBRA-FCA software which accuracy is better than ± 1.5 mm (95% percentile), with a specificity of 100% and a sensitivity of 78% for detection of migration of more than 1.0 mm, using RSA as the gold standard.

Results: At the minimum 15-year follow-up, 73 patients (77 hips) were still alive and had not been revised at a mean of 17.3 ± 0.8 years, 8 patients (8 hips) had been revised for high polyethylene wear associated with periacetabular osteolysis, 66 patients (69 hips) were deceased, and 8 patients (10 hips) were lost to follow-up. Among the 8 revision procedures, the femoral component was loose in 3 cases. A total of 1689 radiographs were digitized of which 263 were excluded by the software for lack of comparability, leaving 142 hips with adequate follow-up evaluation data. At last follow-up, the mean subsidence of the entire series was 0.63 ± 0.49 mm (0 – 1.94 mm). When using a 1.5 mm threshold, 4 of the 142 stems were considered to have subsided.

Thursday, October 7, 2010, 9:00-9:50

Session A2: Alternate Bearings in THA 2

Oxinium Versus Metal on Polyethylene: A Prospective Randomized Evaluation of the Penetration Rate at Two-Year Follow-Up.

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Introduction: The purpose of this prospective randomized study was to compare the 2-year follow-up penetration of Oxinium versus Metal on polyethylene in a consecutive series of low friction total hip arthroplasty.

Methods: Between July 2006 and May 2006, 50 patients (27 females and 23 males) with a mean age of 60.6 ± 11.4 years (21 to 75) were randomized to receive either Oxinium (25 hips) or Metal (25 hips) femoral head. Other parameters, including the femoral component and the all polyethylene socket (EtO sterilized), were identical in both groups. The primary criterion for evaluation was linear head penetration measurement using the Martell system.

Results: At the time of the 2-year follow-up evaluation, two patients were deceased, one was lost to follow-up, and radiographs were excluded by the software in three patients, leaving 44 hips (22 in each study group) with complete clinical and radiologic data available for analysis (median follow-up 2.01 years; 1.9 to 2.3). The median penetration rate was 0.16 mm/year in the Oxinium group versus 0.19 mm/year in the Metal group (Mann and Whitney test, $p = 0.76$). When using the one-year follow-up radiograph as the baseline (limiting the effect of creep), wear was 0.066mm/year in the Oxinium group versus 0.19 in the Metal group (Mann and Whitney test, $p = 0.38$).

Discussion and Conclusion: This study demonstrated a reduction in the yearly linear wear of EtO sterilized polyethylene when using an Oxinium femoral head when compared to metal. Although the difference was not statistically significant, longer follow-up is necessary to evaluate the clinical significance of such a reduction.

Saturday, October 9, 2010, 13:30-14:20

Session B20: Hip Arthroplasty

Mid-Term Results of a Cementless Dual Mobility Socket in Primary THA: Concerns With the 3rd Articulation

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Introduction: Several devices based upon the dual mobility (DM) concept have recently been FDA approved. However, little is available on the efficiency of current DM on THA instability prevention, and on specific complications. The aim of this retrospective study was to report on the minimal 5-year follow-up results of a cementless DM socket.

Methods: Between January 2000 and June 2002, 168 primary consecutive non selected THAs were performed in 92 females and 76 males. The average age at surgery was 67.3 years. A single DM socket design was used (Tregor, Aston Medical, France) consisting of a Ti-sprayed and HA-coated CoCr shell with a highly polished inner surface articulating with a mobile intermediate polyethylene component. The opening diameter of the mobile insert was 6% smaller than that of the femoral head. In 115 hips, the modular femoral head completely covered the Morse taper, whereas a long-neck option leaved the base of the Morse taper

uncovered in the remaining 53 hips.

Results: At the minimum 5-year follow-up, 119 patients were still alive and had not been revised at a mean of 7.2 years (5-8.9 years), 4 hips were revised for dislocation between the femoral head and the mobile insert (intra-prosthetic dislocation) at a mean of 5.9 years, 22 patients were deceased, and 23 patients were lost to follow-up. Intra-prosthetic dislocation occurred in 4 of the 53 hips (7.5%) with an incompletely covered Morse taper, whereas no dislocation were reported in the remaining 115 hips ($p = 0.009$).

Discussion and Conclusion: A current cementless DM socket was highly effective in the prevention of dislocation following primary THA. However, fatigue damage and wear of the mobile insert at the capturing area can lead to intra-prosthetic dislocation requiring revision.

Surgeons should be aware of this specific complication and efforts should be made to avoid aggressive contact at the femoral neck to mobile insert articulation (“3rd articulation”).

Friday, October 8, 2010, 15:00-16:00

Session A15: Alternate Bearings 2

An MRI Classification of Lesions Around Metal-on-Metal Hip Replacements

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Introduction

Metal Artefact Reduction Sequence (MARS) MRI is being increasingly used to detect soft tissue inflammatory reactions surrounding metal-on-metal hip replacements. The UK MHRA safety alert announced in April 2010 recommended cross-sectional imaging such as MRI for all patients with painful MOM hips. The terms used to describe the findings include bursae, cystic lesions and solid masses. A recently used term, pseudotumour, incorporates all of these lesions. We aimed to correlate the pattern of abnormalities on MRI with clinical symptoms.

Method:

Following our experience with over 160 MARS MRI scans of patients with MOM hips we recognized patterns of lesions according to their: wall thickness, T1 / T2 signal, shape, and location. We categorised the 79 lesions from 159 MARS MRI scans of into our novel classification scheme of 1, 2a, 2b and 3. There were two groups of patients: well functioning and painful.

Results:

We found a surprisingly high prevalence of lesions on MRI scan in the well functioning group (11 out of 23, 48%) when compared to the painful group (79 out of 137, 57%). However, there were a significantly greater number of grade 1 lesions in the well functioning group. We suggest that these are post-surgical changes and should not be confused with pathological, tissue destroying lesions.

Discussion

This is the largest ever study of patients with MARS MRI scans of MOM hips. It is the first to use a classification system and the first to compare well functioning with painful hips. We are now able to provide radiologists and surgeons with clinical interpretation of a lesion on MRI scan. Our classification system will provide useful information on both symptomatic and asymptomatic patients. Longitudinal follow up of these patients will provide the final validation.

Thursday, October 7, 2010, 9:00-9:50

Session A2: Alternate Bearings in THA 2

Synchrotron Xray Spectroscopy Reveals Chemical Form of in-Human Metal-on-Metal Hip Wear Debris : Ultima and Current Generation Hips

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Summary

We report the first use of synchrotron xray spectroscopy to characterize and compare the chemical form and distribution of metals found in tissues surrounding patients with metal-on-metal hip replacements that failed with (Ultima hips) or without (current generation, large diameter hips) corrosion.

Introduction

The commonest clinical category of failure of metal-on-metal (MOM) hip replacements is "unexplained" and commonly involved a soft tissue inflammatory response. The mechanism of failure of the Ultima MOM total hip replacement includes severe corrosion of the metal stem and was severe enough to be removed from clinical use. Corrosion is not a feature that we have

found in the currently used MOM bearings. To better understand the biological response to MOM wear debris we hypothesized that tissue from failed hips with implant corrosion contained a different type of metal species when compared to those without corrosion.

Method

Tissue from patients with two types of MOM hip arthroplasty were analysed: Ultima that failed with severely corroded femoral stems (n=12); and large diameter, current generation MOM hips that failed without visible corrosion (n=7). Comparison was also made to samples of cobalt, chromium and molybdenum standards.

We used a high energy synchrotron xray beam to map and characterise the type of metal within the tissues. This enabled us to analyse the type of chemical in a situation that is as realistic as possible: without staining; without the use of a vacuum; and the use of fresh frozen tissue sections with metals at relatively low concentrations. This could not have been achieved without a synchrotron.

Results

Comparison with standards revealed the chemical form of the chromium in the tissues surrounding metal-on-metal hip replacements was chromium (III). This was similar for both corroded (Ultima MOM) and non-corroded (large diameter, current generation MOM) hips. This was chromium (III) phosphate in the non-corroded hips but because the concentration of chromium was lower in the corroded hips it was difficult to differentiate chromium phosphate from oxide. There was some evidence of localisation of cobalt and chromium, both in metallic form. One sample from corroded hips contained chromium (VI).

Conclusion

Chromium (III) phosphate was the predominant metallic species in the tissues surrounding metal-on-metal hip replacements. This may have arisen from corrosion, wear or a combination of both.

Friday, October 8, 2010, 13:30-14:10

Session B12: Shoulder Arthroplasty

Complications and Early Outcomes Following Reverse Shoulder Arthroplasty Using a Prosthesis With a Lateral Center of Rotation

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The reverse ball and socket shoulder replacement, employing a humeral socket and glenosphere, has revolutionized the treatment of patients with arthritis and rotator cuff insufficiency. The RSP (DjO Surgical, Inc., Austin, Texas) is one such device, characterized by

a lateral center of rotation and approved for use in the United States since 2004. Multiple studies by the implant design team have documented excellent outcomes and low revision rates for the RSP, but other published outcomes data are relatively sparse. The objective of this study is to report on the complications and early outcomes in the first consecutive 60 RSPs implanted in 57 patients by a single shoulder replacement surgeon between 2004 and 2010. Forty-four patients were female and mean age at the time of reverse shoulder arthroplasty was 75 years (range 54 to 92 years). The RSP was used as a primary arthroplasty in 42 shoulders and to revise a failed prosthetic shoulder arthroplasty in 18 shoulders. During the study period, 365 shoulder replacements were implanted so that the RSP was used selectively, accounting for only 17% of all shoulder arthroplasties (8.4% for 2004-2007, 24.2% for 2008-2010). Most patients had pseudoparalysis and profound shoulder dysfunction so that mean pre-operative active forward elevation was to 45°, active abduction to 43°, active internal rotation to the buttock, and the mean pre-operative Simple Shoulder Test (SST) score was 1 out of 12. At final follow-up, mean active forward elevation had improved to 101° (p<0.0001), active abduction to 91° (p<0.0001), active internal rotation to the lumbosacral junction (p<0.001), and the mean final SST score was 7 out of 12. There were 16 complications in 14 patients, including 7 reoperations in 6 patients (11%): 3 closed reductions for dislocation, 2 open revisions for instability and for a dissociated liner in the same patient, one evacuation of a hematoma, and one open reduction and internal fixation of a post-operative scapular spine fracture. Two additional scapular spine or acromion fractures and one acromioclavicular joint separation developed postoperatively that impacted outcome adversely but did not require re-operation. None of the glenoid baseplates or humeral stems has been revised and no deep infections have occurred. Experience with reverse shoulder arthroplasty appears to influence the reoperation rate, as 3 of the reoperations occurred following the first 15 reverse shoulder arthroplasties. Overall improvements in active motion and self-assessed shoulder function were comparable to those reported previously. Final active motion results were somewhat lower than those reported previously, which may relate to the selection of predominately pseudoparalytic patients for reverse shoulder arthroplasty in this series. Use of the RSP device for reverse shoulder arthroplasty leads to improved motion and function in carefully selected older patients with pseudoparalysis or a failed shoulder replacement. Re-operations and complications occur but the learning curve may not be as steep as previously reported. This may relate to specific features of the implant system used in this series, as well as to surgeon experience.

Friday, October 8, 2010, 13:30-14:10

Session B12: Shoulder Arthroplasty

Glenohumeral Chondrolysis: Causative Factors and Treatment Options

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Glenohumeral chondrolysis is a devastating condition characterized by the rapid dissolution of glenohumeral cartilage and resultant joint destruction. Excessive intra-articular use of thermal heat, suture anchors that are prominent or loose, and the use of an intra-articular pain pump (IAPP) delivering local anesthetics have all been implicated as causative factors. Between November 2007 and February 2010, 29 patients presented with glenohumeral chondrolysis related to one or more of the causative factors noted above. Seventeen patients have been

followed since their initial presentation, with the remainder presenting for evaluation only, at the suggestion of their attorneys. Of those 17 patients, 7 were male and mean age at the time of their index surgery was 28.6 years (range 15-55 years). Two patients developed chondrolysis as a result of prominent suture anchors and 15 as a result of an IAPP delivering bupivacaine. Two patients underwent placement of an IAPP following closed manipulation for adhesive capsulitis and 13 underwent IAPP placement following arthroscopic labrum repair or capsular plication using one to seven suture anchors. Onset of symptoms related to chondrolysis, such as increased pain, stiffness and crepitation, occurred at a mean 8 months (range 1-32 months) following the index procedure. Twelve of the 17 patients underwent one or more additional arthroscopic procedures, typically for debridement and chondroplasty, and in some cases, capsular release. A loose suture anchor was found in one joint at arthroscopy, which was removed. Eleven patients had radiographs documenting joint space obliteration at most recent follow-up or at the time of prosthetic shoulder arthroplasty. At most recent follow-up, 7 patients had undergone 3 total shoulder replacements and 4 humeral head resurfacing procedures. Four other patients were contemplating prosthetic shoulder arthroplasty. For those undergoing shoulder replacement, range of motion recovered modestly so that active forward elevation improved from 111° to 137° ($p < 0.05$) and active abduction improved from 99° to 123° ($p < 0.05$). Seven of the 12 patients presenting for evaluation only had also undergone prosthetic shoulder arthroplasty elsewhere by the time of their presentation, so that overall, 14 of 29 patients had undergone their first prosthetic shoulder replacement for chondrolysis within 25 months (range 9-54 months) of their index procedure. The onset of chondrolysis in two patients following the use of an IAPP after closed manipulation has not been reported previously. Post-arthroscopic glenohumeral chondrolysis (PAGCL) is a devastating condition that strikes young patients and frequently requires shoulder replacement surgery. The use of an intra-articular pain pump delivering local anesthetics is the principal causative factor for glenohumeral chondrolysis in most patients and should be abandoned.

Saturday, October 9, 2010, 11:15-11:50

Session B19: Hip Mechanics

Comparison of Abductor Muscle Power and Pain Recovery Between 2-Incision and Mini-Watson Jones Approach

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Purpose: To determine the effect of early recovery with 2 different MIS THA for patients with dysplastic hip because of relatively severe muscle weakness before surgery.

Materials & Methods: MIS THA (248 MIS A/L, 96 2-incision) were performed with single surgeon from 2002. Averaged age was 61 years old. Abductor muscle power and VAS score were analyzed preop, 3, 5, 7, 14 days, 2, 6 and 12 months after surgery. Patients were prone position and MicroFET machine (HOGGAN Inc. USA) were used for this analysis. All analysis were performed with single observer (physical therapist).

Results: Averaged skin to skin surgical time was 62 min. in MIS A/L (A/L), 96 min. in 2-

incision (2I). Hospital stay of MIS A/L were averaged 7 days, 10 in 2-incision and all were direct discharge to their home. Abductor muscle power was down in 3 days (2I; 40%, A/L; 65% : $p < 0.05$) because of pain and swelling in both approach. But, better recovery in both group (2I: 58%, A/L; 75% $p < 0.05$) 5 days after surgery, and 80% in 2I, 90% A/L in 14 days (N/S). Six and 12 months results were higher compared contra-lateral normal side before surgery. VAS score in 14 days was better in 2-incision (14/100) compared to A/L (23/100). Both walking ability in 100meters with T cane, and stair climbing ability was not statistically significant in both groups.

Discussion & Conclusion: Muscle sparing MIS A/L approach had better muscle power recovery but less pain in 2-incision in 14 days (compared Hardinge approach recovery were 60% or less). MIS A/L required none fluoroscopy, had shorter surgical time compared to 2-incision, but indication for patients with limited range of motion and severe deformity with dysplasia need to clarify with more surgical cases.

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

Morphologic Evaluation of Femoral Condyles With CT Based Three-Dimensional Digital Templating Software. - Relationship Between the Epicondyle and the Articular Surface in Flexed and Extended Position-

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Restoration of joint line in total knee arthroplasty (TKA) is important for kinematics of knee and ligamentous balance. Especially in revision TKA, it may be difficult to identify the joint line. The aim of this study is to define the relationship between epicondyles and articular surface using CT based three-dimensional digital templating software "Athena" (Soft Cube, Osaka, Japan).

37 knees with osteoarthritis, all cases were grade 2 or lower in Kellgren-Lawrence index, were investigated. Perpendicular lines were dropped from the prominences of the medial and lateral femoral epicondyles to the most distal points of articular surfaces and distances of the lines were measured on the axial and coronal planes. The femoral width was measured as the distance between medial and lateral epicondyles. Each of the distance described above was converted to a ratio by dividing by the femoral width.

On the axial plane, the average distance from epicondyles to the posterior articular surfaces were 29.4 ± 2.2 mm on the medial side and 21.2 ± 2.3 mm on the lateral side. The average of the femoral width was 75.2 ± 4.1 mm. On coronal plane, the average distance from epicondyles to the distal articular surfaces were 25.2 ± 2.8 mm on the medial side and 21.4 ± 2.5 mm on the lateral side.

The ratio for the distance from epicondyles to the distal and posterior joint line compared to femoral width was 0.39 ± 0.02 , 0.28 ± 0.03 , 0.33 ± 0.03 and 0.28 ± 0.03 . The distance from epicondyles to the distal and posterior joint line correlates with the femoral width of the distal femur. This information can be useful in determining appropriate joint line.

Saturday, October 9, 2010, 8:15-9:00

Session A17: Knee Mechanics

Calculation of the Forces Acting on the Knee Joint During Ascent From Kneeling

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The objective of this study is to introduce the forces acting on the knee joint while ascending from kneeling. Our research group has developed a new type of knee prosthesis which is capable of attaining complete deep knee flexion such as a Japanese style sitting, *seiza*. Yet we could not set up various kinds of simulation or experiment to assess the performance of our prosthesis because the data about joints' forces during the ascent from deep knee flexion are lacking. Considering this circumstance, we created a 2D mathematical model of lower limb and determined knee joint force during ascent from kneeling to apply them for the assessment of our prosthesis.

Ten male and five female healthy subjects participated in the measurement experiment. Although the measurement of subjects' physical parameters was non-invasive and direct, some parameters had to be determined by referring to the literature. The data of ground reaction force and each joint's angle during the motion were collected using a force plate and video recording system respectively. Then the muscle forces and the joints' forces were calculated through our mathematical model. In order to verify the validity of our model approach, we first introduced the data during the activities with small/middle knee flexion such as level walking and rising from a chair; these kinds of data are available in the literature. Then we found our results were

in good agreement with the literature data. Next, we introduced the data during the activities with deep knee flexion; double leg ascent [Fig.1 (a)] and single leg ascent [Fig.1 (b)] from kneeling without using the upper limbs.

The statistics of the maximum values on the single knee joint for all the subjects were; during double leg ascent, $F_{max} = 4.6 \pm 0.6$ (4.3--5.2) [BW: (force on the knee joint)/(body weight)] at knee flexion angle of $b = 140 \pm 8$ (134--147)°, during double leg ascent, $F_{max} = 4.9 \pm 0.5$ (4.0--5.6) [BW] at $b = 62 \pm 33$ (28--110)° for the dominant leg, and $F_{max} = 3.0 \pm 0.5$ (22.2--3.8) [BW] at $b = 138 \pm 6$ (130--150)° for the supporting leg respectively. We found that the moment arm length, i.e., the location of muscle insertion significantly affected the results, while ascending speeds did not affect the results much. We may conclude that the single leg ascent should be recommended since F_{max} did not become large while deep knee flexion. The values could be used for assessing the strength of our knee prosthesis from the risk analysis view point.

Figures

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

10-17 Years Survivorship of CAD-CAM Primary and Revision Hip Stems

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Total hip replacements have shown great benefits to patients through relief of pain and restoration of function. However, because of the extensive variation in the size and shape of the femoral canal, especially for the situation encountered in the revision hip arthroplasty, standard uncemented hip systems with a limited number of sizes are unable to provide an accurate fit in every case. This study showed clinical results of 112 primary total hip replacements and 158 revision total hip replacements, using custom made CAD-CAM (Computer Aided Design-Computer Aided Manufactured) hip prostheses inserted between 1992 and 1998.

For primary hip replacements, the implants were designed to produce proximal line-to-line fit with the femoral bone and to provide optimal biomechanical environment of the hip. The stem was HA coated, 53 males and 58 females were included. Mean age was 46.2 years (range 24.6yrs - 62.2 yrs). The average duration of the follow up was 24 years (10 – 17 years). The mean Harris Hip Score (HHS) was improved from 42.4 to 90.3, mean Oxford Hip Score (OHS) was improved from 43.1 to 18.2 and the mean WOMAC hip score was improved from 57.0 to 11.9. There was 1 revision due to failure of the acetabular components but there were no failures of the femoral components. In the whole follow-up period, the survival of the femoral stem alone was 100%.

For revision hip replacements, the implants were designed using our design strategies of graduate approach to different revision situation based on Paprosky's classification of femoral bone defect. The implants were HA coated; some of them had distal cutting flutes. A total of 158 patients (97 males and 61 females) who had operation between 1991 and 1998 were followed up, among them 138 cases were due to aseptic loosening, 6 cases were periprosthetic fractures and 14 cases were infection. The average age was 63.1 years (range 34.6 – 85.9 years). The minimum follow up was 10 years (range 10 – 12 years). The mean Harris Hip Score was improved from 44.2 to 89.3, mean Oxford Hip Score was improved from 41.1 to 18.2 and the mean WOMAC hip score was improved from 52.4 to 12.3 respectively. 6 cases required further revision surgery, among them 3 were due to aseptic implant loosening, the overall survivorship at ten years was 97%.

The CAD-CAM hip stems are able to provide optimal implant fixation and restore hip function for every patient regardless their original femoral shape, bone condition and biomechanics of the hip. The excellent medium to long term clinical results justifies the use of CAD-CAM custom hip stems.

Friday, October 8, 2010, 15:20-16:00

Session B14: Hip Resurfacing

Wear Simulator Studies of a Deflection Compensating Hip Joint

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Wear simulator studies of a Deflection Compensating hip joint

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Introduction

In vitro studies have shown that low clearance metal-on-metal hip joints have the potential of reducing wear during the running-in phase [1]. However, cementless acetabular cup relies on press fitting into the acetabulum, which can generate non-uniform compressive stresses and non-uniform *in vivo* cup deformation [2, 3]. This could then lead to equatorial contact, resulting in higher wear and friction for a MoM bearing with low clearance. To benefit from low wear generated by low clearance and at the same time to avoid the potential of head seizure and high frictional torque caused by cup deformation, a deflection compensation acetabular cup (DefCom) has been developed based on the Birmingham Hip Resurfacing (BHR) device. The articulating sphere of the DefCom cup provides a low clearance bearing area, whilst the non-

articulating sphere maintains the standard BHR clearance. The aim of this study was to evaluate the wear performance of the novel DefCom hip joint using a hip wear simulator.

Materials and Methods

Five pairs of 50 mm DefCom devices were tested in a ProSim hip wear Simulator for 5 million cycles (MC) at a frequency of 1 Hz. The lubricant was new born calf serum with 0.2% sodium azide diluted with de-ionised water to achieve protein concentration of 20 mg/ml. The flexion/extension was 30° and 15° and the internal/external rotation was 10°. The force was Paul-type stance phase loading with a maximum load of 3 kN and a standard ISO swing phase load of 0.3 kN. Five standard 50 mm BHR devices were tested under the same testing conditions for comparison. Statistical analyses were performed at a 95% confidence level (CL) using the statistics function in Excel (Microsoft® Excel 2003).

Results

Fig. 1 shows the cumulative volume loss against number of wear cycles for the DefCom and the BHR devices. Similar to the BHR device, the DefCom joints experienced relatively higher amount of material loss during the running-in phase from 0 to 1.0 Mc. However, the running-in wear rate for the DefCom device ($0.23 \pm 0.06 \text{ mm}^3/\text{MC}$) was much lower than that for the BHR device ($0.72 \pm 0.15 \text{ mm}^3/\text{MC}$). Steady state wear was achieved for all the joints from 1.0 to 5.0 MC. The steady state wear rate was $0.11 \pm 0.03 \text{ mm}^3/\text{MC}$ for DefCom and $0.18 \pm 0.01 \text{ mm}^3/\text{MC}$ for the BHR joints.

Discussion

This study has shown that the DefCom acetabular cup has the potential to reduce the initial running-in wear by reducing the clearance at the contact area between the head and cup. The device also has the potential to avoid deformation induced head seizure and high frictional torque by maintaining a larger clearance at the periphery of the cup.

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Fig. 1. Total volume loss of DefCom and BHR devices (Error bar represents \pm 95% Confidence Limit)

Figures

Correlation Between Edge Loading and Wear in Hip Implants

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Introduction

All hip replacements depend upon good orientation and positioning to ensure that implants function well *in vivo*. Mal-orientated devices can lead to poor patient gait, poor range of motion, impingement, edge loading and high wear, which in turn may result in the premature failure of the implants.

Aim

To investigate the correlation between edge loading and wear on retrieved implants through linear wear analysis and radiographic examination of implants *in vivo*.

Materials & Methods

55 BHR retrieved acetabular cups with known times *in vivo* were examined. Linear wear analysis was conducted using a Taylor-Hobson Talyrond 290 roundness machine. Edge loaded cups were classified as cups which showed the wear area crossing over the edge of the cup. Non-edge loaded devices were devices with the wear area within the articulating sphere of the cup, Figure 1. The maximum deviation of the profile from an ideal circle was taken as the maximum linear wear. The implant orientation angles for one edge loaded acetabular component was determined by superimposing BHR models, generated by ProEngineer Wildfire 4 with ISDX II extension software, onto frontal x-ray images, Figure. 2.

Results

In this study 32 cups were classed as edge loaded and 23 classed as non-edge loaded. Non-edge loaded cups had a linear wear rate of $1.48 \pm 1.01 \mu\text{m}/\text{year}$. Edge loaded cups generated a significantly higher linear wear rate of $24.02 \pm 22.72 \mu\text{m}/\text{year}$ than non-edge loaded devices. For the device analysed radiographically, the inclination was 62° and version angle was 16° . The inclination angle of this device is outside the recommended inclination angle for the BHR and would be considered as mal-orientated. The linear wear result showed that the device was edge loaded with a wear rate of $22.25 \mu\text{m}/\text{year}$.

Discussion/Conclusion

This study aimed to find a correlation between edge loading and high wear of retrieved devices. The results in this study show that edge loaded bearings generate significantly higher linear

wear rates compared to the non-edge loaded group. The devices in the edge loaded group also showed a greater scatter with unpredictable linear wear.

Figures

Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Usefulness of New Distal Femoral Cutting Guide for MIS-TKA

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(Purpose) Many TKA instruments were developed in these days. Distal femoral cutting guide using intra-medullary system were divided into two methods, from anterior or medial. Many companies employed anterior cutting guide, however these guides have a disadvantage of wide skin and quadriceps incision. Only Zimmer provided medial cut guide which performed short skin and quadriceps incision. However, reference point (medial femoral condyle) will be a risk of imprecise cutting for a medial condyle defect cases. We tried L-shaped new distal femoral cutting guide, reference point will be both femoral condyle and cutting from antero-medial side. The purpose of this study was to prove usefulness of the new guide.

(Materials and Methods) Twenty-nine knees were employed in this study. All knees were treated with Optetrak knee system (Exactec). Surgical methods were as follows, mid line skin incision, short para-patellar deep incision, no patellar resurfacing, PS type implant and cement fixation were employed. 13 knees were used original anterior cutting guide (O group) and 16 knees were used new antero-medial cut guide (N group). Study items were length of skin incision, length of Quadriceps incision, surgical time, JOA score, and component tilting angles (implant position were compared to femoral axis with AP and lateral view of roentgenograms).

(Results) Average skin incision was 11.7cm in O group and 10.6cm in N group. Average Quadriceps incision was 4.1cm in O group and 2.9cm in N group. There were significant difference in length of skin incision and length of Quadriceps incision. Average surgical time was 155min in O group and 147min in N group. Average component angles of AP view were 84 deg. in O group and 83 deg. in N group. Average component angles of lateral view were 99 deg. in O group and 99 deg. in N group. There were no significant differences between O group and N group in surgical time, component angles, amount of bleeding, and post surgical JOA scores.

(Conclusions) New distal femoral cutting guide demonstrated same precise cutting compared to original guide. New distal femoral cutting guide achieved small skin incision and small quadriceps incision which is useful for MIS-TKA.

Comparison of the Stem Geometries of Lateral Flare Stems Using 3D CAD and FEA -Stems Are Alternative Load Interface Between Pelvis and Femoral Cortex-

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One of the ironies in modern technology for arthroplasty is the stress shielding in cementless stems. The aim of the development of cementless stems had been reduction of stress shielding which cement stems are not free from. In healthy femur, trabecula start from the femoral head and reach at both medial and lateral cortex in rather narrow area around lesser trochanter. So the load from the femoral head is transferred at the level on both medial and lateral side. Cement stems should have binding to the cortical bone from collar to the tip of the stem where the cement interlays, and then the load is transferred gradually from the tip to the collar, which means mild stress shielding. When distal bonding is removed, the load could be transferred as normal femur. This should have been one of the biggest requests for cementless stem. But in realty many cementless stems have difficulty to obtain a load transfer at the level like normal femur.

Since 1990, we have been mainly using lateral flare stems to obtain contact on both medial and lateral side at proximal level. In the present study, different types and length of the designs were compared by 3-Dimensional fill, 3-Dimensional fit and Finite Element Analysis.

Materials and Methods

Stems from DJO: Revelation Standard, Revelation Short, and Linear stems were inserted into patients' canal geometries. Three-D fill and 3-D fit which were reported ISTA2009 and stress transfer were observed by FEA.

Results

The closest fit and fill were observed Revelation Short and Revelation Standard then Linear. The most proximal load transfer was observed Revelation Short, followed by Revelation Standard then Linear.

Observation of 3D Image Preoperative Planning in the Operation Theater Using 3-Dimensional Display Without Goggles

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We have been using 3-dimensional CAD software for preoperative planning as a desktop tool daily. In ordinary cases, proper size stems and cups can be decided without much labor but in our population, many arthritic hip cases have dysplastic condition and they often come to see us for hip replacement after severe defects were created over the acetabulum. It is often the case that has Crowe's type III, IV hips with leg length difference. For those cases preoperative planning using 3D CAD is a very powerful tool.

Although we only have 2-dimensional display with our computer during preoperative planning, 3 dimensional geometries are not so difficult to be understood, because we can turn the objects with the mouse and can observe from different directions. We can also display their sections and can peep inside of the geometries. It is quite natural desire that a surgeon wishes to see the planned geometries as a 3-dimensional materials. For some complicated cases, we had prepared plastic model and observed at the theater for better understanding. When we ask for a model service, each model costs \$2,500. We also have small scale desk top rapid processing tool too, however it takes 2 days to make one side of pelvis. Observation of the geometries using 3-dimensional display can be its substitute without much cost and without taking much time. The problem of using 3D display had been the special goggle to mask either eye alternatively.

In the present paper, we have used a 3D display which has micro arrays of powerful prism to derive different image for each eye without using any goggle.

Method

After preoperative planning, 2 images were prepared for right eye and left eye giving 2-3 degree's parallax. These images were encoded into a special AVI file for 3-dimensional display. To keep fingers away from the device, several scenes were selected and 3-dimensional slide show was endlessly shown during the surgery.

Result

Cup geometries with screws had been prepared and cup position with screws direction were very useful. The edge of acetabulum and cup edge are well compared then could obtain a better cup alignment. Screws are said to be safe if they were inserted in upper posterior quadrant. However so long as the cluster cup was used, when the cup was given 30 degrees anterior rotation, 25 mm screw was still acceptable using CAT angiography.

Conclusion

Three dimensional display without goggle was a useful tool to observe preoperative planning inside the operation theater.

Saturday, October 9, 2010, 16:00-16:50

Session B22: Arthroplasty- Getting it Right!

Accuracy of Cup Center Position, Leg Length, and Offset in Image-Free Hip Navigation System

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In previous congress of ISTA in Hawaii, we reported the results about accuracy of the cup center position in our image-free navigation system. In the new version of our navigation system, leg elongation and offset change as well as cup center position can be navigated. In this study, we therefore investigated the accuracy of cup center position, leg elongation and offset change.

Twenty four THA operations were performed with using the image-free OrthoPilot THA3.1 dysplasia navigation system (B. Braun Aesculap, Tuttlingen, Germany) between August 2009 and December 2009 by three experienced surgeons. In this system, cup center height was shown as the distance from tear drop, and cup medialization was shown as horizontal distance from inner wall of acetabulum. Leg elongation and offset change were navigated by comparing the two reference points in femur between registration before neck resection and that after inserting the trial implant. After operation, the cup angles were measured on CT image, and cup center position, leg elongation and offset change were measured on plain radiography. We compared these values that indicated by the navigation system to those measured on the CT image and the plain radiography.

The average cup inclination was 37.5 ± 7.0 degree and anteversion was 22.2 ± 4.7 degree. The

average absolute difference between navigation and measured angles were 5.2 ± 4.0 degree in inclination, 5.9 ± 4.0 degree in anteversion. The difference of cup height was 5.8 ± 3.9 mm, cup medialization was 3.8 ± 2.7 mm, leg elongation was 4.3 ± 3.3 mm, and offset was 5.4 ± 4.1 mm, respectively.

By using this new version navigation system, we can plan the cup center position and navigate it within smaller error of vertical and horizontal direction than the previous system. Moreover, leg elongation and offset change can be satisfactory navigated during operation. However surgeon's skill and learning curve might have influence the accuracy. We have to continue to evaluate this system and make effort to further improvement.

Thursday, October 7, 2010, 10:20-11:00

Session A3: Bearing Mobility Issues

A Patient Specific Template Technique Improved Femoral Component Alignment in Hip Resurfacing

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(Introduction)

There is many reports about complications with a resurfacing total hip arthroplasty (RHA). One of the most common complications is the femoral neck fracture. A notch and malalignment were risk factors for this. For an accurate implanting the femoral component in RHA, we performed 3D template and made a patient specific template (PST) using 3D printer and applied this technique for a clinical usage. We report a preliminary early result using this novel technique.

(material and method)

We performed 10 RHAs in nine patients (7 male, 2 female) from June 2009 to March 2010 due to osteonecrosis in 7 hips and secondary osteoarthritis in 3hips with a mean age of 48 years (40-60). We obtained a volumetric data from pre-operative CT and planned using 3D CAD software. Firstly, size of femoral components were decided from the size planning of cups. We aimed a femoral component angle as ten degrees valgus to the neck axis in AP and parallel in lateral view avoiding a notch. We measured femoral shaft axis and femoral neck axis in AP and lateral view using 3D processing software. PSTs were made using Laser Sintering by 3D printer which had the heat tolerance for sterilization in order to insert the femoral guide wire correctly. We operated in postero-lateral approach for all the patients PST has the base (contact part) fit to posterior inter trochanteric area. It has the arm reached from the base and sleeve hole

to insert the guide pin into the femoral head. We measured the femoral component angle in three dimensions using the 3D processing software postoperatively. We compared the difference of this angle and the pre-operative planed angles. We also investigated the operation time, the volume of bleeding during operation and complications.

(Results)

The mean femoral neck angle is $131.9 \pm 7.2^\circ$. The mean femoral component angle in AP view is $142.5 \pm 5.4^\circ$. The mean femoral component angle in lateral view is $0.1 \pm 1.2^\circ$. The mean calculated difference in AP view is $3.5 \pm 2.8^\circ$. And the mean calculated difference in lateral view is $0.9 \pm 0.7^\circ$. The mean operation time was 120 ± 25 minutes. The mean volume of bleeding was 401 ± 325 ml. No major complication was noted.

(Discussion)

By planning three-dimensional, it was possible to make an accurate preoperative planning. Though it is a very preliminary report with a small number of cases, we are encouraged to continue this procedure from this data. An application of PST for implanting femoral component in resurfacing THA brought us an accurate implanting as planned. This technique do not prolong an operation time, cost less and can be done with less invasions compared with a navigation system.

Saturday, October 9, 2010, 10:20-11:05

Session A19: Miscellaneous Arthroplasty

Massive Endoprosthetic Replacement for Forearm Tumours: Our Experience at Stanmore

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There is very limited literature available on the use of prosthetic replacement in the treatment of primary and secondary tumours of the radius. In the past these were treated with vascularised and non-vascularised autografts which had associated donor site morbidity, problems of non union, graft or junctional fractures and delayed return to function. Our study is a mid to long term follow-up of implant survivorship and the functional outcome of metal prosthetic replacement used for primary and metastatic lesions of radius. We had 15 patients (8 males:7 females) with a mean age of 53 years. 8 patients underwent proximal radial replacement, 2 with

mid-shaft radial replacement and 6 patients had distal radial replacements with wrist arthrodesis. The indications for replacement included metastatic lesions from renal cell carcinoma, primary giant cell tumours, ewings' sarcoma, chondroblastoma, radio-ulnar synostosis and benign fibrous histiocytoma. The average follow up was 5 years and 6 months (range 3 months - 18 years). Four patients died as a result of dissemination of renal cell carcinoma and two patients were lost to follow-up. There were no complications with the prosthesis or infection. Clinically and radiographically there was no loosening demonstrated at 18 years with secure fixation of implants. Two patients developed interosseoous nerve palsies which partially recovered. Functional outcomes of the elbow were assessed using the Mayo performance score with patients achieving a mean score of 85 postoperatively (range 65-95). All but one patient had full range of motion of the elbow. The patient with radio-ulnar synostosis had a 25 degree fixed flexion pot-operatively. Although the distal radial replacements had decreased range of movements of the wrist due to arthrodesis, they had excellent functional outcomes. Only one patient required revision surgery due to post-traumatic loosening of the implant. Our results of the use of endoprosthetic replacement of radius in the treatment of tumours are encouraging with regards to survivorship of the implant and functional outcome. This type of treatment results in an early return to daily routine activities, good functional outcome and patient satisfaction.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#)

Friday, October 8, 2010, 16:30-17:20

Session A16: Computer Navigation in THA

Accuracy of Robotically Assisted Acetabular Cup Implantation

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Introduction

Recent gains in knowledge reveal that the ideal acetabular cup position is in a narrower range than previously appreciated and that position is likely different based on femoral component anteversion. For that reason more accurate acetabular cup positioning techniques will be important for contemporary THA. It is well known that malalignment of the acetabular component in THA may result in dislocation, reduced range of motion or accelerated wear. Up

to 8% of THA patients have cups malaligned in version by more than $\pm 10^\circ$ outside of the Lewinnek safe zone. This type of malalignment may result in dislocation of the femoral head and instability of the joint within the first year, requiring reoperation. Reported incidences of reoperation are 1-9% depending on surgical skills and technique. In addition, cup malalignment is becoming increasingly important as adoption of hard on hard bearings increases as the success of large head hard on hard bearings seems to be more sensitive to cup positioning. This study reports the accuracy of a haptic robotic system to ream the acetabulum and impact an acetabular cup compared to manual instrumentation.

Methods

Six fresh frozen cadaveric acetabula were CT scanned and three-dimensional templating of the center of rotation, anteversion and inclination of the cup was determined pre-operatively. Half of the specimens were prepared with manual instrumentation while half were prepared with robotic guidance. Haptic and visual feedback were provided through robotics and an associated navigation system to guide reaming and impaction of the cup. The robot constrained the orientation and position of the instruments thus constraining the inclination, anteversion and center of rotation of the reamer, trial and the final cup. Post-operative CT's were used to determine the achieved cup placement and compared to the pre-operative plans.

Results

In all cases, robotic guidance resulted in placement of the acetabular cup within $\pm 3^\circ$ of anteversion, $\pm 3^\circ$ of relative to the pre-op plan. The average absolute inclination error was $1.5 \pm 1.2^\circ$ and the average absolute anteversion error $1.3 \pm 1.4^\circ$. Cup placement with robotic assistance was significantly more accurate and precise than with manual instrumentation. With manual instrumentation the errors were, on average, 4.2 times higher in inclination and 4.8 times higher in anteversion compared to robotic instrumentation.

Conclusion

This haptic robotic system substantially improved the accuracy of acetabular reaming and placement of the final cup compared to traditional manual techniques. With greater knowledge of ideal acetabular cup position, highly accurate techniques may allow surgeons to decrease the risk of dislocation, promote durability and improve the ability to restore appropriate leg length and offset. Haptic robotics has proven to be safe and effective in both knee and hip surgery and provides the potential to redefine the "instrument set" used for orthopedic procedures.

Friday, October 8, 2010, 15:20-16:00

Session B14: Hip Resurfacing

Functional Outcome of the Birmingham Hip Resurfacing: 300 Patients With a 2 to 7 Year Follow-Up in a Non-Designer Centre

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The metal-on-metal total hip resurfacing arthroplasty is a good solution for the younger patient with osteoarthritis of the hip. It is effective in pain resolution and provides a good function.

Our study of 300 BHR arthroplasties with a follow-up of 2 to 7 year shows good results in a young and active population.

With an overall survival of 96.7% we obtained similar results to those of the design centre. The overall postoperative HHS score of 95.78 +/- 12.63 is in line with other studies. We noticed a similar increase in HHS in female patients and male patients.

Even in the HOOS scores there was no significant difference between both groups. This is an important finding for the surgeon as well as the patients.

Looking at the VAS scores for satisfaction or reoperation we could state that the high expectations of this population have been fulfilled.

With have an acceptable revision rate of 2.42% the patients undergoing a revision were of a similar mean age than those in the overall group. Five of them are female, two are male. Since there were twice as many female as male patients there is little difference in revision percentage between both groups.

There was 1 patient with a bilateral revision because of ALVAL (aseptic lymphocytic vasculitis associated lesion).

Although femoral neck fractures are a known complication , there where none in our series.

Patients are able to lead an active life and perform sports. The postoperative benefits are equal in men and women. The satisfaction rate confirms that we are able to meet the expectations in this high demand group.

Thursday, October 7, 2010, 11:10-11:50

Session A4: Hip Resurfacing

The Effect of Cementing Technique on Polymerization Heat Generation and Thermal Necrosis in Hip Resurfacing Arthroplasty

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Introduction

Hip resurfacing arthroplasty has gained popularity as an alternative for total hip arthroplasty. Usually, cemented fixation is used for the femoral component. However, each type of resurfacing design has its own recommended cementing technique.

In a recent investigation the effect of various cementing techniques on cement mantle properties was studied. This study showed distinct differences in cement mantle volume, filling index and morphology.

In this study, we investigated the effect of these cement mantle variations on the heat generation during polymerization, and its consequences in terms of thermal bone necrosis.

Materials and methods

Two FEA models of resurfacing reconstructions were created based on CT-data of *in vitro* implantations (Fig 1). The two models had distinct differences with respect to the amount of cement that was used for fixation. The first model was based on an implantation with low-viscosity cement, with anchoring holes drilled in the bone, and suction applied to maximize cement penetration. The second model was based on an implantation with medium viscosity cement smeared onto the bone, with no holes and no suction, leading to a thin cement layer.

Thermal analyses were performed of the polymerization process, simulating three different types of bone cement: Simplex P (Stryker), CMW3 (DePuy J&J) and Osteobond (Zimmer), with distinct differences in polymerization characteristics. The polymerization kinematics were based on data reported previously.

During the polymerization simulations the cement and bone temperature were monitored. Based on the local temperature and time of exposure, the occurrence of thermal bone necrosis was predicted. The total volume of necrotic bone was calculated for each case.

Results and discussion

The simulations showed distinct differences between the temperature distributions in the various models. The highest temperature was found in the CMW3 model with a large cement volume (Fig. 2, Table 1), while the Osteobond model with a thin cement mantle produced the lowest temperature rise in the bone.

The necrotic bone volume was highest in the CMW3 model with a large cement mantle, while the lowest volume was found in the model with a thin cement layer (Table 1).

Assuming that the bone that is being penetrated by cement also is affected by thermal and toxic necrosis, more than 70% of the bone inside the resurfacing implant may become necrotic. In contrast, when using a less invasive cementing technique, thermal necrosis can be reduced to approximately 20% of the volume inside the resurfacing implant. A large zone of necrotic bone at the cement-bone interface may have serious implications for the strength and stability of resurfacing arthroplasty.

Conclusion

We conclude that the cementing technique and type of cement used for fixation of a resurfacing implant can dramatically affect the viability of the femoral bone, and therefore the survival of the reconstruction. Thermal necrosis may be reduced by minimizing cement penetration, although this may also have consequences for the mechanical stability.

Figures

Thursday, October 7, 2010, 8:30-9:20

Session B2: Knee Arthroplasty in the Indian Sub Continent

Analysis of Valgus Angle Following Navigation Total Knee Arthroplasty.

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Introduction

Proper alignment of the components and soft tissue balance are the two factors that determine the long term outcome of total knee arthroplasty (TKA). On the femoral side a distal cut made perpendicular to the MA will restore the MA of the leg. Different methods are commonly used to resect the femur perpendicular to its MA. In uncomplicated cases, most surgeons routinely use a fixed valgus cut angle (VCA) of 5° or 6°. Various studies have questioned the use of fixed valgus angle resection to restore the mechanical axis. The purpose of this prospective study is to analyze the variability in the valgus angle following computer assisted TKA.

Materials and methods

Twenty-three patients who underwent computer assisted TKA in our institution in 2009 were involved in the study. A total of 40 knees were available for analysis. All the knees underwent a CT scanogram postoperatively. Each scanogram was analyzed using the Amrita medvision® software. The angle subtended between the mechanical axis and the distal femoral anatomic axis is the valgus angle. Two independent observers calculated all the values and the interobserver reliability was calculated.

Results

The average age of the patients was 65.6 years. The kappa coefficient of agreement was 0.8, which shows good interobserver reliability.

The average angle formed by the femoral component with the mechanical axis was 91.6° and the average valgus angle calculated was 7.41°. 14 knees out of 40 (35%) were lying within the range of 4 - 7 degrees. In 25 knees (65%) valgus angle was more than 7 degrees. In one case the valgus angle was less than 4 degrees.

Conclusions.

Fixed valgus angle resection is not reliable in restoring mechanical axis in total knee arthroplasty. In the absence of facilities for surgical navigation, a pre operative planning with long leg films is extremely important to achieve long-term success.

Friday, October 8, 2010, 15:20-16:00

Session B14: Hip Resurfacing

Hip Implants - Tribological Testing Influenced by Physiological Conditions

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Introduction: Hip implant research has been carried out for decades using hip simulators to reflect situations *in vivo*. With regards to metal on metal (MoM) implant testing, it has been reported that there is no significant difference between the wear generated by various cobalt chromium (CoCr) microstructures. On the contrary, higher wear, metal ion levels and subsequent failures have been reported in heat treated (high carbon, low carbide) devices compared to as cast (high carbon, high carbide) devices *in vivo*. During testing, the bearing surfaces may be masked from the effect of microstructure on wear under fast and continuous cycles, while *in vivo*, the extensive range of kinetics and kinematics, stop/start motion, varying walking frequencies could break down the fluid film, resulting in a less favourable lubrication regime. The aims of this study were to develop a more physiologically relevant hip simulator test protocol, and investigate the effect of microstructure on wear.

Materials & Methods: Three pairs of 50mm as cast (AC) and four pairs of 50mm double heat treated (DHT) CoCr MoM devices were tested in a ProSim hip simulator. In order to determine the frequency for testing, Patients' activities have been monitored using a Step Activity Monitor (SAM) device. The data showed a relatively slower walking pace (frequency) than that used in the hip simulator studies. The new frequency, along with stop/start motion and various kinetics and kinematics profiles have been used in putting together a more physiologically relevant hip simulator test protocol. The lubricant used in this study was new born calf serum with 0.2 % (w/v) sodium azide concentration diluted with de-ionised water to achieve an average protein concentration of 20 g/l. Gravimetric measurements have been taken at 0.5, 1, 1.5 & 2 million cycle (Mc) stages and ion analysis has been carried out on the serum samples.

Results & Discussions: A biphasic wear pattern similar to the parts *in vivo* was observed. Under the newly developed physiologically relevant test conditions, the DHT CoCr devices generated 40% higher wear than the AC CoCr devices (Figure 1).

The metal ion analysis results also showed a similar biphasic wear trend, however, the difference between the AC and DHT devices was further increased by approximately 30 % at 2

Million cycle stage (Figure 2).

It has been reported that the DHT devices generate smaller size particles and in much larger numbers compared to those generated by the AC devices. This would result in a larger net surface area of the wear particles exposed to corrosion and thus would contribute to a higher amount of metal ion levels with the DHT devices compared to AC devices.

Conclusion: The *in vitro* results obtained with the new test protocol correlate well with the *in vivo* results. The higher wear, metal ion levels observed with double heat treated CoCr devices compared to as cast CoCr *in vivo* were also represented *in vitro*, highlighting the effect of microstructure on wear.

Figures

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

Japanese Success of Deep Knee Flexion in Total Knee Arthroplasty.

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Kneeling is one of important motion in Asians culture, also there were teachers of tea or flower ceremony who sit seiza routinely. But also, people in the Middle East need deep flexion kneeling when they pray. At the symposium with the title of "A Challenge of deep flexion after TKA", held at the 33rd Annual Meeting of Japanese Society of Reconstructive Arthroplasty in 2003, it was agreed that the definition of post-operative deep flexion to be more than 130 degrees of flexion. Four hundred and seventy two patients treated with a **total** of 598 consecutive primary **total knee** arthroplasties were performed and 480 **knees** were followed for 4.1 to 10.6 years (mean, 7.2 years). Preoperatively, the mean Hospital for Special Surgery **knee** score was 45.8 points. At the time of latest follow-up, the mean **knee** score was 88.5 points. The mean preoperative and postoperative ranges of **flexion** were 116 and 134 degrees, respectively. No knee developed osteolysis, aseptic loosening. A revision operation was performed in 3 **knees** because of infection. Achieving deep flexion is multi-factorial, such as preoperative planning, surgical procedure, prosthesis design, and postoperative rehabilitation. About surgical tips for deep flexion, posterior positioning of femoral component will increase the femoral posterior offset and decrease the anterior patello-femoral pressure. Through osteophyte removal will increase the posterior clearance and avoid the bone-polyethylene impingement. The flexion gap should be balanced after creating a balanced extension gap, since preparation of the flexion gap affects the extension gap in TKA. Based upon studies of the healthy knee in deep flexion, it was hypothesized that deep flexion would require tibial internal rotation greater than 20 degrees, greater posterior translation of the lateral femoral condyle than the medial condyle, and subluxation of the articular surfaces in terminal flexion. However, as the results of our

fluoroscopic analysis of kinematics during deep flexion kneeling after fixed bearing PS TKA, tibial internal rotation increased with greater knee flexion, but there was high variability about the trend line. Patients with deeply flexing fixed bearing PS knee arthroplasty showed two phases of condylar translation with deep flexion. Interestingly, these two-phase translations are dictated by the design of the cam/post mechanism and serve to maintain the condyles within the posterior articular surfaces of the tibia plateau. Surface separation of both medial and lateral condyles was observed in terminal flexion. At least direct edge wear by the femoral condyle in maximum flexion is denied from this phenomenon. However, potential problems of TKA that allows for deep flexion are considerable such as dislocation, polyethylene wear, and anterior knee pain. In TKA using PS type of implant, the risk of insert damage also exists in factors other than deep flexion motion, such as cam/post or notch/post. Surgeons must confirm carefully not to set implants loose, or not to leave remnants of osteophytes during surgery and to pay attention not to raise the activity level of patients too high after surgery.

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

Intra-Operative Gap Measurement and Component Type Selection in Total Knee Arthroplasty, Cruciate Retaining or Posterior Substitute.

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Introduction: There is no criteria to select cruciate retaining (CR) or posterior substitute (PS) component in total knee arthroplasty (TKA). In this study, extension and flexion gaps were measured intra-operatively with posterior cruciate ligament (PCL) remained to reveal characteristics of the gaps. Component type selection, CR or PS, was decided intra-operatively according to the gaps in each knee.

Materials and methods: One hundred and sixty knees with osteoarthritis were investigated. Extension gap (EG) was made by resection of 8 mm distal femur and 10 mm proximal tibia. After measurement of femoral AP size, about 4 mm bigger 4-in-1 femoral cutting guide than measured size was used for pre-cut of femoral posterior condyle [Figure 1]. With this technique, flexion gap (FG) was made 4 mm smaller than usual measured resection. The gaps were measured by a tension device with 30 pounds tension and FG was corrected by the amount of pre-cut. According to the EG and corrected FG, component type was decided. Too small FG usually needed PCL resection or (and) smaller size of femoral component to make enough final FG. On the other hand, large FG needed careful consideration to sacrifice PCL for adequate final FG. In these cases, CR component was selected usually. If necessary, soft tissue was released for good ligament balance. As the final step of the surgical procedure, the size of

femoral component was decided for adequate final FG. It was changeable up to 4 mm larger than measured size[Figure 2].

Results:After pre-cut of femoral posterior condyle and correction of FG by the amount of pre-cut, the range of the gaps were 10~31 mm (average 20.6 ± 3.7) in flexion and 8~29 mm (average 17.5 ± 3.4) in extension. There were wide variations in both gaps. The range of the difference between corrected FG and EG was -4~12 mm (average 3.1 ± 3.3) and corrected FG was significantly larger than EG ($P<0.001$). Since PCL resection makes FG wider than EG, selection of PS implant would result in much larger final FG in many cases. Of course, larger size of femoral component was available to make FG smaller, but there was limitation. These cases were not suitable for PS component. On the other hand, there were some cases with smaller FG than EG. To select CR component in these cases, it was necessary to use smaller size of femoral component for enough final FG. It led to smaller posterior condylar offset and posterior flexion space. These cases were not suitable for CR component. Considering adequate size of femoral component, CR was used in 122 knees and PS in only 38 knees from the gaps.

Conclusion:Because of wide variations in EG and FG, it is difficult to use only one component, CR or PS, in every cases. Larger femoral component with PS or smaller component with CR than measured size is possible to use, but there is limitation. Considering adequate size of femoral component and the final gaps, selection of component type should be decided by intra-operative gap measurement in each knee.

Figures

Saturday, October 9, 2010, 8:15-9:00

Session A17: Knee Mechanics

In Vivo Kinematics of Mobile-Bearing Total Knee Arthroplasty Including Polyethylene Insert During Stairs Up and Down

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Background: Mobile-bearing (MB) total knee prostheses have been developed to achieve lower contact stress and higher conformity compared to fixed-bearing total knee prostheses. However, little is known about the in vivo kinematics of MB prostheses especially the motion of the polyethylene insert (PE) during various daily performances. And the in vivo motion of the PE during stairs up and down has not been clarified. The objective of this study is to clarify the in

vivo motion of MB total knee arthroplasty including the PE during stairs up and down.

Patients and methods: We investigated the in vivo knee kinematics of 11 knees (10 patients) implanted with PFC-Sigma RP-F (DePuy). Under fluoroscopic surveillance, each patient did stairs up and down motion. And motion between each component was analyzed using two- to three-dimensional registration technique, which used computer-assisted design (CAD) models to reproduce the spatial position of the femoral, tibial components, and PE (implanted with four tantalum beads intra-operatively) from single-view fluoroscopic images. We evaluated the range of motion between the femoral and tibial components during being grounded, axial rotation between the femoral component and PE, the femoral and tibial component, and the PE and tibial component during being grounded.

Results: The mean flexion angle of being grounded during stairs up was 72.0° \pm 8.74° (Max, Min). The femoral component relative to the tibial component demonstrated 8.77° external rotation during stairs up. The PE relative to the tibial component demonstrated 8.23° external rotation and the femoral component relative to the PE demonstrated 3.93° external rotation during stairs up. The average ROM during stairs down was from 40.8° to 5.75° (Max, Min). The external rotation of the femoral component relative to the tibial component was 4.73° during stairs down. The tibial component rotated 6.36° relative to the PE and the femoral component rotated 3.95° relative to the PE. In both two movement, there was a positive correlation between the femoral component relative to the tibial component and the PE relative to the tibial component in terms of axial rotation at each flexion angle.

Discussion and conclusion: In this study, we evaluated the in vivo motion of the PE during stairs up and down. there was a positive correlation between the femoral component relative to the tibial component and the PE relative to the tibial component about axial rotation at each flexion angle.

Thursday, October 7, 2010, 10:20-11:00

Session A3: Bearing Mobility Issues

A Comparison of Mobile-Bearing Versus Fixed-Bearing Total Knee Arthroplasty

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Background: Currently there are various knee prosthesis designs available each with its plus and minus points; there is no general consensus on whether mobile-bearing knees are functionally better than fixed-bearing ones. This study is designed to compare outcomes after total knee arthroplasty with both of the above prostheses.

Materials & Methods: 50 patients (68 knees) who'd had a total knee arthroplasty between April 1999 and April 2008 at both Akhtar and Kian Hospitals for primary osteoarthritis were selected. In 30 cases a fixed-bearing knee (Scorpio®, Stryker) and in the remaining 38 a mobile-bearing prosthesis (Rotaglide®, Corin Group) was used. Patients' knees were scored

before and after the operation according to the Knee Society Scoring System. The mobile-bearing group had an average age of 65 and 34 months' follow-up; in the fixed-bearing group the average age was 69 and the average follow-up 30 months.

Results: The average knee score in the mobile-bearing group rose from 29 to 64 while in the fixed-bearing group the score changed from 31 to 68. The average functional score moved from 45 to 67 in the mobile-bearing group and from 34 to 57 in the fixed-bearing group. The average overall score, for the fixed-bearing group, moved from 65 to 125 and in the mobile-bearing group from 75 to 128.

Conclusion: In both groups the average knee/functional knee scores increased after the operation and all patients were happy with the results, however statistically there was no meaningful relationship between pre-and post-operation scores. So regarding to our findings, there is no preference between these two types of prosthesis.

Key Words: Total Knee Arthroplasty, Mobile-Bearing Prosthesis, Fixed-Bearing Prosthesis, Knee Society Score.

Friday, October 8, 2010, 11:10-11:50

Session A13: Alternate Bearing Materials in Arthroplasty

Minimum 5 Year Results for Modular Metal on Metal THA

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Modular Metal on Metal THA – Minimum 5 Year Results

Introduction

Metal on metal hip bearings (MoM) are under scrutiny. Short and mid-term complications attributed to metal wear debris have been reported. Distinctions between MoM prostheses exist. Thus, generalizing findings from one design to another is questionable. This study reports minimum 5 yr. PinnacleTM modular MoM results.

Methods

Between September 2001 and October 2004, 95 consecutive MoM THAs were performed by one surgeon in a prospective cohort design. Mean age was 53 yrs (range 34-70); 57 were male. Mean BMI was 29 (range 20-46). OA was noted in 87 patients. Head size was 28mm in 3 and 36mm in 92. Surgical approach was postero-lateral in all patients. Harris Hip Score (HHS), WOMAC, ROM and radiographs were evaluated preoperatively, at 6-months, and yearly thereafter.

Results

Mean follow-up was 6 yrs (SD 1.7). Mean radiographic follow-up was 5.2 yrs (SD 1.2). Radiographs were available for 83 hips. Mean HHS improved from 43 preoperative (range 15–68) to 98 (range 86-100, $p < 0.0001$). Mean WOMAC score improved from 56 (range 15-94) to 12 (range 0-63, $p < 0.0001$). Flexion improved from 95° (range 50-115) to 102° (range 90-120, $p < 0.0001$). Complications included trochanteric fx (6 mo) without component removal, traumatic femoral Fx (40 days) with stem replacement, and one dislocation. No other device related adverse events were reported. No peri-acetabular osteolysis was observed. Six year survival was 100% for the acetabular shell / modular metal liner combination.

Conclusion

Excellent mid-term results were obtained in a young, active cohort treated with modular MoM THA. No AVAL, pseudotumor, unexplained pain or other complication attributable to wear debris or the MoM articulation was observed. These findings indicate that THA with the Pinnacle™ modular MoM bearing performs well in a high demand population at mid term follow-up.

Thursday, October 7, 2010, 16:50-17:40

Session B8: Management of Complications in TKA

Treatment of Periprosthetic Osteolysis Using Trabecular Metal in Revision Knee Arthroplasty

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Introduction: Several options exist for the treatment of periprosthetic osteolysis in revision knee surgery. We describe our preliminary short-term experiences using trabecular metal (TM) technology in order to fill bony defects either on the femoral or on the tibial side.

Material and Methods: 52 revision knee surgeries in which this TM technology had been used were retrospectively reviewed clinically and radiographically. Indication for revision included 51 cases with aseptic loosening of Total Knee Arthroplasty. In one case of periprosthetic infection, a staged revision procedure was performed. Assessment of bone loss included the AORI classification (1989) and was performed pre- and intraoperatively. Clinical evaluation was performed using the HSS score. In 6 cases in addition to using the TM cones, an impaction grafting technique was performed.

Results: Average follow up was 22 months. So far, not loosening of a TM cone neither

clinically nor radiographically was observed. In 74% of the cases, either a type FII-TII-FIII or TIII defect was seen. Average number of pre-existing surgeries was 4,6. Pre-operative Range of motion was 0-84 degrees and 0-98 degrees at time of latest follow up. Complications in this series included 2 periprosthetic fractures and 1 periprosthetic infection, later revised to a successful fusion. Upon explantation of the TM cone in this case, stable osteointegration was observed. HSS score increased from 34 to 62 points postoperatively (49-93).

Discussion: Treatment of severe periprosthetic osteolysis in our eyes can be managed successfully in the short-term range using TM technology which requires a meticulous surgical technique and proper indication. This material might be successfully combined using homologous bone as an adjunct.

Friday, October 8, 2010, 8:40-9:50

Session B10: Navigation and Robotics in Arthroplasty

Use of Navigation Aids as Additional Training Tool for Orthopaedic Trainees

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Introduction

There have been concerns regarding the quality of training received by Orthopaedic trainees. There has been a reduction in working hours according to the European working times directive. National targets to reduce surgical waiting lists has increased the workload of consultants, further reducing the trainees' surgical experience. Navigation assisted procedures are successfully used in orthopaedics and provides useful feedback to the surgeon regarding

precision of implant placement. We investigated the use of navigation aids as an alternative source of training surgical trainees.

Methods

We choose a navigation assisted knee replacement (TKR) model for this study. A first year Orthopaedic registrar level trainee was taught the TKR procedure by a scrubbed consultant in 5 cases. He was then trained in use of non-CT based navigation surgery. The Trainee then performed navigation assisted non-complex primary TKR surgery. A consultant Orthopaedic surgeon was available throughout for advice and support. Data collected included pre and post procedure valgus and varus alignment of the knee, total operative time and WOMAC scores pre and post operatively.

Results

A total of 42 TKRs were performed. Intra-operative review by the consultant surgeon was necessary on 3 occasions in the first 10 cases and two occasions in the remaining cases. The average operative time reduced from 184.25 minutes in the first 10 cases to 163.11 minutes in the next 20 cases and 150.33 minutes in the next 12 cases. The varus/ valgus alignment was corrected to within 8 degrees in all cases. A significant improvement in WOMAC scores was recorded for all patients ($p < 0.05$).

Conclusion

We believe that this model can be used as a training aid in various orthopaedic surgical procedures.

Thursday, October 7, 2010, 10:20-10:50

Session B3: Cartilage Repair/Regeneration

Validation of a Prognostic Classification System for Acetabular Cartilage Lesions

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Introduction

In recent years, there has been a significant advancement in our understanding of femoro-acetabular impingement and associated labral and chondral pathology. Surgeons worldwide have demonstrated the successful treatment of these lesions via arthroscopic and open techniques. The aim of this study is to validate a simple and reproducible classification system for acetabular chondral lesions.

Methods

In our classification system, the acetabulum is first divided into 6 zones as described by Ilizalithurri VM et al [Arthroscopy 24(5) 534-539]. The cartilage is then graded as 0 to 4 as follows: Grade 0 – normal articular cartilage lesions; Grade 1 softening or wave sign; Grade 2 - cleavage lesion; Grade 3 - delamination and Grade 4 –exposed bone. The site of the lesion is further typed as A, B or C based on whether the lesion is 1/3 distance from acetabular rim to cotyloid fossa, 1/3 to 2/3 distance from acetabular rim to cotyloid fossa and > 2/3 distance from acetabular rim to cotyloid fossa.

For validating the classification system, six surgeons reviewed 14 hip arthroscopy video clips. All surgeons were provided with written explanation of our classification system. Each surgeon then individually graded the cartilage lesion. A single observer then compared results for observer variability using kappa statistics.

Results

We observed a high inter-observer reliability of the classification system with a kappa coefficient of 0.89 (range 0.78 to 0.91) and high intra-observer reliability with a kappa coefficient of 0.91 (range 0.89 to 0.96).

In conclusion we have developed a simple reproducible classification system for acetabular cartilage lesions seen at hip arthroscopy.

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Introduction

Infection following total joint arthroplasty is a major and devastating complication. After removal of the initial prosthesis, an antibiotic-impregnated cement spacer is inserted for approx. three months. Treatment is completed by a second stage revision arthroplasty.

Up to now, spacers are produced from conventional bone cements that contain abrasive radio-opaque substances like zirconium dioxide or barium sulphate. As long as spacer wear products (cement particles containing these hard substances) are not fully removed during the final revision surgery they may enter the articulating surfaces of the revision implant leading to third body wear.

In order to reduce the formation of reactive wear particles, a special cement (Copal® spacem) without abrasive zirconium dioxide or barium sulphate was developed.

To date, no comparative tribological data for cement spacers have been published. Hence, we carried out a study on the wear properties of Copal® spacem (with and without gentamicin) in comparison to conventional bone cements (Palacos® R and SmartSet® GHV).

Material and Methods

In order to assure reproducible forms of the femoral and tibial components, silicon rubber moulds were produced and filled with the respective cement. Force-controlled simulation was carried out on an AMTI knee simulator (Figure 1). The test parameters were in accordance to ISO 14243-1 with a 50% reduced axial force (partial weight bearing). Tests were carried out at 37 °C in closed chambers filled with circulating calf serum. Tests were run for 240,000 cycles (representing the average step rate during 6-8 weeks) at a frequency of 1 Hz. For wear analysis, digital photographs of the spacer were taken at the beginning and at the end of the testing period. The areas of wear scars were measured by the means of a digital image processing software.

Results

At the end of wear test none of the cement specimens showed cracks or failures. Pairwise comparison between the cement types revealed significant differences: Larger wear scars were observed for Copal® spacem compared to Copal® spacem + gentamicin (TUKEY test, $p=0.025$), whereas smaller wear scars were measured compared to Palacos® R (Figure 2), (TUKEY test, $p<0.001$). Copal® spacem + gentamicin showed the smallest wear scars with significance to all tested cements (Copal® spacem (TUKEY test, $p=0.025$), Palacos® R (TUKEY test, $p<0.001$), and SmartSet® GHV (TUKEY test, $p=0.006$).

Discussion

Copal® spacem without and especially with gentamicin showed considerably smaller wear scar areas at 240,000 cycles compared to the well established cements Palacos® R and SmartSet® GHV (Figure 2). This finding is due to the soft calcium carbonate in Copal® spacem, which is clearly less abrasive against the surfaces of the sliding partners when compared to bone cements containing zirconium dioxide as radio contrast agents.

Summarising these results, Copal® spacem provides a new and interesting approach to produce enhanced spacers with decreased wear. This concept should be further investigated from a mechanical, material-scientific and clinical point of view. Whether the favourable properties of Copal® spacem are applicable in order to improve survival of the revision implant needs to be investigated in a long-term study.

Figure 1. Cement spacer in the knee simulator.

Figure 2. Wear scars on the tibial plateau. On the left side Copal® spacem + gentamicin and on the right side Palacos® R.

Figures

Friday, October 8, 2010, 15:00-16:00

Session A15: Alternate Bearings 2

Ceramic-on-Metal vs. Ceramic-on-Ceramic. a Hip Simulator Wear Study.

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Introduction

Osteolysis and aseptic loosening in total hip replacement (THR) is often associated with polyethylene (PE) wear. This caused interest in alternative bearing surfaces. Since the mid nineties, research focused on hard-hard bearings like metal-on-metal (MOM) or ceramic-on-ceramic (COC). However, concerns remain about biological reactions to metallic wear debris or failure of the ceramic components. A new approach to reduce wear with a minimized risk of failure may be the use of a metallic cup in combination with a ceramic head, the so called ceramic-on-metal bearing (COM). The aim of this study was to estimate the wear behaviour at an early stage of this COM bearing type in comparison to COC bearings using a hip simulator.

Material and Methods

Simulator studies were carried out on a single station hip simulator (MTS 858 Mini Bionix II, Eden Prairie, USA) in accordance to ISO 14242-1. Bovine serum was used as the test medium. Four COM and four COC bearings were used, both 36mm in diameter. The heads were made of a mixed-oxid ceramic (Biolox Delta®) paired with a high carbon wrought CoCrMo cup in the

COM group whereas both components were made of BioloX Delta® in the COC group. Simulation was run to a total of 2.4×10^6 cycles. Wear measurements were performed in intervals of 0.2×10^6 cycles using a gravimetric method (Sartorius Genius ME235S, measuring solution: 15 µg, Sartorius, Göttingen, Germany).

Results

Wear of the COM and COC pairings is shown in Figure 1. During the first 200,000 cycles a mean wear rate of $0.16 \text{mm}^3/10^6$ cycles was found followed by a decreased wear rate of $0.04 \text{mm}^3/10^6$ cycles for the COC bearings. The overall wear ranged from 0.08mm^3 to 0.17mm^3 , with a mean of 0.12mm^3 . There was found a high variability in the wear progression between the four COM implants (Figure 1). A mean wear rate of $0.13 \text{mm}^3/10^6$ cycles was determined during the first 200,000 cycles followed by a decreased wear rate of $0.05 \text{mm}^3/10^6$ cycles. The overall wear of the COM implants ranged from 0.02mm^3 to 0.21mm^3 , with a mean of 0.13mm^3 . All ceramic heads from the COM bearings showed metallic material transfer in form of stripes whereas no visible wear traces were found on the COC heads.

Discussion and Conclusion

The COM implants showed very low wear levels that were similar to the COC bearings and far below wear levels of conventional MOM bearings. However, there was a spreading up to the thirteen fold between lowest and highest wear volume of the COM at the end of the study. Concerning COM implants such high variability was also seen by other investigators. The simulator conditions are highly reproducible (as seen for the COC bearings). Considering the high variations in patients demand, the influence of patient related activity parameters should be further investigated in terms of wear. Moreover, this study was performed without implementing subluxation, impingement or malalignment which might also increase wear. These effects together with the influence of third body wear needs to be further considered.

Figure 1: Mean wear progression of COM and COC bearings. Standard deviation at each interval is labeled by indicators.

Figures

Friday, October 8, 2010, 16:30-17:20

Session A16: Computer Navigation in THA

Comparison of Computer Navigated Total Hip Arthroplasty Versus Conventional Total Hip Arthroplasty Utilizing the Direct Anterior Approach

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Introduction:

The incorporation of computer navigation in total hip arthroplasty (THA) has been much slower than for total knee arthroplasty (TKA). Computer navigation has proven itself in the realm of TKA but still has yet to advance in THA. The reasons for this include the lack of ease of incorporation, accuracy and precision, and the addition of overall operative time. Another reason for this lack of progress is that a majority of THA's are done with the patient in the lateral position through a posterior or lateral approach making the tracker placement and the registration process somewhat cumbersome. In the direct anterior approach the patient is in the supine position, which accommodates pelvic tracker placement and significantly facilitates the registration process. At our institution we use the direct anterior approach and computer navigation on all of our primary THA's. We hypothesized that computer navigation facilitates cup placement and leg length determination with out significantly increasing our operative time.

Materials and Methods:

This was a prospective study comparing a consecutive series of 150 computer navigated total hips to a consecutive series of 150 none navigated total hips. The two groups were similar by age, sex, and BMI. Operative times were collected using our secure online database. The start and stop of operative time was incision to final reduction respectively. Post operative radiographs were analyzed using TraumaCad 2.0 (Voyant Health, Columbia, MD). Cup angle and leg length were measured on A/P pelvic views. Simple descriptive statistics and t-tests were used to analyze data.

Results:

There were a total of 134 men and 166 women with a pre operative diagnosis of osteoarthritis. The conventional cohort contained 64 men and 86 women with an average age of 65.6 (26.1-91.3) and BMI of 29.3(15.7-50.9). The computer navigation cohort contained 70 men and 80 women with an average age of 65.5 (44.8-90.2) and BMI of 28.6 (17.5-44.0). The average operative times of the conventional and computer navigation cohorts were 62.4 min (33-165) and 53.0 min (38-63) ($p < 0.0001$) respectively. The average cup angle was 37.2 (25-52) for the conventional cohort and 41.0 (26-55) for the computer navigation cohort ($p = 0.0046$). The leg length discrepancy average was 3.2 mm (-13.0mm to 13.0mm) for the conventional cohort and 2.1 mm (-6.0mm to 15.0mm) for the computer navigation cohort ($p = 0.0012$).

Conclusion:

The results from our study suggest that computer navigation is easy to incorporate when utilizing a direct anterior approach and in fact shortens the operative time. The accuracy and precision of cup angle placement and leg length discrepancy are comparable to our conventional method but appears to be slightly improved with computer navigation. Although more work is needed to progress this promising technology, we feel that incorporating computer navigation for hip surgery in the supine position is simple and of great value.

Comparing Femoral Component Rotation Using a Force Sensing Device Versus Conventional Methods With Anatomic Landmarks

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Introduction

Total knee arthroplasty is traditionally performed using bone anatomy to dictate femoral implant rotation and soft tissue release to balance any resulting deficiencies. A force sensing device has been developed that reverses this conventional order. It measures the forces in the medial and lateral compartments and dictates the femoral rotation cuts when these are equal. The purpose of this study was to compare the traditional methods of femoral rotation (TEA, AP axis, and posterior referenced) to this novel approach using computer navigation with the force sensor to determine a balanced flexion gap.

Methods

This was a prospective cohort study of 50 consecutive primary TKA's. Inclusion criteria were diagnosis of OA and primary TKA. Exclusion criteria were inability to use force sensing device. The cohort consisted of 29 females and 19 males with an average age of 70.8 years (50.2-90.3) and BMI of 32.0 (19.8 – 56.1). Intra-operative data was collected using computer navigation. Post operative CT scans were obtained on 31 of the 50 knees to assess femoral implant rotation to the patients' true TEA. CT measurements were made by two different observers. Simple descriptive statistics and t-tests were used for analysis.

Results

The novel approach, which is assumed to be a well-balanced/symmetric flexion gap, had an average rotation within 1.8 degrees to the TEA as evidenced by the CT measurements. The navigation data showed that the posterior referenced, TEA, and AP method would have resulted in an asymmetric flexion gap (greater than 3° from CT observed TEA) in 52%, 52%, and 44% respectively as opposed to the novel approach at 23%.

Conclusion

This study showed that this novel device when accompanied with computer navigation can result in a balanced flexion gap and femoral implant rotation within 3° of the TEA 77% of the time.

Influence of Patellar Height on Soft Tissue Balance in Total Knee Arthroplasty

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Introduction

Accurate soft tissue balancing has been recognized as important as alignment of bony cut in total knee arthroplasty (TKA). In addition, using a tensor for TKA that is designed to facilitate soft tissue balance measurements throughout the range of motion with a reduced patello-femoral (PF) joint and femoral component in place, PF joint condition (everted or reduced) has been proved to have a significant effect for intra-operative soft tissue balance. On the other hand, effect of patellar height on intra-operative soft tissue balance has not been well addressed. Therefore, in the present study, we investigated the effect of patellar height by comparing intra-operative soft tissue balance of patella higher subjects (Insall-Salvati index >1) and patella lower subjects (Insall-Salvati index ≤ 1).

Materials and methods

The subjects were 30 consecutive patients (2 men, 28 women), who underwent primary PS TKA (NexGen LPS-flex PS: Zimmer, Warsaw, IN, USA) between May 2003 and December 2006. All cases were osteoarthritis with varus deformity. Preoperative Insall-Salvati index (ISI) was measured and patients were divided into two groups; the patella higher group (ISI ≥ 1 : 18 knees average ISI was 1.12) and the patella lower group (ISI ≤ 1 : 12 knees average ISI was 0.94). Component gap and ligament balance (varus angle) were measured using offset-type tensor with 40lb distraction force after osteotomy with the PF joint reduced and femoral trial in place at 0, 10, 45, 90, 135 degrees of knee flexion. Data of two groups were compared using unpaired t test.

Results

Component gap was increased from 0 to 90 degrees of knee flexion and decreased at 135 degrees of knee flexion in both groups. Component gaps of the patella higher group in average were 10.9, 14.3, 16.6, 18.2, 16.8 mm at 0, 10, 45, 90, 135 degrees of knee flexion, respectively. Component gaps of the patella lower group in average were 9.6, 13.6, 14.6, 15.5, 14.0 mm at 0, 10, 45, 90, 135 degrees of knee flexion, respectively. When comparing two groups, component gaps of the patella higher group showed larger trend than those of the patella lower group. Especially at 90 and 135 degrees of knee flexion, the patella higher group showed significant larger values than the patella lower group ($p < 0.05$). Varus angles of the patella higher group in average were 2.2 \pm 3.4 \pm 5.0 \pm 5.9 \pm 6.1 degrees at 0, 10, 45, 90, 135 degrees of knee flexion, respectively. Varus angles of the patella lower group in average were 1.7 \pm 2.8 \pm 4.4 \pm 4.9 \pm 4.6 degrees at 0, 10, 45, 90, 135 degrees of knee flexion, respectively. Varus angles of the patella higher group showed slight larger trend than those of the patella lower group, however there was no significant differences between two groups.

Discussion

In the present study, the patella higher group showed significant larger component gaps than the patella lower group at high flexion angles (90, 135 degree). This result suggests that smaller pressure on extensor mechanism of the patella higher group has led to larger component gaps at higher flexions. In conclusion, pre-operative measurement of ISI can help surgeons predict intra-operative soft tissue balance.

Thursday, October 7, 2010, 8:30-9:20

Session B2: Knee Arthroplasty in the Indian Sub Continent

A 11 to 14 Year Follow-Up Study of the Rotaglide Mobile

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We report long term outcomes of the Rotaglide mobile bearing total knee arthroplasty (RTK).

(Method) Between 1995 and 1998, 61 RTK prostheses were implanted at our institution consecutively. Of 34 knees with a median duration to end of follow up of 13.0 years (range 11.4 to 14.2 years), the clinical result using Knee Society Score and radiological analysis using Knee Society Roentgenographic System was evaluated.

(Result) The prosthesis had an estimated survival probability of 94.1% at 13 years. There was one case of deep infection and one case of meniscal component failure.

Clinical evaluation and knee function : The mean Knee score and function score at final follow-up are 90.0 ± 8.3 and 61.8 ± 29.6 . The mean postoperative range of motion at final follow-up was from 0.7° (range $0-20^\circ$) to 117.8° (range $90-135^\circ$).

Radiological analysis : The mean post operative FTA, α angle, β angle, δ angle are $173.8 \pm 3.9^\circ$, $96.4 \pm 2.2^\circ$, $90.9 \pm 3.1^\circ$, $81.3 \pm 2.9^\circ$. Clear zone was recognized in 2 tibia components but no progression was confirmed in the follow-up duration.

(Discussion) RTK is mobile bearing total knee which has a one piece meniscal component that is able to glide antero-posteriorly and rotate on the tibial component. Area contact between meniscal component and femoral component can be maintained from 0° to 90° of flexion. RTK gives satisfactory long-term clinical results. No knees were revised for aseptic loosening. This may be a result of the implant design.

In Vivo Kinematics of Rotating Platform Mobile-Bearing Total Knee Arthroplasty

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Abstract

Background: Mobile-bearing (MB) total knee prostheses have been developed to achieve lower contact stress and higher conformity compared to fixed-bearing total knee prostheses. However, little is known about the in vivo kinematics of MB prostheses especially about the kinematics of polyethylene insert (PE). In vivo motion of PE during squatting still remains unclear. The objective of this study is to investigate the in vivo motion of MB total knee arthroplasty including PE during squatting.

Patients and methods: We investigated the in vivo knee kinematics of 11 knees (10 patients) implanted with Vanguard Rotating Platform High Flex (Biomet®). Under fluoroscopic surveillance, each patient did a weight-bearing deep knee bending motion. Motion between each component was analyzed using two- to three-dimensional registration technique, which uses computer-assisted design (CAD) models to reproduce the spatial position of the femoral, tibial components, and PE (implanted with five tantalum beads intra-operatively) from single-view fluoroscopic images. We evaluated the range of motion between the femoral and tibial components, axial rotation between the femoral component and PE, the femoral and tibial component, and the PE and tibial component, and AP translation of the nearest point between the femoral and tibial component and between the femoral component and PE.

Results: The mean range of hyper-extension was $0.5 \pm 3.2^\circ$ (range: -4.0 to 4.7°) and the mean range of flexion of $119.0 \pm 11.3^\circ$ (range: 98 to 137°). The external rotating femoral component relative to the tibial component demonstrated $8.6 \pm 3.2^\circ$ (range: 5.5 to 14.7°) for 0-120 degrees flexion. The PE rotated $9.6 \pm 4.5^\circ$ (range: 2.5 to 18.0°) externally relative to the tibial component, the femoral component rotated little relative to the PE. In upright standing position, the femoral component already rotated $1.2 \pm 9.8^\circ$ (range: -16.5 to 15.9°) externally relative to the tibial component and the PE also rotated $0.8 \pm 9.8^\circ$ (range: -16.1 to 16.0°) externally on the tibial tray. From 0° to 120° of flexion there was almost little A-P translation of the medial femoral condyle within 2 mm. The lateral condyle translated posteriorly with knee flexion. The average amount of posterior translation was 5.7 ± 1.6 mm (range: 2.5 to 7.5 mm). The femoral component relative to the tibial component exhibited a medial pivot pattern external rotation for 0-120 degrees flexion.

Discussion and conclusion: In this study, we evaluated the in vivo motion of MB total knee arthroplasty including PE during squatting. About this total knee prosthesis, the mobile-bearing mechanism which advantages over fixed-bearing prosthesis to keep high conformity might work well, and arc of range of motion was maintained. Furthermore, in upright standing position, the femoral component and PE already rotated externally relative to the tibial component in almost equal measure. This indicated that, self-aligning mechanism, another

Saturday, October 9, 2010, 9:10-9:50

Session A18: Complication Management

Isolated Lateral Ligament Laxity in Primary Total Knee Arthroplasty: Cohort Study of Stemmed Versus Unstemmed Implants

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Introduction: While the use of stemmed implants is accepted for patients with medial ligament laxity in primary total knee arthroplasty (TKA), the role of stemmed implants in the setting of isolated lateral laxity is unclear. We present a cohort study to assess the effect of unstemmed, constrained TKA for isolated lateral laxity.

Methods: 1745 primary TKA performed by the senior surgeon were reviewed. 39 knees in 33 patients with isolated lateral laxity managed with unstemmed components were compared to matched stemmed controls (37 knees in 28 patients). Lateral instability was defined intra-operatively based on >7mm gap in mid-flexion/ full extension/ figure-of-four with well-positioned components. Primary outcome measures were clinical failure for aseptic loosening (with need for revision as the endpoint) and any radiographic signs of loosening.

Results: Average follow-up was 43 months for the unstemmed group (UG) and 25 months for the stemmed group (SG). UG and SG were matched for age, gender, BMI, arthritis etiology, and co-morbidities. The incidence of isolated lateral ligament laxity in this cohort was 4%. There was no difference in clinical outcomes between cohorts. There was no evidence of radiographic loosening; no revisions were performed for aseptic loosening in either group. One SG patient was revised for mid-flexion instability, while one UG patient had an isolated dislocation event without need for revision. Two patients in the UG were treated with incision/debridement and poly-exchange for acute infection. One patient in the SG underwent 2-stage reimplantation.

Conclusion: From this data, a post/constraint can be used without stems to compensate for isolated lateral laxity. There is no significant increased risk of loosening with increased constraint, as lateral instability is primarily a swing-phase phenomenon. The goal is limiting varus thrust with improved gait kinematics and patient comfort. Further biomechanical testing and long-term clinical results are needed.

a Comparative Analysis Between the Surgical and Minimally Invasive Anterior Approach to the Direct Lateral in Total Hip Arthroplasty

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A Comparative analysis between the surgical and minimally invasive anterior approach to the direct lateral in total hip arthroplasty

Backgrounds

The authors present an analysis of 30 cases of total hip prosthesis performed with minimally invasive surgical earlier compares with 30 cases of total hip prosthesis performed surgically with direct side. The intent is to demonstrate the immediate and clear advantages especially in the postoperative surgical minimally invasive front.

Methods:

The authors present a randomized study of thirty cases of patients undergoing surgery for osteoarthritis of the hip prosthesis with primary surgical minimally invasive front compared to a group of 30 patients undergoing surgery with direct surgical side. All patients had the same cementless implants and instruments with the same surgeon. Patients were then evaluated in four different times: before surgery, immediate postoperative, after 1 week and 4 months after surgery.

Results and conclusions:

The experience of the authors on the surgical front shows the immediate and clear advantages in postoperative species by saving the muscle tissues, little pain, little bleeding, more quick and easy re-education and rehabilitation.

Delta AMC Ceramic Joints in THA : A Monocentric Study of 141 Cases With Minimum 2 Years Follow-Up.

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Introduction

Wear performances and fracture toughness of the alumina-matrix composite (AMC) BioloX-delta® are pointed out in the literature. This study is a prospective monocentric evaluation of 32 and 36 mm AMC / AMC bearing surfaces .

Material and methods

141 THA were included prospectively since 2006 in 127 patients . (62 females ,65 males ,mean age 62,2 years, mean BMI 25,5). 134 cases were primary implantations. Mean follow-up is 40.9 months (29.8-53.4).In all patients we used the same cementless stem and cup.

Clinical and radiological data were evaluated with a special attention for ceramic fracture and squeaking .

Results

At follow-up mean HHS is 95.4 . We faced current problems in this series (2 post-op.dislocations in non compliant patients, 1 hematoma, 3 early septic complications in immunodepressed patients)

Intraoperative events were 3 non relevant femur fractures and 1 partial acetabular fracture

4 cases needed a revision (1 cup and 1 stem loosening , 1 painful stem, 1 limb length discrepancy)

No abnormal wear, osteolysis or implants migration could be detected in the other cases . No ceramic head fracture or liner chipping occurred.No patient reported squeaking.

Discussion and conclusion

In this monocentric report the Delta COC articulation provides similar functional scores and survivorship as previously published ceramic on ceramic series. We did not observe ceramic fracture . Unusual rates of liner chipping have been described in an other multicentric study.According to our experience and despite the short follow-up ,we suggest that those complications could be related to cup design rather than to the ceramic material .

Saturday, October 9, 2010, 9:10-9:50

Session A18: Complication Management

Ceramic Strategy for Cup Revisions: Minimum 3 Years Follow-Up With Alumina Matrix Composite Ball Heads and Sleeves

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Introduction

The ceramic-on-ceramic strategy in acetabular revision faces potential limitations due to the femoral stem, as the implantation of ceramic ball head on a previously used taper is not recommended. Delta ® ball heads with titanium sleeves have been proposed to avoid femoral revision. The study reports a minimum 3 years follow-up experience using this strategy.

Materials and Methods

This series report 42 revisions (16 metal-on-metal and 26 PE THA) in 39 patients (mean age 59.2 years, mean BMI 25). The 12-14, 5°46 sleeves were used in 24 cases and 10-12, 6° in 18 cases. (32mm ball head in 26 cases and 36 mm in 16 cases). Titanium serum level has been studied to detect the potential release from the sleeve-taper interface.

Results

We did not observe ceramic fracture or squeaking. Serum titanium levels remained under the detection limit. 3 procedures failed:

- 2 hips in the same immunodeficient patient due to septic complications (secondary successful one stage revisions)

- 1 failure of cementless fixation

4 dislocations occurred (2 cases due to neurological deficiencies, 2 cases explained by the lack of offset of the previous stem). No revision was required.

Conclusion

The ceramic on ceramic strategy without femoral revision can be considered according to this study. Accurate informations on the taper details are required, as well as carefull peroperative inspection to exclude damaged stems .The dislocation risk is significant when the previous femoral implantation is suboptimal.

Thursday, October 7, 2010, 11:00-11:20

Session B4: Ethnic and Gender Issues in TKR.

Complications After Total Knee Arthroplasty With Anterior-Posterior Glide Low Contact Stress Mobile-Bearing

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Purpose

The purpose of this study was to evaluate the complications related to the prosthesis design in patients managed with cemented total knee arthroplasty (TKA) with the anterior-posterior glide (APG) mobile bearing prosthesis.

Materials and Methods

One hundred eighty three total knee arthroplasties were performed using APG Low Contact Stress mobile bearing prosthesis (Depuy, Warsaw, IN) on 146 patients with an average of 8.4 years follow-up (range, 7 to 10 years). Patients were evaluated clinically and radiologically according to the American Knee Society clinical scoring system. The anteroposterior translation, anterior soft tissue impingements, and complications were assessed at the follow-up periods.

Results

No knee had loosening and measurable polyethylene wear on radiographs. There were late dislocations of bearing in 2 knees (1.1%), anterior soft tissue impingements in 6 knees (3.3%) at an earlier follow-up, abnormal anteroposterior translation in 5 knees (2.7%), and a fracture of the femoral component induced by osteolysis in 1 knee. Two patients with late dislocation of bearing had preoperative varus deformity more than 15° angulations and 20° flexion contracture.

Conclusion

An improvement in a restraint mechanism of the APG mobile bearing prosthesis is needed to minimize the development of complications with regard to a combination of this design and patient factors.

Thursday, October 7, 2010, 11:10-11:50

Session A4: Hip Resurfacing

Long Term Outcome in Modern Hip Resurfacing Arthroplasty. a Minimum of 10 Years Follow Up.

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The modern generation of hip resurfacing arthroplasties was developed in the early 1990's with one of the original designs being the McMinn Resurfacing Total Hip System. This was a hybrid metal on metal prosthesis, with a smooth hydroxyapatite coated press fit mono block cobalt chrome shell with a cemented femoral component. Although no longer produced in this form, lessons may be learned from this original series of components. With metal on metal resurfacing arthroplasty now facing criticisms and concerns with regard function, bone preservation capability and soft tissue issues such as 'pseudotumors', it is the aim of this long-term study to assess the outcome and survival of an original series of resurfacing arthroplasties.

27 resurfacing arthroplasties were performed in 25 consecutive patients between June 1994 and November 1996. 16 right hips and 11 left were performed in 14 female patients and 11 male patients. The average age at the time of surgery was 50.5 years (SD 7.9, range 30-63). All surgeries were performed by a single surgeon using a posterior lateral approach. Following the initial early care, each patient received bi-annual follow up along with open access to the clinic with any concerns or complications. A retrospective review of the case notes was conducted and outcome scores retrieved from a prospectively updated database. Radiographs were analyzed and a Kaplan Meier survival chart was constructed for the group.

At latest review 3 patients have died (5yrs, 8yrs and 13.8yrs) and 1 patient has been lost to follow up (5yrs). 7 resurfacings have required revision, all due to acetabular loosening, at a mean follow up of 7 years 11months (SD 2.03years, range 4-10). Metallosis was documented in 4 of the revision cases, however no extensive soft tissue inflammation or 'pseudotumor' identified. The mean follow up of the remaining 16 hips is 12years and 10months (SD 12.8months, Range 10.4yrs-14.0 years). The Kaplan Meier survival at a minimum follow up of 10 years is 75.8% (95% CI 0.67-0.95). Mean Oxford hip scores at latest follow up was 20.6 (SD 8.8, range 12-38). There was no significant difference between cup inclination angles for the surviving cohort and those who required a revision procedure with mean cup inclinations of 52.5 (SD 5.5, range 45-60) and 58 degrees respectively (SD 9.1, range 50-70)(p=0.255).

This original series of hip resurfacings, with up to 14 years follow up, shows a survival of 76% at the minimum follow up of 10 years. All failures were due to loosening of the smooth backed

acetabulum, which with a modern porous coating, failure may have been avoided or delayed. Despite high inclinations angles no soft tissue reactions were identified within this series. No femoral failures were identified suggesting unlike much literature focus, long-term failure may not be related to the femoral head or neck.

Saturday, October 9, 2010, 10:20-11:05

Session A19: Miscellaneous Arthroplasty

Biomechanical Behavior Between Prodisc-L and Physio-L in Total Disc Replacement

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The emerging of non-fusion surgery is aimed to solve the long-term complication of fusion surgery that may bring the adjacent disc degeneration. Among several kinds of artificial discs developed in these years, the majority in the market is Prodisc-L (Synthes Inc.) which is designed with the purpose to restore the motions including anteroposterior translation, lateral bending, and axial rotation. There is also one artificial disc called Physio-L (Nexgen Spine) which is made of hyper-elastic material (Polycarbonate Polyurethanes) and is designed to restore the motions mentioned above plus axial loading. The concept of using hyper-elastic material as disc is to mimic the material properties of intervertebral discs so that this disc both absorbs the axial loading and also restores the physiological range of motion. Few studies focused on the biomechanical behavior of hyper-elastic artificial discs have yet been reported. Therefore, the purpose of this study is to compare the biomechanical behavior between Prodisc-L and Physio-L.

A validated three-dimensional finite element model of the L1-L5 lumbar intact spine was used in this study with ANSYS software [Fig.1]. Total disc replacement surgery, partial discectomy, total nucleotomy and removal of the anterior longitudinal ligament were performed at the L3/L4 segment of this intact model, and the Prodisc-L and Physio-L were implanted into L3/L4 segment, respectively. In addition, hyper-elastic materials adopted by Physio-L are usually categorized by their hardness into soft and hard [Fig.2]. Therefore, two kinds of Physio-L were studied. A 400 N follower load and a 10 N-m moment were applied to the intact model to obtain four physiological motions as comparison baseline. The implanted models were subjected to 400 N follower load and specific moments in accordance with the hybrid test method.

For the Prodisc-L model in the surgical segment, the range of motion (ROM) varied by -26%, +17%, -0.01%, and -0.04% in flexion, extension, lateral bending, and axial rotation, respectively, as compared to intact model [Fig.3]. For the Physio-L (soft) model, ROM varied by +10%, +8%, +3%, and +19% in four physiological motions, respectively. For the Physio-L (hard) model, ROM varied by +1%, +8%, +1%, and +11% in four physiological motions, respectively. For the Prodisc-L model in the adjacent segments, ROM varied by +4% ~ +10%, -

2% ~ -5%, -1% ~ -4%, and +1% ~ -2% in four physiological motions, respectively. For the Physio-L (soft) model, ROM varied by 0% ~ -5%, -2% ~ -5%, -0% ~ -5%, and -9% ~ -11% in four physiological motions, respectively. For the physio-L (hard) model, ROM varied by +4% ~ -2%, +8% ~ -5%, +1 ~ -5%, and +11% ~ -6% in four physiological motions, respectively.

As seemed in the simulation, the behavior of Physio-L (both soft and hard) is similar to that of intact model under flexion and extension, but not in axial rotation. In addition, Physio-L (hard) model is more similar to intact model as compared to Physio-L (soft) model.

Figures

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Custom Made Hinged Spacers in Revision Knee Surgery for Patients With Infection, Bone Loss and Instability

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Polymethyl methacrylate spacers are commonly used during staged revision knee arthroplasty for infection. In cases with extensive bone loss and ligament instability, such spacers may not preserve limb length, joint stability and motion.

We report a retrospective case series of 19 consecutive patients using a custom-made cobalt chrome hinged spacer with antibiotic-loaded cement. The "SMILES spacer" was used at first-stage revision knee arthroplasty for chronic infection associated with a significant bone loss due to failed revision total knee replacement in 11 patients (58%), tumour endoprosthesis in four patients (21%), primary knee replacement in two patients (11%) and infected metalwork following fracture or osteotomy in a further two patients (11%). Mean follow-up was 38 months (range 24–70). In 12 (63%) patients, infection was eradicated, three patients (16%) had persistent infection and four (21%) developed further infection after initially successful second-stage surgery. Above knee amputation for persistent infection was performed in two patients.

In this particularly difficult to treat population, the SMILES spacer two-stage technique has demonstrated encouraging results and presents an attractive alternative to arthrodesis or amputation.

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Comparison of Drain Clamp After Bilateral T.K.A.

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Suction drains provide an easy and feasible method for controlling hemorrhage after total knee arthroplasty. However, there has been no compromise regarding the optimal clamping time for these drains. We conducted a randomized clinical trial to compare 12-hour drain clamping and continuous drainage after total knee arthroplasty in terms of wound complications, blood loss and articular range of motion. In order to eliminate any other factor except duration of clamping, we chose to compare knees belonging to one single person, as well as restricting the study to those knees undergoing surgery due to osteoarthritis. From a total of 100 knees (50 patients) studied, the 12-hour clamping method resulted in a significantly smaller amount of post-operative blood loss ($p < 0.001$). The passive ranges of motion and wound complications were not significantly different between the two groups.

Friday, October 8, 2010, 8:40-9:50

Session B10: Navigation and Robotics in Arthroplasty

Demographic Factors and Their Influence Inresult of THA

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Background: The role of different surgical approaches and types of implant (1-17), surgical technique (9, 10, 21-24), patient's age (6, 8, 31), activity level (5), weight (17) and other demographic factors have been investigated in a lot of studies. The aim of this study is to assess the effect of demographic factors as well as the effect of traditional life-style in patients who had total hip arthroplasty (THA) in our centre within the past 20 years.

Materials and Methods: We reviewed the average Harris Hip Score (HHS) and the prosthesis survival in 210 patients including 235 THAs and 49 revisions between 1985 - 2005. The mean

F/U was 6.1 years and average HHS was 78.08 ± 15.7 . 26 patients were dead and 17 were inaccessible. The effects of traditional life-style and daily activity level on implant loosening were also considered.

Findings: Multivariable analysis showed that patient's sex, surgical technique, surgeon, BMI, use of cement weren't related to either implant loosening or HHS. We had 25 prosthesis dislocations, which all happened by trauma. Considering revision surgery as the end point, the following 10-year-survivals were calculated; cemented cup 60%, uncemented cup 85% and both cemented/uncemented stems 80%. Considering radiographic evidence of loosening as the end point, the 10-year-survival of cups was 80% and that of cemented, uncemented stems was 60% and 70%.

Conclusion: Delay in performance THA resulted in more limping (because of anatomy deterioration and muscles weakness) and lower HH. Scores. Additionally, the survival of our THAs were generally shorter than literature.

Thursday, October 7, 2010, 8:30-9:20

Session B2: Knee Arthroplasty in the Indian Sub Continent

Anthropometric Measurements of the Indian Knee for Total Knee Arthroplasty

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Background: There is paucity of data concerning the morphological dimensions of the distal part of the femur and the proximal part of the tibia in Indian population. The objective of this study was to analyse the exact anatomic data collected from patients undergoing total knee arthroplasty.

Methods: Morphologic data from the distal part of the femur and proximal part of the tibia, from 50 knees, were obtained during total knee Arthroplasty, with a microcalliper. The study included 30 women and 20 men, who had a mean age of 65 years. A characterisation of the aspect ratio (the medial-lateral to anterior-posterior dimensions) was made for the proximal aspect of the tibia and distal part of the femur.

Results: A significant difference was noticed in the dimensions of males and females. Females were found to have smaller dimensions, and the difference was statistically significant. From the morphologic data no significant difference was noted in the aspect ratio of both femur and tibia in males and females, and between larger and smaller knees. A comparison of the bone dimensions from the study data and the dimensions of the femoral component showed average medial-lateral overhang of +1.9 mm in women.

Conclusion: The results of this study will allow manufacturers to make more appropriate determination of the sizes of components for total knee arthroplasty in Indian population having smaller anthropometric measurements than Western populations.

Key Words: Indian anthropometry, component design, total knee arthroplasty.

Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

Measurements of Knee Kinematics During TKA Surgery Using Navigation System Correlate With Postoperative Kinematics

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It is widely accepted that navigation system for TKA improves precision in component alignment. Furthermore, some of the system can measure knee kinematics during surgery. On the other hand, the measurements of kinematics during surgery have limitations because of anesthesia and usage of air tourniquet. The purpose of the present study is to compare the knee kinematics during surgery using navigation system and that after surgery using 2D/3D Registration Technique. Our final goal of the study is to improve clinical outcome by performing feedback of good clinical results to operating theater by means of kinematic analysis.

Kinematics of ten TKA knees for female (average age 71 years old) medial compartmental osteoarthritic knees concerning axial rotation and anterior-posterior translation were measured twice, the time during surgery and 4 weeks after surgery. During surgery, measurement was performed using CT based navigation system (Vector Vision 1.6, Brain LAB, Heimstetten, Germany). Four weeks after surgery, knee kinematics was measured again using a 2-dimensional to 3-dimensional registration technique, which used computer-assisted design models to reproduce the position of metallic implants from single-view fluoroscopic images. Surgery was performed by single surgeon using subvastus approach to eliminate the influence of approach to muscle balance. Implant using the present study was P.F.C. Sigma RP-F (DePuy, Warsaw, USA).

Axial rotation in navigation and 2D/3D are 12.3 ± 2.3 , and 12.6 ± 3.8 , respectively. Axial rotations in both of the measurement have the same pattern. A-P translations also have the same pattern between measurement in navigation and that in 2D/3D technique. These results suggested that intraoperative kinematic measurement links to postoperative kinematics. Studies of correlations between kinematics and good clinical results are ongoing.

The Evidence Based Approach Towards Management of Periprosthetic Fractures Around the Hip.

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INTRODUCTION:

The number of patients undergoing total hip replacement surgery is rising and thus the number of periprosthetic fractures is set to increase. The risk factors for periprosthetic fractures include osteolysis, rheumatoid arthritis, osteoporosis and use of certain types of implants. Evidence from literature suggests that the mortality rate within one year is similar to that following treatment for hip fractures thus as surgeons it is important for us to understand the various management strategies of these fractures.

MANAGEMENT:

Acetabular periprosthetic fractures are uncommon and classified into Type I, in which the acetabular component is radiographically stable and Type II, in which the acetabular component is unstable. It is better to prevent than to treat these fractures.

Femoral periprosthetic fractures have several classifications the most commonly used is the Vancouver classification (fig 1).

Type-A fractures are proximal and can involve the greater or lesser trochanter. These are often related to osteolytic wear debris and therefore revision of the bearing surface with bone grafting is recommended. AG involves the greater trochanter and A_L involves the lesser, and these can usually be stabilised by cerclage wires supplemented by screws or plates if required (fig 2).

Management of type B fractures is more controversial and will be discussed in depth with reference to all recent papers at the meeting and data from the Swedish Joint Registry. In summary the management is shown in fig 3.

In type-C fractures, one should ensure the fixation device bypasses the femoral stem by at least 2 diaphyseal diameters. Management is as shown in fig 4.

DISCUSSION:

The incidence of periprosthetic fractures is rising and effective management involves a multi-disciplinary approach, and begins with taking a careful history to identify co-morbidities, pre-fracture mobility, and pre-fracture symptoms of loosening or acetabular erosion. Use of NSAIDs and smoking status should be noted. Examination findings should focus on mental status, any signs of infection, neurovascular status and the integrity of the soft tissue envelope. Clear radiographs are required to effectively comment on bone quality and the identification of any pathological lesions. White cell count, CRP and ESR should help confirm the absence of infection and if any doubt exists, a pre-operative aspiration should be considered. Ideally surgery should be performed within 2 days of fracture by a revision arthroplasty surgeon, followed by monitoring on a high dependency unit.

With regard to the formulation of an operative strategy, certainly there is no substitute for careful assessment of remaining bone stock, diameter of the canal, fracture configuration and patient-related factors. There is a paucity of data in the current literature relating to the management of acetabular fractures. Displaced femoral fractures are managed with cerclage fixation along with bone grafting of any osteolytic lesions and revision of the bearing surfaces.

Regarding femoral periprosthetic fractures it would appear that one should err on the side of long stem revision arthroplasty +/- impaction allografting should any doubt exist around loosening of the implant since this reduces the one-year mortality rate and the risk of failure.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#)

Thursday, October 7, 2010, 16:30-17:20

Session A8: Periprosthetic Fractures in THA

THA in Sickle Cell Disease Patients

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18 Patients with SCD and 2ndry Osteoarthritis of their hips due to Avascular Necrosis underwent uncemented THA.

There were 12 male and 6 female patients.

Patient had their pre op WOMAC/SF-36/ HOOS /and Oxford hip scores recorded preoperatively as well as 3 month, 6months and one year post op.

The outcome scores at one year were significantly better than the pre operative scores

However, when compared to a matched cohort of patients who underwent THA for reasons

other than SCD /AVN, e.g. primary OA, rheumatoid arthritis, post traumatic OA, the WOMAC pain score improvement was less.

Saturday, October 9, 2010, 10:30-11:05

Session B18: Pot Pourri!

A Rrandomized Prospective Study Comparing the Quality of Surgical Fields Resulting From Automatically Determined Tourniquet Cuff Pressure Versus Surgeon Chosen Tourniquet Cuff Pressure

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In this study patients were randomized between surgeon chosen pressure (control) and an automatically determined tourniquet pressure(study group). Of 112 patients in the study group, 5% failed to obtain an automatic pressure. Of the remainder, the average tourniquet pressure was 198 +/- 20.2 mm Hg compared to 259.6 +/- 4.4 mmHg for the control group (p<0.0001). Of the study group 94 (88.6%) had good to excellent fields compared to the control group where 100 (77.5%) had good to excellent fields (p<0.05). The automatic measurement of limb occlusion pressure results in better operative fields at a lower pressure.

Saturday, October 9, 2010, 14:50-15:20

Session A22: Tribology and Biomechanics in Arthroplasty

Hydroxyapatite Block for Reconstruction of Severe Dysplasia or Acetabular Bone Defects in Total Hip Arthroplasty- Operative Technique and Clinical Outcome

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Abstract

BACKGROUND: Acetabular defects are encountered in both primary total hip arthroplasty (THA) in patients with developmental dysplasia of the hip (DDH) and in revision THA. The purpose of this study was to evaluate the clinical and radiographic results of one method of acetabular reconstruction for THA using a hydroxyapatite (HA) block with either an autogenous graft or allograft of impacted morsellized bone in conjunction with a cemented socket.

METHODS: Fourteen hips in 14 patients (all female; average age, 64 years) were treated with the above technique in primary (11 DDH) or revision THA (three loosened sockets). All patients were followed clinically in a prospective fashion, and radiographs were analyzed retrospectively. One initial patient had 16-year follow-up, whereas the remaining 13 patients had follow-up between four and 5.5 years. **RESULTS:** No acetabular components were revised, including the socket of 16-year postoperative case which remains rigidly fixed and supported by the graft and HA block with only mild polyethylene wear and minor osteolysis. The mean Japanese Orthopaedic Association (JOA) score for the hips improved from 37 points preoperatively to 90 points postoperatively. **CONCLUSIONS:** The authors report very good results of acetabular reconstruction with the use of these biomaterials in conjunction with impaction morsellized bone graft in THA. Osteointegration and good clinical outcome were achieved in all of cases. However longer-term outcome should be the subject of further investigation, as the majority of these patients had only mid-term follow-up of 4 to 5.5 years.

Acetabular bone defects, especially proximal, lateral acetabular bone deficiency, present one of the more difficult technical problems associated with primary total hip arthroplasty (THA) in patients with developmental hip dysplasia (DDH) and in cases of acetabular bone loss in revision THA. The greater the extent of the coverage of the acetabular component by bone graft, the greater the rate of late failure.¹ Faced with the difficulties of the previous operative techniques, the authors developed a new shaped biomaterial, a hydroxyapatite (HA) block, to assist in the reconstruction of acetabular bone defects. The biomaterial consisted of a solid block of HA with porous aspects for promoting rigid bony fixation through osteoconduction. The advantages of the HA block are: (1) increased strength and flexibility properties compared to bone, providing structural support for the morsellized bone graft while preventing collapse of the bone graft during the incorporation period; and (2) simplification of surgical technique by eliminating the need to trim and shape a bulk bone graft.

The purpose of this study was to evaluate the clinical and radiographic results of the method of acetabular reconstruction in THA using a cemented socket in conjunction with an HA block graft with impaction morsellized bone graft.

Patients and Methods

Patients with lateral acetabular defects were selected for participation in this study if the coverage of the socket by the graft would be expected to be 50 % or more if the bulk femoral head graft were conventionally used. As a result, the patients had either moderate/severe dysplasia or dislocation of the acetabulum at time of primary THA or an acetabular roof defect in revision cases. The defects were classified preoperatively according to the classification systems of Crowe² for primary cases or the system of D'Antonio (AAOS)^{3,4} for revision. The Crowe classification of hip subluxation or dislocation was Group II for two hips, Group III for six, and Group IV for three (Table 1). All of the hips for revision were classified Group III (combined superior segmental and superior cavitory defect) by the D'Antonio (AAOS) classification (Table 1).

Fourteen hips in 14 patients (all female; average age, 64 years) with 11 DDHs and three loosened sockets were treated with primary and revision THA, respectively. The patients were followed up clinically using the Japanese Orthopaedic Association (JOA) score⁵ in a prospective fashion, and radiographs were analyzed retrospectively. One initial case had 16-

year follow-up, and the remaining 13 patients had follow-up between four and 5.5 years.

Hydroxyapatite (HA) block. The block (manufactured by Sumitomo Osaka cement Co. Ltd. at the time of surgery, now Olympus Terumo Biomaterial Co. Ltd.) consisted of HA solid material with porous sections on two aspects, 1 mm depth each, which aimed to provide rigid fixation to host bone by osteoconduction on the bony interface and to prevent cracking of the block by metal screws at the time of installation on the other side. (Fig. 1) Blocks were available in four sizes (length, width, height): 3 x 1 x 1.5, 3 x 1.5 x 1.5, 4 x 1 x 1.5, or 4 x 1.5 x 1.5 cm, each, and each block had three or four holes for fixation, depending upon the size of the block.

Operative technique. All operations were performed with the patient in the lateral decubitus position and using a posterolateral approach without osteotomy of the greater trochanter. The HA block was used to manage the lateral acetabular roof defect located proximally at the rim of the acetabulum. Before fixation, the acetabular roof was trimmed to accommodate the rectangular shape of the HA block (Fig. 2) and then a suitable size of the HA block was placed and fixed by metal screws (Fig. 3). The coverage ratio of the socket by the graft was defined as width of morsellized bone plus HA block to the socket (Fig. 2). An all-polyethylene socket (manufactured by Japanese Medical Materials (JMM) Co. Ltd.) was cemented in place with use of an impaction autogenous graft or allograft of morsellized bone. All but three stems (cases #4, 10, and 13) were cemented. Highly porous HA granules (size: 0.1-0.6 mm in diameter) were mixed in to increase the volume of morsellized bone in the cases #9-14 (Table 1). The brand of used cement was Simplex-P for the cases #2 and 3 and Endurance (CMW) for the other cases. All of the cases were operated by the same surgeon (M.M.) assisted by his colleagues.

The coverage ratio was 50% or more in all of the cases (Table 1). Eleven sockets were inserted and fixed within the true (original) acetabulum, and three, all classified as Crowe Group IV, were located more proximally as the distance from the lower border of the socket to the tear drop was between one and 2.5 cm in each of those cases. We were compelled to place the socket more proximally in those three cases of severe dysplasia, because it was not possible to elongate the affected extremity sufficiently (4cm or more). HHH

Post-operative regimen. On the third post-operative day the patients began a rehabilitation programmed by clinical path under the supervision of a physiotherapist. The use of crutches for ambulation was begun on the 10th to 14th post-operative day, with progressive weight-bearing as tolerated. Time to full weight bearing was 3 to 4 weeks postoperatively.

Results

No acetabular components had definite radiographic evidence of loosening, and no acetabular components were revised. Both the HA block and the bone graft used in acetabular reconstruction in THA functioned well, even in the one initial case with 16-year follow-up. In that one initial case, the HA block and the socket remained rigidly fixed, although the autograft was partially resorbed. (Table 1, Fig. 4) Only mild polyethylene wear and minor osteolysis were noted on the latest radiograph of the initial patient. For the 13 other cases, all sockets were also rigidly fixed with full incorporation of both the HA block and the autograft or allograft (Table 1, Fig. 5), and there was no radiographic evidence of resorption of the impacted bone graft in any of the 13 cases with four to 5.5 year follow-up. Radiolucent zones between the HA block and the acetabular roof diminished over time, and stable fixation of the block was maintained in all cases. Clinically, the mean Japanese Orthopaedic Association (JOA) score for the hips improved from 37 points preoperatively to 90 points postoperatively. (Table 1)

Discussion

There have been several reports on the use of bulk femoral head autograft for acetabular reconstruction in acetabular bone deficiency due to developmental dysplasia of the hip.

Spanghel et al.⁶ reported that the method of reconstruction with the bulk autograft for moderate anterolateral acetabular bone deficiency provided reliable uncemented socket fixation in a study with 5- to 12-year follow-up. Shinar and Harris reported that 21 of the 27 acetabular

components (78 %) that remained rigidly fixed were supported by graft over <50 % of the contact area in a 16-year average follow-up study.¹ However, loosening and revision rates increased due to socket migration with collapse of the graft with >50% coverage.^{1,7,8} Therefore, many authors recommend that the extent of coverage of the acetabular component by the graft should be < 50 % of the contact area. Kobayashi et al.⁷ recommended more proximal placement of the socket, resulting in a high hip center, to obtain adequate coverage in THA for acetabular bone deficiency due to DDH when it is not possible to achieve >50% coverage of the socket by the ilium at the level of the true acetabulum.

In the current study, the sockets were inserted and fixed within anatomic position as much as possible to re-establish to the true (original) acetabulum. Installation of the socket within the true or original acetabulum in THA has beneficial for reducing loosening and revision rate⁹; restoring acetabular bone stock; and avoiding bony impingement of the hip joint. However, the risk of collapse of the graft becomes high, because the lower the position of the socket, the more the covering ratio of the graft increases. On the other hand, whether the bone graft for the roof of the acetabulum collapses or not is somewhat dependent on mechanical strength of the graft. Use of a high strength biomaterial, such as solid HA, as a graft seems to reduce the risk of collapse of the graft in cases when the covering ratio exceeds 50%.

In revision THAs with lateral acetabular bone deficiency, such as D'Antonio (AAOS) type III, the use of oblong cup is one option. Landor et al.¹⁰ provided evidence in favor of the use of oblong implants indicating that the major advantage was the anchoring of an oblong cup in the patient's own load-bearing bone. However, the success of these cementless techniques depended on the degree and location of bone loss.¹¹ In case of loosening of the oblong cup, bone deficiency might be extremely large. In addition, there are no reports on the use of the oblong cup for acetabular reconstruction in primary THA in patients with DDH.

Dr. Terayama, one of the authors of this study, introduced the Charnley technique and prosthesis of low friction arthroplasty for the hip to Japan in 1970. Long term results of his operated series reported excellent radiological and clinical outcomes, including cases with coverage of the socket by the graft ranging from 5% to 49%.⁷ However, similar to the report by Shinar and Harris¹, revision rates increased in cases of coverage of 50 % or more. Because of those increased failure rates, he developed the technique to utilize a solid biomaterial to prevent collapse of the graft in 1993. A solid hydroxyapatite (HA) block was chosen due to its biological characteristics and was designed specifically for clinical use in cases of severe DDH or acetabular bone defect due to socket loosening cases in revision THA.

We carefully observed the initial case clinically and radiographically for 10 years before confirming that this technique could provide long-term implant stability. Encouraged by the results in this one test case, we used the HA block in an additional 13 cases in which the coverage of the socket by the graft was 50 % or more. Clinical and radiographical follow-up of the latter cases have also shown no evidence of loosening and need for revision, although duration of follow-up is relatively short, average of 4.7 +/- 0.6 years (range, 4.0 to 5.5).

In Japan, solid or porous HA as granules or plastic materials have been commonly used clinically^{12,13}, and their excellent osteoconductivity has also been recognized in animal study.¹⁴ Mechanical properties of the solid HA, with porosity of 2% or less and size 6mm in diameter x 10mm height, were 600 +/- 264 MPa (megapascal) for compressive strength and 81 +/- 17 MPa for flexural one *in vitro*.¹⁵ The properties of the porous HA, whose porosity was 42% and size was 10mm in diameter x 20mm height, were 35 +/- 3.9 MPa for compressive strength and 16 +/- 3.2 MPa for flexural one *in vitro*.¹⁵ These strengths are extremely high in comparison with polymethylmethacrylate bone cement as well as human bone.¹⁶ Based on these data, we developed the HA composite consisting of solid material for most part and a small porous portion to interface with bone. In the initial test case, the rigidly fixed HA block resulted in stable socket fixation. If bulk bone graft alone had been used for this acetabular reconstruction, it might have resulted in implant failure because there is radiographic evidence that the autograft was partially resorbed.

In the current study of short- to mid- term results of THA with severe acetabular bone defects, the composites have shown to remain stable in weight bearing conditions. We reported very good results with use of these biomaterials in conjunction with impaction morsellized bone graft. Osteointegration and good clinical outcome, evaluated according to the JOA score, were achieved in all cases. Longer-term outcome should be the subject of further investigation.

Acknowledgements

The authors wish to thank Judy Feinberg Ph.D. for her technical assistance and advice.

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Figures

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Revision Total Knee Arthroplasty for Treatment of Supracondylar Fracture of the Femur After Total Knee With Osteoporosis

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Internal fixation for supracondylar fracture of the femur after total knee arthroplasty (TKA) is technically difficult and troublesome because the distal bony fragment is often osteoporotic and too small to fix by screws or K-wires. In addition, the femoral component interferes with the screws or K-wires to be inserted from distal direction for fixation of the fracture. **Patients and Methods.** Four knees in 4 patients (all female; average age, 81.5 +/- 2.6 years) with the fracture after TKA were treated with revision TKA. Follow-up period was between six months and 3 years postoperatively. **Operative technique.** All operations were performed with the patient in the supine position and using a curved anterior (Payer) approach with or without osteotomy of the tuberositas tibiae. The femoral component was removed with detachment from fractured bony fragments. New femoral component with long stem for fixation of the fracture were inserted with bone cement in each case. **Post-operative regimen.** On the third postoperative day the patient began flexion and extension exercise of the operated knee joint with a rehabilitation programmed by clinical path under the supervision of a physiotherapist. The use of crutches for ambulation was begun on the 10th to 14th postoperative day, and the extent of weight bearing was allowed individually according to the stability of the fixation of the fracture. The time to full weight bearing in each patient was 3 to 8 weeks postoperatively. **Results.** Postoperative courses were uneventful in all of the cases. The supracondylar fracture of the femur was rigidly fixed and healed radiographically within 8 weeks postoperatively in each case. The JOA scores were improved in all of the cases. The mean Japanese Orthopaedic Association (JOA) scores for the knees improved to 90 points postoperative. No femoral components had definite radiographic evidence of loosening and were re-revised. **Discussion.**

In the current study of short-term results of revision total knee arthroplasty for treatment of supracondylar fracture of the femur after total knee with osteoporosis, the component have shown to remain stable in weight bearing conditions and functioned well. Fracture healing and good clinical outcome, evaluated according to the JOA score, were achieved in all cases. Longer-term outcome should be the subject of further investigation. **Conclusion.** The revision TKA was a successful method for treatment of the supracondylar fracture after TKA.

Saturday, October 9, 2010, 10:20-11:05

Session A19: Miscellaneous Arthroplasty

Percutaneous Axial Lumbar Interbody Fusion (AxiaLIF): Technical and Clinical Topics of a New Minimally Invasive Lower Spine Fusion Way.

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Nowadays many new minimally invasive techniques are experienced to perform lower lumbar interbody fusion in attempt to decrease the complications related to open anterior approach. AxiaLIF (axial lumbar interbody fusion) system is a percutaneous transsacral approach that exploits the virtual presacral retroperitoneal space to perform annulus-sparing discectomy and interbody instrumented fusion of lower lumbar disc spaces. Additioning posterior percutaneous instrumentation, a robust axial construct is placed which restores disc height, sagittal balance and lordosis with minimal muscle dissection, blood loss and postoperative pain.

Via fluoroscopically-guided approach, AxiaLIF procedure creates a presacral retroperitoneal corridor in the midline through a paracoccygeal skin incision of 2-3 cm. This space is void of neuro-vascular major elements. A safe working cannula is put in and docked in the S1-S1 entry level and a transsacral channel is realized gaining the central space of the disc. A 360° annulus-sparing radial discectomy is performed with special cutters even in case of collapsed disc space and the bone graft is inserted. The following screwing of AxiaLIF rod restores disc height via distraction if necessary, decompresses the neural foramen indirectly and undertakes instantaneous rigid fixation of adjacent vertebral bodies. Using the same incision point and trajectory through the presacral space as AxiaLIF, it is possible to realized a similar procedure L4-S1 vertebral fusions called AxiaLIF 2L.

Between february 2009 and may 2010 25 patients (16F:9M) affected by degenerative disc disease (17) and grade 1 or 2 spondylolisthesis (8) were included in this study. Evaluated outcomes were the amount of bleeding, the presence of presacral hematoma, the functional recovery time, the surgery time rate, the x-ray time rate, the complication rate (infection, pelvic visceral injury, postoperative pain).

21 of 25 patients underwent AxiaLIF L5-S1 procedures, 4 of these with a stand alone implant and 17 followed by posterior instrumentation. In the remaining 4 patients, a AxiaLIF 2L L4-S1 procedures is performed. 4 of 25 patients had a perioperative suction drainage. Mean operative time for L5-S1 AxiaLIF procedure was 49 minutes. A 2nd p.o.d. CT pelvic scan of undrained and drained groups showed a mean presacral hematoma of 45 cc and 17 cc respectively reduced

one month later to a mean value of 19 cc and 3 cc. Hemoglobin rate mainly reduced of 1,7 g/dL between pre and postoperative time. At one month all patients improved their quality of life significantly but one had a gluteal pain. No patient had perioperative infections or pelvic visceral injuries or required blood transfusions. This study seems to assess that AxiaLIF procedure is a minimally invasive lower spine technique actually. The presacral hematoma presence seems to have no side effect and it may be prevented by perioperative drainage. More large studies are needed to confirm our results.

Saturday, October 9, 2010, 11:15-11:50

Session B19: Hip Mechanics

Multicenter Longitudinal Densitometric Clinical Study on Periprosthetic Osteointegration and Bone Remodelling of Trabecular Titanium

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INTRODUCTION: Trabecular TitaniumTM is an innovative material characterised by an high open porosity and composed by multi-planar regular hexagonal cells. It is not a traditional coating and its tri-dimensional structure has been studied to optimise osteointegration. Furthermore, it has excellent mechanical properties, as a very high tensile and fatigue resistance and an elastic module very similar to the that of the trabecular bone. The aim of this study is to evaluate the osteointegration and bone remodelling measuring the longitudinal pattern of change in BMD around a cementless acetabular cup made from Trabecular TitaniumTM (Delta TT cup, Lima Corporate, Italy) in primary total hip arthroplasty (THA).

METHODS: Dual-energy x-ray absorptiometry (DEXA) analysis, radiographic evaluation on standard AP and lateral views and clinical evaluation with Harris Hip Score (HHS) and SF-36 were performed at 1 week, 3, 6, 12 months after surgery.

RESULTS: Between February 2009 and June 2010, 72 patients underwent primary THA with Delta TT cup at 4 centres. There were 36 (50%) female and 36 (50%) male with an average age of 63 (range 39-75).

Preliminary results include 72 patients with 56 at 3 months, 42 at 6 months and 28 at 12 months. The mean HHS improved from 48 points (range 14-79) preoperatively to 88 (range 74-100) at 3 months, to 94 (range 71-100) at 6 months and to 97 (range 94-100) at 12 months. SF-36 reported a progressive improvement of all domains.

An initial transient decrease of the bone mineral density (BMD) occurred between 1 week and 3 months after surgery, then bone mass returns to baseline values after 6 months and increased at 12 months. No radiolucent lines nor osteolysis have reported and no revision occurred.

There were 2 complications not related to the implant on study: one dislocation solved with a close reduction and one dislocation solved with a revision of the neck and the head, but not compromising the cup.

CONCLUSIONS: Delta TT acetabular cup allows to obtain a very good primary stability, thanks to the high friction coefficient of the Trabecular TitaniumTM, followed by a good and fast osteointegration, as reported by early DEXA outcomes. Preliminary results showed also a very good clinical and functional improvement. Long-term follow-up is ongoing in order to prove these promising results.

Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

The Influence of Pre-Operative Deformity on Intra-Operative Soft Tissue Balance in Posterior-Stabilized Total Knee Arthroplasty

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Abstract

Using a tensor for total knee arthroplasty (TKA) that is designed to facilitate soft tissue balance measurements with a reduced patello-femoral (PF) joint, we examined the influence of pre-operative deformity on intra-operative soft tissue balance during posterior-stabilized (PS) TKA. Joint component gap and varus angle were assessed at 0, 10, 45, 90 and 135° of flexion with femoral trial prosthesis placed and PF joint reduced in 60 varus type osteoarthritic patients. Joint gap measurement showed no significant difference regardless the amount of pre-operative varus alignment. With the procedures of soft tissue release avoiding joint line elevation, however, intra-operative varus angle with varus alignment of more than 20 degrees exhibited significant larger values compared to those with varus alignment of less than 20 degrees throughout the range of motion. Accordingly, we conclude that pre-operative severe varus deformity may have the risk for leaving post-operative varus soft tissue balance during PS TKA.

Keywords: total knee arthroplasty, soft tissue balance, kinematics, patello-femoral joint, posterior stabilized

Introduction

A primary goal of total knee arthroplasty (TKA) is to obtain stable and well-aligned tibiofemoral and patello-femoral (PF) joints, aiming to patients' satisfaction in long term clinical outcomes. To this end successfully, the accurate alignment of knee implants and balancing of soft tissues are the two important criteria [1-3]. Recently, the use of computer-assisted navigation systems has been reported to improve the achievement of bone cuts and implantation accurately [4-9]. Of such systems that are currently available, we have already reported on a CT-free navigation system (Vector Vision^R, Depuy-Brain LAB, Heimstetten, Germany) significant improvements in the accuracy of implantations in relation to the mechanical axis and a early clinical outcome equivalent to that of a manual group [10, 11].

On the other hand, a common difficulty with manually-performed TKAs is obtaining accurate intra-operative soft tissue balancing, an aspect of this procedure that surgeons traditionally address through their "subjective feel" and experience with an everted patella. Knee instability after primary TKA due to inadequate correction of the soft tissue imbalances is considered an important factor for early TKA failure [12, 13]. We have developed a new tensor for TKAs that enables us to assess for soft tissue balancing throughout the range of motion about the knee with a reduced PF joint. This tensor permits us to intra-operatively reproduce the post-operative alignment of the PF and tibio-femoral joints [14]. Using this new tensor for TKAs, we have described the design of this tensor, our initial intra-operative soft tissue balance measurement, its clinical relevance [15-18].

Pre-operative deformity of the knee is different from patients to patients. In the varus knee especially, many surgeons recognize that progressive shortening or contraction of soft tissue structures on the medial side may occur, whereas the lateral structures may become stretched [19-22]. Whereas severe intra-operative varus deformity needs substantial soft tissue release on the medial side during TKA, the ideal amount of medial release is still controversial; there exist two strategies for soft tissue balancing in the varus knees. Some believe to be ideal to create equal medial and lateral gaps even severe deformed knees [2, 23, 24], and others accept some degrees of lateral laxity especially at flexion, based on the evidence showing post-operative diminishment of lateral laxity after TKA with time, as long as proper alignment is maintained [25, 26].

In the present study, accordingly, we report on our experience with this device for the intra-operative soft tissue balance measurements of various grade of pre-operative varus deformity during posterior-stabilized (PS) TKAs, performed with a reduced patella. The purpose of the present study is to analyze the difference of soft tissue balance due to the difference of pre-operative varus deformity.

Materials and Methods

From a group of 60 consecutive osteoarthritic females performed the same type of implant received, we retrospectively divided into three groups depending on the amount of pre-operative alignment; 20 patients with less than 10 degrees of pre-operative varus alignment (the varus alignment < 10° group), 20 patients with more than 10 degrees and less than 20 degrees of pre-operative varus alignment (the 10° < varus alignment < 20° group), and 20 patients with more than 20 degrees of pre-operative varus alignment (the varus alignment > 20° group). The mechanical axis of the knee was determined on a pre-operative long standing weight-bearing anteroposterior radiograph. All surgeries were performed using PS type implant (NexGen LPS Flex, Zimmer, Inc., Warsaw, IN) by the same senior author between September 2003 and August 2005. The varus alignment < 10° group had a mean age of 73.7 ± 1.3 years, the 10° < varus alignment < 20° group a mean age of 73.8 ± 1.7 years, and the varus alignment > 20° group a mean age of 73.8 ± 1.7 years. After excluding patients with valgus deformity and severe bony defects predicting the possibility of the use of augmentation block or bone graft,

each remaining patient had a varus deformity, with an average pre-operative coronal plane alignment of $4.6 \pm 0.6^\circ$ in the varus alignment $< 10^\circ$ group, $14.2 \pm 0.3^\circ$ in the $10^\circ < \text{varus alignment} < 20^\circ$ group, and $23.3 \pm 1.0^\circ$ in the varus alignment $> 20^\circ$ group.

New TKA tensor

As previously described, our TKA tensor consists of three parts: an upper seesaw plate, a lower platform plate with a spike and an extra-articular main body (Fig. 1A)[14-18]. Both plates are placed at the center of the knee. The PS TKA tensor consists of a seesaw plate with a proximal post along the center that fits the inter-condylar space, as well as a cam for the femoral trial prosthesis. This post and cam mechanism controls the tibiofemoral position in both the coronal and sagittal planes. These mechanisms permit us to reproduce the joint constraint and alignment after implanting the prostheses.

This device is ultimately designed to permit surgeons to measure the ligament balance and joint center/joint component gap, while applying a constant joint distraction force. Joint distraction forces ranging from 30lb (13.6 kg) to 80lb (36.3 kg) can be exerted between the seesaw and platform plates through a specially made torque driver which can change the applied torque value. After sterilization, this torque driver is placed on a rack that contains a pinion mechanism along the extra-articular main body, and the appropriate torque is applied to generate the designated distraction force; in preliminary *in-vitro* experiments, we obtained an error for joint distraction within $\pm 3\%$. Once appropriately distracted, attention is focused on two scales that correspond to the tensor: the angle ($^\circ$, positive value in varus imbalance) between the seesaw and platform plates, and the distance (mm) between the center midpoints of upper surface of the seesaw plate and the proximal tibial cut. By measuring these angular deviations and distances under a constant joint distraction force, we are able to measure the ligament balance and joint center/joint component gaps, respectively.

Intra-operative measurement

We performed all TKAs using measured resection technique with a conventional resection block. After inflating the air tourniquet with 280 mmHg at the outset of each procedure, we performed a medial parapatellar arthrotomy. In all patients, the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) were both resected. We performed distal femoral osteotomy perpendicular to the mechanical axis of the femur using preoperative long leg radiographs. Femoral external rotation was preset at 3° or 5° relative to the posterior condylar axis, which were determined by pre-operative computed tomography. After this, we performed a proximal tibial osteotomy, ensuring that each cut was made perpendicular to the mechanical axis in the coronal plane and with 7° of posterior inclination along the sagittal plane; there were no bony defects noted along the eroded medial tibial plateau in any of these cases. Following each osteotomy, we removed osteophytes, released the posterior capsule along the femur, and corrected any ligament imbalances that occurred in the coronal plane by releasing soft tissues along the medial structures of the knee according to the following criteria; (1) more than 20 mm of medial gap between the cutting surfaces of the femur and the tibia, (2) more than 10 mm of joint component gap, and (3) less than 5 cm of medial collateral ligament (MCL) release from the joint surface. In all knees with varus deformity, step by step appropriate release of medial side soft tissue (posteromedial capsule, MCL, semimenbranosus, and pes anserine tendons) was performed with a spacer block, in which residual lateral laxity especially at flexion was allowed.

Following each bony resection and soft tissue release, we fixed the tensor to the proximal tibia and fitted the femoral trial prosthesis. The joint distraction force was set at 40 lb. in all patients. We selected this distraction force because it re-creates a joint gap in full extension with femoral trial which corresponds to the insert thickness of our preliminary clinical studies. We loaded this joint distraction force several times until the joint component gap remained constant; this was done to reduce the error which can result from creep elongation of the surrounding soft tissues. At this point, we measured the ligament balance (varus angle) ($^\circ$) and joint component gap (mm) with the knee at 0° (full extension), 10° (extension), 45° (mid-range flexion), 90° (flexion) and 135° (deep flexion), each with the patella reduced. For each measurement with a reduced PF joint, we inserted a patellar trial prosthesis and temporarily repaired the medial parapatellar arthrotomy by applying stitches both proximally and distally to the connection arm

of the tensor (Fig. 1B). During each measurement, the thigh and knee were aligned so as to eliminate the external load on the knee at each flexion angle.

To explore the joint gap of medial and lateral compartment, "medial and lateral compartment gap" were calculated using the following parameters: joint component gap (center gap), ligament balance (varus angle), and width between medial and lateral apex of femoral component representing the contact points to polyethylene insert. Thus, medial compartment gap is defined as "center gap" - $0.5 \times$ "width between medial and lateral apex of femoral component representing the contact points to polyethylene insert" \times sin "varus angle", and lateral compartment gap is "center gap" + $0.5 \times$ "width between medial and lateral apex of femoral component representing the contact points to polyethylene insert" \times sin "varus angle".

After expressing each measurement as a mean \pm standard error of the mean (SE), we utilized a statistical software package (Statview 5.0, Abacus Concepts Inc, Berkeley, CA) to analyze the data. We performed repeated measured of analysis of variance (ANOVA) to compare the soft tissue balance of three groups, and performed a post hoc analysis by Fisher's PLSD test. $P < 0.05$ was considered statistically significant.

Results

Kinematics of ligament balance

The mean values of joint component gap with the knee at 0, 10, 45, 90 and 135 degrees of flexion were 11.4, 14.9, 16.8, 18.0 and 16.1 mm in the varus alignment $< 10^\circ$ group, 11.1, 15.2, 16.2, 18.0 and 16.3 mm in the $10^\circ <$ varus alignment $< 20^\circ$ group, and 11.6, 15.1, 18.0, 19.3 and 16.1 mm in the varus alignment $> 20^\circ$ group.

In assessing the kinematics of the joint component gap, knees significantly increased in the joint component gap until 90° of knee flexion, and then significantly decreased toward deep knee flexion in all three groups (Fig. 2). This pattern of joint gap showed no significant difference among the three groups in each angle (Fig. 2).

The mean values of varus angle with the knee at 0, 10, 45, 90 and 135 degrees of flexion were 1.4, 1.5, 2.2, 3.4 and 3.6° in the varus alignment $< 10^\circ$ group, 2.3, 2.6, 3.3, 4.5 and 4.9° in the $10^\circ <$ varus alignment $< 20^\circ$ group, and 4.2, 4.5, 6.3, 7.1 and 6.7° in the varus alignment $> 20^\circ$ group.

In assessing the kinematics of the varus imbalance, there were slow increases in the varus angle from extension to 90° of knee flexion. During flexion beyond 90° , the size of the varus angle kept constant values (Fig. 3). The varus angle in the varus alignment $> 20^\circ$ group showed significantly larger values compared to those of the other two groups in each angle ($p < 0.05$) (Fig. 3).

Medial and lateral compartment gap

The width between contact points of femoral component to polyethylene insert was 42.4 ± 0.2 , 42.4 ± 0.2 , and 40.5 ± 1.0 mm in the varus alignment $< 10^\circ$ group, in the $10^\circ <$ varus alignment $< 20^\circ$ group, and in the varus alignment $> 20^\circ$ group, respectively, with no significant differences. The mean values of medial compartment gap with the knee at 0, 10, 45, 90 and 135 degrees of flexion were 10.9, 14.4, 15.9, 16.8 and 14.8 mm in the varus alignment $< 10^\circ$ group, 10.3, 14.2, 15.0, 16.3 and 14.9 mm in the $10^\circ <$ varus alignment $< 20^\circ$ group, and 10.1, 13.6, 15.8, 16.8 and 13.7 mm in the varus alignment $> 20^\circ$ group. The mean values of lateral compartment gap with the knee at these same degrees of flexion, respectively, were 11.9, 15.5, 17.6, 19.3 and 17.4 mm in the varus alignment $< 10^\circ$ group, 11.7, 16.1, 17.4, 19.6 and 18.5 mm in the $< 10^\circ$ varus alignment $< 20^\circ$ group, and 12.8, 16.7, 20.2, 21.8 and 18.4 mm in the varus alignment $> 20^\circ$ group.

In assessing medial compartment gap, the values showed consistent balance after significant increases during initial 10 degree of flexion and until significant decreases during deep knee flexion in all groups, with no significant difference among the three groups (Fig. 4A). In

assessing lateral compartment gap, there were significant decreases ($p < 0.05$) after significant increases during 90 degree of flexion in the joint gap ($p < 0.05$). Upon comparing the three groups, there was a significantly larger lateral compartment gap in the varus alignment $> 20^\circ$ group at 45 and 90 degree of flexion (Fig. 4B).

Discussion

In the present study, relationship between the amount of pre-operative deformity and intra-operative soft tissue balance was assessed using TKA tensor that is designed to facilitate soft tissue balance measurements with femoral trial prosthesis in place and a reduced PF joint. Our procedures of soft tissue balancing avoiding joint line elevation achieved optimal post-operative coronal alignment. However, the balance was different from knee to knee with affected by the pre-operative varus deformity. Therefore, we divided varus osteoarthritic knees into three groups based on the pre-operative deformity and demonstrated that the difference in the intra-operative soft tissue balance was due to the difference of pre-operative deformity.

In the comparison of joint component gap kinematics among the three different pre-operative deformity groups, we showed similar kinematic patterns showing increase until 90° of knee flexion and decrease toward deep knee flexion, and no difference among the groups throughout the flexion angle of the knee. In the comparison of medial-lateral ligamentous balance, on the other hand, varus imbalance showed significant larger values in the varus alignment $> 20^\circ$ group compared to that of the other two groups throughout the knee flexion angle in spite of similar patterns showing slight increases in the varus angle to 90° of knee flexion and constant balance after that. In the varus alignment $> 20^\circ$ group, more than 5 degrees of varus imbalance was left after 45 degrees of flexion. These result indicate that appropriate medial-lateral balancing is difficult in the knee of pre-operative severe varus deformity especially with varus alignment $> 20^\circ$.

To explore deeper insight in ligament balance kinematics in our patient population, we calculated each medial and lateral compartment gap using the parameters obtained. Regarding medial compartment gap, three groups showed similar pattern with no significant difference with constant values after significant increases during initial 10 degree of knee flexion and significant decreases after 90 degrees of knee flexion in each group. In the assessment of lateral compartment gap, however, the varus alignment $> 20^\circ$ group showed significant larger joint gaps especially at 45 and 90 degrees of flexion compared to the other groups, with a similar pattern showing decreasing values after significant increases during 90 degree of flexion in each group. These results suggest that the kinematics of medial-lateral soft tissue balance may mainly depend on, rather than the consistent length of medial structures, the larger length change of lateral structures. In the present study treating with only varus osteoarthritis patients, lateral structures including lateral posterior capsule, popliteus tendon, and fibular ligament were considered relative intact or elongated, whereas medial structures including posteromedial capsule, MCL, semimembranosus, and pes anserine tendons seemed to be contracted and shortened with their degeneration. In the severe deformed knee with more than 20 degrees of pre-operative varus alignment, varus imbalance tends to remain to large extent in flexion due to elongated lateral structures, especially in PCL resected TKA.

In the present study, the knees with the pre-operative varus alignment $< 20^\circ$ showed intra-operative lateral laxity of less than 5 degrees throughout the range of motion after soft tissue release on the medial side. Even in normal knees, lateral ligamentous laxity and medial ligamentous laxity are not balanced. More lateral ligamentous laxity than medial ligamentous laxity has been observed [27-29]. To restore joint line, we and the others allow some degrees of lateral side laxity as long as proper alignment is maintained [25, 26, 30]. Based on these evidences, we believe that some degrees of lateral laxity less than 5 degrees of lateral laxity at extension observed in the varus alignment $< 20^\circ$ groups were considered acceptable. On the other hand, the knee with the varus alignment $> 20^\circ$ group resulted in the remaining amount of lateral laxity more than 5 degrees. Depend on the deformity and intra-operative soft tissue balance with a spacer block, we performed step by step soft tissue release of medial structures including posteromedial capsule, MCL, semimembranosus, and pes anserine tendons in addition to removal of the osteophytes that impede on the medial soft tissue sleeve. In such severely deformed varus knees, some surgeons may recommend the complete release of medial-sided

structures including MCL cut for achievement of well-balanced knee [22], however, we avoided this procedure considering potential widening of joint gap with elongation of the lower extremity and consequently patella baja as a result of joint line elevation with thicker polyethylene insert. Therefore, the results in the series of study may be based on these operative procedures. However, some surgeons reported that post-operative lateral ligamentous laxity in the varus knee immediate after TKA diminished with time [30]. They assessed stress radiographs of the knees using a Telos SE arthrometer and found that 8.6 degrees of lateral laxity at extension diminished to 5.1 degrees at 3 months after TKA. Considering post-operative course, our intra-operative results 4.2 degrees of lateral laxity at extension in the knee with the varus alignment $> 20^\circ$ group may be acceptable.

. Our study has some limitations. TKA procedures with a new tensor in the present study were performed following the independent cut manner, in which soft tissue balance was assessed after the bone cuts. Regarding rotational alignment of the femoral component, superiority of techniques for positioning the femoral component in flexion using measured resection technique or tensioned gap technique has been controversial [31-36]. The tensor used in this study can be used for TKAs with tensioned gap technique as well [37]. Following tibia cut first, we can determine the rotational alignment of the femoral component in flexion using the tensor. After that, depending on the balance, we can perform the posterior cut of the femur. Accordingly, in the near future, we should compare these techniques to acquire the real aligned soft tissue balance post-operatively.

In the present study, we elucidate the intra-operative soft tissue balance kinematic pattern during PS TKA when they are evaluated while preserving a more physiological condition of the knee observed depending on pre-operative deformity. We believe that this pattern is more reflective of the true post-operative kinematics, and thus by maintaining a reduced patella for each intra-operative measurement, the surgeon will be able to adjust the soft tissue balance more accurately and thereby expect a better post-operative outcome.

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Figure Legends

Fig. 1: New TKA tensor

The new tensor consists of three parts: upper seesaw plate, lower platform plate and extra-articular main body (A). Two plates are connected to the extra-articular main body by the offset connection arm through a medial parapatellar arthrotomy, which permits reduction of the PF joint while performing measurements (B).

Fig. 2: Kinematics of joint component gap in different varus alignment groups

Knees increased in the joint component gap until 90° of knee flexion, and then decreased toward deep knee flexion in all three groups, with no significant difference among three groups.

Fig. 3: Kinematics of varus imbalance in different varus alignment groups

Kinematics of the varus imbalance showed slow increases in the varus angle from extension to 90° of knee flexion. During flexion beyond 90°, the size of the varus angle kept constant values. The varus angle in the varus alignment > 20° group showed significantly larger values compared to that of the other two groups in each angle. (#: P<0.05 vs. the other groups)

Fig.4: Comparison of medial and lateral compartment gap among different alignment (a: medial compartment gap, b: lateral compartment gap)

A. Medial compartment gap kept the consistent values after increases during initial 10 degree of knee flexion and until decreases during deep knee flexion in all groups, with no significant difference among the three groups.

B. Lateral compartment gap significantly decreased after significant increases during 90 degree of flexion. Upon comparing the three groups, there was a significantly larger lateral joint gap value in the varus alignment > 20° group at 45 and 90 degree of flexion. (#: P<0.05 vs. the other groups)

Figures

Friday, October 8, 2010, 11:10-11:50

Session A13: Alternate Bearing Materials in Arthroplasty

Deformation and Fracture Behaviors in a Biomedical Co-29Cr-6Mo-0.14N Alloy Analyzed by X-Ray Tomography

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Co-Cr-Mo alloys represent the most important category of metallic biomaterial for surgical implant applications. Recently, Chiba et al. developed a new type of bio- medical Co based alloy of Co-29Cr-6Mo-0.14N alloy. In this alloy design, the content of N is intended to be controlled to obtain the microstructure consisting of γ single phase. This developed alloy exhibits the lower stacking energy as compared to that of the practical bio-medical Co-Ni based alloy, thereby resulting in the deformation behavior accompanied by strain induced ϵ martensitic transformation.

In this work, the damage process leading to fracture during tensile testing of a biomedical grade Co-29Cr-6Mo-0.14N alloy was analyzed on the basis of three-dimensional damage observation using X-ray tomography and electron backscattered diffraction of the fractured specimen. Initial cracking occurred at grain and annealing twin boundaries, where strain concentrates due to impingement of ϵ -hcp plates formed through strain induced martensitic transformation (SIMT). Crack propagated along interface between γ -fcc matrix and SIMT ϵ -hcp on {111}, resulting in the occurrence of a quasi-cleavage fracture.

Saturday, October 9, 2010, 8:15-9:00

Session A17: Knee Mechanics

A Sliding Stem in Revision Total Knee Arthroplasty Provides Stability and Reduces Stress Shielding; a RSA Study Using Impaction Bone Grafting in Synthetic Femora

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Introduction

Within the reconstruction of unicondylar femoral bone defects with morselized bone grafts in revision total knee arthroplasty (TKA), a stem extension appears to be critical to obtain adequate mechanical stability. Whether the stability is still secured by this reconstruction technique in bicondylar defects has not been assessed. Long, rigid stem extensions have been advocated to maximize the stability in revision TKAs. The disadvantage of relatively stiff stem extensions is that bone resorption is promoted due to stress shielding. Therefore, we developed a relatively thin intramedullary stem which allowed for axial sliding movements of the articulating part relative to the intramedullary stem. The hypothesis behind the design is that compressive contact forces are directly transmitted to the distal femoral bone, whereas adequate stability is provided by the sliding intramedullary stem. A prototype was made of this new knee revision design and applied to the reconstruction of uncontained bicondylar femoral bone defects.

Materials and Methods

Five synthetic distal femora with a bicondylar defect were reconstructed with impacted bone grafting (IBG) and this new knee revision design. A custom-made screw connection between the stem and the intercondylar box was designed to lock or initiate the sliding mechanism, another screw (dis)connected the stem. A cyclically axial load of 500 N was applied to the prosthetic condyles to assess the stability of the reconstruction. Radiostereometry was used to determine the migrations of the femoral component with a rigidly connected stem, a sliding stem and no stem extension.

Results

We found a stable reconstruction of the bicondylar femoral defects with IBG in case of a rigidly connected stem. After disconnecting the stem, the femoral component showed substantially more migrations. With a sliding stem rotational migrations were similar to those of a rigidly connected stem. However, the sliding stem allowed proximal migration of the condylar component, thereby compressing the IBG.

Discussion

A stable reconstruction of uncontained bicondylar femoral defects could be created with IBG and a TKA with a thin stem extension. It appeared that the presence of a functional stem extension was important for the stability of the bicondylar reconstruction. In an effort to reduce stress shielding, we developed a sliding stem mechanism. This sliding stem provided adequate stability, while compressive contact forces are still transmitted to the distal femoral bone. Clinical studies have to confirm that our sliding stem mechanism leads to long term bone maintenance after revision TKAs.

Evaluation of the Stem Position of Total Hip Arthroplasty With CT-Based Navigation System

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(Objectives) Many reports were shown about the angle of the cup in total hip arthroplasty (THA) with CT-based navigation system. However, there are few reports about the position of the stem. We investigated the position of the stem in navigated THA. We evaluated the position and alignment of stem which were shown on intra-operative navigation system.

(Materials and Methods) We treated 10 hips in 10 patients (1 male and 9 females) by navigated THA. 7 osteoarthritis hips and 3 idiopathic osteonecrosis hips were performed THA with VectorVision Hip 2.5.1 navigation system (BrainLAB). Implants were AMS HA cups and PerFix stems (Japan Medical Materials, Osaka). The positions of stem were decided on the 3D model of femur before operation. According to the preoperative planning, we put the implants with navigation system and recorded the position. We measured the position and alignment of stem with 3D template software after operation. We checked for complications.

(Results) The average error of stem alignment was 0.9 degrees in anteroposterior direction, 1.2 degrees in mediolateral direction and 3.5 degrees in rotation. The average error of the distance between the tip of greater trochanter and the shoulder of stem was 1.6mm on postoperative CT. Though there were no infections and fractures, 7 cases had postoperative pain on the lesion where we insert tracker pin.

(Conclusions) The accuracy of longitudinal stem alignment was correct but the anteversion varies widely. We usually perform THA by minimally invasive technique. Therefore the reference points of proximal femur were restricted at narrow area for registration and the landmarks for deciding the rotational alignment were difficult to be picked up correctly.

Controlled Release of Antibiotics From Beta-TCP Mixed in HA in IBBC as Prevention of Infection in Joint Replacement

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[INTRODUCTION] : Since 1985, not resorbable crystalline osteoconductive hydroxyapatite (HA) granules were interposed on the interface between bone and bone cement at the cementation (Interface Bioactive Bone Cement : IBBC) of total hip arthroplasty (THA) to prevent generation of connective tissue and osteolysis for the longevity of cemented THA. To prevent the patients from infection, we are planning to use b-tricalcium phosphate (Beta-TCP) impregnated with antibiotics along with HA granules. However, there have been no reports on the loading and release of antibiotics from fine granules of Beta-TCP. Here, we have investigated the loading of antibiotics on Beta-TCP and their release *in vivo*.

[MATERIALS AND METHODS] : Beta-TCP was impregnated with antibiotics such as flomoxef sodium (**F**), vancomycin hydrochloride (**V**) cefotiam dihydrochloride (**C**) and cefozopran hydrochloride (**CE**) under normal or reduced pressure. After washing with PBS three times, Beta-TCP loaded with the antibiotic was placed in PBS. An aliquot of solution was sampled at appropriate time intervals and the amount of the released antibiotic was estimated based on the anti-bacterial activity.

[RESULTS AND DISCUSSION] : When drug loading was done by dropping the antibiotic solution to Beta-TCP granules, the amount of antibiotic released from 20 mg of HA was 8 µg for **F**, 0 µg for **V**, 6 µg for **C** and 520 µg for **CE**. Their release completed within 24 hrs. When the antibiotic loading was done under reduced pressure, 20 mg of Beta-TCP was loaded with 40 µg of **F**, 130 µg of **V** and 25 µg of **C**, but the released amount was 16 µg for **F**, 8 µg for **V** and 0 µg for **C**. Each drug was released within 10 hrs. Meanwhile, 8000 µg of **CE** was loaded on 20 mg of Beta-TCP and its release continued for 6 days. When Beta-TCP loaded with **C** or **CE** was placed in 0.25 MEDTA to dissolve Beta-TCP gradually, the release of **C** and **CE** sustained over 14 days along with the dissolution of Beta-TCP. The release of **C** from Beta-TCP continued over 19 days in EDTA. The released amount of **C** and **CE** were 116 µg and 7100 µg, respectively. Thus, **CE** seemed the most suitable for our purpose in terms of the loaded amount and releasing behavior. However, **CE** as well as **C** showed the eminent sustained release in EDTA solution. Since Beta-TCP shows bioabsorption, it is expected to be efficient antibiotics carrier. It is worthy to use adequate sizes of Beta-TCP granules impregnated with antibiotics in combination with osteoconductive HA in IBBC for the protection of the infection after joint replacement, especially in revision surgery after infection.

[REFERENCES] : Oonishi H. et al: THA with hydroxyapatite granules at cement-bone interface, 15-to 20-year result. Clin Orhtop Relat Res. 2008; **466**:373-379.

Functional Relevance of Patellofemoral Thickness Before and After Unicompartamental Patellofemoral Replacement.

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Abstract:

The aim of this study was to assess the increase in the anterior diameter of the knee and the impact of this increase on the range of motion and function of the knee.

Twenty-eight patients (34 knees) who underwent Patello-femoral replacement with FPV (Wright Medical) prosthesis between 2005 and 2009 who were identified retrospectively and analyzed using chart and radiological review. Oxford and AKSS knee-scores were gathered prospectively pre-operative and at follow-up.

Trochlear height was measured using lateral radiograph. Trochlear height was compared pre and postoperatively. Patellar height was also measured in preoperative and postoperative skyline view and was compared. The range of movement at six weeks and the Oxford and American knee society knee scores at six months postoperatively were noted. Association between increased anterior height and improved range of motion was studied.

All but three-knees regained full knee extension. Postoperative mean range of flexion of the knee joint was 116 degrees. The mean Oxford knee and the mean American Knee Society Knee Scores significantly improved post-operatively

The trochlear height was increased by 4mms. Patellar height was also increased by 3 mms resulting in average total increase of 7 mms in the anterior-posterior diameter of the knee. We found no relationship between range of motion of the knee and the increase in the anterior-posterior diameter. We found a negative correlation between increase in the antero-posterior and preoperative trochlear and patellar height.

We conclude that FPV Patello-femoral replacement results in correct anatomical reconstruction of the trochlear height rather than 'overstuffing' of the patellofemoral joint which can lead to stiffness and failure of resolution of pain post-operatively. This should in turn result in durable improvements in pain and function.

Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Effect of Arthritis in the Other Compartments on the Outcome After Unicompartamental Arthroplasty (Makoplasty)

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Recently in the literature the indications of unicompartmental knee arthroplasty have been extended by the inclusion of patients with arthritis which is predominantly but not exclusively effecting the medial compartment. The aim of this study is to evaluate the outcome of MAKO unicondylar replacement in the treatment of knee osteoarthritis after the initial surgical insult is worn off to evaluate the impact of residual patellofemoral and lateral osteoarthritis on the outcome of medial unicompartmental knee replacement.

135 patients who underwent uncomplicated 144 MAKO medial unicondylar replacements for knee arthritis were identified and studied. Original radiographs were used to classify severity of patellofemoral and lateral compartmental osteoarthritis in these patients. Severity of patellofemoral and lateral compartmental osteoarthritis was analyzed against Oxford and Knee Society (AKSS) scores and amount of ipsilateral residual knee symptoms at 6 months post-operative period.

Pre-operative Oxford and Knee Society scores, and other comorbidities and long term disability were studied as confounding variables.

We found significant improvement in symptoms and scores in spite of other compartment disease. Poorer outcome was seen in association with comorbidities and long term disability but not when radiographic signs of arthritis in the other compartments were present. Six patients required revision of which three had (lateral facet) patellofemoral disease in the original x-rays.

In conclusion there is no direct relationship between postoperative symptoms and poor outcome and radiographic disease in the other compartments. However when symptoms are severe enough to necessitate revision this is due to patellofemoral and not lateral compartment disease.

Friday, October 8, 2010, 8:40-9:50

Session B10: Navigation and Robotics in Arthroplasty

Assessment of Accuracy of Robotic Assisted Unicompartmental Arthroplasty (Makoplasty)

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The conventional Knee arthroplasty jigs, while being usually accurate, often result in prostheses being inserted in an undesired alignment resulting in poor postoperative outcome. This is especially true about unicompartmental knee replacement. Computer navigation and robotically

assisted unicompartamental knee replacement were introduced in order to improve surgical accuracy of the femoral and tibial bone cuts.

The aim of this study was to assess accuracy and reliability of robotic assisted, unicondylar knee surgery (Makoplasty) in producing reported bony alignment. Two hundred and twenty consecutive patients who underwent medial robotic assisted unicondylar knee surgery (Makoplasty) performed by two surgeons (RJ & GP) were retrospectively identified and included in the study. Femoral and tibial sagittal and coronal alignments and posterior slope of the tibial component were measured in the post-operative radiographs. These measurements were compared with the equivalent measurements collected during intra-operative period by the navigation to study the reliability and accuracy of femoral and tibial cuts.

Results: We found an average difference of 2.2 to 3.6 degrees between the intra-operatively planned and post-operative radiological equivalent measurements.

In conclusion: assuming appropriate planning, robotically assisted surgery in unicondylar knee replacement will result in reliably accurate positioning of component and reduce early component failures caused by malpositioning. Mismatch between preplanning and post-op radiography is caused by poor cementing technique of the prosthesis rather than wrong bony cuts.

Thursday, October 7, 2010, 8:00-8:50

Session A1: Alternate Bearings in THA 1

The Use of a Metal Acetabular Shell With a Polycarbonate-Urethane Liner for Total Hip Reconstruction

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A retrospective single-center review has been performed to gather clinical data on the use of polycarbonate-urethane (PCU) as an articulating bearing material inside a cobalt-chrome (Co-Cr) press-fit acetabular shell.

As of January 2010, the Co-Cr shell and PCU liner have been implanted into 25 total hip patients which were retrospectively followed. The indications for use were in 24 cases of osteoarthritis, and 1 revision case. No patient was lost to follow-up. The average follow-up time was 17.6 months (range 8-27). The average age of these patients was 67.9 (range 44-84), the sex distribution was 14 female and 11 male patients, of whom 15 were right and 10 left side. 24 patients received a total hip replacement with the metal acetabular system and a cementless femoral stem and 1 patient received the metal acetabular shell coupled to a cemented resurfacing head.

None of the cases has had a dislocation, revision, dislodgement, or infection. At follow-up, the

mean Harris hip score was 98 points (80-99). X-rays showed good bone-implant contact without any osteolysis or bone rarefaction.

A detailed review of the clinical data of these patients shows that a PCU liner inserted into a Co-Cr acetabular shell is as safe and effective as other commonly used acetabular shells in other total hip systems currently available. No new or unintended adverse or device-related events were discovered with the clinical use of PCU in a Co-Cr acetabular shell.

Friday, October 8, 2010, 10:20-11:00

Session A12: Materials

Long-Term Wear Performance of an Advanced Bearing Knee Technology

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Introduction:

The most common bearing couple used in total knee arthroplasty (TKA) is ultra-high molecular weight polyethylene (UHMWPE) articulating against a CoCrMo alloy femoral component. Although this couple has demonstrated good clinical results, UHMWPE wear has been identified as one of the principal causes for long-term failure of total knee joint replacements¹ indicating a need for improvements in TKA bearings technology.

The wear resistance of UHMWPE can be improved by radiation crosslinking; however, in order to get the full benefit of this improved wear resistance, an abrasion resistant ceramic counterface is necessary.² Since the radiation crosslinking degrades mechanical properties, it is also important to have an optimized radiation dose and subsequent processing. The purpose of this study was to evaluate the long-term wear performance of VERILAST Technology comprising two advanced bearing technologies, abrasion resistant OXINIUM femoral components (OxZr)³⁻⁴ and wear/strength optimized 7.5 Mrad crosslinked polyethylene (7.5-XLPE).⁵

Materials and Methods:

Three component assemblies of LEGION™ cruciate retaining (CR) OxZr femoral components, 7.5-XLPE tibial inserts were tested on an AMTI knee simulator under displacement control at 1 Hz frequency as described previously.² The tibial inserts were manufactured from compression molded GUR 1020 UHMWPE, radiation crosslinked to 7.5 Mrad dose, remelted to extinguish free radicals, and sterilized by EtO. The wear test was conducted for 45 Mcycle, which was considered to be a conservative estimate for the amount of cycles that would occur during 30 years of typical in-vivo use based on the relationship between patient age and the number of loading cycles as reported in the literature.⁶⁻⁸

Results:

The predominant wear feature on the 7.5-XLPE inserts was burnishing. There were no signs of fatigue wear or delamination. The mean volumetric wear rate (\pm SD) of the 7.5-XLPE inserts articulating against OxZr femoral components for 45 Mcycle was 0.58 ± 0.17 mm³/Mcycle.

In a previous wear test under substantially identical conditions for 5 Mcycle simulating approximately 3 years of use, the mean volumetric wear rate of CoCr and virgin UHMWPE (CPE) couples was 23.4 ± 2.4 mm³/Mcycle.² The mean volumetric wear rate of the OxZr/7.5-XLPE couples was approximately 98% lower compared to the CoCr/CPE couples ($p < 0.01$).

After simulating 3 years of use, the mean volumetric wear of OxZr/7.5-XLPE couples (2.67 mm³) was approximately 98% lower than CoCr/CPE couples (120.42 mm³) (Figure 1). Furthermore, after simulating 30 years of use, the mean volumetric wear of OxZr/7.5-XLPE couples (22.78 mm³) was approximately 81% lower than the CoCr/CPE couples after simulating 3 years of use (120.42 mm³) (Figure 2).

Discussion:

This study demonstrates that coupling OxZr femoral components with 7.5-XLPE inserts results in a TKA bearing combination that provides and maintains significantly lower, long-term wear performance.

References:

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Figures

[Figure 1](#) [Figure 2](#)

Wear Testing of Highly Crosslinked UHMWPE Against 36 Mm CoCr and 44 Mm Oxidized Zirconium Femoral Heads

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Introduction:

Large diameter femoral heads offer increased range of motion and reduced risk of dislocation. However, their use in total hip arthroplasty has historically been limited by their correlation with increased polyethylene wear. The improved wear resistance of highly crosslinked UHMWPE has led a number of clinicians to transition from implanting traditionally popular sizes (28mm and 32 mm) to implanting 36 mm heads. Desire to further increase stability and range of motion has spurred interest in even larger sizes (> 36 mm). While the long-term clinical ramifications are unknown, in-vivo measurements of highly crosslinked UHMWPE liners indicate increases in head diameter are associated with increased volumetric wear [1]. The goal of this study was to determine if this increase in wear could be negated by using femoral heads with a ceramic surface, such as oxidized Zr-2.5Nb (OxZr), rather than CoCrMo (CoCr). Specifically, wear of 10 Mrad crosslinked UHMWPE (XLPE) against 36 mm CoCr and 44 mm OxZr heads was compared.

Materials and Methods:

Ram-extruded GUR 1050 UHMWPE was crosslinked by gamma irradiation to 10 Mrad, remelted, and machined into acetabular liners. Liners were sterilized using vaporized hydrogen peroxide and tested against either 36 mm CoCr or 44 mm OxZr (OXINIUM™) heads (n=3). All implants were manufactured by Smith & Nephew (Memphis, TN).

Testing was conducted on a hip simulator (AMTI, Watertown, MA) as previously described [2]. The 4000N peak load (4 time body weight for a 102 kg/ 225 lb patient) and 1.15 Hz frequency used are based upon data obtained from an instrumented implant during fast walking/jogging and have previously been shown to generate measurable XLPE wear [2,3]. Lubricant was a serum (Alpha Calf Fraction, HyClone Laboratories, Logan, UT) solution that was replaced once per week [2]. Liners were weighed at least once every million cycles (Mcycle) over the duration of testing (~ 5 Mcycle). Loaded soak controls were used to correct for fluid absorption. Single factor ANOVA was used to compare groups ($\alpha = 0.05$).

Results:

The predominant wear feature displayed on the articular surface of liners was burnishing. There were no signs of fatigue wear or of delamination. Mean wear rates (\pm std dev) of liners articulated against 36mm CoCr and 44 mm OxZr heads were $3.7 \pm 0.4 \text{ mm}^3/\text{Mcycle}$ and $2.7 \pm 0.4 \text{ mm}^3/\text{Mcycle}$, respectively (Figure 1). This difference was statistically significant ($p =$

0.04).

Discussion:

Although large diameter heads offer biomechanical advantages, their use in total hip arthroplasty has historically been limited due to correlation with increased polyethylene wear. While highly crosslinked liners exhibit significantly improved wear resistance over conventional UHMWPE, their wear has also been shown to increase with head size [1]. Results presented here indicate that this increase in wear can be negated by using OxZr, rather than CoCr. Specifically, wear of XLPE liners was lower against 44 mm OxZr heads than against 36 mm CoCr heads.

References:

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2. Parikh et al, *Trans ORS* 2009:2340
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Figures

Friday, October 8, 2010, 8:40-9:30

Session A11: Knee Arthroplasty in the Middle East

New Concept in Soft Tissue Balancing During Primary Total Knee Arthroplasty

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New concept in soft tissue balancing during primary total knee arthroplasty

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Background:

Performing total knee replacement needs both bony & soft tissue consideration. Late John Insall advocating spacer blocks with concept of balanced & equal flexion – extension Gap. Although

we usually excise both ACL & PCL, still it is possible to retain more soft tissue. Both PCL retaining & sacrificing Require intact collaterals for stability. Superficial MCL & LCL should be preserved, if possible.

after PCL removal the following advantages could obtain : More correction of fixed varus or valgus deformity , More surgical exposure . but there are no proved disadvantages like ; increasing in stress & loosening of bone-cement-prosthesis interface , specific clinical difference in ROM , forward lean during stepping up , proprioception inferiority . in other hand Over tight PCL cause excessive rollback of tibia & knee hinges open ,preventing flexion (booking) , and Severe posteromedial poly wear in poor balance PCL might be happened .

Mid range laxity when Post.Capsule is tight ,even with correct tensioning in full extension & 90 degree flexion , may occur (and secondary collateral ligaments imbalance throughout ROM) . There is a major effect of capsular contracture in coronal mal alignment with flexion contracture. Full MCL releases not only correct fixed varus but also open the medial space in flexion. MCL & post. Capsule has combined valgus resistant effect in extension. PCL release increase flexion gap more, May be necessary to release something that affect extension gap as compensated balancing (Post.medial capsule) .Any flexion contracture need to posterior capsulotomy & post. Condyle osteophyte removal before femoral recut.

So it is possible to perform posteromedial capsulotomy prior to superficial MCL release.

Method :

From May to Dec. 2009, 22 patients (23 knees) with primary DJD and varus deformity of knees were operated by myself with joint replacement . most patients had some degree of varus correction in flexion , passively . the varus angle was less than 25* , means mild to severe but not decompensated . For soft tissue balancing during Total knee arthroplasty I consider the following steps;

Medial capsule & deep MCL release, PCL release, Posteromedial capsulotomy , semimembranous release , Superficial MCL release , Pes anserinus release . **Post.medial capsulotomy was done in all cases.**

The Average Age was 64.74 years, 19 patients were female (83%) and one of them had bilateral TKA simultaneously. Lt Knee was operated in 14 cases (70% of 24). Spinal anesthesia was applied in 82%. 10 patients were operated with MIS technique and 13 patients with Standard medial parapatellar incision. **Semi membranous release was necessary** in 4 cases (preop varus 17,20,24,25*) . **MCL release was mandatory** in 2 cases (preop varus 17 , 24 * & No Flexibility in 30* flexion).for checking balanced medial and lateral subtle laxity (playing), I have used simple blade with 1 & 2 mm thickness in each ends for younger patients , and the other one with 3&4 mm thickness in elder cases .

Results:

Average follow up period is **234.45** days. Average Operating time was 1 : 32 (h:m) . Average Transfusion = 1.22 unit packed cell . No Flexibility in 30* flexion was seen in 3 patients.

Average varus malalignment = 15.29* (2-25*) / **Av. Valgus angle = 7.19*** (5-10 *) / **Av. DLFA = 90.47*** (87-93*) / **Av. PMTA = 83.41*** (77-88.5*) / **Av. Ext. rotation cut = 3.11***

Stage I + PCL + Post.Med. Capsular release was performed in 82.61% . / **Av. Post op alignment : 1.8 * varus** (0 -6 *) (worse in medial pivot knee) .

Av. Polyethylen size : 12.4 (9 in oxynium -19 in plus) / **Semi membranous release was necessary** in 4 cases (preop varus 17,20,24,25*) (Post.Op varus 1,6,4,2) . / **S.MCL release**

was mandatory in 2 cases (preop varus 17 , 24 * & No Flexibility in 30* flexion) (Post.Op varus : 1 , 4 *) .

pre operation knee society score : stage I = 27.8 , stage II = 37.9 increase to stage I = 85.47 , stage II = 75.65

Conclusion:

In society with more kneeling habitués , during performing total knee arthroplasty with less than 25* degree varus malalignment plus some degree flexibility of the deformity in flexion , it is wise to consider posteromedial capsular release prior to semi membranous & S.MCL release to obtain full correction of alignment. But the most important things is reaching to full align limb regardless of which chosen technique.

Thursday, October 7, 2010, 9:00-9:50

Session A2: Alternate Bearings in THA 2

Total Hip Replacement in High Riding DDH, Using Proximal Femoral Neck Shortening Osteotomy, in L Step Cut Fashion

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Total hip replacement in high riding DDH

Using proximal femoral neck shortening osteotomy, in L step cut fashion

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Background:

There are many difficulties during performing total hip replacement in high riding DDH. These difficulties include:

1- In Acetabular part : bony defect in antero lateral acetabular wall / finding true centre of rotation / shallowness of true acetabulum / hypertrophied and thick capsular obstacle between

true and false acetabulum

2- In Femoral part : small diameter femoral shaft / excessive ante version / posterior placement of greater trochanter

3- anatomic changes in soft tissue & neurovascular around the hip including : adductor muscle contracture / shortening of abductor muscles / risk of sciatic nerve injury following lengthening of the limb after reduction in true acetabulum / vascular injury

The purpose of this lecture is how to manage above problems with using reinforcement ring (ARR) for reconstruction of true acetabulum and step cut L fashion proximal femoral neck shortening osteotomy in a single stage operation

Method:

23 surgeries in 19 patients, including 18 female and one male were performed by me from Jan. 1997 till Dec. 2009. Six patients had bilateral hip dislocation, but till now only four of them had bilateral stepped operation. Left hip was involved in 15 cases (65.2%). The average age was 40 years old. All hips were high riding DDH according to both hartofilokides and crowe classification. Reconstruction of true acetabulum was performed with aid of reinforcement ring and bone graft from femoral head in all cases. Trochantric osteotomy was done in all, followed by fixation with wire in 22 cases which needed two revisions due to symptomatic non union (9%). Hooked plate was use in one case for trochantric fixation. Due to high riding femur, it was necessary to performed femoral shortening in neck area as a step cut L fashion.

In two patient , one with bilateral involvement, after excessive limb lengthening following trial reduction , it was necessary to performed concomitant supracondylar femoral shortening .(3 cases = 13%)

22 mm cup & miniature muller DDH stem were used in 18 cases (78.26%). In 5 cases, one bilaterally, non cemented stem and 28 mm cemented cup in ring were used.

Primary adductor tenotomy was performed in 9 cases. Secondary adductor tenotomy needed in 2 cases (totally = 47.82%). Repair of iatrogenic femoral artery tear after traction injury with retractor, occurred in 2 cases (8.69%).

All patients evaluate retrospectively. Average follow up month is 68.7.

Results:

One case of left acetabular component revision due to painful bony absorption in infero medial part of ring with poor inclination wad done , after 2 years of primary operation . Know after 13 years she has had early signs of stem loosening in the same side.

Another acetabular component revision following traumatic dislodgment of cup and cement from ring was performed after 13 months from primary operation. Again she had poor implant inclination.

So revision rate is 8.69%. (One case will need revision in near future, so the revision rate will increase to 13%)

Radiological wires breakage which were used for greater trochanteric fixation , could be seen in 11 cases (47.82%) , but only two of them with functional impairment needed to re-fixation with Menen plate(18.18% of trochanteric non union).

Average limb lengthening after operation is 4.3 Cm (2-7 Cm). Only one case of transient Sciatic nerve paresis had happened for 2 months followed by complete recovery.

Two case of secondary adductor tenotomy wre done, one after traumatic dislocation of prosthesis with pubic fracture, and the other one after restriction of hip abduction.

The average Harris hip score from 23 pre-operatively has been increase to 85.38. (The pre op. scores were 12.625 – 40.775 / The post op. scores were 64.92 – 96)

No post operative infection was seen.

Discussion:

This is a midterm follow up survey , but 7 cases have more than 9 years follow up with only one stem loosening (11% long term loosening rate). It is a challenging procedure for performing joint replacement in high riding DDH , if so using reinforcement ring with graft for true acetabulum reconstruction and getting primary proximal femoral shortening in a step cut L fashion around the lesser trochanteric region would be a worthy procedure. In high riding DDH due to hypoplasia of lesser trochanter, there is not a significant difference in bone resistance and it is possible to get shortening in this area without fearing of deco promising bony stability. The average shortening is 3 Cm.

In specific cases with more severe contracture for preventing neuro-vascular complication, concomitant shortening osteotomy in supracondylar area is recommended.

Although greater trochanter fibrous union has produced less functional impairment, but a better technique should be considered. Distal and lateral advancement of osteotomised greater trochanter lead to better abductor muscle performance and less limp.

Adductor tenotomy has a great importance in contracted soft tissue, so in any case with abduction limitation it should be performed.

Figures

[Figure 1](#)

Saturday, October 9, 2010, 15:00-15:30

Session B21: Innovation in Hip Arthroplasty

Minimal Invasive (MIS) Posterior Approach in Short Stem Total Hip Arthroplasty-Short Term Results

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Minimal invasive surgery (MIS) is accepted when the scar is 10 cm or less. The anterior and the antero-lateral approaches had gained recently interest in the total hip arthroplasty because they allow complete muscle sparing. The postero-lateral and lateral approaches were proposed to be less satisfactory from this point of view. The goal of this paper was to report an objective and careful assessment of the advantages of the minimal invasive posterior approach in short stem (Nanos) total hip arthroplasty.

Material and methods: From July 2005 to March 2009 a total of 113 (70 males, 53 female) uncemented Nanos-short-stem prothesis were implanted in 111 patients. The patients average age was 53 years (33-73). The indication for this procedure was predominantly coxarthrosis. In all cases a minimal invasive posterior approach was used. The mean follow up period was 2,5 years (range 6 months- 4,5 years). The patients were assessed using Harris Hip Score and radiologically to detect any bone changes, the stand of the prothesis and peri-articular ossifications

Results: The perioperative Harris Hip Score was 53 (28-77), postoperative was 94 (86-100). Until now we have not discovered any prothesis specific complications. Radiological follow up examinations showed the development of increasing trabecular reinforcement of the femoral neck and pertrachantric regions. There is no evidence of any loosening or migration of the prothesis. No luxation. Calcification was noted in 8 cases (Grad 1), 4 cases (Grad 2), 1 case (Grad 3). In 3 cases we have to change the cup because of malposition

Conclusion: the stem design of Nanos-short-stem prothesis allowed a metaphyseal intertrochanteric multipoint primary fixation. The surgical technique using posterior approach give a good access to the femur and acetabulum. It allows intraoperative ROM as well as extension in the event of intraoperative complications. Long term studies still be needed.

Friday, October 8, 2010, 13:30-14:10

Session B12: Shoulder Arthroplasty

Swanson-Prosthesis in Bouchard Arthrose: Is Still Indicated ?

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Background: Bouchard -arthrose is often familial and affect predominantly females. It starts as acute inflammation of the soft tissue and with time may progress to severe deformity and limitation of movement. In the early phases one of the most common operation in the management is the synovialectomy. In late stages with severe destruction and deformity of the joint arthrodesis can be carried out . However, arthrodesis may lead to severe loss of function. One of the most commonly and world wide used prosthesis to maintain movement is the Swanson –spacer.

Material and Methods: 20 Swanson-implants in 14 patients (12 female,2 male) were evaluated subjectively and objectively using PIJA-score (Interphalangeal-joint –score) and Dash –score.. The follow period was 4.6 years (range 1-11 years).

Results: The IPJA-score ranged 8-14 points (median 11.8) and the median Dash- score was 28 points.. Improvement of pain was observed in 90% of the cases. Flexion more than 30° in 85% and full extension in 75%. Ulnar deviation was noted in 7 patients (35%), mostly of the index finger. Fracture of the prosthesis occurred only in 1 case. No loosening was observed radiologically.

Discussion: Swansin prosthesis is good alternative to arthrodesis and be restricted only in cases where the musculotendinous structures are intact. In cases where the index finger is affected ,arthrodesis is preferred.

Total Joint Replacement (De La Caffinire) in Steoarthritis of Trapeziometacarpal Joint Technique and Results

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Background: The trapeziometacarpal joint (TMJ) of the thumb is a common site of primary osteoarthritis. Pain, crepitis and instability secondary to subluxation are common symptoms associated with TMJ arthritis. Conservative therapy help to control symptoms however with time, many patients progress with pain, deformity and functional limitation. The goals of operative intervention are to restore stability and strength, decrease pain and to provide a functional range of motion. Francobal-prosthesis may fulfil these criterions.

Technique: We implanted the prosthesis through a dorso-radial straight longitudinal or slightly curved skin incision. A dorsal capsulotomy is performed and at this step adduction deformity should be addressed. An osteotomy of the proximal surface of the first metacarpal is made perpendicular to the long axis of the medullary cavity followed by reaming of the medullary cavity and then a trial fit. This is followed by preparation of the trapezium including removing any osteophytes, drilling of a cavity. Dental burs may be used at this step to deepen the cavity. The process of cementation started by cementation of the cup with its opening neutral to the joint surface, and if there is any muscle tension, bone is removed from the metacarpal before the metacarpal component is cemented. Reduction is achieved by snapping. The capsule and wound are closed and the thumb is immobilised in an adduction splint for ten days.

Results: Results showed marked improvement of pain in many patients with high rate of satisfaction. No restriction of movement or instability was observed. In some cases, loosening of the shaft was noticed. However, this does not affect the overall function.

Discussion: De La Caffinière-prosthesis presents one of the operative options in the management of trapeziometacarpal joint (TMJ). Arthritis, however, this operation is recommended only in selective cases where skaphoid-trapezium-trapezoid(STT) joints are not involved.

Effect of Hindfoot Alignment on Mechanical Axis Deviation After Total Knee Arthroplasty in Osteoarthritis

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The weight bearing axis of the limb goes from the pelvis to the ground and includes the hindfoot. However, the influence of hindfoot alignment on mechanical axis deviation and overall limb alignment after total knee arthroplasty (TKA) is unknown. This study aimed to assess the change in hindfoot alignment after TKA for knee osteoarthritis, the difference in mechanical axis deviation at the knee when calculated using the ground mechanical axis as compared to the conventional mechanical axis, and the effect of hindfoot alignment on the overall postoperative limb alignment after TKA.

We evaluated the pre- and postoperative hip-knee-ankle (HKA) angle, conventional mechanical axis deviation (CMAD), ground mechanical axis deviation (GMAD), and tibiocalcaneal angle (TCA) in 125 patients who underwent 165 consecutive TKAs. Overall, the change in pre- and postoperative mean TCA was not significant ($p=0.48$) whereas it was significant ($p=0.01$) in knees with $\geq 15^\circ$ deformity where the hindfoot valgus decreased by approximately 25%. Preoperatively, there was no significant difference between mean CMAD and mean GMAD whereas postoperatively the difference was significant ($p=0.0001$). Hindfoot valgus alignment of $\geq 10^\circ$ was present in 22.5% of limbs and 29% limbs had a postoperative GMAD of ≥ 10 mm in spite of the limb alignment being restored to within 3° of neutral after TKA.

Despite accurate restoration of limb alignment after TKA, as a result of persistent hindfoot valgus alignment the ground mechanical axis may pass lateral to the centre of the knee joint - with potential detrimental effects on bone, ligaments and implants.

Thursday, October 7, 2010, 13:30-14:10

Session B5: Computer Navigation in TKR 1

Computer-Assisted Total Knee Arthroplasty in Arthritis With Recurvatum Deformity

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Genu recurvatum deformity is uncommon in arthritic knees undergoing total knee arthroplasty (TKA). We retrospectively analysed radiographs and navigation data to determine the clinical and radiographic results of computer-assisted TKA in knee arthritis with recurvatum deformity.

Based on alignment data obtained during computer assisted (CAS) TKA, 40 arthritic knees (36 patients) with a recurvatum deformity of at least 5° were identified. The mean recurvatum deformity was 8.7° (6° to 14°). On preoperative standing hip-ankle radiographs, 23 limbs (57.5%) had a mean varus deformity of 169.4° (153° to 178°) and 17 limbs had a mean valgus deformity of 189.2° (182° to 224°). The intraoperative navigation data showed mean tibial resection of 7.5mm (4.6 to 13.4mm) and distal femur resection of 7.5mm (3.3 to 13mm) with a mean final extension gap of 21.2mm and a flexion gap at 90° of 21.1mm and on extension. On table, the mean knee deformity in sagittal plane was 3° flexion (1.5° to 4.5° flexion).

Postoperatively, the mean HKA angle on standing hip-ankle radiographs was 179.2° (177° to 182°). On postoperative lateral radiographs, joint line in extension was moved distally in 35 limbs by 2.3mm (0.3 to 4mm) and proximally in 5 limbs by 2.2mm (2.2 to 2.4mm); the mean preoperative posterior femoral offset of 28.7 mm changed to 27.9 mm postoperatively. At a mean follow up 28 months (14- 48 months) the knee, function, and pain scores improved by 61, 48, and 28 points, respectively and there was no recurrence of recurvatum deformity at final follow up.

Genu recurvatum is a notoriously difficult condition to address at TKA. The challenges are to be able to detect it at surgery and take appropriate measures in terms of resection and releases to correct it satisfactorily. Computer assisted TKA helps to achieve excellent deformity correction, limb alignment, gap balancing and function in patients with recurvatum deformity by accurately quantifying and helping to modify the amount of bone cuts and titrate soft tissue release.

Thursday, October 7, 2010, 14:20-15:00

Session B6: Computer Navigation in TKR 2

Analysis of Outliers in Computer-Assisted Total Knee Arthroplasty

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Computer navigation has been advocated as a means to improve limb and component alignment and reduce the number of outliers after total knee arthroplasty (TKA). We aimed to determine the alignment outcomes of 1500 consecutive computer-assisted TKAs performed by a single surgeon, using the same implant, with a minimum 1 year follow-up, and to analyze the outliers. Based on radiographic analysis, 112 limbs (7.5%) in 109 patients with mechanical axis malalignment of $> 3^\circ$ were identified and analyzed.

The indication for TKA was osteoarthritis in 107 patients and rheumatoid arthritis in 2 patients. Fifty-eight patients (53%) had undergone simultaneous bilateral TKA and 13 patients (12%) had a BMI >30 . Preoperative varus deformity was seen in 100 limbs and valgus deformity in 12 limbs. Thirty limbs (27%) had an extra-articular deformity (2 post HTO limbs, 3 malunited fractures, 1 stress fracture, 21 severe femoral bowing and 3 tibial bowing) and 21 limbs (19%) had severe lateral laxity or subluxation. Thirty-eight limbs (34%) had a preoperative deformity of $\leq 10^\circ$ and 24 limbs (21.5%) had varus or valgus deformity of $>20^\circ$.

Postoperatively, 11 limbs were malaligned at $\pm 3^\circ$, 74 limbs at $\pm 4^\circ$, 22 limbs at $\pm 5^\circ$, 2 limbs at $\pm 6^\circ$, and 2 limbs at $\pm 7^\circ$. Coronal plane malalignment of $> \pm 3^\circ$ of the femoral component was seen in 28 limbs, tibial component in 32 limbs, and both femoral and tibial components in 13 limbs. Twenty-six limbs with preoperative varus deformity had a postoperative valgus alignment of $>183^\circ$ and 3 limbs with valgus deformity had a postoperative varus alignment of $<177^\circ$.

The incidence of outliers for postoperative limb alignment was low at 7.5% with the tibial component showing a higher incidence of coronal malalignment. Malalignment may be more common in cases of simultaneous bilateral procedures, preoperative limb alignment of $\leq 10^\circ$, limbs with extra-articular deformities and severe lateral instability. There was a tendency towards over-correction of the hip-knee-ankle axis in both varus- and valgus-deformed knees. Further detailed statistical analysis of the data will be presented.

This is the largest single-surgeon series of consecutive navigated TKAs and consequently the largest analysis of outliers that highlights which knees are likely to fall outside the ± 3 degrees of acceptable alignment and which therefore behoove the surgeon to exercise greater caution.

Short Term Results of Primary THA Using RevelationV2: A Lateral Flare Femoral Component

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Dislocation after total hip arthroplasty (THA) is one of the most serious complications. We recently modified the design of Lateral Flare femoral component (RevelationV2) with six degrees lower anteversion to reproduce the normal hip condition in Japanese. In addition, we added 10-degree slope on the posterior neck to prevent dislocation especially aimed to high anteversion cases. The purpose of this study is to verify the clinical outcome after this design modification.

Hospital records and database were retrospectively reviewed. We investigated 46 consecutive hips in 43 patients who underwent primary total hip arthroplasty using RevelationV2 from September 2007 to August 2009. All patients implicated preoperative planning using CAT scan with their informed consents.

The mean age and BMI at surgery were 63 years old and 23.1. Preoperative diagnosis was osteoarthritis (40/46: 87%), rheumatoid arthritis (2/46: 4%) or avascular necrosis of femoral head (4/46: 9%). There were 41 hips (89.2%) of Crowe I, 3(6.5%) of Crowe II and 2(4.3%) of Crowe III. Preoperative femoral neck anteversion averaged 28 degrees, whereas postoperative combined anteversion (the sum of femoral neck anteversion and anterior cup inclination) averaged 46 degrees. During follow up, 5 complications, in details, 3 mild peroneal nerve palsy, 1 pulmonary embolism and 1 dislocation following deep infection were reported. In conclusion, although no ordinal dislocation was found in this series, longer observation will need to judge appropriateness of this new component.

Improving Cup Positioning Using a Mechanical Navigation Instrument

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Improving Cup Positioning Using a Mechanical Navigation Instrument

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Acetabular component malpositioning is the most common reason for instability and wear resulting in revision total hip arthroplasty (THA). The current study aimed to assess a novel mechanical navigation device which was designed to simply and efficiently indicate appropriate cup orientation during surgery. The accuracy was compared to a series of hip arthroplasties performed using CT-based computer-assisted cup placement.

The study group consisted of 70 THAs performed using the mechanical device. The control group consisted of 146 THAs performed using CT-based computer navigation. Postoperative cup positioning was measured using a validated 2D/3D-matching method. An outlier was defined outside a range of ± 10 degrees from the planned inclination or anteversion.

In the study group the mean accuracy for inclination was 1.3 ± 3.4 (-6.6 – 8.2) and 1.0 ± 4.1 (-8.8 – 9.5) for anteversion with no outliers for either parameter. In the control group the accuracy for anteversion (3.0 ± 5.8 [-11.8 - 19.6]; $p=0.6\%$) and the percentage of outliers (6.8%; $p=3.3\%$) differed significantly. The accuracy for inclination (3.5 ± 4.1 [-12.7 - 9.5]; $p=21.4\%$) and the percentage of outliers (4.8%; $p=9.9\%$) did not differ significantly.

The use of this mechanical navigation device can result in similar accuracy of acetabular cup orientation compared with CT-based surgical navigation. All cups were placed within a zone of ± 10 degree range of inclination and anteversion. This mechanical navigation device allows accurate cup navigation with minimal additional time and equipment.

Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Prospective Comparison of Total Hip Arthroplasty Performed Using Conventional and Tissue-Preserving Techniques: A Minimum 2-Year Outcome Study

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Prospective Comparison Of Total Hip Arthroplasty Performed Using Conventional And Tissue-Preserving Techniques: A Minimum 2-year Outcome Study

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Introduction. The use of less invasive techniques for total hip arthroplasty (THA) has remained controversial with some studies showing a higher incidence of complications. The technique of performing total hip arthroplasty through a superior capsulotomy was developed to maximally preserve the soft tissue envelope surrounding the hip. The current study assesses the recovery and complications of hips replaced using conventional and tissue preserving techniques.

Methods. 206 hips in 191 patients with a mean follow-up of 4.3 ± 1.0 (range, 3.2 – 5.9) years underwent total hip arthroplasty using the superior capsulotomy technique. The mean age at operation was 55.7 ± 12.9 (19 – 85) years and the operation was performed for 106 hips (51%) in men. The surgical technique involves exposing the superior hip joint capsule posterior to the medius and minimus, and anterior to the short external rotators. The femur is prepared with the femoral head in place and then the femoral head is excised without dislocation. These 206 hips were compared to a cohort of 279 hips replaced using the transgluteal exposure (control group). These 2 series were controlled for complexity and demographic factors. Recovery was evaluated using the Merle d'Aubigné score at 6 and 12 weeks postoperatively.

Results. Two of the 206 hips (1%) replaced using the superior capsulotomy have been revised, one for failure of osseointegration of a nonmodular CoCr acetabular component and one for fracture of a ceramic liner at 21 months. In addition, there were 3 surgical complications. These included one intraoperative and one postoperative nondisplaced trochanteric fracture treated nonoperatively and one anterior hip dislocation. Assessment of the control group demonstrated five revisions: one for recurrent dislocation, two for failure of osseointegration of the femoral component, one for malseating of an acetabular liner, and one for fracture of a ceramic liner. Four hips developed trochanteric wafer nonunions of which 2 required repair. There was one intraoperative trochanteric fracture and two postoperative displaced trochanteric fractures requiring repair. Three hips sustained intraoperative femoral cracks that were cerclaged, and one pelvis sustained a posterior wall fracture that was repaired at surgery. There were two arthrotomies, one for treatment of infection and one for suspected infection. The complication rate was significantly higher in the control group than in the study group. Compared to the control group, the hips replaced using the superior capsulotomy technique had significantly higher hip scores at the 1st and 2nd followup: 1st f/u Merle D'Aubigné score of 15.6 ± 1.6 (9 – 18) vs 13.1 ± 1.8 (8 – 18) and 2nd f/u 17.1 ± 1.1 (13 – 18) vs 16.2 ± 1.6 (10 – 18).

Conclusion. These results suggest that the superior capsulotomy technique, with the goal of soft tissue preservation, is a safe and reliable method of performing total hip arthroplasty compared to one conventional THA technique. These results show that the patients recovered quickly and experienced a low incidence of perioperative complications.

Outcome of Ceramic-Ceramic Total Hip Arthroplasty in Patients With Developmental Dysplasia of the Hip

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Outcome Of Ceramic-Ceramic Total Hip Arthroplasty In Patients With Developmental Dysplasia Of The Hip S.D. Steppacher, M. Tannast, S.B. Murphy New England Baptist Hospital, 125 Parker Hill Avenue, 02120 Boston, USA

Total hip arthroplasty (THA) in patients with developmental dysplasia of the hip (DDH) has been associated with increased rates of complications and revision. Hip instability and wear-induced osteolysis are among the more common and serious of these problems. The current investigation prospectively assessed the survivorship and clinical results of patients with DDH treated by alumina ceramic-ceramic THA.

We investigated 161 consecutive hips in 145 patients with DDH classified as Crowe type I (131 hips, 81%), II (26 hips, 16%), III (2 hips, 1%), and IV (2 hips, 1%). All patients had an uncemented titanium acetabular component with a flush mounted alumina ceramic-ceramic bearing. The mean age at operation was 48.0 ± 12.2 years (range, 18 – 79 years). The preoperative Merle d'Aubigné score was 11.4 ± 1.7 (6 – 15). 27 hips (17%) had at least one previous surgical procedure. 92 hips (57%) were replaced with the use of surgical navigation for acetabular component positioning. The mean cup diameter was 49.9 ± 3.4 mm (46 – 60 mm). 88 (55%) bearings were 28mm and 73 (45%) bearings were 32mm.

At a mean follow-up of 6.1 ± 2.5 years (2 – 11.3 years), the mean Merle d'Aubigné score was 17.4 ± 0.9 (14 – 18). There were no cases of osteolysis or dislocation. There was one reoperation of an early displaced cup. In addition, there was one calcar crack that was cerclaged, one intraoperative trochanteric fracture also repaired at surgery. No patient complained of squeaking. 94 patients with 100 hips (61%) completed a questionnaire specifically asking for squeaking. None of these patients reported squeaking. The 10-year Kaplan Meier survivorship of the implants (revision of any component for any reason) was 99.4% (95% confidence interval 98.2-100%).

Results of ceramic-ceramic THA in young patients with low to middle graded DDH after two to eleven years follow-up are promising with no radiographic signs of osteolysis or dislocation.

Effect of Proximal Stem Surface Roughness on the Initial Mechanical Stability

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Introduction

The initial mechanical stability of cementless femoral stems in total hip arthroplasty is an important factor for stable biological fixation. Conversely, insufficient initial stability can lead to stem subsidence, and excessive subsidence can result in periprosthetic femoral fracture due to hoop stress. The surface roughness of stems with a surface coating theoretically contributes to initial mechanical stability by increasing friction against the bone, however, no reports have shown the effect of surface roughness on stability. The purpose of this study was to evaluate the effect of differences in surface roughness due to different surface treatments with the same stem design on the initial stability.

Materials and Methods

Proximally titanium plasma-sprayed femoral stems (PS stem) and proximally grit-blasted stems (GB stem) were compared. The stem design was identical with an anatomic short tapered shape for proximal fixation. The optimum size of PS stem based on 3D templating was implanted in one side of 11 pairs of human cadaveric femora and the same size of GB stems was implanted in the other side. After implantation, the specimens were fixed to the jig of a universal testing machine in 25cm of entire length so that the long axis of the femur was positioned at 15-degrees adduction to the vertical. Vertical load tests were conducted under 1 mm/minute of displacement-controlled conditions. After 200 N of preload to eliminate the variance in the magnitude of press-fit by manual implantation, load was applied until periprosthetic fracture occurred.

Results

The same size of PS or GB stem was successfully implanted in all 11 pairs without fracture. The distances of subsidence until fracture occurred were 2.2 ± 1.2 mm in the PS stem and 2.5 ± 1.1 mm in the GB stem and no significant difference was detected. The load applied for 1 mm of subsidence was 792 ± 478 N in the PS stem and 565 ± 431 N in the GB stem and there was a significant difference between the two groups. The load at fracture was 3037 ± 1563 N in the PS stem and 2614 ± 1484 N in the GB stem and there was a significant difference between the groups.

Discussion

A significantly larger load was applied for 1 mm of subsidence in the PS stem compared to the GB stem. This suggests that the plasma-spray porous-coated surface had a less slippery interface than the grit-blasted surface. Both femora of a pair fractured at the same level of hoop stress that was induced by the same amount of stem subsidence but at significantly different loads. The fact that the load at fracture in the PS stem was significantly larger than that in the GB stem was due to differences in shear stress caused by different levels of friction. The

scratching effect against the femoral canal due to the rougher surface of the plasma-spray porous-coating works advantageously for initial mechanical stability.

Thursday, October 7, 2010, 11:10-11:50

Session A4: Hip Resurfacing

The Fate of Initial Gaps Between the Cup and Acetabular Floor in Resurfacing Hip Arthroplasty

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Introduction

Current standard cups of metal on metal resurfacing hip arthroplasty (RHA) have no dome holes and it is very difficult for surgeons to confirm full seating of these cups. This sometimes results in gap formation between the cup and acetabular floor. Although the incidence of initial gaps using modular press-fit cups with dome screw holes has been reported to range from 20 to 35%, few studies have reported the incidence of gap formation with monoblock metal cups and its clinical consequences in RHA. The purpose of this study was to investigate retrospectively the incidence of initial gap formation and whether the initial gap influences the clinical results in RHA.

Material and Method

RHA was performed on 166 hips of 146 patients using the Birmingham Hip Resurfacing (BHR) (MMT, UK) between 1998 and 2007. Mean age at operation was 48.7 years (range, 19-85 years). Mean duration of follow-up was 6.9 years (2.0-10.6). Acetabular reaming was performed with the use of hemispherical reamers and the reamer size was increased up to an odd number diameter which provided tight rim fit in the antero-posterior direction. The same size hemispherical provisional cup with dome holes and slits was used to check the cavity for complete seating. If the provisional cup could not be seated on the floor, reaming was repeated with the same reamer to remove the rim bump until full seating was achieved. Acetabular cups of 1mm larger diameter were impacted into the acetabulum by a press-fit technique. After press-fit fixation, the stability of the cups was confirmed with a synchronized movement of the pelvis and the cup inserter by applying a gentle torque. Clinical evaluation was performed using WOMAC at the latest follow-up. Radiographic assessments were performed using radiographs immediately after the surgery, at 3 weeks, 3 months, 1 year, and then annually thereafter. We evaluated the height of the gap between the cup and acetabular surface, cup inclination angle, cup migration and the time to gap filling. To investigate the relationship between the magnitude of the gap and the radiographic results, the patients were divided into two groups according to the height of the initial gap; the cases with a gap of less than 3 mm on the initial radiograph

were grouped into a small gap group, the cases with a gap of 3mm or more were grouped into a large gap group. We compared the changes in the height of the gap, in the cup inclination angle and the cup migration between the groups.

Results

Gaps were identified in 21 of 166 hips (13%) on the postoperative radiograph. The average height of the gaps was 2.4 mm (0.56-4.5mm). Of the 21 hips with gaps, there was no revision during the follow up period. 12 of the 21 hips were classified into the small gap group, 9 of the 21 hips were classified into the large gap group. In the small gap group, there were no changes of cup inclination angle of more than 3 degrees nor was there cup migration of more than 3mm. On the other hand, in the large gap group, 6 of the 9 hips showed reductions of the cup inclination angle of more than 3 degrees with 3mm or more of migration during the initial 3 months ($P < 0.05$). After 3 months, neither progressive angle change nor migration of the cup were observed. All acetabular components were judged to be bone ingrown at the last follow up.

Conclusions

The incidence of initial postoperative gaps (13%) of this series is similar to that of modular cementless cups fixed with press-fit technique. There were no serious clinical consequences of the initial gap during the 6.9 year follow up. However, gaps of 3mm or more led to early migration of the acetabular component and change in inclination angle.

Friday, October 8, 2010, 8:40-9:30

Session A11: Knee Arthroplasty in the Middle East

Can an Anterior Quadriceps Release Improve Range of Motion in the Stiff Arthritic Knee?

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We hypothesize that tethering adhesions of the quadriceps muscle are the major pathological structures responsible for a limited range of motion in the stiff arthritic knee. Forty-two modified quadriceps muscle releases were performed on 24 patients with advanced osteoarthritis scheduled for total knee arthroplasty. The ranges of motion were documented intraoperatively both before and immediately after the release. Passive flexion improved significantly in all patients (mean, 32.4 degrees of improvement, $P < .001$) following a modified quadriceps release, despite any presence of osteophytes or severe deformities. These results strongly implicate adhesions of the quadriceps muscle to the underlying femur, which prevent the distal excursion of the quadriceps tendon, as the restrictive pathology preventing deep flexion in patients with osteoarthritis.

Friday, October 8, 2010, 8:40-9:50

Session B10: Navigation and Robotics in Arthroplasty

Comparing Navigated Versus Conventional TKR. Short Term Radiological Result

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60 patient were included in this comparative study. Patients were divided into 3 groups. Group A including TKR done navigation guided in a navigation techniques experienced center. Group B including patient done navigation guided in less experienced center. Group c including patients done conventionally by an experienced surgeon. Accuracy was the primary end point. Where an independent observer was requested to comment on the post operative x-ray blindly and to measure accuracy using software. Result showed no significant difference in post operative radiological accuracy in the 3 groups.

Thursday, October 7, 2010, 16:50-17:40

Session B8: Management of Complications in TKA

Methicillin-Resistant Staphylococcus Aureus in Total Knee Arthroplasty Treated With Revision and Direct Intraarticular Antibiotic Infusion

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Introduction: Resistant organisms are difficult to eradicate in infected total knee arthroplasty, and treatment of methicillin-resistant Staphylococcus aureus (MRSA) is especially challenging. Whereas most surgeons use antibiotic-impregnated cement during revision to treat infection, the delivery of the drug in adequate doses is limited in penetration and duration. This study presents the 2- to 8-year prospective results of one-stage revision and intraarticular antibiotic infusion protocol used to treat MRSA.

Methods: Eighteen knees (18 patients) with methicillin-resistant *Staphylococcus aureus* were treated between January 2001 and January 2007 with one-stage revision protocol that included débridement, uncemented revision of total knee components, and intraarticular infusion of 500 mg vancomycin via Hickman catheter once or twice daily for 6 weeks. (Figure 1) No intravenous antibiotics were used after the first 24 hours. Serum vancomycin levels were monitored to maintain levels between 3 and 10 µg/mL. The mean serum vancomycin peak concentration was 6 ± 2 µg/mL and the mean serum vancomycin trough concentration was 3 ± 1 µg/mL at 2 weeks postoperative.

Results: Knee synovial fluid peak and trough vancomycin levels were measured in two knees. Synovial fluid peak concentrations were 10,233 µg/mL and 20,167 µg/mL and trough concentrations were 724 µg/mL and 543µg/mL, respectively. Minimum followup was 27 months (range, 27-75 months). Mean followup was 62 months, (range, 27–96 months). At 2-year followup, mean Knee Society score was 83 ± 9 . No radiographic evidence of implant migration has occurred. One knee became reinfected with methicillin-resistant *Staphylococcus aureus* and was reoperated at 5 months. A necrotic bone segment was found, the knee was debrided and revised, and the antibiotic infusion protocol was readministered. The knee remained free of infection at 42 months postoperatively.

Conclusions: One-stage revision with uncemented components and 6 weeks intraarticular vancomycin administration safely and effectively treated MRSA-infected TKA with no apparent complications.

Figures

Thursday, October 7, 2010, 10:20-11:00

Session A3: Bearing Mobility Issues

Roughness and Surface Polarity of Retrieved Zirconia Femoral Heads

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Introduction: Recent clinical studies found no apparent reduction in wear using yttria-stabilized zirconia (Y-TZP) instead of cobalt chromium alloy femoral heads bearing against cross-linked UHMWPE. The purpose of this study was to compare the surface topography of retrieved Y-TZP and magnesia-stabilized zirconia (Mg-PSZ) femoral heads and evaluate the influence of time *in vivo*. The increase in average roughness (Ra, Sa) of Y-TZP due to phase transformation *in vivo* is well documented, while Mg-PSZ does not roughen or undergo phase transformation *in vivo*. However, the effects of phase transformation on the polarity (skewness, Ssk) of the surface of retrieved ZrO₂ heads has not been reported. We hypothesized that phase

transformation associated with the increased roughness of Y-TZP would influence skewness and thus the wear potential of the heads.

Materials and Methods: Y-TZP (n = 18) and Mg-PSZ (n = 17) femoral heads were retrieved from revision THA. Heads were cleaned and scanned by optical profilometry (magnification = 10x) at three locations per specimen. After subtracting the curvature of the heads, roughness statistics (Sa, Ssk) were calculated and averaged for each specimen and then correlated to age *in vivo*, with $p < 0.05$ for significance.

Results and Discussion: As expected, the roughness Sa of Y-TZP heads increased exponentially with age *in vivo* ($p < 0.001$, $r^2 = 0.766$), while Mg-PSZ heads did not roughen with age ($r^2 = 0.007$; Figure 1). The skewness data of Y-TZP retrievals were noisy with a weak positive correlation to age *in vivo* ($r^2 = 0.016$), but were consistently positive (average Ssk of all Y-TZP specimens = 0.770), indicating its roughness was caused by positive features. Positive features such as raised edges have been reported to adversely affect wear rates in the lab, and combined with the increased average roughness suggests an accelerated wear potential with age *in vivo*. In contrast, the skewness data for the Mg-PSZ retrievals were negative (average Ssk = -1.00), indicating its roughness was caused by small negative features, with no relationship to age *in vivo* ($r^2 < 0.001$). A surface best described by negative features would tend to entrap lubricant for better wear characteristics. Recent hip wear simulator tests reported Mg-PSZ femoral heads to exhibit significantly less wear compared with CoCr femoral heads. These *in vitro* data suggest that the low average roughness and negative polarity of Mg-PSZ femoral heads should provide superior wear characteristics *in vivo*.

Conclusions: This study illustrated that Mg-PSZ zirconia ceramics remained stable and did not roughen or develop raised edges *in vivo*, in contrast to Y-TZP ceramic femoral heads. We believe that clinical studies with Mg-PSZ femoral heads would illustrate a significant reduction in wear of cross-linked UHMWPE liners. Future work will expand this study with additional specimens, and attempt to reduce the noise of the skewness data to more clearly discern any trends between Ssk and age *in vivo*.

Figures

Saturday, October 9, 2010, 11:15-11:50

Session B19: Hip Mechanics

The Effect on Radiographic Osseointegration of Geometric Variations in Acetabular Component Design

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Purpose:

To review prospectively collected data on patients undergoing primary total hip arthroplasty utilizing two different cementless acetabular components.

Materials & Methods:

All patients undergoing primary total hip replacement surgery at our institution are entered prospectively into a database which includes history and physical examination, radiology, WOMAC and SF-36 scores. The patients are re-examined, re-x-rayed and re-scored at 3 months, 6 months and 1 year after surgery and yearly thereafter.

Using this database we are able to identify patients who have undergone total hip replacement using one of two geometric variants of the acetabular component. The first design is hemispherical and the second design has a peripheral rim expansion designed to increase initial press-fit stability.

Results:

Five hundred and twenty-seven consecutive primary total hip replacements were identified using either of the geometric variants of the acetabular component. Results at a mean of 7 years revealed a 95.6% survivorship with no significant difference between the two component designs with revision for aseptic loosening as the end point. Functional scores between the two groups of patients also demonstrated no statistically significant difference.

Radiologic assessment, however, showed a difference between the two designs. The hemispherical design which matches the reamer line-to-line had 80% complete osseointegration on final radiologic review while the second design with a peripheral rim expansion had only 57% complete osseointegration. This was statistically significant. The peripherally expanded components also had a greater number of screws inserted at the time of surgery, felt by us to be a reflection of initial surgeon dissatisfaction with component stability at the time of insertion of the component.

Bearing Surfaces in Primary Total Hip Arthroplasty

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Aim: This prospective randomised controlled trial aims to compare the clinical and radiological outcomes of ceramic on ceramic, cobalt chrome on ultra-high molecular weight polyethylene, and cobalt chrome on highly cross-linked polyethylene bearing surfaces at a minimum of five years.

Methods: One hundred and two primary total hip replacements were performed in ninety one patients between February 2003 and March 2005. All patients were younger than 65 (mean 52.7, 19-64). They were randomised to receive one of the three bearing surfaces. All patients had 28mm articulations with a Reflection uncemented acetabular component and a Synergy stem (Smith & Nephew, Memphis, Tennessee). Patients were followed up periodically up to at least sixty months following surgery. Outcome measures included WOMAC and SF12 scores. Radiological assessment included implant position, evidence of osteolysis and measurement of linear wear.

Results: Ninety seven hip replacements in eighty seven patients were available for review at a minimum of five years. Two hips were revised (one for infection and one for periprosthetic fracture), leaving a total of ninety four hips available for final review. There were no differences in age, gender, body mass index, diagnosis, level of activity, and comorbidities between the three groups. At a minimum of five years there were no statistical differences in the clinical outcomes using the WOMAC or SF12 scores. Three patients in the ceramic group reported squeaking. Radiological evaluation revealed mean annual wear rates in the ceramic group of 0.006mm/yr, standard polyethylene of 0.151mm/yr and highly cross linked polyethylene of 0.059mm/yr. ANOVA analysis revealed these differences in wear rates to be significant ($p < 0.0001$).

Conclusions: In the mid term there are no differences in clinical outcome between ceramic on ceramic, cobalt chrome on ultra-high molecular weight polyethylene, and cobalt chrome on highly cross-linked polyethylene bearing surfaces in total hip arthroplasty. Radiologically there was little evidence of linear wear in the ceramic group. Cobalt chrome on ultra high weight polyethylene has a significantly greater annual linear wear rate than that of cobalt chrome on highly cross-linked polyethylene.

The Cam Impinging Femur Has Multiple Morphologic Abnormalities

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Introduction: Femoro-acetabular impingement (FAI) is a common source of impaired motion of the hip, often attributed to the presence of an aspherical femoral head. However, other types of femoral deformity, including posterior slip, retroversion, and neck enlargement, can also limit hip motion. This study was performed to establish whether the “cam” impinging femur has a single deformity of the head/neck junction or multiple abnormalities.

Materials and Methods: Computer models of 71 femora (28 normal and 43 “cam” impinging) were prepared from CT scans. Morphologic parameters describing the dimensions of the head, neck, and medullary canal were calculated for each specimen. The anteversion angle, alpha angle of Notzli, beta angle of Beaulé, and normalized anterior heads offset were also calculated. Average dimensions were compared between the normal and impinging femora.

Results: Compared to the normal controls, the impinging femora had wider necks (AP: 15.2 vs 13.3 mm, $p < 0.0001$), larger heads (diameter: 48.3mm vs 46.0mm, $p = 0.032$) and decreased head/neck ratios (1.60 vs 1.74, $p = 0.0002$). However, there was no difference in neck/shaft angle (125.7° vs 126.5° , $p = 0.582$) or anteversion angle (8.70 vs 8.44° , $p = 0.866$). Most significantly, 53% of impinging femora also had a significant posterior slip (>2 mm), compared to only 14% of normal controls. Average head displacements for the two groups were: FAI: 1.93mm vs Normals: 0.78mm ($p < 0.0001$).

Conclusions: The CAM impinging femur has many abnormalities apart from the “bump” at the head/neck junction. These femora have increased neck width and head /neck ratio, a smaller spherical bearing surface, and reduced neck offset from the medullary canal. Therefore, surgical treatment limited to localized re-contouring of the head–neck profile may fail to address significant components of the underlying abnormality.

Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

The Flexion-Extension Axis of the Knee and the Rotational Orientation of Tibial Components

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Introduction: Proper rotational alignment of the tibial component is a critical factor affecting the outcome of TKA. Traditionally, the tibial component is oriented with respect to fixed landmarks on the tibia without reference to the plane of knee motion. In this study, we examined differences between rotational axes based on anatomic landmarks and the true axis of knee motion during a functional activity.

Materials and Methods: 24 fresh-frozen lower limb specimens were mounted in a joint simulator which enable replication of lunging and squatting through application of muscle and body-weight forces. Kinematic data was collected using a 3D motion analysis system. Computer models of the femur and tibia were generated by CT reconstruction. The motion axis of each knee (TFA) was defined by the 3D path of the femur with respect to the tibia as the knee was flexed from 30 to 90 degrees. The orientation the TFA was compared to 5 different anatomic axes commonly proposed for alignment of the tibial component.

Results: The average alignment error of the 5 different anatomic axes ranged from 0.1° ER to 10.7° IR from the true direction of knee flexion. The most accurate indicator of the direction of motion was derived by projecting the trans-epicondylar axis of the femur onto the tibial plateau. On average, this axis was externally rotated by $0.1 \pm 6.9^{\circ}$. However, values varied over 21.6° . In comparison, an axis passing through the medial-third of the tibial tubercle from the center of the plateau was internally rotated by $0.3 \pm 6.0^{\circ}$ (range: 23.9°).

Conclusion: This study demonstrates that rotational axes derived from anatomic landmarks on the proximal tibia provide an estimate of the direction of movement of the femur that is highly variable. Constructions based on the epicondylar axis and the medial third of the tibial tubercle are accurate when averaged over large numbers of cases. However, these methods can lead to up to 10 degrees of internal rotation of the tibial component in individual cases.

Thursday, October 7, 2010, 7:30-8:20

Session B1: Computer Navigation in TKA

Which Steps Do Trainees Find Most Difficult in Performing Knee Replacement?

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Introduction: Although the "learning curve" in surgical procedures is well recognized, little data exists documenting the accuracy of surgeons in performing individual steps of orthopedic procedures. In this study we have used a validated computer-based training system to measure variations instrument placement and alignment in TKA, specifically those relating to tibial preparation.

Methods: Eleven trainees (surgical students, residents and fellows) were recruited to perform a series of 43 knee replacement procedures in a computerized training center. After initial instruction, each trainee performed a series of four TKA procedures in cadavers (n=2) and bone replicas (n=2) using a contemporary TKA instrument set and the assistance of an experienced surgical instructor. The Computerized Bioskills system was utilized to monitor the placement and orientation of the proximal tibial osteotomy and the tibial tray.

Results: The tibial component was implanted with an average posterior slope of $3.2^{\circ} \pm 2.7^{\circ}$. In 14% of cases the tibial resection sloped anteriorly, and in another 5%, the posterior slope exceeded 10° . In 83% of trials, the trainees cut the tibia with less posterior slope than intended, ranging from

-10.0° to $+5.6^{\circ}$ (average: $-2.0^{\circ} \pm 4.0^{\circ}$). The average rotational orientation of the tibial component was $5.4^{\circ} \pm 5.3^{\circ}$ of external rotation, however individual values ranged from 7.6° of int rot to 14.4° of ext rot. Overall, 19% of components were placed in internal rotation.

Conclusions: Tibial preparation still presents significant difficulty to many less experienced surgeons, despite the use of modern instrumentation and careful didactic instruction. The errors measured in the computerized bioskills lab unfortunately replicate clinical cases often presenting with symptoms necessitating early revision,. Greater attention is needed to training of surgical skills and intraoperative assessment of component position to improve clinical outcomes of TKA.

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Usefulness of IBG With X-Changed Rim Mesh for Reconstruction of Large Tibial Bone Defect During TKA Procedure

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The objective of this study was to consider whether an impaction bone graft (IBG) with their own bone tips surrounded with an X-changed rim mesh was useful when en bloc bone implantation was not possible for a total knee replacement with large bone defect.

Materials and Method

4 cases and 5 knees (OA: 2 cases 3 knees, RA: 2 cases 2 knees) more than 2 years after the IBG procedure was done using X-changed rim mesh for the large medial tibial defect. All 4 cases were ladies, with the average age being 66.2 years old at that point of the procedure. A medial and posterior release for the connective tissues of knee was performed. The post and pre radiographic evaluations were done by knee society score and JOA score. All the defect or abrasion of the weighted surface was more than 5 mm from the last stage of osteoarthritis. We used a posterior-stabilized type of TKA (Zimmer nexgen), then took radiographs at pre and post operation periods and evaluated the knee scores, FTA, radiolucent line, range of motion and more than 2 years after the operation.

Result

The graft bones were not depressed after more than 2 years and all the patients were satisfied the condition of their knees and made no mention of any knee pain. The average range of motion of their knee joint was: Pre-operation, passive flexion 133°, passive extension - 21°; Post-operation, passive flexion 149°, passive extension -3°. All of the patients did not complain during movement and their walking ability including going up and down stairs was not reduced more than 2 years later. The component placement angle was not changed. The radiolucent line of the femur and tibiae did not appear.

The average femoro-tibial angle improved from 197° to 173° over the course of two years. The femoral/tibial component setting angle was not changed more than 2 years after the TKA operation procedure. Radiolucent zone and component sinking was not seen on both side of femur and tibiae.

Conclusion

After this survey we've found that an IBG procedure with an X-changed rim mesh is a good treatment for large bone defect of the tibiae. We can use this technique if we are not able to take out en bloc bone from their own tibiae or if their en bloc bone is crushed into pieces when trying to fix the bone to their tibiae because of bone fragility.

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Controlled Release of Antibiotics From HA Used in Bone Cement With HA

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[INTRODUCTION] :We have conducted interface bioactive bone cement method (IBBC) in total hip arthroplasty (THA) to prevent generation of connective tissue and osteolysis for the longevity of cemented THA since 1985, in which non-resorbable crystalline osteoconductive hydroxyapatite (HA) granules were interposed on the interface between bone and bone cement. To prevent the patients from infection, we use HA granules impregnated with antibiotics. However, there have been no reports on the loading and release of antibiotics from fine granules of HA. Here, we have investigated the loading of antibiotics on HA and their release *in vitro*.

[MATERIALS AND METHODS] :HA was impregnated with antibiotics such as flomoxef sodium (**F**), vancomycin hydrochloride (**V**) cefotiam dihydrochloride (**C**) and cefozopran hydrochloride (**CE**) under normal or reduced pressure. After washing with PBS three times, HA loaded with the antibiotic was placed in PBS. An aliquot of solution was sampled at appropriate time intervals and the amount of the released antibiotic was estimated based on the anti-bacterial activity.

[RESULTS AND DISCUSSION] : When drug loading was done by dropping antibiotic solution to HA granules, the amount of antibiotic released from 20 mg of HA was 16 μg for **F**, 0 μg for **V**, 13 μg for **C** and 65 μg for **CE**. The release of **F** continued for 48 hrs and that of **V** and **CE** completed within 24 hrs. On the other hand, when antibiotics loading were conducted under reduced pressure, the amount of released antibiotic was 14 μg for **F**, 0 μg for **V**, 0 μg for **C** and 1670 μg for **CE**. The burst release was observed for **CE** and **F**, and the release of them completed in 24 hrs. Then, the release of **C** and **CE** was observed in 0.025 M EDTA solution after the antibiotic was loaded under pressure. Observation was done for 19 days, at which one third of HA was dissolved. After 40 μg of burst release, the release of **C** continued for 19 days, at which the total amount of **C** released was 122 μg . Meanwhile, the release of **CE** continued over 19 days, during which 3350 μg of **CE** was released after the burst release of 3280 μg . Thus, **CE** seemed the most suitable antibiotic for our purpose. The burst release of **CE** absorbed in HA following the issue of **CE** surrounding the HA granules on the interface of bone and bone cement is very effective for the protection of early infection after joint replacement.

[REFERENCES] :Oonishi H. et al: THA with hydroxyapatite granules at cement-bone interface, 15-to 20-year result. *Clin Ortho Relat Res.* 2008; **466**:373-379.

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Anchor Like Sutures for Prophylaxis Against Patellar Ligament Rupture During Total Knee Arthroplasty

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Background: Patellar ligament rupture is an uncommon but devastating complication of total knee arthroplasty. Many predisposing factors may lead to rupture of the ligament during or shortly after surgery. The most common predisposing factor is extensive release of the ligament

to improve exposure in difficult cases or revisions. **Purpose:** The purpose of this study is to show the outcome of new technique for repair of overstretched patellar ligament during total knee arthroplasty. **Patients and method:** This is retrospective case series study for fourteen patients who had over stretched patellar ligament during difficult total knee arthroplasty. Ten patients had less than 50% partial injury of patellar ligament while four patients had more than 50% injury for the patellar ligament. four anteroposterior drill holes arranged in two rows were done from the tibial tuberosity to the medullary canal at the site of tibial component stem. No. 5 Ethibond sutures were passed in form of two loops that encircle the patellar ligament like a sleeve and left untied. The cemented tibial component was inserted then the suture loops were tied from distal to proximal while the knee in 90 degree flexion so as the ligament was anchored to the bone. **Results:** The mean follow up of these cases was 38 ± 2.6 STD months. Active extension to -5 degrees was achieved by all patients while the mean flexion range was 100 ± 4.8 STD. None of the patients had delayed rupture of the patellar ligament during follow up. **Conclusion:** The technique described was effective to regain normal extensor mechanism function after partial injury of the patellar ligament during TKA. It can be used as a prophylactic method against delayed rupture of the ligament when the ligament is overstretched during difficult cases of TKA.

Figures

[Figure 1](#)

Friday, October 8, 2010, 8:40-9:30

Session A11: Knee Arthroplasty in the Middle East

Constrained Condylar Arthroplasty in Severe Varus Deformity

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Background

Standard implants (PCL retaining or posterior stabilized types) can be used if soft tissue balancing techniques allow the implant to tension and stabilize the joint in flexion and extension. In severe varus, Greater constraint implant may be used. The indications for the use of these components were inability to balance the knee in both flexion and extension because of severe deformities or intraoperative incompetence of the medial collateral ligament after aggressive release.

Material and methods

fourteen patients with twenty knees had severe varus deformity with average preoperative tibio-femoral angle 25° . The average age was 56 years (from 48 to 64). There was nine males and

five females. The pre-operative diagnosis was primary osteoarthritis in 90% of patients and rheumatoid arthritis in 10% (two knees out of twenty). The average follow up was 39 month (from 27 to 57 month). Legacy Constrained Condylar Prosthesis (modular constrained knee of Zimmer) was used in all cases with stemmed both tibial and femoral components.

Results

At the final follow up with average 39 month, the average KSSS was improved from 31 to 89.5. The function knee score was improved from 40 to 80. The tibio-femoral angle improved from average 26° To 8° postoperative. All patients (100%) achieved medio-lateral stability with less than 5° varus-valgus laxity.

Conclusion

Constrained condylar knees function well in patients with severely deformed knees requiring primary TKA especially in elderly and low demanding patients. This study does not recommend and against the use of constrained implants in younger active patients with high physical demands.

Figures

[Figure 1](#) [Figure 2](#)

Thursday, October 7, 2010, 15:40-16:00

Session A7: Hip 2

Conservative Postero-Lateral Approach to Hip. Evaluation of 500 Cases.

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The Gibson and Moore postero-lateral approach is one of the most often used in hip replacement. The advantage of this approach is an easy execution but it's criticized because of its invasivity to muscle-tendinous tissues especially on extrarotators muscles and because of predisposition to posterior dislocation.

Since June 2003 we executed total hip replacements using a modified postero-lateral approach which allows to preserve the piriformis and quadratus femoris muscles and to detach just the conjoint tendon (gemelli and obturator internus). Articular capsule is preserved and it will be anatomically sutured at the end of the procedure as well as the conjoint tendon with two transosseous sutures. Piriformis and quadratus femoris muscles result untouched by this approach.

We have executed 500 surgeries with this modified approach.

We have used different stems (straight, anatomical, modular and short) and press fit acetabular cup with polyethylene or ceramic insert and we have always used 36 mm femoral heads when allowed by the cup dimensions. We have used any size both of stems and cups without limitation due to the surgical approach.

The mean age is 61.8 y.o., 324 females and 176 males.

Obese patients, hip dysplasia Crowe 3 and 4 and post traumatic arthrosis are exclusion factors for the execution of this approach. If possible we have maintained the capsulo-tendinous less invasivity. The BMI is not an excluding factor because it's just the gluteus region that is an important factor to decide if to execute or not a less invasive approach.

Analyzing our 500 cases we didn't have any case of malpositioning of the stem in varus or valgus (more than 5°) and considering acetabular cup we had the tendency to position it in valgus position (not more than 40°) in the first 20 cases.

No leg discrepancy more than 1 cm were observed.

Intra-operative blood loss have been reduced of about 30 % and 50% in the post-operative.

All the patients were able to active hip mobilization within the first day after surgery with a mean range of motion of 0-70°.

The patients were mobilized the first day after surgery and 80% of them were able to assisted walk within second day after surgery.

The mean time of stay in hospital was 6.8 days.

After 4 weeks 98% of the patients were able to walk without crutches.

One case of deep infection were evaluated and then solved with surgical debridement; no wound dehiscence.

We had 1 case of anterior hip dislocation in dysplastic arthrosis due to a technical mistake.

In 1 case we had femoral nerve palsy, then solved, probably because of anterior retractor malpositioning.

We had 5 cases of piriformis muscle contracture without sciatic nerve palsy, then solved.

We think that for total hip replacement this conservative postero-lateral approach, thanks to capsule-tendinous modification we have adopted, could be considered an anatomical approach, which doesn't present more dislocation risks compared to other approaches to the hip also thanks to the introduction of 36 mm femoral head that gives more stability and proprioceptiveness.

Besides this approach gives the possibility of a shorter rehabilitation as seen above and it could be consider optimal for total hip replacement.

A NOVEL ROUTE for PROCESSING Co-Cr-Mo ORTHOPAEDIC ALLOYS

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Millions of people suffer from bone and joint inflammatory problems and usually result in extreme cases with total joint replacement. Most commonly affected joints are the hip and the knee. Over the past 20 years there has been a revival in interest of metal-on-metal hip replacements. Various alloys have been used in joint replacement, the most successful in the Cobalt-based alloys. As compared to others the cobalt based alloys have higher wear resistance and therefore less risk of failure. The most common Co-based alloy used in clinical application is the ASTM F75 alloy, which is extensively used in femoral and acetabular components. Conventional methods to fabricate the alloy are via cast or wrought techniques. Wrought alloys are better than their cast materials due to their superior mechanical properties as the forging process promotes plastic deformation. An alternative method of fabrication is via powder processing and has shown significant improvements to produce finer grained materials, which relate to enhancement in properties, such as strength, toughness, ductility.

One of the key stages of powder processing is sintering of the powder to fuse the particles together. A superior but simple sintering processing is spark plasma sintering (SPS), which produces highly dense materials with minimum grain growth. This is achieved by a pulsed electrical current heating the material while applying a pressure to compact the powdered material. This process has the ability to densify nanopowders, in order to produce microstructures with finer grains and superior mechanical properties.

Using SPS and nanopowders for the first time, we have been able to prepare the ASTM F75 cobalt–chromium–molybdenum (Co–Cr–Mo) orthopaedic alloy composition. In this work we have investigated, the effect of processing variables on the structural features of the alloy (phases present, grain size and microstructure). We have been able to produce specimens of >99% of the theoretical density. The structures were free of carbides, which a vital breakthrough. Detrimental carbide phases in the microstructure as found in the more conventional methods of fabrication have shown to cause problems in wear. The compacts are of higher hardness than cast or wrought products despite the absence of carbides in the microstructure. The gain in hardness is because of the presence of oxides in the microstructure and we hope to quantify the oxide content in the future. The mechanisms of oxide formation are explained by considering chemical thermodynamics and kinetics. The next step is to evaluate the tribological performance (wear, friction, lubrication regimes) of this SPS-processed material and compare its performance with conventional MoM products (cast and wrought). The SPS route offers significant advantages over the conventional cast and wrought routes used to prepare this alloy for orthopaedic applications.

New Nanostructured Biomimetic Scaffold for the Treatment of Osteochondral Defects: Pilot Clinical Study at 3 Years Follow-Up

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INTRODUCTION

Osteochondral defects are still a challenge for the orthopaedic surgeon, since most of the current surgical techniques lead to fibrocartilage formation and poor subchondral regeneration, often associated to joint stiffness and/or pain.

Thinking of the ideal osteochondral graft from both the surgical and commercial point of view, it should be an off-the-shelf product; this is the research direction and the explanation for the new biomaterials recently proposed to repair osteochondral defect inducing an "in situ" cartilage regeneration starting from the time of the implantation into the defect site.

For the clinical pilot study we performed, a newly developed nanostructured biomimetic scaffold was used to treat chondral and osteochondral lesions of the knee; its safety and manageability, as much as the surgical procedure reproducibility and the clinical outcome, were evaluated in order to test its intrinsic potential without any cells culture aid.

MATERIALS AND METHODS

A new osteochondral scaffold was obtained by enucleating equine collagen type 1 fibrils with hydroxyapatite nanoparticles in 3 different layers with 3 different gradient ratios at physiological conditions.

30 patients (9F, 21M, mean age 29,3yy) affected by either chondral or osteochondral lesions of the knee (8 medial femoral condyles, 5 lateral femoral condyles, 12 patellae, 8 femoral throcleas) underwent the scaffold implantation from January to July 2007. The sizes of the lesions were in between 2 and 6 squared cm. All patients and their clinical outcome were analyzed prospectively at 6, 12, 24 and 36 months using the Cartilage standard Evaluation Form as proposed by ICRS and an high resolution MRI.

RESULTS

We observed a statistically significant scores improvement and function recovery comparing the pre-operative to the follow-up parameters evaluated. Moreover, we noticed a better improvement from 12 to 24mm follow up while the good results gained at 2yy were confirmed at 3yy follow up evaluation. The MOCART scoring scale was used to analyze the MRIs. In 80% of cases we obtained a complete filling of the cartilage defect and in some patients we even appreciated articular surface congruency. In this series we report 1 failure followed by a re-operation with different technique.

CONCLUSIONS

This new minimally invasive one-step surgical approach to osteochondral defects seems to be an easy and effective procedure. The results obtained are very encouraging and this procedure show satisfactory outcomes even in big osteochondral defects

Thursday, October 7, 2010, 10:20-10:50

Session B3: Cartilage Repair/Regeneration

New Biodegradable and Biocompatible Synthetic Scaffold for Meniscal Regeneration: Preliminary Clinical Experience

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INTRODUCTION

The menisci play a fundamental biomechanical role in the knee and also help in the maintaining of the articular homeostasis; thus, either a lesion or the complete absence of the menisci can invalidate the physiological function of the knee causing important damages, even at long term. Unfortunately, meniscal tears are often found during the ordinary orthopaedic practice while the regenerative potential of this kind of tissue is very low and limited to its peripheral-vascularized part; this is why the majority of these common arthroscopic findings are not reparable and often the surgeon is almost forced to perform a partial, subtotal or even total meniscectomy, regardless of the well-known consequences of this kind of surgery.

MATERIALS AND METHODS

Recently a porous, biodegradable scaffold made of an aliphatic polyurethane (Actifit™, Orteq Ltd) has been developed for the arthroscopic treatment of partial and irreparable meniscal tears; thanks to its particular structure, this scaffold facilitates the regeneration of the removed meniscal part, preventing the potential cartilage damage due to its complete or partial lack.

We performed a prospective clinical study on 17 patients affected by a massive loss of meniscal substance either medial or lateral associated with intraarticular or global knee pain and/or swelling.

We analyzed the patient both clinically and by using the International Knee Document Committee's (IKDC) Subjective and Objective Knee Evaluation Form. We also assessed the sport activity resumption by comparing the Tegner score at the time of the very first visit with the presurgery and prelesional ones. Finally, we also organized a control MRI at 6 and 12 months after surgery.

DISCUSSION

Our preliminary results are encouraging and they confirm the clinical experiences of other study groups. Apparently, the properties of this scaffold help in vessels formation and tissue regeneration potentially allowing the restoration of the surgically removed portion and preventing, or delaying at least, both chondral and articular degeneration.

We also performed some biopsy associated arthroscopic “second-looks” that reinforced the already good clinical results; the biopsies also confirmed the new tissue ingrowth into the biomaterial, potentially leading to the replacement of the previously removed damaged tissue.

CONCLUSIONS

Preliminary results suggest that this surgical procedure can be considered a really promising method for the treatment of both inveterate and symptomatic meniscal tears; however, other randomized studies with a longer follow-up should be done to confirm its reliability and potentialities.

Thursday, October 7, 2010, 8:30-9:20

Session B2: Knee Arthroplasty in the Indian Sub Continent

In Vitro Measurements of the Initial Fixation of the Profix Tibial Baseplate: Conventional Versus “Omega” Stem

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ABSTRACT

**In vitro measurements of the initial fixation of the Profix tibial
Baseplate: conventional versus “Omega” stem**

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Nowadays, initial fixation and relative movements of the tibial baseplate with respect to the bone are not a hot topic anymore. Most surgeons have already accepted cement fixation and don't aim for bone ingrowth anymore. This might change if the trend towards implants that offer always a deeper flexion persists. These implants tend to load the tibial baseplate more posteriorly during deep flexion potentially causing a higher risk of lift_off and thus loosening. The ideal concept pushing our team was the search for a design of either a stem or other fixation features able to hold the baseplate to the bone keeping the amount of bone that needs to be removed within acceptable limits.

The Profix tibial baseplate (Smith&Nephew) has a wide range of fixation techniques available. It can be cemented or used cementless and, in both cases, several stem designs are available. One of these is the so-called Omega stem. It has the advantage of being thin (in fact it is a stem and a chisel at the same time) but also stiff, withstanding bending loads due to its curvature in the transversal plane. It is also relatively short compared to other stems and it is thus bone-sparing and suitable for MIS.

Figures

Friday, October 8, 2010, 14:50-15:10

Session B13: Imaging Technology

Precision Phantom Study of a CR and DR Imaging System for Radiostereometric Analysis Using a Novel Spine Pedicle Screw

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Introduction

Radiostereometric Analysis (RSA) is an imaging method that is increasingly being utilized for monitoring fixation of orthopaedic implants in randomized clinical trials. Extensive RSA research has been conducted over the last 35+ years using standard clinical x-ray acquisition modalities that irradiate screen/film media or Computed Radiography (CR) plates. The precision of RSA can depend on a number of factors including modality image quality.

Objective

This study assesses the precision of RSA with a novel Digital Radiography (DR) system compared to a CR imaging system using different imaging techniques. Additionally, the study assesses the precision of locating beads embedded in a modified spine pedicle screw.

Methods

A modified titanium spinal pedicle screw 4.5 mm diameter, 35 mm length, marked with two 1.0 mm tantalum beads, one inside the head and one near the screw tip was inserted into a bovine tibia segment. Six additional 1.0 mm tantalum beads were inserted into the bone segment superiorly, distally and adjacent to the pedicle screw.

The phantom was placed on a standard clinical diagnostic imaging bed above a custom RSA carbon fiber calibration cage (Halifax Biomedical Inc.). A pair of DR or CR imaging plates were placed below the calibration cage and irradiated 8 times at 100, 125 kV at 2.5 mAs. For DR additional test were performed at 150 kV, and again at 100 kV at 0.5 mAs. At the time of abstract submission CR results at these settings were not available.

To determine precision, the standard deviation of 3D vector distances between beads was determined using RSA for each of the different imaging parameters.

Results

Standard deviations of the inter-bead distances measured in the pedicle screw were 44.4 and 32.1 μm (N=8) respectively for the 100 and 125 kV settings at 2.5 mAs using the DR system, compared to 109.0, 55.8 μm for CR [Fig. 1]. The distances between the bone implanted beads provided standard deviations of 24.4 and 22.7 μm respectively for the 100 and 125 kV settings at 2.5 mAs using the DR system, compared to 33.1 and 33.0 μm with the CR system. Further increasing the photon energy to 150 kV with the DR system reduces the precision error to 22.4 μm in the pedicle screw and remains approximately the same at 21.0 μm in bone. Lowering the mAs while maintaining 100 kV increases the precision error in the pedicle screw (64 μm) and showed no significant difference in bone (24.4 μm).

Conclusion

The current phantom design is basic in nature and does not account for any soft tissue scatter. However, initial results indicate a considerable reduction in precision error when using DR compared to CR imaging equipment for RSA analysis. Increasing the kV did not significantly influence the precision in measuring bead locations in bone. For embedded tantalum beads within a titanium pedicle screw, imaging at higher kV values with the described DR imaging system did allow more precise localization. This approach may be useful in assessing the in vivo position of spine or other titanium implants.

Figures

Periprosthetic Fractures Around Exeter Stems: A New Injury?

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Chris Boulton - Queen's Medical Centre, Nottingham - Nottingham, UK

The clinical results of the cemented Exeter stem in primary hip surgery have been excellent. The Exeter 'philosophy' has also been extended into the treatment of displaced intracapsular hip fractures with 'cemented bipolars' and the Exeter Trauma Stem (Howmedica).

We have identified an increase in the number of periprosthetic fractures that we see around the Exeter stem. We have also identified a particular group of patients with comminuted fractures around 'well fixed' Exeter stems after primary hip surgery that present a particular difficult clinical problem.

Prior to fracture, the stems are not loose, the cement mantle remains sound and bone quality surrounding the reconstruction is good, i.e. classifying it as a Vancouver B1. However the comminuted nature of the fracture makes reduction and fixation with traditional methods difficult. Therefore in these particular circumstances it is often better to manage these as B2 or even B3 fractures, with distal bypass and uncemented reconstruction.

Over an eleven-year period since 1999, 185 patients have been admitted to Nottingham University Hospitals with a periprosthetic femoral fracture around a hip replacement. These patients were identified from a prospective database of all trauma patients admitted to the institution. Of these patients we have identified a cohort of 21 patients (11%) with a periprosthetic fracture around an Exeter polished stem. Hospital notes were independently reviewed and data retrieved. Outcome data was collected with end points of fracture union, revision surgery and death. Data was also collected on immediate and long term post-operative complications.

The mean age was 76 years at time of fracture, and 52% were male. The mean duration between primary index surgery and fracture was 18 months (median 11 months).

15 patients were classified as Vancouver B1, and six as B2 fractures. Of the B1 fractures, 14 underwent fixation and one was treated non-operatively. Of the B2 fractures, four were revised, one was revised and fixed using a plate, and one was fixed using a double-plating technique. Prior to fracture, none of the implants were deemed loose although one patient was under review of a stress fracture which subsequently displaced.

One patient died prior to fracture union. All the other patients subsequently went onto unite at a mean of 4 months. There were no deep infections, non- or malunions. No patient underwent further surgery. Dislocation occurred in one patient and a superficial wound infection occurred in one patient which responded to antibiotic treatment. Three other patients have subsequently died at seven, twelve and fifty-three months post fracture due to unrelated causes.

In our series of patients, in addition to the more standard fracture patterns, we have identified a very much more comminuted fracture. Indeed, we have described the appearance as if the tapered stem behaves like an axe, splitting the proximal femur as a consequence of a direct axial load. As a consequence of the injury, the cement mantle itself is severely disrupted. There is significant comminution and soft tissue stripping, calling into question the viability of the residual fragments. Treatment of this type of fracture using a combination of plates, screws and cables is unlikely to provide a sufficiently sound reconstruction. In our experience we believe these fractures around previously 'well fixed' Exeter stems should be treated as B2/B3 injuries.

Fixation Methods in the Treatment of Vancouver B1 Periprosthetic Hip Fractures: Our Experience of 69 Cases

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We have identified 69 patients with Vancouver B1 periprosthetic fractures around stable femoral implants. Open reduction internal fixation is the recommended treatment; however recent studies have revealed high rates of nonunion. We have reviewed the fixation techniques utilized to treat these patients, and identified outcomes in relation to rates of union, further surgery and mortality.

Patients were identified from a prospective database of all trauma admissions at Nottingham University Hospitals from 1999 to 2010. Hospital notes were independently reviewed and data retrieved.

69 patients were identified. Mean age 77 years and 63% were female. 51 (74%) occurred around total hip replacements and 18 (26%) around hip hemiarthroplasty after a previous hip fracture.

Periprosthetic fracture occurred around an Exeter stem (n=18), Charnley (n=10), Austin Moore (n=15), other (n=6). 20 patients had undergone previous revision surgery. The mean time from index surgery to fracture was 58 months (median 24) around primary stems, and 48 months (median 22) around revision stems.

6 patients (9%) were treated non-operatively. Five of these had undisplaced fractures (all healed but one required revision due to loosening) and one was too unwell.

63 patients (91%) were treated by open reduction internal fixation. Of these, single plate fixation was performed in 40 cases (64%). In the vast majority of cases, lag screw fixation of the fracture with a long (>12 hole) pre-contoured 4.5mm locking plate was utilised with cables. Both locking and cortical screws were used to achieve stable fixation (Figure 1). A double plate technique was used in 16 cases (25%), where plates were placed perpendicularly to each other (laterally and anteriorly). Strut grafts were used in 13 cases (21%). 7 patients (11%) were treated with cables alone.

23 patients have subsequently died (33%). Two have been lost to follow up and three are awaiting union. There is a mean follow-up of 35 months.

Deep infection occurred in 4 cases (6%). Non-union occurred in four cases (6%). Two of these were infected and one was treated with cables alone. Malunion occurred in one case treated with cables. One patient had a dislocation and two superficial infections occurred.

Further surgery took place in 8 patients (12%). Three of the infected cases were revised and one underwent wound washout. The two other non-unions were revised. Three further revisions were performed: one for malunion, one for aseptic loosening (treated non-operatively) and another for a second periprosthetic fracture. Superficial wound washout was performed in one case.

Mortality was 10% at 3 months, 22% at 1 year and 47% at 3 years.

We have identified that union can be achieved in the majority of cases after periprosthetic fracture fixation. Cable fixation was associated with a high complication rate (7 cases: two requiring revision surgery: one nonunion, one malunion).

We recommend that Vancouver B1 periprosthetic fractures are treated with meticulous technique to achieve anatomical reduction and fracture compression using lag screw technique and plating. Further mechanical support can be provided through the use of a second plate, cables and/or strut grafts.

Figures

Saturday, October 9, 2010, 9:00-9:30

Session B17: Novel techniques in Arthroplasty

Acetabular Reconstruction in Severe Bone Defects Using a New Cup With Iliac Screw: Presentation and Preliminary Results

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INTRODUCTION: Since July 2008 we are experimenting a new cup with iliac screw fixation, developed on the idea of Ring and Mc Minn. Iliac fixation is permitted by a polar screw of large diameter, coated by HA, which allows a compression to bone and a firm primary stability. Moreover it's possible to increase primary stability with further smaller peripherals screws. We present this new cup and report the preliminary results.

MATERIALS AND METHOD: Since July 2008 to April 2010, 51 cups were implanted. The diagnosis was aseptic loosening in 36 cases, septic loosening treated by two-stage revision in 7, hip congenital dislocation in 5, one case of post-traumatic osteoarthritis, one case of instability due to cup malposition and a case was an outcome of Girdlestone resection arthroplasty. Mean age was of 66 years (31-90).

RESULTS: We report the results of our first 23 cases, with a minimal follow-up of 12 months. Patients were preoperatively evaluated from both clinical and radiological point of view. Bone defect was analyzed according to the system of Paprosky. In 7 cases bone defect belonged to type 2C, in 8 cases to type 3A and in 8 cases to type 3B. We didn't observe any case of early loosening nor mechanical failure of the implant. The functional outcome, evaluated by Harris Hip Score, was good with a mean score of 82 (72-91).

Osteogenic Differentiation of Adult Human Adipose-Derived Stem Cells Is Achieved by Overexpression of the BMP Receptor 1A

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Numerous investigators have described osteogenic differentiation of bone marrow stromal cells obtained from both murine and human sources over the past decade. The ease of access and large available quantity of adipose tissue, however, makes Adipose-Derived Stem Cells (ADSC) a far more practical alternative for clinical applications, such as operative treatment of non-unions and regeneration of critical bone defects. Therefore, the primary goal of this research endeavor is to achieve osteogenic differentiation of ADSC. Previous work has already demonstrated that bone morphogenetic protein receptor 1A (BMP receptor 1A) signaling is required for healing critical bone defects. Based on this evidence, we used a lentiviral vector to increase expression of BMP receptor 1A by our stem cell population in order to direct their differentiation into the osteoblastic lineage.

We harvested subcutaneous adipose tissue intraoperatively from consenting patients undergoing elective lipoplasty and panniculectomy procedures. The stromal vascular fraction was isolated from this tissue and further refined by passaging in selective media to yield a stable population of ADSC in primary culture. Both the identity and homogeneity of this stem cell population was confirmed using adipogenic induction media and differentiation cocktails. In addition, we subcloned an expression plasmid containing the BMP receptor 1A locus in tandem with green fluorescent protein (GFP) under the transcriptional control of a single promoter. This plasmid was packaged into a lentiviral vector to provide a reliable method of achieving both genomic integration and long-term expression of the BMP receptor 1A gene. Hence, transduction of ADSC using this vector resulted in overexpression of BMP receptor 1A by these multipotent cells. The GFP was then utilized as a reporter gene to screen and enrich the ADSC population for only those stem cells with a robust expression of BMP receptor 1A. The ADSC that overexpressed BMP receptor 1A were found to achieve osteogenic differentiation after 18 to 20 days of in vitro culture, as revealed by immunohistochemistry assays for osteocalcin. Osteogenic differentiation was further confirmed by alizarin red staining and quantitative PCR for alkaline phosphatase gene expression as a biomarker for the osteoblastic lineage.

Our results demonstrate that stem cells derived from the adipose tissue of a patient represent a viable means of culturing autologous osteoblasts in vitro for future implantation at the site of critical bone defects. This method of attaining osseous regeneration is intuitively appealing, given the minimal donor site morbidity associated with removing subcutaneous fat. By transducing the ADSC with a lentiviral vector, we have also collected further evidence implicating the critical importance of signaling mediated by the BMP receptor 1A during osteogenesis. Further tissue engineering studies are now in progress to evaluate the osteogenic differentiation potential of these stem cells under hydrostatic and fluid flow shearing mechanical loads.

Saturday, October 9, 2010, 10:20-11:05

Session A19: Miscellaneous Arthroplasty

Magnetic Resonance Imaging in the Assessment of Total Ankle Arthroplasty

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MRI has been little utilised in the post-operative assessment of joint replacement due to the problem of artifact. With modern machines and sequencing, artifact can be minimised in small joints with titanium prostheses. Twenty four consecutive patients implanted with a Buechel-Pappas Total Ankle Replacement underwent MRI examination at an average of 583 days post surgery to determine its usefulness as an adjunct to x-ray and bone scan in assessing prosthetic integrity and the source of post-operative symptoms.

The purpose of the study was to evaluate the use of modified MRI techniques in the assessment of bone-implant interface, soft tissue changes, bone oedema and extent of osteolysis in setting of total ankle joint replacement and propose a descriptive classification to document the changes.

We found MRI was extremely useful in identifying abnormalities in structures apart from the prosthesis such as occult degeneration in the subtalar joint and ligament pathology. Despite the new techniques, artifact remains a problem when assessing the bone prosthesis interface although adjacent bone oedema is well seen.

MRI has a role in the identification of pathology in the tissues surrounding a TAJR especially with unexplained pain in an otherwise well functioning prosthesis. It's role in the assessment of prosthetic integrity remains qualitative but further work will be required to correlate MRI findings with clinical examination.

Total Knee Arthroplasty After Extra-Articular Deformity for Degenerative Arthritis

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Introduction:

Arthritic knees requiring total knee replacement may present with additional deformities located along the femur or tibia away from the articular region. These deformities may be congenital, developmental, associated with metabolic bone disease, or acquired as a result of malunited fractures or previous advocated for arthritic knee with ipsilateral extra-articular deformity.

Methods: We undertook retrospective study to evaluate the results of total knee arthroplasty in arthritic knee with extra-articular deformity in 26 knees (24 patients). Sixteen deformities were in tibia and ten deformities were in femur. All patients underwent total knee arthroplasty with intraarticular bone resection and soft tissue balancing.

Results: Average period of follow up was 30 months. Average preoperative arc of motion was 57.5 degrees, which improved to 102.5 degrees. The average preoperative knee society knee score 23.5 points, which improved to an average of 91.3 points at the time of last follow up. The average functional score was 27.0 points, which improved to average of 88.0 points. There were no complications such as infection, ligament instability or component loosening.

Conclusion: Intra-articular bone resection is an effective procedure for management of arthritic knees with extra-articular deformity.

Total Knee Arthroplasty in Ankylosed Knees

OBJECTIVE: To evaluate the results of results of total knee replacement (TKA) in stiff and Ankylosed knees.

A retrospective study was done to evaluate the results of total knee arthroplasty performed on 110 knees in 69 patients with spontaneously Ankylosed knees. The reasons of ankylosis was previous infection (pyogenic and tuberculous), inflammatory arthritis (rheumatoid arthritis, Juvenile rheumatoid arthritis, ankylosing spondylitis) and post-traumatic. The age at operation ranged from 30 to 65 years (average 42.8 years). Preoperative arc of movement was between 0 degrees and 20 degrees (average, 14 degrees). The difficulties encountered in surgical exposure were managed by using various extensile exposure techniques. Quadriceps snip was used in all case to avoid patellar avulsion. Follow-up ranged from 5 to 17 years (average, 9 years). The average postoperative arc of movement at final follow-up was 75.8 degrees, with a significant average gain of 61 degrees at final follow up. The average preoperative Hospital for Special Surgery Knee Score was 60 which improved to 75 at the final follow up. The average extensor lag was 8 degrees (range 0- 20 degrees). . Complications included skin edge necrosis (35%), pyogenic infection in 3 patients, and a quadriceps tendon rupture in 1 patient. 4 knees were revised on account of component loosening.

Conclusions: Total knee arthroplasty in Ankylosed knees does achieve correction of deformity with gain in range of motion leading to improved quality of life. Meticulous surgical technique is required to prevent complications. We believe that TKA in Ankylosed knees is a viable option.

Saturday, October 9, 2010, 16:00-16:50

Session A23: Knee Mechanics

The Effect of Greater External Rotation of the Femoral Component as a Result of Gap Ligament Balancing on Patellar Tracking and Flexion Instability in Total Knee Arthroplasty

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INTRODUCTION

Use of a novel ligament gap balancing instrumentation system in total knee arthroplasty resulted in femoral component external rotation values which were higher on average, compared to measured resection systems. In one hundred twenty knees in 110 patients the external rotation averaged 6.9 degrees (+/- 2.8) and ranged from 0.6 to 12.8 degrees. The external rotation values in this study were 4° and 2° larger, respectively, than the typical 3° and 5° discrete values that are common to measured resection systems. The purpose of the present study was to determine the effect of these greater external rotation values for the femoral component on patellar tracking and flexion instability.

METHODS

One hundred twenty knees in 110 patients were consecutively enrolled by a single surgeon using the same implant across subjects. All patients underwent arthroplasty with tibial resection first and that set external rotation of the femoral component based upon use of a ligament gap balancing system. Following ligament tensioning / balancing, the femur was prepared. The accuracy of the ligament balancing system was assessed by reapplying equal tension to the ligaments using a tensioning bolt and torque wrench in flexion and extension after the bone resections had been made. The resulting flexion and extension gaps were then measured to determine rectangular shape and equality of the gaps. Postoperative Merchant views were obtained on all of the patients and patellar tracking was assessed and compared to 120 consecutive total knee arthroplasties previously performed by the same surgeon with the same implant using a measured resection system.

RESULTS

Rectangular flexion and extension gaps were obtained within +/- 0.5mm in all cases. Equality of the flexion and extension gaps was also obtained within +/- 0.5mm in all cases. Merchant views of the total knee arthroplasties showed central patellar tracking with no tilt or subluxation in 90% of the ligament gap balanced knees and 74% of the measured resection knees.

DISCUSSION AND CONCLUSION

External rotation values are higher on average, when ligament tensioning / balancing is employed with this novel system compared to measured resection systems. In this study this resulted in consistent matching of the flexion gap to the extension gap and better patellar tracking. These findings suggest that limiting the surgeon to discrete rotation values may be at odds with where the femur “desires” to be, given soft tissue considerations for each patient.

Thursday, October 7, 2010, 15:10-15:50

Session B7: Robotic Knee Surgery

Total Knee Arthroplasty Following High Tibial Osteotomy.

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High tibial osteotomy is an efficient treatment for medial compartment osteoarthritis of the knee; its used for middle aged patients with high activity levels and can delay the need for total arthroplasty.

The results of total knee arthroplasty after failed high tibial osteotomy are controversies; several authors reported inferior outcomes, but others have concluded that tibial osteotomy doesn't bias following total arthroplasty. The aim of this study was to evaluate the results of failed high tibial osteotomy subsequently converted to total knee arthroplasty and compare the results to group of patients underwent primary arthroplasty; the authors evaluate some of technical problems that a previous high tibial osteotomy can generate, like scar tissue, patellar tendon shortening and changes of proximal tibial anatomy.

Methods: 50 total knee arthroplasty performed after a previous closed wedge osteotomy were matched with 50 patients operated with a primary knee prosthesis for osteoarthritis. The time from a proximal tibial osteotomy to a prosthesis operation was in mean eight years.

Results: the Knee Society clinical and radiographic score system and W.O.M.A.C. evaluation were used to evaluate knees before surgery and at each follow up (average 5 years).

At an average of five years follow up, the clinical results of total knee arthroplasty after high tibial osteotomy were similar to those of primary knee prosthesis.

Discussion: in our study revision of failed proximal tibial osteotomy appears to have more technical difficulties but with overall outcomes that remain comparable at results after primary total knee arthroplasty, so tibial osteotomy is considered a valid option in younger and very active patients with unicompartmental arthritis.

Saturday, October 9, 2010, 16:00-16:50

Session B22: Arthroplasty- Getting it Right!

Prosthetic Reconstruction of the Extremities in Musculoskeletal Oncology: The Experience of the Istituto Rizzoli.

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Objective: was to review the experience of the Rizzoli with megaprosthesis reconstruction of the extremities in musculoskeletal oncology.

Material and methods: Between April 1983 and December 2007, 1036 modular uncemented megaprotheses of the lower limbs were implanted in 605 males and 431 females: 160 KMFTR®, 633 HMRS® prostheses, 68 HMRS® Rotating Hinge and 175 GMRS®. Sites: distal

femur 659, proximal tibia 198, proximal femur 145, total femur 25, distal femur and proximal tibia 9. Histology showed 612 osteosarcomas, 113 chondrosarcomas, 72 Ewing's sarcoma, 31 metastatic carcinomas, 89 GCT, 36 MFH, 68 other diagnoses. Between 1975 and 2006 at Rizzoli 344 reconstructions of the humerus using prosthetic devices (alone or in association with allografts) were performed: 289 MRS®, 37 HMRS®, 2 Osteobridge®, 4 composite prostheses, 8 Coonrad-Morrey®, 4 custom made prostheses. Sites of reconstruction were: proximal humerus 311, distal humerus 19, diaphysis 5, total humerus 9. Histology showed 146 osteosarcomas, 56 chondrosarcomas, 23 Ewing's sarcoma, 67 metastatic carcinomas, 14 GCT, 10 MFH, 28 other diagnoses. Patients were followed periodically in the clinic. Information were obtained from clinical charts and imaging studies with special attention to major complications requiring revision surgery. Major prostheses-related complications were analysed and functional results evaluated according to the MSTTS system. Univariate analysis by Kaplan-Meier actuarial curves was used for studying implant survival to major complications.

Results: Major complications causing implants failure in lower limbs were 80 infections (7.7%), 64 aseptic loosening (6.2%) and 33 breakages (3.2%). In lower limbs infection occurred in 18 KMFTR®, 47 HMRS®, 5 HMRS® Rotating Hinge, 10 GMRS®. Breakage of the prosthetic reconstruction occurred in 16 KMFTR®, 16 HMRS®, 1 HMRS® Rotating Hinge. Aseptic loosening occurred in 15 KMFTR®, 28 HMRS®, 18 HMRS® Rotating Hinge, 3 GMRS®. Major complications causing implants failure in upper limbs were 15 infections (4.3%), 8 aseptic loosening (2.3%) and 4 breakages (1.2%). In upper limbs infection occurred in 14 MRS® and 1 Coonrad-Morrey®. Aseptic loosening in 8 cases MRS®. Breakage in 4 cases MRS® prostheses. Most patients in both lower and upper extremities series showed satisfactory function (good or excellent) according to the MSTTS evaluation system.

Implant survival to all major complications of lower limb megaprotheses evaluated with Kaplan-Meier curve was 80% at 10 years and 60% at 20 years. Implant survival for the newer designs (GMRS®) available only at middle term follow up showed an implant survival to major complications at about 90% at 5 years. Implant survival to all major complications was over 80% at 10 years and 78% at 20 years.

Conclusions: Megaprotheses are the most frequently used type of reconstruction after resection of the extremities, since they provide good function and a relatively low incidence of major complications. Both function and implant survival improved in the last decades with the introduction of newer designs and materials.

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Two Stage Revision for Infection in Modular Megaprotheses of the Lower Limb After Resection for Bone Tumour

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Objective of this study was to analyse results of two stage revisions in infected megaprotheses in lower limb.

Material and methods Between April 1983 and December 2007, 1036 modular uncemented megaprotheses were implanted in 605 males and 431 females with mean age 33.5 yrs: 160 KMFTR[®], 633 HMRS[®] prostheses, 68 HMRS[®] Rotating Hinge and 175 GMRS[®]. Sites: distal femur 659, proximal tibia 198, proximal femur 145, total femur 25, distal femur and proximal tibia 9. Histology showed 612 osteosarcomas, 113 chondrosarcomas, 72 Ewing's sarcoma, 31 metastatic carcinomas, 89 GCT, 36 MFH, 68 other diagnoses.

Infection occurred in 80 cases (7.7%) at mean time of 4 yrs (min 1 month, max 19 yrs) in 18 KMFTR[®], 47 HMRS[®], 5 HMRS[®] Rotating Hinge, 10 GMRS[®]. Sites: 51 distal femurs, 21 proximal tibias, 6 proximal femurs, 1 total femur and 1 extrarticular knee resection. Most frequent bacteria causing infection were: Staphylococcus Epidermidis (39 cases), Staphylococcus Aureus (17) and Pseudomonas Aeruginosa (5). Infection occurred postoperatively within 4 weeks in 9 cases, early (within 6 months) in 12 cases, late (after 6 months) in 59 cases.

Usual surgical treatment was "two stage" (removal of implant, one or more cement spacers with antibiotics, new implant), with antibiotics according with cultures. One stage treatment was used for immediate postoperative infections, only since 1998.

Functional results after treatment of infection were assessed using the MSTs system.

Results A two stage revision was attempted in 73 pts (91.2%): in 58 cases a new prostheses was implanted (with negative laboratory tests for infection) at mean time of 5 months (min 2, max 16 months), but in 3 pts infection recurred and they were amputated; 4 pts died before implanting a new prosthesis; 11 pts were amputated after several spacers since infection did not heal. One stage revision was performed in 4 of the 9 immediate postoperative infections, with successful results.

In 3 cases an amputation was primarily performed, to proceed with chemotherapy.

Revisions for infection were successful in 63 pts (79%), while 17 pts were amputated (21%).

Functional results evaluated in 53 revised cases were good or excellent in 43 (81.1%).

Conclusions Two stage treatment of infected megaprotheses is successful in most cases. One stage has selected indications, mainly in postoperative immediate infections.

Survival of the Implants in Primary and Secondary Reconstructions With GMRS[®] Modular Prostheses for the Lower Limb: Complications, Functional Results and a Comparative Statistical Analysis.

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Purpose of this study is to analyze the results of a modular reconstructive tumor prosthesis for the lower limb (GMRS[®]) with a comparative statistical analysis of primary and secondary implants.

Material and methods From October 2003 to September 2007 at Rizzoli 161 GMRS[®] prostheses were implanted, most after resection of osteosarcoma (94 cases, 58%). It is a modular system with a rotating hinge mechanism for the knee, cemented and uncemented stems, in titanium and chromium-cobalt-molybdenum, curved and straight-fluted, with or without hydroxyapatite coating. Moreover adaptors are available to revise HMRS[®] implants.

This series includes 88 males and 73 females ranging in age from 9 to 80 years. Sites of reconstruction were 109 distal femurs, 19 proximal femurs, 1 total femur and 32 proximal tibias. There were 149 oncologic and 12 non oncologic diagnoses, including 96 primary reconstructions and 65 revisions after failure of previous implant. A retrospective analysis of imaging and complications was performed and functional results assessed according to MSTTS system. Statistical analysis with Kaplan-Meier curves was used to study implant survival.

Results At a mean follow up of 2 yrs. 106 patients are continuously NED, 31 are NED after treatment of one or more local recurrence or metastasis, 7 AWD, 5 DWD. There were 10 major complications: 8 infections (4,7%) (5 in primary and 3 in secondary implants, 2 previously infected) and 2 aseptic loosening (1,2%) (1 each). There were 9 minor complications (4 wound sloughs, 1 stiff joint, 3 disrupted extensor apparatus, 1 patellar instability) requiring revision. Comparative statistical analysis of primary and secondary implants survival at major complications shows no statistically significant difference. Functional results were good or excellent in 95% of the evaluated patients, without any poor.

Conclusions Middle term results are promising: good function, very low incidence of major complications, no breakage of implant components. This prosthetic reconstruction is indicated in oncological cases as well as in selected in some non oncological settings, such as challenging revisions of prosthetic failures with massive bone loss or post-radiation non unions or allografts failures. Although a higher incidence of complications was expected in secondary implants, statistical analysis shows similar survival.

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Revision Hip Arthroplasty for Type IIIB Femoral Defects Using a Modular, Tapered Femoral Component

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Purpose: In revision hip surgery, Type IIIB femurs have presented the greatest historical challenge to achieving stable fixation and osseous integration. This study evaluated the intermediate term outcome of a modular, tapered, distal fixation revision femoral component used in a consecutive revision hip series with special attention to its performance in the defective Type IIIB femur.

Methods: Between February 2002 and January 2005, 51 consecutive revision hip arthroplasties were performed using modular, tapered, distal fixation femoral components. The femoral defects at the time of revision surgery were classified using a system previously described by Paprosky. The most recent radiographs were reviewed and clinic notes examined to assess femoral component stability.

Results: At a minimum of 4.2 years and a mean of 5.8 years follow-up, 2 patients were lost to follow-up. Revision cases classified by the Paprosky femoral defect classification system included 14 Type IIIB hips (28%). All hips reviewed (100%) had radiographic evidence of bony ingrowth. No stem migrated more than 2mm. There were no failures at the modular junction and no component disassociation.

Conclusion: A modular, tapered distal fixation femoral component had a 100% survival rate at mean 5.8 year follow-up after revision surgery. All femoral components showed successful osseous-integration. The ability with modularity to independently place the diaphyseal segment of a femoral component in the best remaining femoral host bone may have provided the greatest opportunity for osseous-integration. In this consecutive revision hip series there was no instance of modular junction fracture or component related failure in cases with minimal or no proximal bone support.

Thursday, October 7, 2010, 14:20-15:00

Session B6: Computer Navigation in TKR 2

OrthoPilot Navigated Total Knee Replacement- Technical Tips

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The presentation will focus on technical tips that make OrthoPilot Navigated Total knee replacement easier and faster. Navigation while providing accuracy and soft tissue balancing, does add time to the procedure and there is a learning curve to Navigation, The presentation will highlight steps where time is wasted and what can be done to speed up the procedure. Sources of error and steps to minimize errors will also be discussed. This will be presentation emphasizing technical tips and no research findings or data will be presented.

Thursday, October 7, 2010, 11:10-11:50

Session A4: Hip Resurfacing

Effectiveness of Patient Matched Hip Resurfacing Femoral Alignment Guide

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Introduction

Hip resurfacing is a bone sparing approach to treating arthritis in younger or more active patients. Accurate positioning of the femoral component in the hip resurfacing procedure is essential for the success of the operation [1-2]. An alignment guide assisting the operator in accurately positioning the resurfacing implant may increase the success rate of the operation. This study focuses on the effectiveness of a CT based resurfacing alignment guide, shown in Figure 1.

Materials and Methods

Four full fresh frozen human cadaveric specimens were CT scanned to reconstruct bone models of the femoral head/neck geometries with no cartilage included in the segmentation. Femoral head resurfacing alignment guides were then created through computer aided design (CAD) modeling using landmarks from the reconstructed bone models for proper seating. A total of 12 resurfacing alignment guides (3 for each specimen) were prepared.

After the exposure of the hip joints, the first two out of three resurfacing alignment guides were used to assess the fit, stability, and visual assessment of valgus and version alignments. The third resurfacing alignment guide for each specimen was placed on the femoral head/neck region and the guide wire was drilled into the femur. A fluoroscopy image was taken to assess and measure the valgus and version alignment. The acceptance criteria for valgus alignment, as shown in Figure 2, is set to be $\pm 2.5^\circ$ from a line parallel to the medial calcar of the femoral neck. Similarly, the acceptance criteria for the version alignment was set to be $\pm 2.5^\circ$ from a line passing through the neutral axis of the femoral neck.

Results and Discussion

The resurfacing alignment guides were firmly secured on the femoral head; they were stable and their auxiliary guide wire placement features were allowed for visual assessments of the alignment. The planned and the measured valgus angles were in agreement and the version alignment neutral to femoral neck axis was within the acceptable range.

Current manual alignment guides require user experience for locating the entry point and trajectory for femoral head resurfacing. The CT based patient matched alignment guide offers a precise and reliable implant positioning, reducing the possibility of notching of the femoral neck and leaving any air pocket around the distal periphery of the implant which could lead to neck fracture or implant loosening, respectively.

Figure 1. Femoral alignment guide

Figure 2. 3-D planned valgus angles

This study demonstrates the effectiveness of a guide made based on the patient specific CT scan assisting the operator in the precise alignment of the femoral implant. The potential benefits of this technology are consistent and accurate alignment of the implant, reduced OR time and ease of use with reduced instrumentation.

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Figures

Accuracy of Femoral Component Alignment Using Specimen Matched Cutting Blocks: An in Vitro Study.

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Purpose: Proper positioning of the components of a knee prosthesis for obtaining post-operative knee joint alignment is vital to obtain good and long term performance of a knee replacement. Although the reasons for failure of knee arthroplasty have not been studied in depth, the few studies that have been published claim that as much as 25% of knee replacement failures are related to malpositioning or malalignment [x].

The use of patient-matched cutting blocks is a recent development in orthopaedics. In contrast to the standard cutting blocks, they are designed to fit the individual anatomy based on 3D medical images. Thus, landmarks and reference axes can be identified with higher accuracy and precision. Moreover, stable positioning of the blocks with respect to the defined axes is easier to achieve. Both may contribute to better alignment of the components.

The objective of this study was to check the accuracy of femoral component orientation in a cadaver study using specimen-matched cutting blocks in six specimens; first for a bi-compartmental replacement, and then for a tri-compartmental replacement in the same specimen.

Materials and Methods: Frames with infrared reflective spherical markers were fixed to six cadaveric femurs and helical CT scans were made. A bone surface reconstruction was created and the relevant landmarks for describing alignment were marked using 3D visualisation software (Mimics). The centres of the spherical markers were also determined. Based on the geometry of the articular surface and the position of the landmarks, custom-made cutting blocks were designed. One cutting block was prepared to guide implantation of a bi-compartmental device and another one to guide implantation of the femoral component of a total knee replacement.

The knee was opened and the custom-made cutting block for the bi-compartmental implant was seated onto the surface. The block was used to make the anterior cut, after which it was removed and replaced with the conventional cutting block using the same pinning holes to ensure the same axial rotational alignment. The other cuts were made using the conventional cutting block and the bi-compartmental femoral component was implanted. Afterwards, a similar procedure was used to make the extra cuts for the total knee component.

The position of the components with respect to the reflective markers was measured by locating three reference points and "painting" the articular surface with a wand with reflective markers. The position of all marker spheres was continuously recorded with four infrared cameras and Nexus software.

Results: Average alignment for the bi-compartmental component in transverse and frontal planes were 0.2° (standard deviation: 2.4°) and 0.4° (standard deviation: 2.8°), respectively. Average alignment for the tri-compartmental component in transverse and frontal planes were 0.6° (standard deviation: 3.2°) and 0.9° (standard deviation: 5.5°), respectively.

Conclusions: The specimen matched cutting blocks, designed based on CT scan data, achieved a similar level of alignment accuracy as reported for navigation systems.

References: Austin et al., "Knee Failure Mechanisms After Total Knee Arthroplasty", Techniques in Knee Surgery, 2004, pp 55-59

An Independent Analysis of the First Sixteen Mobile Bearing Lateral Unicompartmental Knee Replacements. Is There a Learning Curve?

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Introduction.

Despite the theoretical advantages of mobile bearings for lateral unicompartmental knee replacement (UKR), the failure rate in the initial published series of the lateral Oxford UKR's was unacceptably high. The main cause of failure was early dislocation. In contrast, dislocations of bearings in medial UKR's are rare. The lateral compartment present a higher laxity in flexion than the medial. An adaptation of the lateral design by introducing a convex tibial component and biconcave bearing should tackle this difference in kinematics.

The risk of dislocation increased substantially if the lateral tibial joint line was elevated, quantified by the proximal tibial varus angle. This angle had a significant relationship to dislocation.

A recent kinematic study identified roughly 3 times as much posterior translation of the tibia during deep knee bend activities after lateral UKR compared to the normal knee, possibly also resulting in a higher incidence of bearing dislocation.

With the exception of dislocation, the overall early complication ratio in the initial published series of lateral Oxford UKR was also rather high compared to the last published series. Is there a learning curve?

Materials and Methods.

Between January 2009 and April 2010, 16 domed lateral Oxford unicompartmental knee replacements were implanted by the senior author. The valgus deformity was in 2 cases not completely correctable. All femoral components were positioned anatomically. In no case the popliteus tendon was divided. A partial iliotibial band (ITB) release was done in 2 cases. The most common tracking deviation of the bearing peroperatively was a small lift off in deep flexion, seen in 6 cases.

Results.

Dislocation: no.

Clinical outcome:

Twelve of our patients (75%) have already good or excellent results with no pain in rest, no or mild pain with activity and good restoration of function. One patient feels some pain in deep flexion during work as a carpenter. In only one patient there is still a flexion of less than 100°. Small extension deficits are seen in 4 patients.

Radiographic outcome:

The full-leg radiographs showed a valgus axis of 1,2° (-1° to 7°) compared to preoperative 5,8° (0° to 14°). The assessment of the proximal tibial varus angle resulted in an angle of 3,8° (1 to 7°). The measurements on deep flexion radiographs are not yet available.

Discussion and Conclusion.

Until now we had no dislocation of the bearing in our series, but further follow-up is needed. The preliminary clinical results are already promising and display no early complications needing further operations. By anatomical placement of the femoral component the height of the lateral joint line seems to be respected, confirmed by a nearly correct proximal tibial varus angle in all cases. An increased proximal tibial varus angle can also be avoided by minimizing damage to the lateral soft tissues during surgery and so not over-tighten the knee. Therefore the popliteus tendon should stay intact. The elevated posterior translation, as seen in the recent kinematic studies of the lateral Oxford UKP can perhaps also be reduced by respecting those soft tissues.

Saturday, October 9, 2010, 9:00-9:30

Session B17: Novel techniques in Arthroplasty

Parva :A Novel Short Hip Stem

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Purpose of our study is to present the design rationale and the early clinical results for the Parva Stem, an innovative short hip stem. The Parva implant has been designed in order to address the bone sparing concept of a short stem able to achieve a good cervical and interthrocanteric primary fixation associated with a the reliable primary fixation the isthmus level.

The stem has been designed to address the larger possible variety of anatomical variations too. The stem therefore features innovative design concepts including the latest generation Modular Neck System, coupled with a revolutionary manufacturing process and surface engineering technology. This manufacturing process (Powder manufacturing Technology) and Ingrowth Surface (Ti-Por) will be also briefly discussed in the presentation.

Our early clinical results will be also presented (150 stem-one yr. maximum follow up will be presented) although they are not the main purpose of our study oriented more on the novel design and technological manufacturing advancement.

The feed-back we had so far with this state of the art implant is extremely encouraging. Of course further data collection and longer follow up will be needed in order to confirm these early promising results.

Saturday, October 9, 2010, 11:15-11:50

Session A20: Knee Arthritis: Early Intervention

Trufit Resorbable Scaffolds: 2 Yy Clinical Good Results Associated to Delayed Biological Incorporation in the Knee

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Trufit resorbable scaffolds, made of semiporous copolymer, are press-fit introduced in chondral defects of articular surfaces in order to promote filling and regeneration of damaged bone and cartilage tissues. In another previous work, we have presented our good and promising results obtained at 1 yy follow-up. Then, we have had the chance to go on on follow-ups and check patients through second-look arthroscopies and serial MRI's: IKDC score showed 38 points improvement. WOMAC score showed statistically significant pain improvement in 89% of cases and function improvement in 86% of cases. Serial MRI's of the knees showed progressive incorporation of the synthetic plugs and no adverse inflammatory reaction. Second-look arthroscopies showed complete and flush fill of the defects and their resurfacing with hyaline-like tissue under different stages of maturation.

Recently, we have been able to check, clinically and by serial MRI's, the first patients operated 24 months ago. Despite the mantainance of clinical very good results, as showed by other authors, MRI images showed a delayed biologic process of incorporation of the plugs. This finding has not to be misinterpreted as an implant failure and the post-op rehabilitation has to be continued in order to give regenerating cartilage time to complete the maturation process.

Oxinium

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OXINIUM

S.E.Shafiei

Total joint arthroplasty is a safe and effective procedure as an end-stage treatment for arthritis .In the case of hip replacement mean patient age has decreased from sixty-eight to sixty-five years over the past eight years, raising concerns over implant longevity and the complications that occur in association with revision surgery.

The dominant mode of failure of total joint replacements is aseptic loosening, which in many cases is caused by the reaction of bone to the presence of implant debris .In an attempt to increase implant longevity ,bearing surfaces that minimize the volume of debris generated from the articular surface are being developed .Ultra- high molecular weight polyethylene , which has been the mainstay of arthroplasty , changing the material with which the polyethylene articulates has also been addressed in an effort to further improve wear characteristics .

Oxinium is the brand family name of a material used for replacement joints manufactured by the reconstructive orthopedic surgery division of medical devices company Smith& nephew .It consists of a Zirconium alloy metal substrate that transitions into a ceramic Zirconium oxide outer surface. The ceramic surface is extremely abrasion resistant compared to traditional metal implants such as cobalt chromium .It also has a lower coefficient of friction against ultra-high molecular weight polyethylene(UHMWPE) ,The typical counter face material used in total joint replacements.

These two factors likely contribute to the significantly lower UHMWPE wear rates observed in simulator testing.

Reducing UHMWPE wear is thought to decrease the risk of implant failure due to osteolysis .All ceramic material can have a similar effect in reducing wear, but are brittle and difficult to manufacture .The metal substrate of oxinium implants makes component easier to manufacture and gives them greater toughness(a combination of strength and ductility).In essence, this technology combines the abrasion resistance and low friction of a ceramic with the workability and toughness of a metal.

MATERIAL:

The oxinium(OxZr) component are produced from a wrought zirconium alloy(Zr-2.5%Nb) by processing that oxygen naturally diffuses into the Zirconium alloy, Oxygen is absorbed into the metal, actually transforming the surface to ceramic that is about um thick while the rest of the material remain metal to retain its strength .The result is in a superior bearing surface. The ceramic is an enhanced surface that is part of metal substrate rather than an external coating , making it very durable with unusual damage tolerance.

Abrasion resistance:Oxinium implants are dramatically more abrasion-resistant than cobalt chrome implants.

-Hardness :surface hardness is correlated with abrasion resistance as well as properties such as strength and stiffness .The higher surface hardness of Oxinium component , coupled with a strong bonding between the surface ceramic oxide and the metal substrate help explain the superior abrasion resistance of this material as compared to cobalt chrome.

Damage tolerance : Damage to the surface of femoral component is always a risk .The damage tolerance to Oxinium was investigated by two standard tests(crater and groove tests).The result supports the premise that even under extreme conditions catastrophic

trophic failure will not result.

Fatigue strength :The Oxinium component were found to support a minimum fatigue load of 1.000lbs for 10 million cycles which is equivalent to a cobalt chrome femoral component of the same design.

Metal allergies and biocompatibility: Between 3_8% of population has been estimated to have metal allergies .Many of these people need a total joint replacement .But many not be candidates because of metal sensibility. The maximum nickel content for cobalt chrome can be as high as 1% compared to for Oxinium.

Oxinium material advantage:

1_ 4900 times more resistant to abrasion than cobalt chrome for superior durability over time.

2_ 160 times smoother than cobalt chrome.

3_97.5% Zirconium and 2.5% Niobium two of the most biocompatible metals known this allows for a 5-micron thick ceramic surface for enhanced bearing properties, maintaining a metal core to retain strength.

4_More than twice as hard as cobalt chrome, which directly with an increase in resistance to scratching.

5_Has less than traditional femoral heads (cobalt chrome) due to a unique process where the surface of Zirconium metal alloy is transformed into Oxinium by a process that allows Oxygen to absorb into the alloy .The process changes only the surface from a metal to a smooth ceramic .The rest of implant remains metal to maintain its overall strength.

6_ Has a friction rate half of cobalt chrome which results in a dramatic decrease in wear .The ceramic surface reduces friction between the implant device and the polyethylene component or native cartilage ,meaning less potential for wear and a device that should last longer.

Oxinium clinical advantage:

Three types of patient have been indentified as the best candidates for an Oxinium total joint arthroplasty.

1_Suitable younger patient(under 60 year) due to Oxinium,s strength and longevity properties through less wear and tear.

2_Active patients: patients, who desire to return to an active life style, including sport, dancing, gardening or other strenuous activities.

3_Metal allergy patients :Because Oxinium Contain no detectable nickel,is one of the most

biocompatible material to man, it is the choice for patients who exhibit metal allergies.

Disadvantages:

Despite advances in surgical techniques including computer guidance dislocation of the femoral head in hip arthroplasty remain as a serious clinical problem. There are several reports about the presence of significant damage (cracking, gouging and delamination of the surface) subsequent to dislocation and closed reduction of Oxinium femoral heads after open revision and their potential to accelerate wear if successful closed reduction had been achieved. However in the case of dislocation it is recommended that closed reduction should be attempted with caution because significant head damage can occur and in the case of successful reduction close patients follow-up is recommended. Open reduction with femoral head inspection and exchange may be preferable if difficulty is encountered in close reduction maneuvers.

Oxinium and hemiarthroplasty:

Regardless of the studies analyzing the characteristics of Oxinium with polyethylene there are no studies of an Oxinium articulation with the native acetabulum.

Because of the high mortality rate after hip fracture the clinical benefits of Oxinium hemiarthroplasty if existent, are difficult to appreciate and recent studies show no significant advantage were observed for this more expensive prosthesis. For these reasons, although no complications can be directly attributed to the use of Oxinium. There are also no recognized benefits to warrant its use in case of hemiarthroplasty.

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Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Surgical Experience and Results of 1350 Consecutive Mini-Subvastus Knee Arthroplasties

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Background

The current literature tends to suggest that all the different approaches used for Knee Arthroplasty give similar results. The literature also cautions that the MINI quadriceps sparing approaches are to be utilized in very select cases as they are difficult to perform, take longer time, have a greater intra-op complication rate and are associated with a higher number of component malpositioning. Despite these warnings of the literature, the author has been impressed by the physiological nature of the subvastus approach for knee arthrotomy and the author has used this approach exclusively for all Knee arthroplasties in the last 4 years. All primary Knee Arthroplasties have been performed through the mini-subvastus approach, utilizing the principle of a mobile window, irrespective of the degree of pre-operative deformity, obesity, range of motion or previous surgery. All revision Knee Arthroplasties have also been performed through the subvastus approach. All the surgeries have been performed in the private sector in a highly competitive environment with the patient having easy access to various other high volume surgeons performing arthroplasties through a more standard approach.

Aim: To define the place of the subvastus approach in Knee arthroplasty on the basis of surgical experience gained after 1350 consecutive surgeries

Materials and Methods: All knees operated between Nov. 2005 to may 2010 are included in this study and have been prospectively evaluated by American Knee Society Scores. Pre and post-operative radiographs have been obtained in all. Additionally a significant number of knees have had pre and post-operative scanograms and skyline views taken. Surgical technique has involved the subvastus approach in all cases. The first 130 knees have been performed with the tourniquet and the remaining have been performed without a tourniquet but with the use of tranexamic acid peri-operatively. Surgical technique has evolved with the experience gained and would be discussed in detail. Computer navigation has been utilized to take the distal femoral cut in 110 knees. Intra and post-operative complications have been recorded. The author has used both CR and PS knees, mobile and fixed bearing, Gender specific and highflex knees with and without patellar resurfacing. The patients have been followed up at 6 weeks, 3 months and yearly.

Results: The American Knee Society scores have improved significantly in the follow-up period. The post-operative radiographs have shown good alignment in more than 99% of knees. The Hospital stay has been reduced to 3 days and 95% of patients were able to independently ambulate with only a walking stick by the third day without any quadriceps lag. There have been 3 vascular injuries, 1 medial collateral injury, 2 patellar tendon ruptures, 3 periprosthetic fractures and 7 infections of these 1350 knees (complication rate 1.5%.) There are 2 knees awaiting surgery for limb malalignment.. The results in various types of knees are similar but the PS knees have achieved a higher degree of post-op knee flexion more easily.

Conclusions:

The results obtained by this method are comparable if not better than the results obtained in other large series using more traditional approaches. The complication rate is similar but the patient recovery is much quicker. The approach is versatile, has wide applications and remains our approach of choice.

Thursday, October 7, 2010, 7:30-8:20

Session B1: Computer Navigation in TKA

The Role of Selective Femoral Navigation in Restoring the Mechanical Axis Post TKR

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Background Computer navigation is increasingly being recognized as a valuable tool in restoring the mechanical axis post TKR. Its use is as yet not universal due to the costs involved, its availability and the fact that it can be cumbersome and time consuming to use. Additionally it requires the insertion of Schanz pins in the femur as well as the tibia which can be a matter of concern as regards stress fracture and infection. However, it is able to reliably locate the center of the femoral head which is an elusive landmark in the standard method. The center of the ankle involves registration for the medial and lateral malleoli which are subcutaneous and easily palpable. We decided to navigate only the distal femoral cut with a specialized navigation unit called Articular Surface Mounted navigation which does not require the insertion of additional pins through the femur or the tibia . We purposely did not use navigation for the rest of the bony cuts as all the other landmarks i.e. femoral epicondyles, tibial malleoli, and tuberosity etc are all easily palpable. This dramatically reduced the surgical time and increased its user friendliness. We are presenting our results.

Aim: To analyse the radiographic results obtained with selective femoral navigation and compare with

- 1.) standard navigational results from the literature
- 2.) Non-navigated Knees from personal series.

Materials and Methods

We have utilized the ASM navigation for distal femoral cut in 112 knees and obtained long X-rays (scanograms) and routine knee X-rays (AP, Lateral and skyline) to study the mechanical

axis and component positioning. We measured the mechanical axis deviation, femoral and tibial angle on AP and lateral films and patellar tilt or subluxation on post-operative X-rays by a digital imaging programme called Image –J. (As suggested by the Knee Society roentgenographic Score).We have compared our results with other navigated series from literature and our own series of non-navigated knees.(113 knees) We also noted the surgical time to perform the operation and the occurrence of any complications.

Results:

Selective femoral navigation is able to restore the mechanical axis as reliably as other methods of navigation and more reliably than non-navigated knees. On an average, it adds less than 10 minutes to surgical time. Femoral angle, tibial angle patellar tilt and subluxation are similar in both navigated and non-navigated series. Navigation use was not associated with any increased complications and no complication could be ascribed to its use. Selective femoral navigation reduced the outliers in mechanical axis restoration when compared with standard femoral intramedullary instrumentation.

Discussion

Selective distal femoral navigation is a reliable tool in restoring mechanical axis post TKR. It is particularly valuable in knees that have pronounced femoral bowing.

Thursday, October 7, 2010, 13:30-14:10

Session B5: Computer Navigation in TKR 1

Computer Assisted Total Knee Arthroplasty for Significant Tibial Deformities

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Computer assisted total knee arthroplasty has been demonstrated to provide reproducible limb mechanical alignment within three degrees from the neutral mechanical axis. However, restoring proper implant and extremity alignment remains a significant challenge with proximal tibial deficiencies. In this prospective study, we describe the use of computer navigation to quantify the amount of bone loss on the medial or lateral tibial plateau and the use of this data to assess the need for augmentation with metallic tibial wedges.

In this study, we demonstrate that CAS TKR in patients with significant tibial deformities can accurately measure severe tibial deformities, predict tibial augment thickness, and provide excellent mechanical alignment and restore the joint line without excessive bony resection, repeated osteotomies, and repeated augment trialing.

Thursday, October 7, 2010, 13:30-14:10

Session B5: Computer Navigation in TKR 1

CT and Cine Video X Ray Based Analysis of Alignment and Stability of Computer Navigated and Conventional TKR

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There is still want of evidence in the current literature of any significant improvement in clinical outcome when comparing computer-assisted total knee arthroplasty (CA-TKA) with conventional implantation. Analysis of alignment and of component orientation have shown both significant and non-significant differences between the two methods. Not much work has been reported on clinical evidence of stability of the joint.

We compared computer-assisted and conventional surgery for TKA at 5.4 years follow-up for patients with varus osteoarthritic knees with deformity of more than 15*. Our goal was to assess clinical outcome, stability and restoration of normal limb alignment.

We used CT and Cine video X ray techniques to analyze our results in Computer navigated and conventional TKRs. A three dimensional CT scan of the whole extremity was performed and evaluation was done in three planes; saggital, coronal and transverse views. CT scan was done between 10 to 14 days postoperative. Mean deviations in the mechanical axis, femoral and tibial plateau angles, and in transverse view, the trans-epicondylar axis vs posterior condylar axis were measured. The prospective randomized study comprised of 98 patients with surgery done on knees, one side navigated and other side conventional. Mean deviation in the mechanical axis was 2.2* in conventional knees and 1.8* in navigated knees. In 5 % of cases retinacular release was needed and CT analysis showed TEA in deviation of more than 2 * in these cases. We analysed intraoperative data (surgical time and intraoperative complications), postoperative complications, lower limb alignment, radiographic complication on X-ray imaging, and clinical outcome through knee and function score, range of motion and joint stability.

Our results showed that CAS had greater consistency and accuracy in implant placement and

stability of joint in full extension and 90* flexion. In the coronal view, 93.3% in the CAS group had better outcomes compared with EM (73.4%). In the sagittal axis, 90.0% CAS also had better outcomes compared with EM (63.3%). Computer-navigated total knee arthroplasty helps increase accuracy and reduce “outliers” for implant placement.

Thursday, October 7, 2010, 14:50-15:30

Session A6: Hip Miscellaneous

Melorheostosis of the Hip Joint Treated With Total Hip Replacement

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Introduction:

Melorheostosis is a rare bone dysplasia characterized by its classic radiographic appearance resembling dripping candle wax. The condition was originally described by Leri and Joanny in 1922. Its etiology is not fully known and treatment in most instances has been symptomatic. There are nearly 350 reported cases on melorheostosis, joint replacement has been successfully attempted in the shoulder and knee joint. We describe a case of severe melorheostosis affecting the left hip causing secondary osteo-arthritis, which was treated with a total hip replacement (THR). To the best of our knowledge this is the first reported case of its kind in the World literature.

Case history:

A 52-year-old male of Indian origin with known melorheostosis of the left leg for over 30 years, presented with symptoms suggestive of severe osteo-arthritis of the left hip. Previously he had been treated for melorheostosis of the knee joint (fig 1a & 1b) with excisions and decompression of the medial femoral condyle. His left hip became more painful over the last few years. He had a fixed flexion deformity of 20° of the hip, severe muscle wasting and the affected leg was 3 cm longer than the right leg. Radiographs (fig 2a & 2b) confirmed the presence of sclerotic new bone in the acetabulum eroding the femoral head. He had the classical dripping candle wax appearance along the medial border of the neck and shaft of the femur. He underwent a THR using a Corail-Pinnacle un-cemented prosthesis using ceramic on polyethylene bearing surfaces (fig 3a & 3b). Post operatively he made a quick recovery and there was a marked improvement in his symptoms and functional outcome scores at 6 weeks.

Discussion:

Melorheostosis has an incidence of 0.9 in one million and affects men and women equally. It

can affect any site in the body, however lower limbs are more commonly affected. It classically presents on only one side of the cortex of long bones. It is common in synovial joints and crosses the joint line in 35% cases. Its etiology is unknown and it is a benign condition but there are 3 reported cases in literature associated with malignancy. Chronic pain and deformity from melorheostosis can be severely debilitating for patients. Its management in most cases is conservative. Surgical intervention is advocated in chronic debilitating symptoms. Successful resection of these lesions can translate into near complete resolution of the symptoms. A Total hip replacement can be used to treat severe melorheostosis of the hip joint with complete relief of symptoms and achieving a good functional outcome in the short term.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#) [Figure 5](#) [Figure 6](#)

Thursday, October 7, 2010, 16:30-17:20

Session A8: Periprosthetic Fractures in THA

Complications Associated With Operative Treatment of Peri-Prosthetic Femur Fractures Sustained in the Acute Post-Operative Period Following Primary Total Hip Arthroplasty

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INTRODUCTION: The purpose of this study was to determine the rate of complications and re-operations after operative treatment of peri-prosthetic femur fractures sustained within 90 days following primary total hip arthroplasty (THA).

METHODS: 4,433 patients (5,196 consecutive primary THAs) over 10 years at a single institution were retrospectively reviewed. Thirty-five (0.67%) peri-prosthetic fractures that were treated operatively in 32 patients were identified and classified using the Vancouver Classification. There were 9 patients with a type Ag fracture, 2 patients with a type B1 fracture, 17 patients with a type B2 fracture, 1 patient with a type B3 fracture, and 3 patients with a concomitant type Ag and B2 fracture. Eleven (34%) patients were treated with isolated ORIF: greater trochanter (9) or femoral shaft (2). Twenty-one (66%) were treated

with femoral revision combined with (14) or without (7) attempted fracture fragment reduction; a diaphyseal engaging stem was utilized in all revisions. One patient was lost to follow-up leaving 31 patients for evaluation

RESULTS: Nineteen (61%) patients sustained twenty-two major complications including non-union of the greater trochanter in 10 of the 12 Ag fractures, three Brooker grade 3 heterotopic ossification (10%), non-unions of both B-1 fractures (6%), two deep infections (6%), one stem subsidence that required repeat revision (3%), one greater trochanteric fracture with instability (3%), one non-union of an extended trochanteric osteotomy, one hematoma (3%) and one peroneal nerve palsy (3%). Seven patients (23%) required a second operative procedure for management of a complication and one patient required a third operation.

CONCLUSIONS: Operative treatment of acute post-operative periprosthetic fractures is associated with a high rate of major complications (61%) and re-operation (23%). Operative treatment of acute post-operative fractures of the greater trochanter was associated with non-union in 10 of 12 cases (83%).

Friday, October 8, 2010, 11:10-11:50

Session A13: Alternate Bearing Materials in Arthroplasty

Modern Alternative Bearing Total Hip Arthroplasty in Patients Less Than 21 Years Old

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INTRODUCTION: Total hip arthroplasty (THA) is not commonly performed in young patients. However, markedly advanced hip disease can cause disabling end-stage arthritis, and THA may be the only available option for pain relief and restoration of function. We report our experience with modern alternative bearing THA in patients younger than 21 years.

METHODS: Twenty-one consecutive primary THAs were performed in 18 patients. Pre- and post-operative Harris Hip Scores (HHS) and any postoperative complications were recorded. Radiographs were reviewed for evidence of premature component loosening. Mean patient age

at operation was 18 years (range, 13-20). There were 14 females (78%) and 4 males (22%). Nine patients (50%) were Caucasian, 8 (44%) were African-American, and 1 (6%) was Asian. Average follow-up was 45 months (range, 16-85). All patients failed conservative treatment; 15 patients had prior core decompression and bone grafting. Underlying etiology was chemotherapy induced osteonecrosis (7, 33%), steroid induced osteonecrosis (6, 29%), sickle cell disease (5, 24%), and chronic dislocation (3, 14%); 1 patient underwent THA for fracture of a previous ceramic bearing, 1 patient had a slipped capital femoral epiphysis, and 1 patient had idiopathic joint destruction. Components implanted were ceramic/ceramic (14, 67%), metal/highly cross-linked polyethylene (6, 29%), and metal/metal surface replacement (1, 5%).

RESULTS: HHS scores improved from 43.6 pre-operatively to 83.6 post-operatively ($p < 0.001$). There were no infections or dislocations, and one patient with acute lymphocytic leukemia experienced post-operative hypotension following bilateral THA which resolved. At time of final follow-up, there was no radiographic evidence of component loosening; one THA was revised for a cracked ceramic liner.

CONCLUSION: At intermediate-term follow-up, clinical and radiographic results are favorable following alternative bearing THA in patients under age 21. Long-term follow-up is necessary to assess implant longevity in this patient population.

Thursday, October 7, 2010, 13:30-14:10

Session B5: Computer Navigation in TKR 1

Alignment in Conventional Versus Computer-Assisted Total Knee Arthroplasty in Obese Patients

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The combination of obesity and malalignment may result in increased revision rates following total knee arthroplasty (TKA). The purpose of this retrospective matched-pair study was to compare the accuracy of limb and component alignment after TKA using conventional versus computer-assisted technique in obese patients. Radiographic data regarding limb alignment, coronal and sagittal component alignment of 72 conventional TKAs (52 patients) were compared with data of a matched group of 72 computer-assisted TKAs. All procedures were performed by a single surgeon, using a single approach and a cruciate-substituting design.

The mean postoperative limb alignment in the conventional group was $177.2^\circ \pm 2.5^\circ$ compared to $179.3^\circ \pm 1^\circ$ in the computer-assisted group ($p = 0.0001$). The coronal and sagittal alignment of both femoral and tibial components in the computer-assisted group was significantly accurate compared to the conventional group. In the conventional group, 40.2% of limbs (29 out of 72) had a postoperative HKA angle $> \pm 3^\circ$ from the neutral compared to 1.3% of the limbs (1 out of 72) in the computer-assisted group ($p = 0.0001$).

Computer-assisted total knee arthroplasty performed in obese patients showed excellent limb and component alignment with very few outliers when compared to conventional total knee

arthroplasty. Obesity is an appropriate indication for the use of computer navigation during TKA where use of conventional techniques may result in significant limb and component malalignment.

Thursday, October 7, 2010, 8:30-9:20

Session B2: Knee Arthroplasty in the Indian Sub Continent

Determinants of Limb Alignment After Minimally-Invasive Oxford Medial Unicompartmental Knee Arthroplasty

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Excessive under correction of varus deformity may lead to early failure and overcorrection may cause progressive degeneration of the lateral compartment following medial unicompartmental knee arthroplasty (UKA). However, what influences the postoperative limb alignment in UKA is still not clear. This study aimed to evaluate postoperative limb alignment in minimally-invasive Oxford medial UKAs and the influence of factors such as preoperative limb alignment, insert thickness, age, BMI, gender and surgeon's experience on postoperative limb alignment.

Clinical and radiographic data of 122 consecutive minimally-invasive Oxford phase 3 medial unicompartmental knee arthroplasties (UKAs) performed in 109 patients by a single surgeon was analysed. Ninety-four limbs had a preoperative hip-knee-ankle (HKA) angle between 170°-180° and 28 limbs (23%) had a preoperative hip-knee-ankle (HKA) angle <170°. The mean preoperative HKA angle of 172.6±3.1° changed to 177.1±2.8° postoperatively. For a surgical goal of achieving 3° varus limb alignment (HKA angle=177°) postoperatively, 25% of limbs had an HKA angle >3° of 177° and 11% of limbs were left overcorrected (>180°). Preoperative HKA angle had a strong correlation (r=0.53) with postoperative HKA angle whereas insert thickness, age, BMI, gender and surgeon's experience had no influence on the postoperative limb alignment.

Minimally invasive Oxford phase 3 UKA can restore the limb alignment within acceptable limits in majority of cases. Preoperative limb alignment may be the only factor which influences postoperative alignment in minimally-invasive Oxford medial UKAs. Although the degree of correction achieved postoperatively from the preoperative deformity was greater in limbs with more severe preoperative varus deformity, these knees tend to remain in more varus or under corrected postoperatively. Overcorrection was more in knees with lesser preoperative deformity. Hence enough bone may need to be resected from the tibia in knees with lesser preoperative deformity to avoid overcorrection whereas limbs with large preoperative varus deformities may remain under corrected.

Nucleoplasty an Innovative Minimally Invasive Methode for Treatment of Lumbar Radicular Pain

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Nucleoplasty an innovative minimally invasive method for treatment of lumbar radicular pain

By S. Shnayien, MD, Orthopaedic Surgeon, Linz, Germany

Abstract:

Background and Objective:

In industrialized societies, the prevalence of radicular low back pain has exploded in recent years. Lumbar disc prolaps, protrusion, or extrusion account for less than 5% of all low back problems, but are the most common causes of nerve root pain and surgical interventions. The primary rationale for any form of surgery for disc prolaps is to relieve nerve root irritation or compression due to herniated disc material. The primary modality of surgical treatment continues to be either open or microdiscectomy, but several alternative techniques including **Nucleoplasty**. It provokes ablation of the nucleus of the disk by a controlled thermal effect produced by radiofrequency. Nucleoplasty is minimally invasive treatment aimed at removing nuclear material and lowering intradiscal pressure and decompressing through coblation needle inserted percutaneously into the nucleus of intervertebral discs. This paper will show a 3 years experience with 110 cases with lumbar radicular pain secondary to a disc protrusion that underwent Nucleoplasty as their secondary therapy.

Methods:

Included in this series were 110 patients with significant lumbar radicular pain, resistant to interventional therapy done before hand like fluoroscopically guided spinal transforaminal epidural injections or sacral injections with steroids. These cases were done under local anaesthesia with short analgesia and stand by monitoring.

Results:

In the overall cohort, the average Visual Analogue Scale (VAS) pain score decreased

Conclusions:

We conclude that with use of the present selection criteria, Nucleoplasty is very effective long-term treatment for lumbar radicular pain. We recommend modifying the criteria to include only those cases with lumbar radicular pain due to protrusion whose annular integrity is confirmed via MRI and by either selective nerve root blocks and to exclude cases with axial pain.

Saturday, October 9, 2010, 13:30-14:20

Session B20: Hip Arthroplasty

Fifteen Year Results of Hybrid THA Using a Precoated Femoral Stem: A Single Center Experience.

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Purpose:

In an effort to increase the durability of cemented total hip arthroplasties (THA), femoral stems were precoated using polymethylmethacrylate (PMMA). One such design is Harris precoat plus and centralign design (Zimmer, Warsaw, Indiana). The reports on these particular designs are variable, ranging from good survival to early failures, studied over short to medium term. Early failures have been attributed, most of the time to debonding at cement-bone interface. In view of lack of long term and variable results, we reviewed the results of primary hybrid THA performed during October 1990 to December 1995, using a PMMA coated, cemented femoral prosthesis and contemporary cementing techniques.

Materials and Methods:

121 patients (136 hips) underwent primary THA using one of the precoated femoral stems during the study period. Thirty-five patients (36 hips) died and 23 patients (23 hips) were lost to follow-up due to some reasons. Two hips (2 patients) were revised for postoperative infection and hence, not included in study. Collectively, 75 hips (61 patients) were available for clinical and radiological reviews until the last follow-up, with an average follow-up period of 15.5 years (range, 14 to 18.3 years). The average age of the patients at the time of the index surgery was 53.6 years (range, 24 to 82 years). There were 43 males (55 hips) and 18 females (20 hips). Acetabular components used in these 75 hips were Harris Galante porous (HGP) cups in 69 hips and CLS Expansion cup (Protek, AG, Bern) in six hips. The mean age of 61 patients (75 hips) who were available for latest follow-up at December 2009, was 46 years (range, 22-65 years). Third generation cementing techniques and distal cement plug but no centralizer was used in all cases. All surgeries were performed by same surgeon at a single institute.

Results:

23 femoral stems were revised, 20 for aseptic loosening (8 Precoat plus and 12 Centralign) and 3 for periprosthetic fracture with loosening (1 Precoat plus and 2 Centralign). The cementing of the femoral stem was grade A in 29 hips (39%), grade B in 16 (21%), C1 in 6 (8%) and grade C2 in 24 (32%). 21 of 24 hips which showed definitive loosening in radiogram had had cement

grade C2 cementing.

There were 22 acetabular revisions. 11 hips underwent isolated liner exchange for severe wear and osteolysis and in remaining 11 hips, complete acetabular component revision was performed. Indications for acetabular component revisions were aseptic loosening in five, severe lysis in four, extensive wear and metallosis in one, and liner dissociation in one. In one hip, with a fractured acetabular component due to severe pelvic bone defect, both the components were revised.

Conclusion:

Our results suggest that an early failure of the precoated femoral stem was mainly precipitated due to insufficient cementing technique (a thin cement mantle). Inherent flaws of the stem design may also accelerate the mechanism of failure.

Friday, October 8, 2010, 8:40-9:50

Session B10: Navigation and Robotics in Arthroplasty

Early Experience With Customized, Patient Specific Unicompartmental and Bicompartamental Knee Arthroplasty

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INTRODUCTION: Unicompartmental knee arthroplasty (UKA) has been shown to have many benefits over conventional Total Knee Arthroplasty (TKA), but has also been shown to be technically difficult. In fact, technical error is the most common cause of premature failure in UKA. Bicompartamental arthroplasty (BKA) has the potential to perform like TKA with the benefits of UKA. We describe the initial experience with customized alignment guides and implants for UKA and BKA, manufactured based upon preoperative CT scan.

MATERIALS AND METHODS. Twenty three implants in 19 patients were implanted and followed for a minimum of three months postoperatively. Knee society scores and SF-12 scores were collected preoperatively and postoperatively. Radiographs were analyzed with image analysis software for malposition and loosening.

RESULTS. There were 11 female patients who received 12 implants, and 8 male patients who received 11 implants. There were 8 BKA(7 med + pfj; 1 lat + pfj) and 15 UKA (13 medial, 2 lateral). The average age was 69.3 years (range 53-91). Length of followup was average 8.9 months (range 3-19). By 1 month postoperatively, all patients had gained at least 90 degrees of flexion (avg 109; range 90-130) and all were off assisted devices. By 3 months postoperatively, average KSS had improved from 52.8 to 89.6 (pain); 50.9 to 69.9 (function). SF-12 scores for PCS and MCS increased from 34.6 to 39.3 and 50.3 to 55.3, respectively.

There was no difference in functional outcomes between UKA and BKAs. Radiographic analysis showed that no implants overhanged bone by more than 1 millimeter in any dimension. Two of 23 tibial components were placed in greater than 10 degrees of varus (so-called outliers). Conversely, 9/19 tibial components were outliers placed in more than 7 degrees of posterior slope or in reverse slope. The femoral components were designed to be placed parallel to the longitudinal axis of the femur, and 19/23 were within 3 degrees. Interestingly, there was a tremendous amount of variation between patients. There were no postoperative complications. In one case, the tibial component was not completely seated to the bone preparation level. Otherwise, there were no intraoperative complications. No revisions have been performed and none are pending.

CONCLUSIONS. Customized implants are designed to match the patient anatomy as closely as possible, without duplicating gross malalignment or malposition. This study shows that this technology reliably allows placement of UKA and BKA devices within acceptable alignment parameters, with excellent short-term functional results. Interestingly, BKA components performed as well as UKA components, suggesting that a certain percentage of traditional TKA patients can expect UKA-like function after BKA instead of TKA. Of course, much longer followup is required to determine rates of failure from progressive arthritis or device wear. Nevertheless, current customized UKA and BKA components are safe and effective.

Thursday, October 7, 2010, 15:10-15:50

Session B7: Robotic Knee Surgery

Effect of Cement Technique on Component Position During Robotic-Arm Assisted Unicompartamental Arthroplasty (UKA)

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INTRODUCTION: we have previously reported that bone preparation is quite precise and accurate relative to a preoperative plan when using a robotic arm assisted technique for UKA. However, in that same study, we found a large variation between intended and final tibial implant position, presumably occurring during cement curing. In this study, we reviewed a subsequent cohort of patients in which the tibial and femoral components were cemented individually with ongoing evaluation of tibial component position during cement curing.

METHODS AND MATERIALS. Group 1 comprised the simultaneous cementing technique group of patients, previously reported on, although their x-rays were re-analyzed. Group 2 consisted of the individual cementing technique cohort. All implants were identical, specifically a flat, inlay all-polyethylene tibial component. Postoperative x-rays from each cohort of patients were evaluated using image analysis software. Statistical evaluation was performed.

RESULTS. In Group 1, average bone preparation was 5.13 + 2.70 degrees of varus and 7.40 + 2.59 degrees of posterior slope. Final implant position was 3.56 + 1.93 degrees of varus and 5.19 + 3.37 degrees of slope. The variance from intended position was 2.31 + 1.74 degrees of varus and 3.80 + 2.90 degrees of slope. For Group 2, average bone preparation was 5.26 + 3.70 degrees of varus and 5.49+ 2.39 degrees of posterior slope. Final implant position was 6.58 + 3.40 degrees of varus and 6.11 + 2.39 degrees of slope. The variance from intended position was 1.82 + 1.42 degrees of varus and 1.39 + 1.48 degrees of slope. ANOVA revealed no differences between groups regarding bone prep in the coronal plane, final implant slope, or variation from intended coronal position. However, bone prep in the sagittal plane showed statistically significant more slope for Group 1 ($p = 0.03$), increased slope in Group 2 ($p=0.004$), and greater variation from intended sagittal position for Group 1.

CONCLUSIONS. Independent cementing of implants showed decreased variation in final tibial component position. However, some implants showed up to 6 degrees of malposition from the intended position. We believe this to be a shortcoming of the inlay style of tibial component for UKA, which even cannot be overcome with the precision and accuracy of a robotic arm assistant.

Friday, October 8, 2010, 7:30-8:30

Session B9: Complications in Arthroplasty

Eradication of Negative Bone Remodelling Using the C-Stem Polished, Triple-Tapered Femoral Implant

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Negative remodelling of the femoral cortex in the form of calcar resorption due to stress-shielding, and femoral cortical hypertrophy at the level of the tip of the implant due to distal load transfer, is frequently noted following cemented total hip replacement, most commonly with composite beam implants, but also with polished double tapered components.

The C-stem polished femoral component was designed with a third taper running from lateral to medial across and along the entire length of the implant, with the aim of achieving more proximal and therefore more natural loading of the femur. The implant is designed to subside within the femoral cement mantle utilising the cement property of creep, generating hoop stresses, which are transferred more proximally to the femoral bone, starting at the level of the medial calcar. The intention is to load the proximal femur minimising stress-shielding and calcar resorption, as well as reducing distal load transfer as signified by the lack of distal femoral cortical hypertrophy.

We present the results of a consecutive series of 500 total hip replacements using C-stem femoral components, performed between March 2000 and December 2005 at a single institution. Data was collected prospectively and all patients remain under annual follow-up by a Specialist Arthroplasty Practitioner. The operations were performed using a standard surgical technique with third generation cementing using Palacos-R antibiotic loaded cement.

500 arthroplasties were performed on 455 patients with an average age at the time of surgery of 68.3 years (23-92). There were 282 (62%) female and 173 (38%) male patients with osteoarthritis being the predominant diagnosis. 77 patients have died (73 hips) and the average duration of follow-up for the entire series is 81 months (52-124).

Only 2 femoral implants have been revised - one for deep sepsis and the other as part of a revision procedure for a loose acetabulum, although the femoral component itself was not loose. One implant is currently loose following a periprosthetic fracture treated by internal fixation, but none of the remaining implants demonstrates any progressive radiolucencies in any Gruen zones or any features suggestive of current or future loosening. Calcar rounding has been observed, but there have been no cases with obvious loss of calcar height and no cases of distal femoral cortical hypertrophy.

The C-stem femoral component has therefore performed well in clinical practice and the objective of eradicating negative bone remodelling has been achieved. The study is ongoing.

Thursday, October 7, 2010, 16:50-17:40

Session B8: Management of Complications in TKA

Rivaroxaban Versus Enoxaparin in the Setting of Elective Hip and Knee Arthroplasty and Their Effects on Bleeding, Thromboembolism and Delayed Wound Healing

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Introduction

Rivaroxaban is the first licensed oral direct inhibitor of factor Xa. Recent studies from the RECORD trials suggest rivaroxaban has superior efficacy compared to enoxaparin in preventing venous thromboembolism (VTE) with no significant increase in the major bleeding risk.

Concerns remain regarding the incidence of minor bleeding, consequent delayed wound healing and subsequent risk of infection. The aim of this observational study was to assess the incidence of post-operative complications in patients receiving either rivaroxaban or enoxaparin thromboprophylaxis following elective hip and knee arthroplasty.

Methods

258 patients undergoing elective total hip or knee arthroplasty within one NHS Trust were included. 202 subjects (mean age 70.7 years \pm 10.0, 43% male) received a daily dose of 10mg of oral rivaroxaban and 56 (mean age 70.9 years \pm 9.8, 39% male) had a daily subcutaneous injection of 40 mg of enoxaparin as thromboprophylaxis. Endpoints included VTE (deep vein thrombosis and pulmonary embolism), haemorrhagic wound complications, hospital re-admission, requirement for blood transfusion, minor and major bleeding and death.

Results

There were no significant differences in the incidence of deep vein thrombosis, requirement for blood transfusion and readmission rate between rivaroxaban and enoxaparin-treated patients. However, the incidence of minor bleeding (2.0% versus 0%) and haemorrhagic wound complications (4.9% versus 1.8%) were non-significantly higher in the rivaroxaban-treated group. There were no cases of pulmonary embolism, major bleeding or death in either group.

Conclusion

Our experience with rivaroxaban in elective hip and knee arthroplasty showed no significant difference in the incidence of VTE or major bleeding. There was, however, a tendency to greater risk of minor bleeding and consequent delayed wound healing affecting both morbidity and delaying discharge. These may predispose patients to a higher risk of wound infection, and thus these issues require further large scale evaluation.

	Rivaroxaban Group n=202	Enoxaparin Group n=56
DVT/PE	2 (1.0%)	1 (1.8%)
Blood Transfusion (\geq 2 units)	13 (6.4%)	4 (7.1%)
Wound complications	10 (4.9%)	1 (1.8%)
Minor bleeding	4 (2.0%)	0
Major bleeding	0	0
Readmission	2 (1.0%)	1(1.8%)
Death	0	0

Acetabular Component Placement in THR: A New CT-Image-Based Dedicate Software

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Manual postoperative CT calculation of anteversion and inclination of the acetabular cup can be inaccurate and depends on the observer's experience. The aim of this study is to describe and present a validation of a new CT-image-based dedicate software (EGIT) for calculation of the acetabular component placement.

The software principle is based on a three-dimensional reconstruction of a patient's bones from anatomical data collected postoperatively on the patient's CT scan.

15 Patient to be operated for THR were enrolled in this study. All patients were evaluated with post operative CT-scan. Measurement of Cup positioning were performed with two different methods: a manual method, performed by an expert radiologist, and a software CT image based method. Statistical analysis was performed with Intraclass Correlation Coefficient to asses interobserver and intraobserver reliability. A paired T-test was used to detect differences between manual and software methods.

The Intraclass Correlation Coefficient was excellent for both the intraobserver and interobserver reliability. As expected the ICC is higher in the interobserver case.

A mean cup anteversion of 14.2 (S.D. ± 6.9), mean inclination of 44.2 (S.D. ± 5.8) are detected with EGIT by the expert surgeon; Mean Cup anteversion of 13.6 (S.D. ± 5.11), mean inclination of 43.3 (S.D. ± 5.1) are detected with manual method by expert radiologist. No statistical difference have been found ($P > 0.05$).

The EGIT software seems to be an easy, accurate and reproducible method to calculate acetabular cup positioning using standard post-operative CT scan in THA.

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Directed Air Flow to Reduce Airborne Particulate and Bacterial Contamination in the Surgical Field During Total Hip Arthroplasty

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Postoperative sepsis is a costly and potentially devastating problem in total joint arthroplasty. Airborne bacteria and other viable microorganisms shed from surgical staff are a source of deep prosthetic infection, and the density of airborne bacteria is correlated with the rate of postoperative joint sepsis in total joint arthroplasty surgery. Previous studies have also reported a positive relationship between the density of nonviable airborne particulate and viable CFU counts, both airborne and in the surgical wound, during surgery. The purpose of this study was to determine the extent to which a system that delivers a small field of local, directed HEPA-filtered air flow over the surgical field reduces airborne particulate and airborne bacteria during total hip arthroplasty. A minimum of 8 subjects per group provided 80% power ($\alpha = 0.05$) to detect a $\geq 75\%$ difference in bacterial density between groups. All patients who consented to undergo primary total hip arthroplasty were eligible. Thirty-six patients were prospectively randomized into three groups: directed air flow, air flow system present but turned off (sham), and control (standard) conditions. Airborne particulate and bacteria were continuously collected in consecutive 10 minute intervals within 5 cm of the surgical wound using an air sampling device. Data were analyzed using a generalized linear model for repeated measures. Particulate counts and bacterial density at the surgical site were 80% lower on average in the directed air flow group compared to the other two groups ($p < 0.001$) (Figure 1). Density of particulate $> 10 \mu\text{m}$ in diameter was strongly related to bacterial density at the surgical site ($p < 0.001$), as was staff count ($p < 0.001$) and bacterial density at a control site that was remote from the surgical field ($p < 0.001$). The directed air flow system's effectiveness in reducing bacteria appears to be related to its ability to reduce particulate that may carry and allow proliferation of bacteria. The directed air flow system is relatively simple to use and does not appear to hinder the function of the surgeon or operating room staff, impede access to the surgical site, or interfere with the surgical procedure. The directed air flow system can be used in any operating room environment to provide clean air equivalent to a properly-used, well-functioning laminar air flow system. The directed air flow system was effective in reducing airborne particulate and bacteria in the surgical field during total hip arthroplasty.

Figures

[Figure 1](#)

Thursday, October 7, 2010, 7:30-8:20

Session B1: Computer Navigation in TKA

Stress Testing to Optimise Tibiofemoral and Patellofemoral Dynamics During Computer Assisted Surgical Navigation (Casn).

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CASN is generally good at bone morphing and sizing, assisting with component orientation,

gap balancing and providing reasonably accurate alignments of limb and components alike. However, such routine navigation technique fails to use the full potential of the registered information. Current technique provides reasonable static stability information in the coronal plane, but with axial and sagittal planes less well considered. A more dynamic approach seems to be necessary to define 'potential envelopes of motion', seeming to be the best possible way in which CASN will finally show fundamental improvements over 'conventional' technique.

Enhanced dynamic assessment using an upgraded CASN system (Brainlab) is now capable of improved ROM analysis and contact point observations. This consists of storing dynamic information including a) epicondylar axis motion, b) valgus and varus alignments, c) antero-posterior shifts, as well as d) flexion and extension gaps. Tracking values for both tibiofemoral and patellofemoral motion can also be obtained after performing registration of the prosthetic trochlea.

Observations can be made using a set of standardised dynamic tests. Firstly, the lower leg can be placed in neutral alignment and the knee put through a flexion-extension cycle. Secondly the test can be repeated but with the lower leg being placed into varus and internal rotation. The third test can be performed with the lower leg in valgus and external rotation.

Also a new passive technique of 'Drop and Push Testing' into a) flexion and b) extension is giving new information which may prove useful a) in terms of over-stuffing of the extensor mechanism and tightness of flexion gap and b) provision of hyperextension to assist gait. Upgraded software prompts can improve workflows to facilitate optimisation of joint dynamics.

Twenty total knee arthroplasties have been studied using these techniques with particular reference to the patterns of instability found. Marked intra-operative variation in the stability characteristics of the trial implanted joints has been quantified before corrections have been made and final assessments performed. These corrections have also been analysed in terms of change in antero-posterior translations, rotations and contact points. Edge loading and excessive paradoxical motions have been identified and corrective measures carried out, thereby improving PCL tensioning. Component rotations, tibial slope angles, insert thicknesses and femoral sizing have had to be adjusted to optimise range of motion and stability characteristics. Certain cases have been identified where use of more congruent or even stabilised components was considered necessary. Patellar tracking has also been observed during such dynamic tests and appropriate adjustments made to components and soft tissue balancing.

In summary, this study has enabled intra-operative observation, classification and quantification of patterns of instability in 6 degrees of freedom using simple stress tests followed by appropriate adjustments.

Methods to Determine Indications for Partial Resurfacing in the Knee Including Arthroscopic Cartilage Mapping and Radiographic Analysis

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Degenerate chondral surfaces can be assessed in many ways, but arthroscopy is often performed without proper categorisation, mapping, zoning or sizing of lesions. Progression of disease in un-resurfaced compartments is well-recognised to occur, but is only one of several failure mechanisms in partial knee replacement.

A validated 'Functional Zone' mapping method was used to document articular surface damage in 250 sequential cases of knee arthroscopy in patients over the age of 40. Size, shape, location and severity of each chondral lesion were noted using the Outerbridge classification. Analysis determined rates of involvement of particular compartments and assessed potential for partial replacement or local treatment and also to consider the risk of future progression. Radiographs including antero-posterior standing, postero-anterior flexion views (Rosenberg), lateral and skyline views were graded (Kellgren and Lawrence) and compared with the arthroscopic findings.

Our results showed that out of the 210 knees with Grade 3 or greater damage 13.3% of knees showed 'isolated' medial disease of Outerbridge Grade 3 or worse. Isolated lateral disease was noted in 1.4%, patello-femoral disease in 24.3%, bi-compartmental (Medial/PFJ) disease in 30.9% with tibio-femoral and tri-compartmental disease seen in 15.2%. The combination of lateral and patello-femoral disease was seen in 14.8%. Provided that Grade 1 and 2 changes (which were found in other compartments in high percentages) were ignored and ACL status considered, this information seemed to indicate that at the time these procedures were performed, 13.3% of cases were suitable for a medial uni-compartmental device, with sub-analysis of lesion sizes indicating that 17 out of 28 cases (60.7%) were suitable for a localised resurfacing. Lateral uni-compartmental replacement seemed suitable for only 1.4%, patello-femoral replacement in 24.3%, bi-compartmental in 30.9% and total knee replacement in 30%. The mean age for partial resurfacing was 53 years and 59 years for total joint replacements.

Radiological analysis found that the antero-posterior standing views had only 66% sensitivity and 73% specificity for the presence of Grade 3 changes or worse in the medial compartment in comparison with Rosenberg views having a sensitivity of 73% and a specificity of 83%. Skyline views had a sensitivity of 56% and 100% specificity.

This study indicates that a large proportion of cases may be suited to local and limited resurfacing. Cases suitable for Patello-femoral and Bi-compartmental replacements were very common, but with the patello-femoral joint's tendency to be more forgiving in terms of symptoms, meaning that indications for uni-compartmental replacement might well be much higher than the arthroscopic findings suggested. On the other hand, the presence of high levels of Grade 1 and 2 changes in other compartments seems to indicate a need for caution particularly in younger patients. This study also indicates a need for better methods of assessing local cartilage health such as enhanced MRI scanning or spectroscopy.

Highly Crosslinked PE as Alternative Bearing Material for Big Diameter THA

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Several options for high demand/high activity patients for bearings in THA exist. Each of them faces certain known and unknown risks of failure. There is a remarked trend to bigger diameter heads to reduce the incidence of dislocation for such patients. While combinations with hard-on-hard bearings have been used in such incidences, a Polyethylene (PE) option is desirable due to its less sensitivity to edge loading and price.

A highly crosslinked sequentially annealed PE of the 3rd generation was prepared by sequentially crosslinking with appropriate annealing steps with a cumulative dose of 90 kGy and subsequent gas plasma sterilization. The structure of this material was determined using TEM, DSC and SAXS. Free radicals and oxidation was determined by ESR and IR spectroscopy. Mechanical evaluation in the unaged and aged condition were performed by quasi-static, dynamic and functional dynamic tests in comparison with negative controls. Wear testing was performed by ball-on-plate tests and hip joint simulators. PE inserts of various internal diameters up to 44mm and thicknesses of 4-8mm in comparison with a historic inert gas irradiation sterilized PE as negative control. These tests have been carried out at 3 institutions using different set-up and protocols. To look at worst case scenarios the simulator testing was done in an impingement mode and fatigue tests of the thinnest components were performed in 2 different fatigue set-ups up to 10 million cycles.

The structure and crystallinity of the sequentially crosslinked PE were comparable to the controls. The radical concentration was reduced by more than 95% due to the sequential process employed and consequently the oxidation level after artificially aging remained at the level of untreated PE. 5 year storage data confirmed the stability of this polymer. All mechanical testing revealed the maintenance of the properties at the same level as the controls. The screening wear test revealed that the high sliding stress used in this set-up had no effect on the sequentially crosslinked PE even when aged, while the controls showed fatigue wear after a short time of testing.

The decrease in volumetric wear compared to a negative control (28 mm head size) was on average 90% in volumetric independent of the head size and thickness of the PE liner. This result was confirmed by the studies at 2 other institutions with a wear reduction of 86 and 95% respectively. Impingement increased the wear rate marginally, without causing any fractures or failures of the components. The analysis of the wear particles from the simulator studies showed a marked decrease in number with close similarity in appearance and morphology to that from the control tests. Fatigue testing even in a luxation model showed no negative effect on the impact on the rim after 10 million cycles also with the thinnest components.

Highly crosslinked, sequentially annealed PE from the perspective of tribological and fatigue testing can be used safely even in impingement and luxation situations. Other factors in the clinical usage of thin liners may play a role and need to be investigated further.

Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

Design Rationale and Clinical Evaluation of Total Knee Arthroplasty Reproducing Anatomic Geometry for Asian

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Aims: Recently, total knee arthroplasty (TKA) has been generalized as an operation that achieves excellent clinical results. However, younger and Asian patients require even greater implant longevity and functional performance. We hypothesized a novel posterior cruciate-retaining TKA design that restores the anatomical jointline in both sagittal and coronal planes, maintains the femoral posterior condylar offset, and provides low contact stress would provide enhanced patient function with the potential for greater implant longevity.

Methods: The novel TKA design was created based on geometry determined from anatomic specimens, 3-degree step of femorotibial jointline was incorporated in the TKA design for Asian. The novel TKA has an asymmetrical design between the medial and lateral femoral condyle, the medial femoral condyle designed to be 3 degrees larger than the lateral femoral condyle. It refined using finite element analyses (FEA) to minimize peak contact stresses. The alignment evaluation after TKA was performed using using bidirectional CR and CT images. Femorotibial-angle (FTA), the position of the femoral component relative to the 3D mechanical axis, and the rotational alignment of the femoral component relative to the PC line were evaluated before and after TKA to identify changes in the femoral condylar shape. The kinematic evaluation after TKA was performed using a 3D-to-2D model registration technique. Single-plane fluoroscopic imaging was used to record and quantify the motions of knees during a stair-step activity. The contact points between the tibiofemoral motions and the tibial rotational angle were evaluated.

Results: FEA showed peak von Mises stress of 10.5 MPa under 2000 N load, well below the

plastic limit of UHMWPE. Changes in the femoral condylar shape after TKA were small based on alignment analysis of the medial and lateral condyles. Kinematic analysis revealed an average 16.9 degrees tibial internal rotation with flexion to 90 degrees. Condylar translations exhibited a medial pivot pattern from 0 to 90 degrees of flexion, with an average of 0.9 mm anterior translation of the medial condyle and 9.0 mm posterior translation of the lateral condyle. As a result, tibial internal rotation with medial pivot pattern was accepted.

Conclusions: The novel TKA design based on restoration of articular surface orientation and bony geometry exhibits in vivo kinematics and alignment, contact mechanics that are compatible with excellent functional performance and implant longevity for Asian.ı»ç

Friday, October 8, 2010, 14:00-14:50

Session A14: Complication Management

Aggressive Early Debridement Can Be Successful for Infected Total Hip Arthroplasty

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Introduction

Up to 2% of total hip arthroplasties (THA) are still complicated by infection. This leads to dissatisfied patients with poor function, and has far-reaching social and economic consequences. The challenge in these cases is the eradication of infection, the restoration of full function and the prevention of recurrence. We report the outcome of early aggressive debridement in the acutely infected THA.

Methods

We studied 28 consecutive patients referred with acutely infected THA (18 primaries, 10 revisions) which occurred within 6 weeks of the index operation or of haematogenous spread between 1999 and 2006. Microbiology confirmed bacterial colonisation in all cases with 20 early post-operative infections and 8 cases of acute haematogenous spread. Patients with a cemented THA underwent aggressive open debridement, a thorough synovectomy and exchange of all mobile parts. Uncemented THA were treated as a single stage revision with removal of all implants, aggressive debridement and re-implantation of new prosthesis. Antibiotics were continued in all cases until inflammatory markers and the plasma albumin concentration returned to within normal limits.

Results

Ten patients required multiple washouts. 7 patients needed a two stage revision. 21 patients returned to their expected functional level without removal of the implants and with no radiographic evidence of prosthetic failure. At a minimum 2 years follow-up, we had a 75% infection control rate. The outcome was significantly better in patients treated in the first 120

hours after presentation.

Discussion and Conclusion

Our data suggests that there is a role for early aggressive open debridement in acute infections after THA with an excellent chance of eradicating infection.

Thursday, October 7, 2010, 16:50-17:40

Session B8: Management of Complications in TKA

Tranexamic Acid in Total Knee Replacements: A Meta-Analysis

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Introduction

Total knee replacements (TKR) are among the commonest operations performed in orthopaedic practice. Literature review showed that 10-30% of patients who underwent TKR needed 1-3 units of blood.

Tranexamic acid (TXA) has been popularised as an effective way to reduce blood loss and subsequent blood transfusion.

Our aim was to investigate the value of TXA in reducing blood loss and blood transfusion after TKR and other clinical outcomes such as deep venous thrombosis (DVT), pulmonary embolism (PE), ischaemic heart diseases and mortality.

Patients and Methods

A systematic review and meta-analysis of published randomised and quasi-randomised trials which used TXA to reduce blood loss in knee arthroplasty were conducted.

Results

18 clinical trials were considered suitable for detailed data extraction. There were no trials which utilised TXA in revision TKR.

Blood loss: Fourteen studies (885 patients) were eligible for this outcome. Using TXA significantly reduced postoperative blood loss by an average of 203.64.65 ml (P-value <0.00001, 95% CI -177.44-229.84, I² =89 %) and total blood loss by an average of 591.44 ml (P-value <0.00001, 95% CI -646.82-536.06, I² =78 %).

Blood transfusion: Sixteen studies (1085 patients) were eligible to measure the effect of TXA on blood transfusion after TKR. TXA led to a reduction in the proportion of patients who

required blood transfusion (RD -0.34, P-value <0.00001, 95% CI -0.38-0.29, I2 =65).

Other outcomes: There were no significant differences in the length of hospital stay, DVT, PE, mortality, wound haematoma or infections between the study groups.

Conclusion

TXA appears effective and safe in reducing blood loss and allogeneic blood transfusion in primary TKR.

Saturday, October 9, 2010, 10:20-11:05

Session A19: Miscellaneous Arthroplasty

Short Term Results of Mobile Bearing Total Ankle Arthroplasty

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Background: Total ankle arthroplasty (TAA) was performed frequently for ankle deformity caused by rheumatoid arthritis (RA) and osteoarthritis (OA). TAA has some advantages over ankle arthrodesis in range of motion (ROM). However, loosening and sinking of implant have been reported with several prostheses, especially constrained designs. Recently, we have performed mobile bearing TAA and report short term results of this prosthesis followed average 3 years.

Method: 20 total ankle prostheses were implanted in patients with RA (n=14) or OA (n=6) in 19 patients (5 male and 14 female, one bilateral), between 2005 and 2009. We used FINE total ankle arthroplasty that is mobile bearing system (Nakashima Medical Co., Ltd, Okayama, Japan). All patients were assessed for American Orthopaedic Foot and Ankle Society (AOFAS) score, ROM in plantar flexion and dorsiflexion at the point of pre-operation and final follow-up. We evaluated radiolucent line, sinking, and alignment of prostheses at final follow-up.

Results: At the operation, patients were, on average, 64.1 years old. The mean follow-up period was 34.0 (6~55) months. We found excellent satisfaction and a significant improvement of AOFAS score. Plantar flexion and dorsiflexion also improved compared with the preoperative state, but not significantly (table 1). At final follow-up, five ankles (25%) showed radiolucent line around the components or sinking of prostheses. Three ankles (15%) was performed reoperation, due to early infection, progressive medial OA change by sinking, and loosening of the talus component.

Discussion: Radiolucent line around the components or sinking of prostheses occurred at high frequency (25%). But, only two ankles (10%) were had to reoperation, cause by pain. We take account of the fact that the symptom was lack in spite of radiological changes. Good clinical

results can be achieved with FINE total ankle arthroplasty system. However, this series was short term of follow-up. We need to evaluate mid- and long- clinical results. Mobile bearing total ankle arthroplasty is a treatment option for RA and OA.

Figures

Thursday, October 7, 2010, 8:00-8:50

Session A1: Alternate Bearings in THA 1

Third Generation Ceramic-on-Ceramic Total Hip Arthroplasty in Patients Younger Than 30 Years With Avascular Necrosis of Femoral Head: A Minimum 4-Year Follow-Up

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Purpose: The purpose of this study is to evaluate the functional and radiographical results in patients younger than 30 years who underwent cementless third generation ceramic-on-ceramic total hip arthroplasty (THA) for avascular necrosis (AVN) of femoral head.

Materials and Methods: Forty one patients (55 hips) with a minimum 4-year follow-up were included in this study. There were 26 men and 15 women with a mean age of 25.6 years (range, 16 to 29 years). The average duration of follow-up was 5.7 years (range, 4.0 to 6.5 years). All surgeries were done by a single hip surgeon and third generation ceramic-on-ceramic articulation was used. Functional results were measured by Harris hip score (HHS) and WOMAC score. Radiographic evaluation was assessed for loosening and osteolysis according to Gruen's and Delee and Charnley's criteria.

Results: The average HHS improved from 53 preoperatively to 95 at last follow-up and WOMAC score improved from 72 to 25. Thirty nine patients (51 hips) are continuing their normal occupation. There was no aseptic loosening or osteolysis and no prosthesis had been revised. There was one patient who complained of continuous squeaking and two patients with Brooker grade I heterotopic ossification. There were no other major complications.

Conclusions: THA with third generation ceramic-on-ceramic bearings for AVN of femoral head especially in active and very young patients results in satisfactory clinical and radiological results at minimum 4 year follow-up. If long tem follow-up shows excellent results, then the

Friday, October 8, 2010, 11:10-11:50

Session A13: Alternate Bearing Materials in Arthroplasty

Modified Minimally Invasive Two-Incision THA Using Large-Diameter Ceramic-on-Ceramic Articulation

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The authors modified the original minimally invasive (MI) two-incision total hip arthroplasty

(THA) technique and used large-diameter (32mm, 36mm) ceramic-on-ceramic articulation. One hundred and seventy patients that underwent unilateral MI two-incision THA retrospectively reviewed, and surgical morbidities, functional recoveries, radiological implantation properties, and complications were assessed. The mean follow-up was 30.2 months (range, 24-42 months) and mean patient age was 50.4 years (range, 22-83 years). In the lateral position, an anterolateral approach between the gluteus medius and tensor fascia lata and a posterior approach between the piriformis and gluteus medius was used. Mean operation time was 71.2 minutes (range, 48-91 minutes). Mean Harris hip score improved from 41.8 (range, 10-59) to 96.1 (range, 73-100) at last follow-up, and mean WOMAC score from 66.2 (range, 49-96) to 26.9 (range, 24-39). The mean lateral opening angle of the acetabular component was 38.2° (range, 32.1°-47.7°) and the mean stem position was valgus 1.9° (range, varus 2.3° to valgus 4.8°). One patient suffered an intraoperative femur fracture and another underwent revision surgery due to stem subsidence. No patient experienced dislocation. Our data suggest the this modified technique is safe and reproducible in terms of achieving proper implant positioning and early functional recovery. In particular, the complication rates encountered, especially the dislocation rate, were low.

Thursday, October 7, 2010, 8:00-8:50

Session A1: Alternate Bearings in THA 1

Total Hip Arthroplasty in Fused Hips Using Hard Bearing Articulation

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Purpose: This study was undertaken to assess the result of total hip arthroplasty (THA) performed for fused hips.

Patients and Methods: Twenty nine patients (31 hips), aged 21 to 70 years (average 46 years), underwent THA conversion surgery and were followed for an average of 4.6 years (2.4-12.0 years). There were 23 cases of spontaneous fusion and 8 case of surgical fusion. The causes of joint fusion were tuberculosis in 6 hips, childhood coxitis in 13, ankylosing spondylitis in 6 and childhood trauma in 4. Modified two incision technique was used in 9 hips and in 22 hips, the surgery was performed through a posterolateral approach combined with anterior capsulotomy through gluteus medius and tensor fascicula lata interval. In 1 case, greater trochanter osteotomy was done. All acetabular components were inserted at the true acetabulum and the articulations were metal on metal in 7 cases and ceramic on ceramic in 24 cases. Postoperatively, range of motion exercises were encouraged after 2 to 3 weeks of bed rest and subsequent weight bearing crutch ambulation. Then active exercises were strongly encouraged to stretch abductors. We evaluated the clinical and radiological results.

Results: Mean duration of surgery was 178.6 minutes, and mean perioperative blood loss was 1420.1 ml. Post-operative dislocation occurred in 1 case and partial femoral nerve palsy developed in 1 case. Mean Harris Hip Score improved from 42.4 to 84.2 and mean leg lengthening of 36.6 mm was achieved. Sitting cross legged was possible in 15 patients and except 2 patients, all patients were satisfied with the surgery. On the radiologic evaluation, there was no changes in cup position and there was one case with acetabular focal osteolysis. Postoperative dislocation occurred in one case and there was no revision surgery or infection.

Conclusion: Our study suggest that THA performed for fused hips with hard bearing articulation can provide good clinical and radiological results in mid-term follow up.

Saturday, October 9, 2010, 14:00-14:40

Session A21: Knee Arthroplasty

The Effect of Tourniquet in Total Knee Arthroplasty- a Randomized Controlled Trial

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[Introduction] Total knee arthroplasty (TKA) is associated with significant blood loss, for which

blood transfusion might be necessary. The role of the tourniquet is controversial, though it is widely used by orthopedic surgeons. Its use was believed to be effective in decreasing intraoperative blood loss and creating a bloodless surgical field, which theoretically would facilitate the cementing technique and other surgical procedures. However, reactive blood flow reached its peak within five minutes after the tourniquet had been released. The tourniquet controls intraoperative blood loss, but cannot stop postoperative blood loss. Patients who were managed with a tourniquet during the operation often complained of thigh pain. This was possibly caused by the direct pressure of an inflated tourniquet on the nerves and local soft tissues. Limb swelling and increased soft tissue tension caused by reactive hyperperfusion after tourniquet deflation may also contribute to the wound pain. The aim of our study is to investigate the effect of tourniquet on blood loss and soft tissue damage in TKA.

[Materials & Methods] In this prospective, randomized study, 72 patients with primary cemented knee arthroplasty were randomly allocated to two groups (with and without tourniquet). The operation time, blood loss, post-operative hemoglobin, hematocrit, markers of soft tissue damage (myoglobin, Creatine Phosphokinase(CK), LDH, GOT, Creatinine), status of rehabilitation, knee pain and thigh pain were monitored until discharge.

[Results] The intra-operative and total blood loss is more in non-tourniquet. The post-operative levels of hemoglobin and hematocrit were significant higher in tourniquet group until postoperative day 4. Using tourniquet also shortened the operation time. Patients managed without tourniquet showed higher CK level in postoperative day 2. The severity of knee pain was similar in both group. Mild thigh pain was noted in tourniquet group.

[Conclusions] Our randomized controlled trial revealed that the usage of tourniquet in TKA may save blood and save time with minor adverse effect. Without using tourniquet, the prolonged surgical time and excessive hemostasis may cause more soft tissue damage.

Thursday, October 7, 2010, 14:50-15:30

Session A6: Hip Miscellaneous

Sports Ability After Total Hip Replacement for the Hip Dysplasia in Japanese Patients

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The purpose of this study is to prove whether Japanese patients undergoing primary total hip arthroplasty (THA) for the hip dysplasia were able to return to sport after surgery.

A questionnaire survey was completed by 77 patients in 9 males and 68 females between 1 and 3 years after surgery. Mean age at surgery was 66.1 (range, 49 to 87).

In the 3 years before surgery 40 (51.9%) patients were participating in sport. By 1 to 3 years after surgery 43 (55.8%) patients were participating in sport. A total of 33 (82.5%) had returned to their sporting activities by 1 to 3 years after surgery in groups who played sports before surgery and 7 (17.5%) were unable to do with the most common reason being "cannot move as much as I wanted". On the other hand, a total of 10 (27%) had started playing sports after surgery. The sports activities after surgery were the most common being walking, radio calisthenics, and swimming as low-impact sports. A total of 27 (73%) did not play sports before or after surgery with the most common reason being "fear of damage to the hip joint".

In conclusion, when Japanese patients who have undergone THA for hip dysplasia choose to participate in sports, orthopedic surgeons should provide information with which to evaluate the risk of sports activity and recommend appropriate sports activity.

Thursday, October 7, 2010, 11:00-11:20

Session B4: Ethnic and Gender Issues in TKR.

Gender Differences in Japanese Osteoarthritic Knee Joint Geometry

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562 osteoarthritic knees rated as stage 1 or more according to Kellgren's osteoarthritic knee classification were selected randomly and analyzed radiologically. Eighty cases with the height of 155 cm-160 cm, for which a large number of male and female cases are available (34 male cases, 46 female cases) were extracted for analysis. The values measured were significantly larger in male than in female in any region. In order to clarify differences in morphology between the sexes, the ratio between the values measured of various regions was computed. As a result, the value obtained by dividing the length of medial femoral condyle in anterior-posterior direction and the depth of medial femoral condyle in proximal-distal direction by the width of femur at articular level was 0.87 ± 0.03 , 0.56 ± 0.03 in female against 0.81 ± 0.04 , 0.52 ± 0.03 in male, respectively. The value obtained by dividing the length of medial tibia condyle in anterior-posterior direction by the width of tibia at articular level was 0.61 ± 0.05 in female against 0.59 ± 0.04 in male. Anteversion of the femur in female was higher than that in male.

When the differences between the sexes were studied, the values measured of various regions were significantly larger in males than in females even in the group of the same height. Morphologically, the knee of males tended to have a larger width than that of females.

Influence of Intra-Operative Joint Gaps on Post-Operative Flexion Angle After Cruciate-Retaining Total Knee Arthroplasty With a Navigation System.

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Introduction

Total knee arthroplasty (TKA) with a computer-assisted navigation system has been developed to improve the accuracy of the alignment of osteotomies and implantations. One of the most important goals of TKA is to improve the flexion angle. Although accurate soft tissue balancing has been recognized as an essential surgical intervention influencing flexion angle, the direct relationship between post-operative flexion angle and intra-operative soft tissue balance during TKA, has little been clarified. In the present study, therefore, we focused on the relationship between them in cruciate-retaining (CR) TKA with a navigation system.

Materials and methods

The subjects were 30 consecutive patients (2 men, 28 women), who underwent primary CR TKA (B. Braun Aesculap, e-motion) between May 2006 and December 2009. TKAs were performed using a image-free navigation system (OrthoPilot; B. Braun Aesculap, Tuttlingen, Germany). All cases were osteoarthritis with varus deformity. Average patient age at the time of surgery was 74.0 years (range, 62-86 years). After all bony resections and soft tissue releases were completed appropriately using a navigation system with tibia-first gap technique, a tensor was fixed to the proximal tibia and the femoral trial was fitted. Using the tensor that is designed to facilitate soft tissue balance measurements throughout the range of motion with a reduced patello-femoral (PF) joint and femoral component in place, the joint component gap and ligament balance (varus angle) were measured after the PF joint reduced and femoral component in place (Fig.1). Assessments of joint component gap and ligament balance were carried out at 0°, 30°, 60°, 90°, 120° flexion angle, which were monitored by the navigation system. Joint component gap change values during 30°- 0°, 60°- 0°, 90°- 0°, 120°- 0° flexion angle were calculated. The correlation between post operative flexion angles and pre-operative flexion angle, intra-operative joint component gaps, joint component gap change values and ligament balances were assessed using linear regression analysis.

Results

Pre- and post-operative knee flexion angle averaged $120.5 \pm 15.4^\circ$ and $121.2 \pm 8.3^\circ$. Pre-

operative flexion angle was positively correlated with post-operative flexion angle ($R = 0.408$, $P = 0.025$). Average joint component gaps were 13.7, 17.1, 17.5, 16.0 and 15.3 mm at 0, 30, 60, 90 and 120° of flexion, respectively. Average ligament balances were 1.8, 1.3, -0.3, -4.2 and -4.9° in varus at 0, 30, 60, 90 and 120° of flexion, respectively. Average joint component gap changes were 3.4, 3.8, 2.4 and 1.6 mm at each range of motion between 30–0, 60–0, 90–0 and 120–0° of flexion, respectively. Joint component gap at 90° flexion ($R = 0.473$, $P = 0.008$) and joint component gap change value 90–0° ($R = 0.495$, $P = 0.005$) showed positive correlations with post-operative knee flexion angle (Fig.2). The other factors assessed in this study showed no correlation with post-operative knee flexion angle.

Discussion

We performed an intra-operative assessment of soft tissue balance using the tensor in CR TKA with a navigation system. As previously reported, pre-operative flexion angle showed a positive correlation with post-operative flexion angle. Of note, the results showed smaller joint component gap at 90° flexion and joint gap change value 90–0° led to less flexion angle in CR TKA. Compared to posterior-stabilized TKA, CR TKA often results in tightened flexion gap. In such a situation, the results suggest that creation of relative larger flexion gap is important for acquisition of better flexion angle.

Figures

Saturday, October 9, 2010, 14:50-15:20

Session A22: Tribology and Biomechanics in Arthroplasty

Acoustic Analysis of the Impact Sound in the Press-Fit Implantation of Cementless Acetabular Components

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Background:

We have often experienced a change of the tone of the hammering sound during the press-fit implantation of cementless acetabular components in total hip arthroplasty (THA). The tone of the impact sound before the press-fit of acetabular components seems to differ from the tone after the press-fit. This change of tone may depend on the accuracy of the fit of the acetabular component, or it may simply be a subjective perception. The aim of this study is to evaluate the impact sounds in the press-fit implantation of cementless acetabular components.

Methods:

The hammering sounds in press-fit implantation of acetabular components were studied intraoperatively in 22 patients (28 hips) who underwent primary THA for treatment of advanced osteoarthritis. All operations were performed via the direct anterior approach in a supine position. The hemispherical titanium-alloy acetabular component (TriAD; stryker) was implanted in all patients. A sound level meter (NA-28; RION) was used to record and analyze the sounds. The hammering sounds of the first three hits and last three hits were recorded as the "before press-fit" and "after press-fit" sound samples, respectively. A frequency analysis was then performed at the point of peak sound pressure in each sample.

Results:

The dominant frequency of the impact sounds was equal to or lower than 1 kHz in 20% of the before press-fit samples and 76% of the after press-fit samples, and equal to or higher than 4 kHz in 69% of the before press-fit samples and 21% of the after press-fit samples. The frequency of the impact sounds changed significantly ($p < 0.01$) during the press-fit implantation.

Conclusion:

The frequency of the impact sound changed significantly during the press-fit implantation of cementless acetabular components. We conclude that an intraoperative evaluation of the impact sound might help to improve accuracy when implanting the acetabular component.

Friday, October 8, 2010, 15:00-16:00

Session A15: Alternate Bearings 2

Incomplete Seating of the Liner With the TriAD Acetabular System

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Background: The bearing surface is one of the important factors that affect the longevity of total hip replacement (THR). The ceramic on ceramic bearing decreases the rate of dislocation event and the amount of wear debris. We encountered cases of incomplete seating of the liner with the TriAD acetabular system.

Patients and Methods: We examined 25 hips in 24 patients who had undergone total hip replacement by using the TriAD shell with a metal-backed alumina liner. We used the Hardinge approach for performing surgery in all patients. Incomplete seating was judged on the basis of plain anteroposterior and/or oblique radiographs obtained immediately and 3 months after the operation.

Result: Six hips (24%) were found to have incomplete seating of the liner. Four cases were

confirmed on the basis of plain radiographs obtained in the early postoperative period, and 2 were identified at a follow-up examination conducted more than 3 months postoperatively. All patients showed clinical improvement. Revision surgery was not required to rectify incomplete seating.

Conclusions: We agreed with Langdown AJ. et al who reported that this implant design had an elevated rim and that shell deformity upon implantation can cause incomplete seating. Therefore, when using this implant, due care should be taken during implantation of the liner. It is necessary to conduct follow-up examination in patients with incomplete seating of the liner because these patients can have problems such as metallosis, corrosion, fatigue fracture of implants, and implant loosening.

Friday, October 8, 2010, 15:20-16:00

Session B14: Hip Resurfacing

The Outcome of the Treatment of Periprosthetic Hip Infection Using a Two Stage Reimplantation Protocol With a Cement Spacer

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Introduction

Periprosthetic infection is a serious complication after total hip arthroplasty (THA). Two stage procedure using antibiotic-impregnated cement spacer is one of the treatments for late chronic infection after THA. We investigated the effects of two stage procedure on the infection control and the recurrence of infection after revision THA.

Materials and Methods

We retrospectively reviewed a consecutive series of 10 cases of a periprosthetic infection after hip arthroplasty, including 3 THA and 7 bipolar hemiarthroplasty (BHA). They were treated with two stage procedure using antibiotic-impregnated cement spacer from 2004 to 2009. There were 4 women and 6 men with an average age of 68.4 years. The pathogens were methicilin-resistant *Staphylococcus aureus* (MRSA) in 3 cases, coagulase-negative *Staphylococcus* (CNS) in 2 cases, *Enterococcus* in 2 cases, *Streptococcus* in 2 cases, and unknown in 1 case.

After removal of the prosthesis, extensive debridement was performed to remove infected tissues and residual cement. After irrigation with iodine solution, antibiotic-impregnated cement spacer was inserted with proximal cement fixation to prevent dislocation and fracture of the cement spacer. The antibiotics that were impregnated in the cement spacer were VCM in 8 cases, MEPM in 1 case, and CAZ in 1 case. Intravenous antibiotics were administrated for 3 weeks after this first stage surgery, and then oral antibiotics were administrated until C-reactive protein (CRP) rates became negative. After confirming the culture of joint fluid contained no pathogens, second stage revision surgery was performed. The average follow-up period after revision THA was 2.3 years.

We investigated the period from first stage surgery to the day when CRP became negative, and to the day of second stage surgery. The incidence of recurrence of infection after revision THA was investigated.

Results

The average period to negative CRP was 25 days, and that to the second stage surgery was 64 days. There has been no recurrent infection until now.

Discussion

The antibiotics-impregnated cement spacer for the treatment of periprosthetic infection was introduced around 1990, and success rate of this technique was reported to exceed 90%. In our series, we experienced no recurrence of infection in spite of containing 3 MRSA cases and 2 CNS cases. The advantages of the antibiotics-impregnated cement spacer were to avoid soft tissue shortening and to allow patient to walk without weight bearing. We concluded that two-stage revision technique with antibiotics-impregnated cement spacer is an effective treatment for peripros

Friday, October 8, 2010, 11:00-11:50

Session B11: Knee Mechanics

Influence of Activity on the Primary Stability of Three Designs of Cementless Tibial Tray

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Introduction: Cementless tibial fixation has been used for over 30 years. There are several potential advantages including preservation of bone stock and ease of revision. More importantly, for young active patients there is the potential for increased longevity of fixation. However, the clinical results have been variable, with reports of extensive radiolucent lines, rapid early migration and aseptic loosening. Problems appear to stem from a failure to become sufficiently osseointegrated, which in turn suggests a lack of primary stability. In order to achieve bony ingrowth, interface micromotions should be less than 50 microns, whereas fibrous tissue formation is known to occur if micromotions are in excess of 150 microns. The degree of micromotion at the bone-implant interface are dependent on the kinematics and kinetics of the replaced joint. Finite element analyses has been used to assess primary stability, however, it is becoming increasingly difficult to differentiate performance. The aim of this study was to examine the micromotion for a variety of different activities for three commercially available tibial tray designs.

Methods: A finite element model of the implanted proximal tibia was generated from CT scans of a 72 year old male and material properties were assigned based on the Hounsfield units. Three tray designs were evaluated: LCS, Duofix and Sigma (DePuy Inc, Warsaw USA). The implants were assumed to be debonded, with a coefficient of friction of 0.4 applied to the bone-implant interface except for the porous coated region of the Duofix design, which was

assumed to be 0.6. The distal portion the tibia was rigidly constrained. Five activities were simulated based on data from Orthoload.com (patient K1L) including walking, stair ascent, stair descent, sitting down and a deep knee bend. The three force and three moment time histories were discretised to give between 44 and 48 individual load steps. Custom written scripts were used to generate composite peak micromotion plots, which report the peak micromotion that occurs at each point of the contact surface during the gait cycle. The primary stability was then assessed by reporting the maximum micromotion, the average peak micromotion and the percentage of the contact area experiencing micromotions less than 50 microns.

Results and discussion: Similar trends were observed for all three designs across the range of activities. Stair ascent and descent generated the highest micromotions, closely followed by level gait. Across these three activities the mean peak (maximum) micromotions ranged from 64-78 (186-239) microns for PFC Sigma, 61-72 (199-251) microns for Duofix and 92-106 (229-264) microns for LCS. The peak micromotions did not necessarily occur at the peak loads. For instance, for level walking the peak micromotions occurred when there were low axial forces, but moderate varus-valgus moments. This highlights the need to examine the whole gait cycle in order to properly determine the initial stability tibiae tray designs. By exploring a range of activities and interrogating the entire contact surface, it is easier to differentiate between the relative performance of different implant designs.

Saturday, October 9, 2010, 8:15-9:00

Session A17: Knee Mechanics

Kinematic Analysis of Mobile-Bearing Total Knee Arthroplasty Using Image Matching Technique

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<Introduction>

Achieving high flexion after total knee arthroplasty (TKA) is one of the most important clinical results, especially in eastern countries where the high flexion activities, such as kneeling and squatting, are part of the important lifestyle. Numerous studies have examined the kinematics after TKA. However, there are few numbers of studies which examined the kinematics during deep knee flexion activities. Therefore, in the present study, we report analysis of mobile-bearing TKA kinematics from extension to deep flexion kneeling using 2D-3D image matching

technique.

<Materials and Methods>

The subjects were 16 knees of 8 consecutive patients (all women, average age 75.9), who underwent primary mobile-bearing PS TKA (P.F.C. sigma RP-F: Depuy Orthopedics Inc., Warsaw, IN, USA) between February 2007 and May 2008. All cases were osteoarthritis with varus deformity. Postoperative radiographs were taken at the position of extension, half-squatting and deep flexion kneeling 3 month after the surgery, and the degrees of internal rotation of the tibial component was measured by 2D-3D image matching technique. Pre- and post-operative ROM was recorded. Then, we compared the absolute value and relative movement of tibial internal rotation between extension, half-squatting and deep flexion kneeling, and evaluated the correlation of the ROM and the internal rotation.

<Results>

The mean preoperative ROM was from -12 to 118 degrees. After the surgery, ROM was from -2 to 123 degrees. Clinical scores of all cases were significantly improved after surgery. Internal rotation of tibial component was -6.8 to 9.7 (mean, 1.7) degrees at half-squatting position, and -7.2 to 13.6 (mean; 1.9) degrees at kneeling position. There was no correlation between maximum flexion angle and tibial rotation during flexion. There was significant negative correlation between tibial internal rotation angle in extension and tibial rotational movement from half-squatting to deep flexion kneeling ($R; -0.824, P<0.05$).

<Discussion>

The internal rotation of the tibia during high flexion is well known as medial pivot movement in intact knee. And several reports have suggested that the medial pivot movement is related to maximum flexion angle after TKA. In the present study, we showed that there was significant negative correlation between the tibial internal rotation angle in extension and tibial rotational movement from half-squatting to deep flexion kneeling. This result suggested that the internal rotation of the tibial component in extension prevent the medial pivot movement of the knee during deep flexion. Therefore, the rotational alignment of tibial component may have the effect to the flexion angle after TKA.

Friday, October 8, 2010, 16:30-17:30

Session B15: MIS Techniques in TKA

Combined Anterior Cruciate Ligament Reconstruction and Unicompartmental Knee Arthroplasty

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The options for treatment of the young active patient with isolated symptomatic osteoarthritis of the medial compartment and pre-existing deficiency of the anterior cruciate ligament are limited. The indications for the unicompartmental knee prosthesis are selective. Misalignment femoral-tibia, varo-valgus angle more than 7°, over-weight, and knee instability were considered to be a contraindication.

The potential longevity of the implant and levels of activity of the patient may preclude total knee replacement, and tibial osteotomy and unicompartmental knee arthroplasty are unreliable because of the ligamentous instability.

Therefore, we combined reconstruction of the anterior cruciate ligament first and unicompartmental arthroplasty of the knee.

We included in this study six patients, three males and three female, mean age 53.6 years, that presented only osteoarthritis of medial femoral condyle and ACL deficiency.

In the first group included 2 patients, we performed arthroscopy ACL reconstruction with hamstring and unicompartmental knee prosthesis one-step, and in the second group included 4 patients, we performed the same surgical procedure in two-step.

The clinical and radiological data at a minimum of 1.5 years at follow-up. We evaluated all patients with KOOS score, and IKDC score.

At the last follow-up, no patient had radiological evidence of component loosening, no infection, no knee remainder instability. The subjective and objective outcome assessed with the scale documented satisfactory average results, both in patients of first group and in those of second group.

ACL deficiency induced knee osteoarthritis for incorrect knee biomechanics, and all patients could be submit a total knee replacement.

What method for preventing it? This combined surgical treatment seems to be a viable treatment option for young active patients with symptomatic arthritis of the medial compartment, in whom the anterior cruciate ligament has been ruptured.

Future developments and more data are necessary for standardised surgical approach.

Saturday, October 9, 2010, 14:00-14:40

Session A21: Knee Arthroplasty

Patellar Tracking Utilizing Two Different Implant Designs for Total Knee Arthroplasty

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Persistent patellofemoral symptoms can cause patient dissatisfaction after Total Knee Arthroplasty (TKA). The aim of this retrospective study was to evaluate patellar tracking and patient outcomes utilizing two implant designs in TKA.

Medical records and radiographs of two groups of 100 consecutive patients each were reviewed. All patients underwent posterior stabilized TKA by a single surgeon; using the same operative technique but two different implant designs (Group 1: Asymmetric femoral component with deep congruent trochlear groove and Group 2: Asymmetric femoral component with shallow trochlear groove). Data was collected on demographic characteristics, patellar tilt, displacement, prosthesis-bone angle, HSS Patella Score, Knee Society Knee and Function Score. Patellar tilt more than 5° was considered significant. Statistical analysis was done using the SPSS v.16.0.3 software (SPSS, Inc., Chicago, IL).

Patients' age and sex were equivalent in the two groups ($p>0.57$). Median follow up was 2.2 years. Pre-operative incidence of patellar tilt was similar in both groups (18% vs. 17%). After surgery, these values changed to 30% and 77% respectively. This was statistically significant ($p<0.001$). The Knee Society Knee and Function Score improved significantly in both groups, however the improvement in the function score was significantly greater in the first group ($p=0.001$). The improvement in Knee Society Knee Score (50.24 and 48.08; $p=0.18$) and post-operative HSS Score (93 vs. 91; $p=0.19$) were not statistically significant.

Our findings suggest that despite using the same operative technique, patellar tracking was significantly different between the two groups, a finding most likely attributable to the design of the femoral component. Whether the difference in patellar maltracking will affect long-term survival of the patellar component remains to be seen.

Saturday, October 9, 2010, 7:45-8:50

Session B16: Performance and Survivorship in Arthroplasty

Patterns of Osseointegration and Remodeling in Femoral Revision With Bone Loss Using a Modular, Fluted, Tapered Titanium Stem

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Introduction: Studies have documented encouraging results with the use of fluted, tapered, modular, titanium stems in revision hip arthroplasty with bone loss. However, radiographic signs of osseointegration and patterns of reconstitution have not been previously categorized.

Materials and Methods: 64 consecutive hips with index femoral revision using a particular stem of this design formed the study cohort. Serial radiographs were retrospectively reviewed by an

independent observer. Bone loss was determined by Paprosky's classification. Osseointegration was assessed by a slight modification of the criteria of Engh et al. Femoral restoration was classified according to Kolstad et al. Pain and function was documented using Harris Hip Score (HHS).

Results: Mean patient age was 68.3 years and radiographic follow-up 6.2 years. 74% femora had type 3 or 4 bone loss. All distal segments were radiographically osseointegrated. Proximal segment radiolucent lines were frequent (40%). Early minor subsidence occurred in 4 (6.2%) hips. Definite bony regeneration was documented in 73% femora and stress-shielding in 26%. HHS improved from a pre-operative mean of 50.1 points to 86.2 at most recent follow-up.

Discussion: A consistent pattern of bony remodeling and osseointegration occurred which could be applied for assessment of fixation and stability of this stem. The well established criteria of osseointegration for cylindrical cobalt-chrome stems may have to be altered for application to these stems as the mechanism of load transfer is entirely different. Stems with diameter of 18mm or greater are clearly predisposed to stress shielding, predominantly at the mid-shaft region.

Thursday, October 7, 2010, 14:20-15:00

Session B6: Computer Navigation in TKR 2

Effect of Total Knee Arthroplasty on Varus Knee Biomechanics During Gait

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Introduction: Although Total Knee Arthroplasty (TKA) has been shown to correct abnormal frontal plane knee biomechanics, little is known about this effect beyond 6 months. The purpose of this study was to compare sequentially the knee adduction moment during level-walking before and after TKA in varus knees. We hypothesized that adduction moment would diminish after TKA proportionate to the tibio-femoral realignment in degrees.

Methods: Fifteen patients (17 TKA's) with varus knees were prospectively enrolled and gait analysis performed prior to, 6 months and 1 year following TKA. Reflective markers were placed on the lower extremity and motion data collected using six infrared cameras (Qtrac, Qualysis). Ground reaction forces were recorded with a multicomponent force plate (Kistler). A repeated-measures ANOVA was used to compare changes in the peak adduction moment and

peak dynamic varus angle over time.

Results: TKA corrected static knee alignment from 2.2 (2.5) degrees varus to 3.5 (2.7) degrees valgus ($P < 0.001$). Peak dynamic varus angle during gait was reduced from 9.7 (6.5) degrees to 3.6 (5.8) degrees at 6 months and 5.2 (7.6) degrees at 1 year (Main Effect of Time; $P=0.005$). Peak adduction moment was significantly reduced to 85% of pre-op level at 6 months ($P=0.037$) but subsequently increased to 94% of pre-op level at 1 year ($P = 0.539$). Post-op improvement in static alignment did not correlate with the change in adduction moment at any follow-up period ($P = 0.671$). A significant correlation was found between the increase in dynamic varus angle and the subsequent increase in adduction moment from the six-month to the one-year follow-up ($P = 0.008$).

Conclusion: TKA improves knee adduction moment at 6 months but this effect is lost with time (1 year). Despite restoration of static knee alignment and soft tissue balance, loading conditions at medial compartment remain high, predisposing to medial polyethylene wear, a finding reported by retrieval studies.

Friday, October 8, 2010, 8:40-9:50

Session B10: Navigation and Robotics in Arthroplasty

Improving Accuracy by Patient Specific Instruments

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Introduction: The importance of frontal and rotational alignment in total knee arthroplasty has been published. Together with conventional instrumentation, computer navigation has been used for many years now. The pro's and con's of navigation are well known since.

Materials & Methods: We present the results of our first 200 total knee arthroplasties with a Patient Specific Instrument System, called Signature (Biomet). With this system an MRI of the hip, knee and ankle is performed. Based on these images, mechanical axis and rotational landmarks are decided. Preoperative planning and templating is done with a computer program. Alignment, rotation, slope, size, positioning and gaps are planned with the software. Based on this templating a femoral guide and a tibial guide are custom made (Materialise) for each patient that will allow only one unique fit and position. Both of these guides are no cutting guides but pinning guides. From that stage on Vanguard Total Knee (Biomet) is implanted with this system applying conventional surgical techniques and rules.

Preoperative alignment was measured on standing full leg X-rays. Rotational alignment was set according to the epicondylar axis. Slope was by default fixed at 3° posterior slope. Femoral flexion was set at 3° by default. Sizing was done with the system. Tourniquet time, blood loss, mean Hb drop and lateral release rate as hospital stay were analyzed. Postoperative full leg X-rays and CT scan were analyzed.

Results: Preoperative alignment range between 18° varus and 19° valgus. Sizing was accurate in 82% of cases. Postoperative alignment was accurate in 90% of cases with a range between 0°

and 2°. The 2° of varus was often seen on a standing full leg but not on the lying CT scan. Our normal range of alignment is +/- 3°. Rotational alignment was better in valgus knees in the PSI group. Tourniquet time was 10 minutes shorter. The blood loss was dramatically reduced since intramedullary canals were not violated. Mean Hb drop was 1,2 g/dl. No lateral releases were performed. Hospital stay was 5 days (return to home). Extra cost was MRI and guides for a total of 500 euros.

Conclusions:

Patient specific templating gives excellent results both clinically and radiographically.

OR time is reduced resulting in cost reduction.

Avoiding IM rods will reduce blood loss and possible bone marrow embolisation.

Especially in minimally invasive valgus knees this system is advantageous, helping in femoral rotational and tibial alignment.

Signature allows to apply conventional surgical techniques with navigation-like control on the cuts

Thursday, October 7, 2010, 11:00-11:20

Session B4: Ethnic and Gender Issues in TKR.

Bicompartmental Arthroplasty as an Ethnic and Gender Solution in Arthroplasty

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Total Knee Arthroplasty (TKA) has a tendency to change the individual anatomy of the patient within the limits of today used arthroplasty designs. Femoral external rotation will lead to mediolateral overhang by upsizing to avoid lateral notching and downsizing will lead to loss of posterior condylar offset. Posterior slope is usually reduced to avoid problems with posterior stabilized (PS) designs.

We compared 50 bicompartmental arthroplasties (Uni + PFJ) with 50 TKA's. Demographics and BMI are compared. We looked specifically at patient type, preoperative deformity, postoperative function and alignment and results on functional scores.

Bicompartmental arthroplasty is a resurfacing intervention that allows less correction of frontal deformity. Postop alignment was within 3° of varus. Better active flexion was obtained than in TKA. Better function was observed for stair climbing and single leg stability. Rotational position of foot was more natural in bicompartmental as compared to TKA. Functional scores like WOMAC, KOOS and IKDC showed better results for bicompartmental. Illness perception score showed that the resurfacing patient is another patient than the TKA patient. No overhang of components was observed. No change of posterior condylar offset was necessary. Posterior

slope on the medial side was minimally reduced.

In conclusion resurfacing by bicompartimental arthroplasty with two individual components (Uni + PFJ) is an excellent solution to gender and ethnic differences. The individual anatomy of the specific patient goes through minimal changes resulting in better functional results.

Saturday, October 9, 2010, 16:00-16:50

Session B22: Arthroplasty- Getting it Right!

Blood Loss and Transfusion Rates With MIS Total Knee Replacement Surgery in a Community Hospital Setting Utilizing Sympony Platelet Gel

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Total knee arthroplasty has been associated with substantial blood loss in the perioperative period necessitating a substantial risk for blood transfusions. There are various methodologies utilized to decrease postoperative anemia and minimize the need for allogeneic blood transfusions. These include autologous pre-donation, the use of erythropoietin and the use of perioperative cell salvage. Although all of these are successful in decreasing postoperative anemia, there is still a significant risk of allogeneic blood transfusions in the postoperative period. This is a retrospective review of a consecutive series of total knee replacements investigating blood loss and the need for postoperative blood transfusions utilizing MIS surgical techniques and Symphony™ platelet gel as the sole means of blood conservation.

PATIENT DEMOGRAPHICS

Between January 1, 2005 to December 31, 2005, 83 total knee arthroplasties were performed in a variety of community hospitals by a single orthopedic surgeon. The mean age was 64 years (SD 11.6, range 28-90) and the mean BMI was 34.1 (SD 7.6, range 21.3 to 53.4). 71% of the patients were females and 29% males.

All patients, regardless of deformity, age or size, had a quad sparing MIS total knee arthroplasty performed utilizing cemented posterior stabilized components and all patellae were resurfaced. No patients pre-donated any blood products or had erythropoietin and no drains were utilized postoperatively. All patients had application of Symphony™ platelet gel prior to the interoperative release of the tourniquet. All patients received Coumadin on the day of surgery and were managed for four weeks postoperatively to keep their INR approximately 2.0.

RESULTS

The mean preoperative hemoglobin was 14 (SD 1.2, range 10.7 to 16.6). The average postoperative hemoglobin was 10.0 (SD 1.1, range 8.0 to 14.2). The average drop in

hemoglobin was 4.0 with a SD of 1.1. A total of two patients were transfused in this series of 83 patients for a total transfusion rate of 2.4%. The average length of stay was 3.4 days with the SD of 3.7. No patients suffered a CVA, myocardial infarction or pulmonary embolus in the two-month postoperative period.

CONCLUSIONS

The results show that even utilizing MIS surgical techniques and Symphony™ platelet gel, there is still substantial blood loss in patients undergoing unilateral total knee arthroplasty utilizing cemented components with a mean drop of hemoglobin of four grams or 20% of their mean preoperative hemoglobin. However, in spite of significant loss of hemoglobin, most patients tolerated the postoperative anemia very well and there were no complications in this series related to anemia and this did not prolong their length of stay, which was an average of 3.4 days. Only a very low percentage of patient's in this series required a postoperative transfusion (2.4%). This report supports the continued use of MIS surgical techniques along with Symphony™ platelet gel to minimize the need for postoperative transfusions in total knee arthroplasties.

Friday, October 8, 2010, 15:00-16:00

Session A15: Alternate Bearings 2

5-Year Results of a Series of 100 Consecutive Arthroplasties With a Large Diameter Metal-on-Metal Femoral Head

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Purpose of the study: to verify, after a period of 5 years, that no particular complication overshadows the benefits of a large diameter metal-on-metal articulation in combination with a conventional femoral stem with regard to stability and functional result.

Patients and methods

Between October 2003 and May 2005, 100 hips in 99 patients were treated with an uncemented Emeraude stem and a Durom Resurfacing Cup made from cobalt-chrome with high carbon content. Mean age at time of surgery was 60 years. 80 of the operated patients were reviewed after a follow-up of 5 years and two months: the results are expressed according to Merle d'Aubigné and Harris, by means of the UCLA and the WOMAC scores. The radiographs were reviewed by independent observers. The patients underwent a chrome and cobalt test in whole blood. Of the 20 patients lost to follow-up, 13 had died, 1 could no longer be located, 1 had been revised because of a peri-prosthetic fracture and the remaining 5 were unable to show up

for the follow-up examination. A telephone interview and the WOMAC did not reveal any complication in their cases.

Results

The mean Merle d'Aubigné and Harris scores increase from 9.8 to 16.3 and from 37.4 to 79.9, respectively. The UCLA score improves from 4.2 to 6.5. The corrected WOMAC is 77.2%. But the results after 1 year show a distinct difference between the first 30 patients (Harris score of 58.2) and the subsequent patients (Harris score of 82.4). The radiographic analysis does not show any migration; the observed radiolucencies, whether around the fixation wings or at the level of the surface coating, are not progressive; mean cup inclination is 52°.

The mean values for chrome are 1.95 µg/l and for cobalt 2 µg/l.

Discussion and conclusion

This study confirms the relevance of this concept with regard to stability (no dislocations) and functional result, and reveals no particular complication. The less good clinical results are to be attributed to the pain previously noted in the first 30 cases, before our technical experience led us to impact an undersized cup in respect to the last used rasp. This technique enables a better centering of the cup, ensures that the latter does not protrude nor expose it to excessive equatorial compression, which seems to cause pain. We have no doubt that it is this technical modification that has spared us the complications that have led some of our colleagues to abandon this type of implant.

Thursday, October 7, 2010, 16:50-17:40

Session B8: Management of Complications in TKA

Surface Treating of Endoprostheses by Stitching-in Silver

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Infected mega-endoprostheses are difficult to treat with systemic antibiotics due to encapsulation of the implant by fibrous tissue, formation of biofilms and antibiotic resistant bacteria. Modifying the implant surface by incorporating a bactericidal agent may reduce infection. Infection rates are typically in the range of 8% to 30%. This study describes a novel process method of "stitching-in" ionic silver into the implant surface, *in vitro* testing and its early clinical usage.

A novel process has been developed to “stitch in” ionic silver into the upper surface of titanium alloy (Ti6Al4V). The process produces a modification by anodisation of the titanium alloy in dilute phosphoric acid, followed by absorption of silver from an aqueous solution. The engineered surface modification is therefore integral with the substrate and loaded with silver by an ion exchange reaction. Using this technique the maximum inventory of silver for typical a mega-prosthesis is 6mg and this is greater than 300 times lower than the No Observable Adverse Affects Level (NOAEL). Scanning electron microscopy revealed that the silver was concentrated in pits and forming reservoirs of ionic silver exposed to the body tissues.

Laboratory-based studies focusing on the safety and efficacy of silver as a bactericidal agent have included investigation into cytotoxicity using fibroblast and osteoblast cell lines, the impact of silver in reducing corrosion and laboratory testing to establish if the modified surface has an effect on the wear and mechanical characteristics. A range of fatigue, static, tensile pull off tests were performed. The silver elution profiles for both silver loaded and HA coated over a silver loaded surface have been examined. Histological studies were also performed to examine the impact of the silver on osseointegration.

The *in vitro* results confirm that silver is an effective antimicrobial agent. The mechanical characterization studies have identified that the surface treatment has no or minimal impact on the implant surface. Early results of the elution studies are encouraging showing that the HA coating of a silver loaded surface does not “seal” in the silver.

To date (May 10) 147 silver treated mega-prostheses have been implanted since March 2006. The majority of implants were distal femoral (29%), proximal tibial (23%) or hemiplevic (10%). The most common indication was revision of a failed limb salvage reconstruction (58%), with the dominant cause of failure being infection. The next most common indication was bone tumour (31%) and the large majority were used in the high risk skeletal locations of the tibia (44%) and the pelvis (27%). Early clinical results are encouraging indicating a significant reduction in the incidence of infection.

Three implants have been retrieved. An analysis of a proximal humeral replacement that had been *in situ* for 6 mths identified that there was 10-20% remaining on the implant surface.

This novel process of “stitching-in” silver appears to be a safe and effective surface treatment in helping to control infections of mega-prostheses. This technology has the potential to be transferred to other arthroplasty joints.

Saturday, October 9, 2010, 14:50-15:20

Session A22: Tribology and Biomechanics in Arthroplasty

Mobile-Bearing Total Knee Arthroplasty for Knee Osteoarthritis Complicated With Permanent Patellar Subluxation

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Permanent patellar subluxation is treated with surgeries such as proximal realignment and distal realignment, ; however, it is difficult to cure this condition by using any methods. We performed mobile-bearing total knee arthroplasty (TKA) in a case of severe knee osteoarthritis complicated with permanent patellar subluxation since childhood, and obtained good results without performing any additional procedures.

The patient was an 82-year-old woman with severe pain in the left knee. During the initial examination, the range of motion of the left knee joint was -10° of extension to 140° of flexion, and the Japanese Orthopaedic Association (JOA) score for knee osteoarthritis was 40 points (maximum score : 100). Preoperative radiographs showed a varus deformity in the left lower extremity with a femorotibial angle (FTA) of 188° , the axial view showed luxation of the patella.

We performed TKA using a mobile-bearing implant. Intraoperative findings revealed that the central articular surface of the distal femur had disappeared, and that the patellar articular surface was concave and dome-shaped. The lateral patellofemoral ligament was released; this procedure was identical to that performed in conventional TKA.

Postoperative radiographs showed good alignment, with an FTA of 173° . In the axial view, the patella was located in a reduced position at any angle of knee joint flexion.

The postoperative range of motion of the left knee joint was 0° of extension to 130° of flexion. The patient was able to walk without the support of a T-shaped cane.

There are many surgical treatments for permanent patellar subluxation. The appropriate treatment is selected according to the type and seriousness of the dislocation and the age of the patient.

From the findings of the present case, we believe that in a case of knee osteoarthritis complicated with permanent patellar subluxation, surgery performed using a mobile-bearing implant would eliminate the necessity of performing additional proximal realignment and distal realignment.

Thursday, October 7, 2010, 11:00-11:20

Session B4: Ethnic and Gender Issues in TKR.

Sizing and Sature in TKA: Surgical Implications and Considerations

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More than two thirds of TKA are performed on women. Most TKA systems are based on the male anatomy. Therefore one could ask if a women specific design is needed in Knee

Arthroplasty. There are two distinct types of distal femur: the normal one and the narrow one. In the narrow femur the problem of overhang can occur because for a given AP dimension (sizing of the implant) the corresponding ML dimension is too large. Many years ago these findings were already published in different articles. It is only in recent years that interest came from the industry. In our department a study project was initiated in January 2006. This led to the development of the Stature Femoral component for the Advance Medial Pivot knee prosthesis. The first one was implanted in June 2007 and since then it is used in 60% of our female patients and 11% in our male patients. The reason why it is quite often used in male patients is because not only gender influences distal femoral geometry but also morphotype is an important factor. Therefore irrespective of gender, ectomorphs will have smaller ML ratios and thus will have smaller knees and will benefit from a Stature variant. Moreover we have seen that the correct use of the Stature variant can also influence our clinical scores and our percentages of ligament releases with overall better results.

Thursday, October 7, 2010, 15:10-15:50

Session B7: Robotic Knee Surgery

Early Outcomes of Robotically Guided Bicompartamental Arthroplasty

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Introduction:

Bicompartamental osteoarthritis involving the medial tibiofemoral and the patellofemoral compartments is often treated with total knee replacement. Improved implants and surgical techniques have led to renewed interest in bicompartamental arthroplasty. This study evaluates the radiographic and early clinical results of bicompartamental arthroplasty with separate unlinked components implanted with the assistance of a robotic surgical arm. In addition, we examine the amount of bone resected using unlinked bicompartamental components compared to total knee replacement. Finally, a retrospective review of total knee cases examines the applicability of this early intervention procedure.

Methods:

97 patients received simultaneous but geometrically separate medial tibiofemoral and patellofemoral arthroplasties with implants specifically designed to take advantage of a new bone and tissue sparing implantation technique using haptic robotics. These patients came from four surgeons at four different hospitals. The average follow-up was 9 months. Pre- and post-operative radiographs were taken. ROM, KSS and WOMAC scores were recorded. The patients had an average age of 67 yrs (range: 45-95), BMI of $29 \pm 4 \text{kg/m}^2$. 47% of the patients were

male.

We retrospectively reviewed pre and post operative notes from 406 consecutive TKA patients from a single surgeon. Intraoperative data included the integrity of the three compartments and the ACL.

Results:

At only six weeks follow-up, patients recovered their pre-operative ROM ($p=0.37$). Knee Society Knee scores (knee and function) and WOMAC scores (pain, function and total) significantly improved from pre-operative values at every follow-up of 6 weeks, 6 months and 1 year ($p<0.05$). Radiographically, there was no evidence of loosening, wear or progression of OA. There were also no perioperative complications.

Using computer simulation, the amount of bone removed using bicompartamental arthroplasty compared to traditional TKA was predicted. Total bone removed on the femur and the tibia using a standard TKA implant is 3.5 times the bone removed using a bicompartamental only implant and 4 times the bone removed when using a bicompartamental inlay implant.

In the review of 406 TKA cases, the ACL was intact in 66% of these cases. Based on these data alone, 16% of these TKA patients were indicated for a unicondylar arthroplasty, 12% medial UKA, 3% lateral UKA and 1% PFA. In addition, 31% were indicated for bicompartamental arthroplasty with 4% bicondylar (medial and lateral UKA), 6% lateral UKA and PFA and 21% medial UKA and PFA. While these data don't yet account for fixed versus flexible deformities, excessive osteophytes or other contraindications, it seems clear that the disease often treated with a TKA does not actually involve all three compartments.

Conclusions:

Modular bicompartamental arthroplasty is an effective method for treating arthritis of the knee restricted to the medial and patellofemoral compartments. Early results using contemporary prostheses are encouraging and should prompt further mid- and long-term study. Robotic assistance of bicompartamental arthroplasty has shown good early clinical and radiographic success. In addition, bicompartamental arthroplasty removes significantly less bone than total knee arthroplasty. Also, data indicates that many total knee patients have healthy cruciates and disease in only two of the three compartments, indicating that TKA is an overtreatment of earlier stage osteoarthritis. Longer term studies will determine the clinical significance of preserving healthy cartilage and ligaments routinely resected with traditional tricompartmental TKA.

Figures

the Femoral Component?

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Introduction

High-flexion knee implants have been developed to accommodate a large range of motion (ROM > 120°) after total knee arthroplasty (TKA). In a recent follow-up study, Han et al. [1] reported a disturbingly high incidence of femoral loosening for high-flexion TKA. The femoral component loosened particularly at the implant-cement interface. Highly flexed knee implants may be more sensitive to femoral loosening as the knee load is high during deep knee flexion [2], which may result in increased tensile and/or shear stresses at the femoral implant fixation.

The objective of this study was to analyse the load-transfer mechanism at the femoral implant-cement interface during deep knee flexion (ROM ≤ 155°). For this purpose, a three-dimensional finite element (FE) knee model was developed including high-flexion TKA components. Zero-thickness cohesive elements were used to model the femoral implant-cement interface. The research questions addressed in this study were whether high-flexion leads to an increased tensile and/or shear stress at the femoral implant-cement interface and whether this would lead to an increased risk of femoral loosening.

Materials & methods

The FE knee model utilized in this study has been described previously [3] and consisted of a proximal tibia and fibula, TKA components, a quadriceps and patella tendon and a non-resurfaced patella. For use in this study, the distal femur was integrated in the FE model including cohesive interface elements and a 1 mm bone cement layer. High-flexion TKA components of the posterior-stabilised PFC Sigma RP-F (DePuy, J&J, USA) were incorporated in the FE knee model following the surgical procedure provided by the manufacturer. A full weight-bearing squatting cycle was simulated (ROM = 50°-155°). The interface stresses calculated by the FE knee model were decomposed into tension, compression and shear components. The strength of the femoral implant-cement interface was determined experimentally using interface specimens to predict whether a local interface stress-state calculated by the FE knee model would lead to interface debonding.

Results

During deep knee flexion, tensile stress concentrations were found at the femoral implant-cement interface particularly beneath the anterior flange. Shear stress concentrations were observed at the interface beneath the anterior flange and the posterior femoral condyles. The peak tensile interface stress increased from 1.6 MPa at 120° of flexion to 5.5 MPa during deep knee flexion at the interface beneath the anterior flange. The peak shear stress was even higher at this interface location and increased from 4.1 MPa at 120° of flexion to 11.0 MPa at maximal flexion (155°). Based on the interface strength experiments, 5.8% of the interface beneath the anterior flange was predicted to debond at 120° of flexion, which increased to 10.8% during deep knee flexion.

Discussion

Obviously, the FE knee model utilized in this study contains limitations which may have

affected the interface stresses calculated. However, the results presented here clearly demonstrate increasing tensile and shear stresses in substantial parts of the femoral implant-cement beneath the anterior flange during deep knee flexion. Based on the interface strength experiments the anterior interfacial stress-state calculated by the FE knee model leads to local interface debonding during deep knee flexion, which increases the risk of femoral loosening. Proper anterior fixation of the femoral component is essential to reduce the risk of femoral loosening for high-flexion TKA.

References

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Saturday, October 9, 2010, 10:30-11:05

Session B18: Pot Pourri!

Bisphosphonate-Associated Subtrochanteric Stress Fractures: An Emerging Epidemic

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The senior author has treated a series of patients with subtrochanteric and diaphyseal femoral stress fractures associated with long-term alendronate or other bisphosphonate usage. Several patients completely fractured their femurs prior to referral. Most patients had consulted other physicians and were referred for presumed neoplasms. All patients had been diagnosed with osteoporosis and had been treated with bisphosphonates. Their plane radiographs revealed abnormalities that are pathognomonic of bisphosphonate-associated stress fractures. However, due to the subtle nature of these new unfamiliar abnormalities, most were unrecognized as such by clinicians (including experienced ISTA member hip surgeons) and radiologists. This series is presented to illustrate this pattern of impending fracture.

The authors have reviewed and will present a series (n=17) of femoral stress fractures in bisphosphonate-treated patients to illustrate the clinical and radiographic pattern of these stress fractures, and review their treatment.

The most common lesion is a subtrochanteric lateral cortical thickening that in actuality is a horizontal plane "dreaded black line" of a stress fracture with surrounding proximal and distal cortical thickening of the endosteal and periosteal bone. The stress fracture line is obscured unless a near-perfect radiographic projection is obtained. The lesion is best seen with CT scans. MRI scans reveal the stress fracture lines with surrounding edema (Fig 1), which may be

misinterpreted as a tumor. Without treatment, a low-impact completed fracture will likely occur.

Many bisphosphonate-associated impending subtrochanteric femoral stress fractures are misdiagnosed as trochanteric bursitis, leading to subsequent displaced subtrochanteric fractures [Fig. 2 - Note subtle impending fracture lesion on right, completed fracture on left]. The clinical and subtle radiographic findings must be recognized by orthopaedic surgeons, particularly hip surgeons, to prevent these complete fractures. These fractures are preventable with internal fixation. Long-term administration of bisphosphonates can have adverse effects, and alternatives to long-term continuous dosing must be investigated to determine optimal administration regimens.

Figures

[Figure 1](#) [Figure 2](#)

Friday, October 8, 2010, 8:00-8:30

Session A10: Bearings and Tribology

Metal Bearings in Hip Arthroplasty – What Have We Learned?

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Metal Bearings in Hip Arthroplasty – What Have We Learned?

Large metal on metal bearings have come back to hip arthroplasty the past five to ten years with great promise to minimize wear debris, eliminate osteolysis, reduce dislocations and improve range of motion. While some of these claims have proven to be true, new problems have surfaced that threaten the success of these devices. Metallosis, “pseudotumours” and ALVAL (aseptic lymphocytic vasculitis associated lesions) are appearing. These lesions produce pain that is difficult to confirm on routine exam and xray but eventually lead to early revision surgery.

This paper will examine the advantages and complications of this hard bearing surface with a special look at complications, their prevention and management.

Mid-Term Results of Hi-Tech Knee Cementless Total Knee Arthroplasty : 5 To12 Years Follow-Up

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Introduction: The purpose of this study is to evaluate the mid-term results of clinical and radiographic results Hi-tech knee a cementless total knee arthroplasty (Nakashima medical Co. Ltd., Okayama, Japan). This TKA system was developed in Chiba University from 1994. The characteristic of this system are flat on flat CR-TKA and cementless fixation. Contact surface are made of titanium alloy and UHMWPE, which is produced by the direct compression mold manufacturing method.

Material and Method: Between May 1998 and May 2005, we performed 53 consecutive primary TKAs for 42 patients. There were 41 women and 1 man with a mean age of 64.4 years (39 to 78 years). The average follow up period was 7 years 8 months (5 years to 12 years). Osteoarthritis knee were 21 knees and rheumatoid arthritis were 32 knees. The mean pre-operative FTA was 181.7

degrees (168 to 203 degrees). The method of the operation went in measured cut technique for all cases. All 53 knees were implanted with a cruciate retaining prosthesis. All compartments, included a patella component, were fixed without cement. Clinical evaluations were performed according to American Knee Society (KS) system, knee score and function score.

Results: The mean preoperative and postoperative, at the latest follow up, maximum flexion angles were 104 and 114 degrees, respectively. The KS knee score and function score improved from 47.5 and 38.9 points before surgery to 87.6 and 80.4 points after surgery, respectively. Postoperative alignment FTA average 174.8 degrees. Within follow up period, it maintained good valgus-varus stability. There was no major loosening. Six knees (11%) were observed radiolucent line at medial tibia plateau less than 1mm. No revisions of TKA were required because of loosening or sinking. There was also no problem at patellar component.

Conclusions: Hi-Tech knee a cementless TKA system was made for the suitable for a Japanese knee, strong initial fixation in a concept. The patella component is also cementless fixation. Contact surface are made of titanium alloy and UHMWPE of the direct compression mold method, it was able to protect the abrasion of the polyethylene in a stable state, too. The mid-term results of Hi-Tech knee a cementless TKA , not only OA but also RA patient knee, provided almost good results.

Cadaveric Evaluation of the MAKO Multi Compartmental Knee Kinematics

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Introduction:

The MAKO Surgical Rio Robotic Arm utilizes the pre-op CT images to plan positioning of the uni-condylar and patella-femoral components in order to achieve the most desirable kinematics for the knee joint. We hypothesize that the anatomic matching surfaces and the cruciate retaining design of the Restoris knee will best replicate normal knee kinematics. We tested the healthy cadaveric knee versus the MAKO knee and the most common TKR designs in order to evaluate and compare the kinematic properties.

Methods:

Six healthy male left knees were dissected to leave only the knee capsule and the quadriceps tendon intact. The femur and the tibia were cut 20cm from the joint line and potted with cement into a metal housing. The knee was attached to a crouching machine capable of moving the knee joint through its normal human kinematics from extension to maximum flexion, validated in previous studies. Forces applied to the quadriceps tendon allowed the knee to flex and extend physiologically, and springs attached to the posterior were substituted as the hamstrings at a rate of half the force exerted by the quadriceps as shown in the literature. Three dimensional visual targets attached to the bones were tracked by computer software capable of recreating the positions of the bones in any given flexion angle. A cruciate retaining and posterior stabilized TKR design were chosen to represent the TKRs most commonly available in the market today. The intact knee, MAKO implanted knee, CR and PS TKR designs were tested in sequence on the same specimens. The computer software analyzed the normal distance between the bone surfaces and plotted the locations of contact which could then be quantitatively compared for each given scenario [Fig. 1].

Results:

Our results showed that the MAKO knee kinematics resembled the normal knee kinematics throughout the knee flexion range. The TKR designs altered the kinematics of the knee where the internal rotation of the tibia was no longer observed with the increasing flexion angle, while the femoral roll back in high flexion was only replicated by the post of the PS design and not by the CR design.

Conclusions:

Anatomic restoration of the joint surfaces and retention of the cruciate ligaments maintained normal kinematics, which is expected to be an advantage in obtaining improved clinical results.

Figures

[Figure 1](#)

What Can We Do With Periprosthetic Fractures?

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WHAT CAN WE DO WITH PERIPROSTHETIC FRACTURES ?

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Aim: Periprosthetic fractures are usually observed in patients aged over 65 years. The incidence of postoperative periprosthetic femur and tibia fractures is rising with increasing number of hip and knee joint replacements and the increasing life expectancy. The aetiology of periprosthetic fractures is multifactorial. Minimal trauma is causal for the fracture in most cases. Other risk factors are: generalized osteoporosis, loosening of the prosthesis and revision arthroplasty. Our aim is restoration of the patient's pre-fracture functional status.

Method: Between 2004 and 2009 in the Asklepios Orthopedic Clinic Hohwald 118 patients (82 women, 36 men) were operated because of periprosthetic fractures. Mean patient age at surgery was 71 years (range 60-87). The right treatment depends on the location of the fracture and the stability of the implant. Very important is also the quality of bone and the patient's general state of health.

Results: A successful surgical treatment requires a careful preoperative planning. The type of the fracture with or without prostheses instability and with or without bone defect all have influence on the type of patients surgery. Two patients died within one year. There were 2 cases of infection and cases of 5 late healing. Fixation with different plates was used for 67 fractures, at intact and undamaged endoprosthesis was used usually osteosynthesis with "Less Invasive Stabilisation System" plate (LISS, NCB). It combines high primary stability with the biological advantages of a slide-insertion plate osteosynthesis.. Retrograde nailing was possible in 5 patients and 8 further with screws and cerclage wiring. In 38 cases we changed the endoprosthesis partially or completely. We reconstructed prosthetic damage or periprosthetic fractures with bone defect using modular prostheses. This system allows a large number of additional components and their combination with cone blocks for reconstruction of severe bone

defects.

Conclusion: Periprosthetic fractures have such a range of clinical presentations that they need to be managed on individual basis. The best functional results for stable implants gived internal fixation with a plate. Alternative osteosynthetic techniques and additive minimal osteosynthesis can work better in special cases. Modular prostheses for bone replacement are a method of choice for fractures with extensive bone loss. Nonoperative treatment should only be performed in exceptional cases. Periprosthetic fractures are serious complications because of the mortality and the difficulty in achieving functional recovery after treatment. Our primary aim is remobilization as early as possible-that is the best prevention of secondary complications.

Keywords:

Periprosthetic fractures, Total hip replacement, Total knee replacement, Revision arthroplasty

POSTERS

Poster: 1

Pyoderma Gangrenosum in Revision Total Hip Arthroplasty: Clinical and Histopathological Findings.

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Introduction: Pyoderma gangrenosum (PG) is a medically treatable neutrophilic ulcerative dermatosis which may occur in surgical or traumatic wounds. This poster report describes the clinical and histopathological findings associated with PG in revision total hip arthroplasty (THA).

Methods: A 76 year-old male underwent revision THA and required warfarin for paroxysmal atrial fibrillation. Postoperatively, he developed wound drainage, skin blistering with bullae and a necrotic purulent appearance, and an elevated INR(6.8). He returned to the OR for presumed infection (or possible warfarin induced skin necrosis), underwent irrigation and debridement – the fascia was intact and cultures were negative. A well-demarcated atypical ulcer, with an irregularly bordered area of redness was noted around the wound, which was biopsied in multiple locations. At 3-years following revision, the hip is functioning normally and the ulcer and skin have remodelled and the patient is asymptomatic (Fig 4)

Results: The histology of the biopsy demonstrates the typical findings associated with PG including (Fig 1,2)ulceration with epithelial undermining. The ulcer is covered by fibrinopurulent exudate along with the presence of a dense dermal neutrophilic infiltrate. Higher magnification (Fig 3) demonstrates lysis of collagen within the ulcer. Warfarin induced skin necrosis would show vascular thrombi with initial bland necrosis, differentiating it from PG.

Discussion: PG is a clinically distinctive, but non specific, necrotic ulcer that may occur at a surgical site and may mimic infection or warfarin-induced skin necrosis. PG is previously unreported in revision THA. Confirmation of the diagnosis requires clinical-pathologic correlation and exclusion of infection by appropriate microbiological studies. This is important as the primary management is medical and not surgical.

Summary: Pyoderma Gangrenosum is a necrotic ulcer which may mimic surgical infection or warfarin induced skin necrosis. PG is previously unreported in revision THA, and is treatable.

Figure legend:

Figure 1: The biopsy shows (a) ulceration with epithelial undermining. The ulcer is covered by fibrinopurulent exudates along with the presence of a dermal neutrophilic abscess. (Haematoxylin-Eosin, 40x)

Figure 2: Epithelial undermining shown in a higher power view. (Haematoxylin-Eosin, 100x)

Figure 3: Higher magnification demonstrates lysis of collagen within the ulcer. (Haematoxylin-Eosin, 200x)

Figure 4: Clinical photograph of the healed ulcer over the right hip at 36 months postop.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#)

Poster: 2

The Use of Constrained Cementless Acetabular Component for Instability in Total Hip Replacement

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Background:

Recurrent dislocation after total hip arthroplasty is a disabling complication that can be difficult to treat. The purpose of the present study was to evaluate the early clinical and radiographic outcome associated with the use of a constrained acetabular component for instability in total hip arthroplasty

Patients and Methods:

Fifteen patients underwent either primary or revision total hip arthroplasty with cementless constrained acetabular component for different indications. The mean patient age at surgery was 57.4 years and the mean clinical and radiological follow-up period was 26.4 months. Clinical assessment was performed by the Harris hip score and at the latest follow up patients reported outcome using the Oxford hip score questionnaire. All radiographs were evaluated for evidence of loosening.

Results:

No dislocations were noticed in 14 out of 15 cases. Only one case had redislocations with the constrained prosthesis. The average Harris hip score increased from a preoperative mean of 22 (range, 16 - 36) to a postoperative mean of 85 (range, 66-94). Preoperatively, the Oxford Hip Score had a mean score of 48.6 and decreased to 20.5 at the final examination. All but one of the 15 hips had a well-fixed, stable cup. Femoral components stability was classified as stable bone ingrowth in all cases.

Conclusion:

Constrained acetabular component is a highly effective option for the treatment of hip instability in primary and revision arthroplasty in those at high risk of dislocation. The aseptic loosening rate is a major concern and has to be evaluated with long term studies.

Poster: 3

Comparison of Different Modalities of Post Operative Analgesia in Unilateral Total Knee Replacement Patients

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Introduction: We report the results of a prospective randomised trial comparing different modalities of post operative analgesia in unilateral total knee replacement(TKR) patients.

Methods: 90 patients aged between 50 to 80 years undergoing unilateral TKR were randomised into 3 groups.

Group 1: Patients only received patient controlled morphine analgesia (PCA). (control)

Group 2: Patients received PCA and intra-articular marcaine via continuous infusion pump.

Group 3: Patients received PCA and intra-operative periarticular injection of steroid and marcaine.

Visual analogue pain scores (VAS) , morphine consumption via PCA, number of days to ambulation, active range of movement(AROM) of operated knee, and length of stay(LOS) were the primary outcomes measured.

Results:Adequate pain control achieved in all 3 arms.

Group 3 demonstrates :

1. significant reduction in pain scores ($p= 0.002$) in the first 6 hours post surgery.
2. Significant reduction in the total morphine usage ($p=0.042$).
3. Decreased LOS compared to Group 1 ($p=0.006$) and Group 2 ($p=0.01$)

The number of days to ambulation, and AROM of the operated knee during the inpatient stay were similar in all 3 groups. The mean duration of surgery for Group 2 (100min +/- 23) was significantly longer compared to the other groups ($p=0.03$). After 24 months of follow up, no post surgical complications (eg, infection) were demonstrated in this study.

Conclusion: The periarticular injection of analgesia with steroid appears to be a safe and effective modality for pain control post TKR and demonstrates superiority over both control and infusion arms.

Poster: 4

Testing High Performance After Knee Arthroplasty: A New Objective Functional Score

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Functional recovery assessment after total knee arthroplasty requires specific evaluation tools. The objective of our study was to develop and validate a new objective functional scoring system which detect the ability of the patients to perform high activity level tasks. A secondary objective was to assess the activity level of patients with a total and unicompartmental knee arthroplasty compared to their peers.

Four matched groups of fifty patients each, below 65 years old, were recruited. One group were normal patients, one were patients with an osteoarthritic knee, one group were patients who underwent unicompartmental knee arthroplasty, and one group were patients who underwent posterior-stabilized total knee arthroplasty. All arthroplasty patients had the following inclusion criteria: Charnley category A, 18 months minimum follow-up, and excellent score at the Knee Society score. Examinations were performed by two blinded examiners. Outcome measures include the Knee Society Scoring System, the Knee Osteoarthritis Outcome Score (KOOS), and the new Knee Performance Score. The new score was developed to be administered in few minutes in every medical office setting, and without special instruments. It included simple tasks which explore the knee strength, flexibility, agility, and proprioception.

Patients with a well functioning posterior-stabilized total knee arthroplasty performed similarly to their healthy peers and to those patients with a unicompartmental arthroplasty. For few proprioceptive and agility tasks the healthy group and the unicompartmental one performed statistically better then the total knee group. Patients with a replaced or normal knee who rated higher in the strength tasks had a higher overall performance score. The new score showed high intra and interobserver reliability. Distribution of data did not show ceiling effect within excellent results.

The study has contributed further evidence to understand the level of functional recovery after knee arthroplasty. Subtle differences between different arthroplasty designs and patients categories may be evidenced using a more sensitive functional scoring system.

Flexion-Extension Gaps Configuration in Revision Knee Arthroplasty

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Gaps balancing during revision knee arthroplasty is a fundamental step of the procedure. Mismatch between flexion and extension must be addressed with different technical solutions involving prosthetic components modularity. The purpose of the study was to quantify flexion and extension gaps mismatch in revision knee arthroplasty.

A consecutive series of 46 revision knee arthroplasty performed between January 2006 and May 2009 was intraoperatively evaluated for gaps measurements. A tensiometer device was utilized with a torque wrench of 40 pounds. Measurements were taken after components were removed and soft tissue debridement performed (Fig1). Revisions were septic in 26% of the cases.

Gaps measured, on average, 27 mm (range: 23-33) in extension, and 32 mm (range: 24-38) in flexion. In 87% of the cases flexion gap was larger than the extension gap (Fig2, 3). In these cases, space in flexion was larger, on average, of 5mm (range 2-15 mm). Only one case had an extension gap larger than flexion gap, and in 5 cases there was no mismatch. Medial-lateral gaps symmetry was present only in 17% of the cases. Medial gap was larger than lateral in 46% of the cases. A larger lateral gap than medial gap was found in 37% of the cases.

The most frequent gaps scenario in revision knee arthroplasty is flexion large and extension normal. The second most frequent scenario is flexion very large and extension large. Occasionally, gaps can be equal or larger in extension. The surgeon should be ready, during revision TKA, to frequently manage a larger flexion gap compared to the extension gap.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#)

The Use of Modular Endoprosthesis for Tumors of the Proximal Femur

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Background:

Modular endoprosthetic replacements are commonly required to treat primary bone tumors as well as solitary metastasis of the proximal femur. Modular prostheses provide an off the shelf availability and can be adapted to most reconstructive situations for proximal femoral replacements.

Patients and methods:

Twelve consecutive patients underwent resection of the proximal femur and modular endoprosthetic replacement. The mean age was 45.25 years (ranging from 19 to 66 years). The follow up period of the study ranged from 14 to 120 months with a mean of 40 months. The Musculoskeletal Tumor Society (MTS) score described by Enneking *et al.* was used to assess functional outcome.

Results:

At latest follow up, two cases with metastatic diseases of the proximal femur were still alive with the disease. Another patient died after 14 months due to systemic metastasis. Eight cases were rated as excellent and one case as good. One case with a localized soft tissue recurrence in the surgical incision that appears six months after surgery and was excised with safety margin.

Conclusion

Modular endoprosthetic reconstruction provides good functional outcome in patients after proximal femoral tumour resection. They provide yet another treatment option in limb salvage. These patients have been evaluated and seem to have acceptable functional outcomes.

Poster: 7

Avascular Necrosis of Femoral Head: Reshaping the Head With Bone Graft

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INTRODUCTION. Avascular necrosis (AVN) of the femoral head is a condition that affects young adults that progresses to joint destruction. In an attempt to defer total hip arthroplasty in these patients, multiple treatment options have been proposed with still unsatisfactory results.

OBJECTIVE. Develop a technique to restore the articular surface with bone graft impacted through surgical hip dislocation approach in patients with AVN of the femoral head Ficat 4 to prevent early articular degeneration.

MATERIAL AND METHODS. We performed a prospective study in 5 patients with AVN of femoral head Ficat 4, 32 years old average (24-39). We treated all of them with a reshape of the femoral head with bone graft through surgical hip dislocation approach, all got a complete spherical head after the procedure. They were followed up with radiographs, CT and Harris Hip Score (HHS) at 3, 6, 12 months and then annually.

RESULTS. We obtained a complete spherical head in all cases, and restitution of the articular surface after surgery. HHS initially showed an improvement during the first six months (20 points average) Nevertheless patients began with progressive deterioration either in symptomatology and imaging. At 24 months after surgery (18-36) all patients had returned to preoperative HHS, radiographs and CT showed a complete collapse in the bone grafted zone. All patients needed a total hip replacement at that moment. There were no other associated complications.

CONCLUSIONS. The bone graft for the treatment of AVN of the femoral head Ficat 4, has no impact on the natural history of the disease. Patients had no clinical nor imaging improvement at short term follow up. We must look for another therapeutic alternative for young patients to preserve hip joint.

Poster: 8

Worse Clinical Prognosis Factors in the Surgical Treatment of Femoroacetabular Impingement

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We identify clinical, radiological and surgical factors that are associated with poorer clinical outcomes in the surgical treatment of femoroacetabular impingement

With the aim of establish bad prognosis' factors in clinical outcomes in the treatment of femoroacetabular impingement (FAI), we performed a retrospective study in 50 hips with FAI treated through surgical hip dislocation. We evaluated clinical, radiological and surgical features. Clinical outcomes were determined classifying according to symptomatology in: "asymptomatic", "better" and "without changes or worse" with respect to their preoperative condition. Statistical analysis was performed with SPSS v15.0.

The mean follow up was 4.2 years (3 - 8.5); 70% hips were “asymptomatic” , 22% “better” and 8% “without changes or worse”. In patients older than 45 years-old, 40% were “asymptomatic” versus 77% in younger than 45 years-old (p=0.03). Mixed impingement presented 37% “asymptomatic” versus 87% in cam and 82% in pincer impingement (p=0.003). In cases with osteoarthritis, 64% were “asymptomatic” versus 79% in those there were not radiologic osteoarthritis (p=0.225). The risk of osteoarthritis increased when the patient was >35 years-old (p<0.001). A longer time of symptomatology was associated with greater incidence of osteoarthritis (p=0.2). When the labrum was conserved, 80% were “asymptomatic” versus 65% when the labrum was resected (p=0.25).

Surgical hip dislocation is a good technique for the treatment of FAI, with good clinical results. We identify clinical, radiological and surgical factors that are associated with poorer clinical outcomes; they were: age >45 years-old, mixed impingement, hip osteoarthritis, labrum resection and prolonged symptomatology time.

Keywords: femoroacetabular impingement, surgical dislocation of the hip, hip osteoarthritis.

Poster: 9

Long-Term RESULTS of WAGNER-TYPE CONICAL STEMS for CEMENTLESS FEMORAL REVISION

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Long-term results obtained with the conical tapered stem designed by Wagner for cementless hip revision were on the whole very encouraging. Nevertheless we have identified some defects of the stem such as an excessive valgus neck, an insufficient offset for larger stems and a lack of modularity, making soft tissues tension sometimes difficult.

The T3 stem was designed with the purpose of correcting these defects. The T3 stem is made of Titanium alloy with a textured surface finish and is modular. The lateral offset has been increased to 42 mm (34 mm for Wagner’s stem) and the cervico-diaphyseal angle has been reduced from 145° to 138° degrees. Recently, the T3 stem has been substituted by the Restoration having a more varus neck (132° instead of 138°) and 3 sizes of distal stem (instead of 2). In this retrospective study we have analyzed the preliminary results obtained with the T3 stem.

We reviewed the first 30 consecutive cases having an average FU of more than 10 years.

We have always used a trans-femoral approach with “prophylactic” distal cable circlage. In no case an homologous bone graft was used. No re-revision was necessary. 87% of the femurs

showed good bone reconstruction and 23% some subsidence (only three cases >1 cm) without clinical symptoms except for the necessity of a compensatory heel pad.

Distal fixation stems like T3 are the implants of choice for severe bone stock loss (Paprosky 2C-3) for their immediate mechanical stability allowing early weight bearing. Transfemoral approach allows complete removal of debris and scar tissue, enhancing bone reconstruction, but a learning curve is necessary.

Poster: 10

A Novel Implant Modification for Post-Operative Hip Arthroplasty Stem Anteversion Identification

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Introduction

The technique for balancing a total hip on the femoral side involves positioning the stem to optimize leg length, offset, and component rotation. While plain radiographs can measure post operative leg length and offset, only a CT scan or MRI from the hip to the knee can determine stem anteversion by comparing femoral component rotation to the knee epicondylar axis. This is important information to obtain when planning a revision hip arthroplasty for instability or for acetabular revisions where the stem is well fixed.

Methods

We performed twelve total hip arthroplasties using a custom modified Zweymuller-type femoral stem where the anteversion of the implant could be measured radiographically on post-operative standing x-rays. Intra-operative surgeon assessment of stem anteversion was recorded as well. The radiographic measurements were validated based on post-operative CT or MRI scans performed within 3 weeks of surgery that measured the stem anteversion relative to the distal femur epicondylar axis.

Results

There were no peri-operative complications with a minimum follow up of 3 months. The radiographically measured post-operative femoral stem anteversion was accurate to within 2 degrees with a detectable range from 45 degrees of retroversion to 45 degrees of anteversion. Intra-operative assessment was less accurate when noted by the resident assist surgeon

compared to the attending surgeon.

Discussion

Proper implant orientation is critical to the long term success of a total hip arthroplasty, especially with newer hard bearings. Evaluation of this orientation is also an important part of pre-operative planning in revision surgery. While leg length discrepancy and offset mismatch are easy to determine based on post-operative x-rays, assessing stem rotation usually requires more powerful imaging methods which are costly and may have some morbidity. While surgical positioning of stem rotation of many popular proximally fixed tapered cementless stem designs can not be adjusted without significant intra-operative fracture risk, the distally fixed rectangular Zweymuller-type stems can accommodate near infinite stem anteversion safely. Our modification to this design enhances its functionality since it can aid in future pre-operative revision planning should the bearing or acetabular component fail.

Poster: 11

Isolated Patellar Arthroplasty at 15-Years: Dramatic Femoral, Tibial and Patellar Osteolysis : Not a "Simple Revision".

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Introduction: Isolated patellar arthroplasty (IPA) was performed prior to the advent of patellofemoral arthroplasty (PFA) for selected indications. The patella was resurfaced and the trochlea left unresurfaced. No studies of the long-term outcomes of IPA have been reported. The purpose of this study is to present a case with minimum 15-year follow up of IPA.

Methods: A 45 year-old female underwent IPA in 1994 for isolated patellar cartilage loss and osteoarthritis, and failed prior treatments (arthroscopy x3, open lateral release) with an all polyethylene 2-peg cemented patellar component (GUR 1050 ram extruded, g-air sterilization). At 15-years postop, she presented with anterior knee pain, swelling, effusions. Imaging demonstrated dramatic osteolysis involving the patella, posterior tibial PCL origin, and the femoral epicondylar collateral ligament origins. The remaining patellar host bone shell was very thin, with moderate OA of the tibia-femoral joint.

Results: Conversion to cemented total knee arthroplasty (TKA) was performed with bonegrafting of osteolytic defects, PCL substitution and a stemmed tibial component, and revision of the patella to a porous metal cementless implant. At 2-years follow up she is pain free, with radiographs demonstrating anatomic implant alignment and the porous metal patellar component ingrown.

Discussion: This report demonstrates the dramatic longterm effects of polyethylene wear that may occur with patellar arthroplasty. Osteolysis involving not only the patella, but the tibia and

femur may occur at the site of important ligamentous origins and insertions, compromising ligamentous function and host bone. The patellar component polyethylene method of sterilization likely contributed to the osteolysis. Caution regarding long-term results of current generation patellofemoral arthroplasty implants may be extrapolated from this 15-year case report. Revision of this long-term arthroplasty is not a 'simple revision' and patients undergoing current generation patellofemoral arthroplasty procedures should be followed closely for similar radiographic changes.

Summary: The dramatic longterm osteolysis associated with isolated patellar arthroplasty may involve tibial and femoral ligamentous attachments, compromising host bone and future TKA surgery.

Poster: 12

Intraoperative Evaluation of the Gender Knee

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The purpose of this study was to determine if the Gender Solutions NexGen® knee (Zimmer, Warsaw, IN) was successful in reducing femoral component overhang in women, which has been linked to joint pain.¹ This study compiled intraoperative data on 900 primary TKAs, including type of implant (gender vs. standard NexGen®) and measurement of femoral overhang. Comparative analysis showed that in 72% of cases the standard femoral components overhung in at least one zone, and the gender specific femoral component was selected in 70% of cases to correct this. In 15% of cases, better passive patellofemoral tracking was also observed in the gender component than in the standard. These findings suggest that the gender specific system does indeed address the need for femoral component sizing specific to women.

1. Mahoney OM and Kinsey T. Overhang of the Femoral Component in Total Knee

Arthroplasty: Risk Factors and Clinical Consequences. J Bone Joint Surg Am. 2010;92:1115-21

Postural Control Features in Total Hip Replacement Patients

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Total hip replacement (THR) is a widely accepted strategy to resolve the pain and functional limitation caused by hip arthritis or joint necrosis. Previous studies showed that THR was able to relieve the hip pain, change static standing balance, improve gait and quality of life.

Previous studies found that patients would increase the walking speed 1 year after THR and their performances approached the normal adults'. The researchs also showed that the affected leg's single support time increased significantly at 10 years after the surgery, due to relief of pain and improved range of motion. And the other research showed that, the stride length was improved at 3 months after the surgery.

The challenges of postural stability during crossing obstacles is greater than walking in daily life. But there is few study investigated the performances of crossing obstacles in THR patients. Previous studies showed that there were different postural control strategies between the young and older adults. The studies measured the COM-COP inclination angles during obstacle crossing, using the variances such as anterior-posterior, medial COM-COP peak inclination angles (A-P, M angles), instantaneous anterior and upward COM velocity (COM-Vy, COM-Vz) (Fig. 1). In older adults, there were slower COM-Vy, greater M angles, and smaller A-P angles than the young adult's performances, in the purpose of conservative crossing strategy. But there was still no study focused on the THR patients while they executing the challenged crossing obstacle activities.

The aim of this study is to compare the dynamic posture control at 1 week before surgery, 6 weeks and 3 months after surgery in THR patients to understand the recovery processes. The results of this study were expected to help clinicians develop the rehabilitation plans for optimal fall prevention after surgery and thus, fastening the patients returning to independent life and increasing the quality of life.

Using 8-camera motion analysis system (Vicon 512, Oxford, UK) and 2-forceplate (AMTI, USA) with 120Hz, 960Hz sampling rate to collect kinematic variables (walking speed, affected leg single support time and single/ double support time ratio in level walking, A-P and M peak inclination angles, instantaneous COM-Vy and COM-Vz occurred on the peak inclination angles) (Fig.2).

The results showed that, there was no significant difference in walking speed, step length, and single/ double support leg time ratio during level walking (Fig.3). But there was significant height in medial inclination angle ($p = 0.030$), significant time effect in COM-Vy ($p = 0.005$), and both time and height effect in COM-Vz ($p = 0.002$, $p = 0.018$) during obstacle crossing(Fig.4).

This results indicating that the more challenging the activity was, the more instability the dynamic postural control would be in the THR patients, and these subjects might use more compensatory strategies.

Figures

Poster: 14

Exchanging Polyethylene Liner With Cement Fixation in Well-Fixed Cementless Acetabular Cup

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Purpose: To analyze the short-term results of exchanging polyethylene(PE) liner with cement fixation in retained stable cementless acetabular cup.

Materials and Methods: A consecutive series of 19 hips of 19 patients who underwent revision total hip arthroplasty(THA) exchanging the liner with cement fixation in the retained stable acetabular cup were evaluated at an average follow-up of 38.9 months (24~75 months). The causes of revision surgery were liner wear and liner dislodging in all cases. There were 3 kinds of retained cementless cups, Harris-Galante(HG) II in 16hips, HG I in 2 hips and AML in 1 hip. There was a breakage of locking mechanism in 16 hips. There were 3 hips without breakage of locking mechanism, and it was a case of metal cup malposition, metal shell damage, and cup dislodging without tyne damage. All of the PE liner was exchanged into the cross-linked PE liner except with a case with low profile cup. In all cases, bone graft as an additional procedure was performed for the osteolysis around the acetabular components. Clinically, Harris hip scores, hip pain, limping and ROM were evaluated. Radiological changes, such as osteolysis, liner dissociation and wear, and bone graft incorporation were analyzed in consecutive series of radiographs.

Results: There was no case of re-revision surgery. There was a satisfactory improvement in Harris hip score from an average of 74.5 to 91.5. We could not find any cases with liner wear and liner dissociation from the cement fixation. There was no sign of alteration in the stability of polyethylene liner. The size of the osteolytic lesions significantly reduced postoperatively. Neither new osteolytic lesions nor a progression of Osteolysis were seen at the latest follow-up in bone graft area except a case with partial bone resorption. As a complications, there have been 4 cases of hip dislocation. None of these patients experienced recurrent dislocation after primary closed reduction.

Conclusion: Exchanging a PE liner with cement fixation revealed satisfactory short-term results. The result of the study demonstrates that the indication of this operation technique can

be extended to the cup with malposition, damaged shell, or the cup which has a high risk of liner dissociation because of weak original locking mechanism such as HG I and II cup. Even though our short-term follow-up study revealed excellent results, more long-term follow-up studies are mandatory to determine the long-term stability at the metal cup-cement-liner interfaces.

Key words: Osteolysis, cementless acetabular cup, polyethylene liner, cross-linked polyethylene, revision total hip arthroplasty

Poster: 15

Dilute Betadine Lavage Prior to Closure for the Prevention of Acute Postoperative Deep Periprosthetic Joint Infection

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Introduction: Infection is a devastating complication following total joint arthroplasty. Prior work has shown that a dilute betadine lavage prior to wound closure decreases the rate of infection following orthopaedic spine procedures. The purpose of this study was to evaluate the efficacy of a dilute betadine lavage in preventing early deep post-operative infection following total hip (THA) and knee (TKA) arthroplasty.

Methods: Dilute betadine lavage (0.35%) for 3 minutes prior to wound closure was introduced into the practice of the senior author in June 2008. 1,862 Consecutive cases (630 THA and 1,232 TKA) performed prior to initiation of this protocol were compared to 688 consecutive cases (274 THA and 414 TKA) after initiation of the dilute betadine lavage, for the occurrence of acute postoperative infections (within the first 90 days post-operatively). Infections were defined as gross purulence encountered within the joint at the time of surgical exploration or a deep culture positive for bacterial growth. A chi-squared analysis was performed to compare the rates of infection with and without the use of betadine lavage.

Results: Eighteen acute post-operative infections (0.97%) were identified prior to the use of dilute betadine lavage and one (0.15%) since its introduction ($p = 0.04$). There were no significant differences in the age (63.7 vs. 63.4; $p = 0.59$), percentage of female patients (66.2% vs. 66.9%; $p = 0.74$), or primary diagnosis of osteoarthritis (89.4% vs. 90.6%; $p = 0.38$) between the two groups.

Conclusion: These results suggest that dilute betadine lavage prior to surgical closure may be an inexpensive, effective means of reducing acute post operative infection following total joint arthroplasty.

Poster: 16

Dilute Betadine Lavage Prior to Closure for the Prevention of Acute Postoperative Deep Periprosthetic Joint Infection

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Introduction: Infection is a devastating complication following total joint arthroplasty. Prior work has shown that a dilute betadine lavage prior to wound closure decreases the rate of infection following orthopaedic spine procedures. The purpose of this study was to evaluate the efficacy of a dilute betadine lavage in preventing early deep post-operative infection following total hip (THA) and knee (TKA) arthroplasty.

Methods: Dilute betadine lavage (0.35%) for 3 minutes prior to wound closure was introduced into the practice of the senior author in June 2008. 1,862 Consecutive cases (630 THA and 1,232 TKA) performed prior to initiation of this protocol were compared to 688 consecutive cases (274 THA and 414 TKA) after initiation of the dilute betadine lavage, for the occurrence of acute postoperative infections (within the first 90 days post-operatively). Infections were defined as gross purulence encountered within the joint at the time of surgical exploration or a deep culture positive for bacterial growth. A chi-squared analysis was performed to compare the rates of infection with and without the use of betadine lavage.

Results: Eighteen acute post-operative infections (0.97%) were identified prior to the use of dilute betadine lavage and one (0.15%) since its introduction ($p = 0.04$). There were no significant differences in the age (63.7 vs. 63.4; $p = 0.59$), percentage of female patients (66.2% vs. 66.9%; $p = 0.74$), or primary diagnosis of osteoarthritis (89.4% vs. 90.6%; $p = 0.38$) between the two groups.

Conclusion: These results suggest that dilute betadine lavage prior to surgical closure may be an inexpensive, effective means of reducing acute post operative infection following total joint arthroplasty.

A Novel Method to Determine the Lower Limb Mechanical Axis in the Coronal Plane

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OBJECTIVE

Correct implant positioning is widely recognized as a key factor in the long-term success of total knee arthroplasty. According to the literature, malalignment of 3° or less in the frontal plane was observed in 75-80% of cases performed using the classical method (intramedullary rod allowing bone cut adjustment according to preoperative X-ray planning) and 90-95% of cases using traditional computer assisted surgery (CAS). Despite improving alignment accuracy, CAS has not been accepted as widely as expected due to cost and time involved.

Our goal is to describe a new method for determining lower-limb mechanical axis in the coronal plane which improves alignment accuracy and is easier to use and less expensive. This new method relies on mechanical instruments to align the frontal plane with an extramedullary system.

METHODS

According to basic Euclidean geometry, the perpendicular bisector of a chord circle passes through the center of a circle (Figure 1). When a knee is brought from abduction to adduction, it moves on a circle. The center of this circle is the hip's center of rotation.

The Exactech Mechanical Positioning System features a vertical bar firmly fixed to the operating table rail and a horizontal arm overhanging the operated knee (Figure 2). The system can be used to mark any point on the femoral condyle and "remember" its spatial location. The situation in space of a selected point on the femur is determined both in abduction and adduction. A rod passing perpendicularly through the center of the segment joining these two positions automatically crosses the center of the hip.

The coronal plane femoral axis was determined using this method and alignment was verified using an image intensifier to visualize the hip joint center in 20 total knee replacements performed between March and June 2007. The differences between the actual hip center and the mechanical axis were documented in the results.

RESULTS

In comparison with the ideal 0° reference axis:

Mean error (in degrees) \pm SD: 0.6 \pm 0.6

Error \leq 1°: 80% of cases

Error \leq 3°: all cases

CONCLUSIONS

The Exactech Mechanical Positioning System determines the mechanical axis of the lower limb in the frontal plane without violating the femoral intramedullary canal. The results shown verify

the alignment accuracy and repeatability of the instrument. Although, the results in this study are very promising, it is recognized that this was a small patient sample and controlled use by one surgeon. It is recommended that more studies be conducted of the alignment system in the hands of additional surgeon evaluators and on their patient populations.

Figures

Poster: 18

Minimum 25 Years Follow-Up of a Cementless Hip Stem: Definitive Results of Our 300 First CLS

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High survival rates have been reported for the uncemented CLS Spotorno stem in previous publications by the designer's surgery team. Analogous results were reported by several independent works in which this stem was implanted, also in combination with different cups. To investigate the real longevity of this stem we performed an update of our follow-up (the last was published in 2003): in this work we report the outcome of first consecutive 299 patients (300 hips) in which the first generation CLS stem was implanted between 1983 and 1985, with a resulting minimum follow-up period of 25 years.

We retrospectively evaluated radiographic and clinical results (by Harris hip score) of available patients. In order to obtain overall survival curves, we considered revision (or indication to revision) of the stem as the end point of the survival curve; patients who died with a well functioning hip were not considered as failures; in only 1 case a patient deceased with a pendant indication to revision. This way we found a trend comparable to our previous curves published in 2003.

We also elaborated survival curves with asepting loosening of the stem as the only end point: in this case we obtained a 95% isolated survival rate of the stem at 25 years (95% confidence interval, 91%–97%). Clinical scores definitively lose its importance at so long term follow-up (due to cup revision surgeries outcomes), anyway our median Harris hip score was 82 points. Surprisingly no thigh pain was reported in available patients and no distal femoral osteolysis was found in radiograms we could evaluate.

The long-term survival of our CLS stem series favorably compares with other similar studies

and it's the highest rate has been reported for an uncemented stem in the third decade.

Poster: 19

Cement Penetration in Impaction Bone Grafting by YU Revision System: Experimental Study

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Background: The impaction bone graft (IBG) technique is one of the important surgical technique to recover bone stock and obtain implant stability in revision for failed femoral stem with extensive bone defect. The purpose of this study is to evaluate the thickness of the cement mantle and grafted layer, and cement penetration to the grafted layer in the improved IBG technique by experimental model.

Materials and methods: Frozen swine femoral head and distal femur were morsellized by comb type bone mill. Morsellized bone was impacted into five sawbones (model no. 1193, Sawbones, USA). YU revision system (JMM, Osaka, Japan) was used for IBG procedure. The canal of femur was completely packed with morsellized bone at first and reamed by drill through the guide pin. Finally, the medullar space was finished up with the stem impactor and bone pusher. Helical CT scan (Aquilion 16, Toshiba, Japan) was examined after removal of the stem to analyze the thickness of the cement mantle and grafted layer, and cement penetration to the grafted layer.

Results: Average thickness of cement mantle was 1.32 mm (0.84 - 2.02 mm) and average thickness of Grafted layer was 3.26 mm (1.08 - 10.07 mm). Cement penetration was found at any slice level, and some of which reached to the endosteal of the sawbone.

Discussion: IBG technique with morselized allogenic bone to the patient with small femur and narrow canal is difficult. Grafted layer tends to insufficient especially at middle part of the implant. Our modified IBG technique is useful to make the grafted layer safety and uniformly. It is reported the structure characteristic of the cement and grafted morsellized bone complex is one of the important factor on primary stability of the implant. The results of this study seemed to indicate strong mechanical strength.

Conclusion: Our modified IBG technique was useful for the formation of adequate cement mantle and the grafted layer.

Poster: 20

Intra-Operative Analysis of the Kinematic Behavior of a Total Knee Replacement by a Navigation System. Initial Experience and Further Development.

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INTRODUCTION: Modern total knee replacements aim to reconstruct a physiological kinematic behavior, and specifically femoral roll-back and automatic tibial rotation. The most frequent studies are cadaver studies, which cannot reproduce easily the real clinical situation. Most clinical studies only analyze the post-operative kinematic with fluoroscopic evaluation, but there are few possibilities to compare pre- and post-operative kinematics and to assess the modification due to prosthesis implantation. An intra-operative analysis may allow improving the reconstruction by choosing the most appropriate component adaptation and ligament tension. We developed a specific software derived from a clinically used navigation system to allow in vivo registration of the knee kinematics before and after total knee replacement. We wanted to test for the feasibility of the intra-operative registration of the knee kinematics during standard, navigated total knee replacement.

MATERIAL-METHODS: We are using on a routine basis a non image based navigation system for total knee replacement. The standard software has been modified in order to allow the intra-operative registration of the knee kinematic before and after implantation. The software measures the respective movement of the femur and the tibia, and specially antero-posterior translation and tibial rotation during passive knee flexion. Kinematic registration was performed twice during an usual procedure of navigated total knee replacement: 1) Before any bone resection or ligamentous balancing; 2) After fixation of the final implants. 200 cases of total knee replacement have been analyzed. Post-operative kinematic was classified as following: 1) Occurrence of a normal femoral roll-back during knee flexion, no roll-back or paradoxical femoral roll-forward. 2) Occurrence of a normal tibial internal rotation during knee flexion, no tibial rotation or paradoxical tibial external rotation.

RESULTS: Recording the kinematic was possible in all cases. The results of both pre-operative and post-operative registrations were analyzed on a qualitative manner. The results were close to those already published in both experimental and clinical studies. About femoral roll-back, 54% had a normal femoral roll-back during knee flexion after total knee replacement, 13% had no significant roll-back and 33% had a paradoxical femoral roll-forward. About tibial rotation: 65% had a normal tibial internal rotation during knee flexion, 16% had no significant tibial

rotation and 19 had a paradoxical tibial external rotation.

DISCUSSION: It is possible to record the kinematic behavior of a knee intra-operatively during total knee replacement. This might help choosing the most appropriate type of reconstruction to get a closer to a normal kinematic. The surgeon might for example test different posterior tibial slopes, different heights of polyethylene inlays, different rotational position of the tibial component... However, only passive kinematic may be analyzed, and it might be significantly different from the active kinematic after the procedure. Furthermore, this software allows a kinematic registration of the antero-posterior stability, which is not commonly displayed by usual navigation system. This may help choosing between preservation or substitution of the posterior cruciate ligament.

Poster: 21

Accuracy of CT Based Navigation System for Acetabular Component Placement in Cementless Total Hip Arthroplasty

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Introduction: Proper positioning of the acetabular component in total hip arthroplasty (THA) is essential regarding the short-term success and longevity. Improper cup placement may lead to dislocation, accelerated polyethylene wear associated with periprosthetic osteolysis, and component loosening. Because of substantial errors of manual technique in cup placement even with experienced surgeon, computer aided navigation system has been developed in recent years. The advantage of applying navigation system is enhanced especially when we operate in the lateral decubitus position, which may precipitate misjudgment in estimation of pelvic orientation. The purpose of this study was to evaluate how accurate we were able to place cementless cups with CT based navigation system compared with the conventional mechanical guiding instruments.

Materials and Methods: Sixty patients who underwent cementless total hip arthroplasty with CT based navigation system (Stryker Japan) were employed for this study. The average age of the patients at the time of surgery was 63.9 years (range, 30-84 years, 9 men and 51 women). We implanted cementless hemispherical TriAD cups (Stryker Japan) using direct lateral approach in lateral decubitus position. For all the patients, post-operative CT scans were performed and the cup inclination and anteversion angle were measured using 3D image-processing software (Stryker, Japan). Control group included 30 patients who underwent THA with the conventional mechanical guiding instruments, using same implant and surgical exposure. The difference between the intra-operative target angle and the angle measured from the post-operative CT image were calculated and the accuracy was compared between the navigated and conventional groups.

Results: The accuracy (mean of the absolute difference between intra-operative target angle and post-operative CT angle) of anteversion angle was 4.0 ± 4.7 degrees in navigated group, and 12.5 ± 8.2 degrees in conventional group. The accuracy of the inclination angle was 3.1 ± 3.5 degrees in navigated group, and 5.4 ± 3.4 degrees in conventional group. When we focus on the recent 30 cases in the navigated group, the accuracy of anteversion and inclination angle was 2.5 ± 2.1 degrees and 1.7 ± 1.4 degrees respectively. There was no postoperative dislocation in both groups.

Conclusions: Our study clearly showed that CT based navigation system improved accuracy of the cup placement in cementless THA, especially for the anteversion angle. On the contrary, unexpected poor accuracy of the conventional technique was revealed. Although there are some disadvantages such as initial investment, additional operation time for the placement of trackers and surface registration, and learning curve, the CT based navigation system has great advantage to minimize the complication due to improper placement of the cup and maximize the longevity of total hip arthroplasty.

Poster: 22

Dysplastic Hip

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Dysplastic hip means abnormality during development resulting in abnormality of depth, orientation and/or configuration, it is usually associated with proximal femoral abnormality and there is statistical association between an abnormal center edge angle and the incidence of hip osteoarthritis.

50 cases of dysplastic hip were done by different techniques with the aim to regain the anatomical hip center with reasonable coverage and well fixed cups.

All the cases are evaluated according to Crowe classification with new technique for hip replacement in D.D.H by iliofemoral distraction and new evaluation in hip replacement following fracture neck femur.

Lumbar Disc Replacement. an 11-Years Experience.

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LUMBAR DISC REPLACEMENT. AN 11-YEARS EXPERIENCE.

INTRODUCTION

The treatment of low back pain due to a disc pathology has been changed in the last years thanks to the improvement of the biomechanical knowledge and therefore to the role of the intervertebral disc in the segment of motion. However prosthesis and instrumentations have had important improvements. Arthrodesis is still a diffused technique in vertebral surgery but the overloading of the discs above and below is a common complication. The segment of motion preservation is becoming imperative not only in young patients.

MATERIAL AND METHODS

From November 1998 to March 2009 we implanted 92 lumbar disc prosthesis in 88 patients. 70 were females and 18 males. The minimum age was 21 years old and the maximum 60 years old. The average was 40. We have never treated patients over 60 years old neither patients with poor subcondral bone quality. Most of the cases were primitive lumbar disc degeneration, only 14 of the patients treated were suffering for low back pain and radicular pain after previous surgery. In 8 cases the levels were L3L4, in 59 L4L5 and in 25 L5S1. In 4 patients we performed a 2 level disc replacement. Charitè was used in 4 cases, Prodisc in 12 and Maverick in the remaining 76 cases (64 frontal and 12 oblique implants). The follow up starts from a minimum of 3 months to a maximum of 11 years and 6 months.

RESULTS

VAS and Oswestry disability index were used to evaluate the clinical outcomes. In 95% of the cases we had excellent results with the remission of the symptoms. We had 3 cases of abdominal muscles paresis and 1 of these underwent an abdominal plastic reconstruction. In 4 patients we had a paravertebral simpatic suffering with an alteration of the thermal sensibility of the lower limb. One male patient developed an irritation of the sacral plexus with an inverse eiaculation. In only 6 cases a radiological asymmetric positioning was found, even if without symptoms. There was an important remission of the radicular pain in the 14 cases of secondary surgery. The complications might have been linked to the first operations since we never have found them in the most recent cases. The weight bearing was allowed the day after surgery with an abdominal bandage. In most of the patients the feeling of an important and immediate clinical changing was found. All of the patients returned back to work and practicing sports.

CONCLUSIONS

We consider that the prosthesis with a fixed metal on metal insert are easier to handle especially considering the surgical implantation technique, furthermore the one with the oblique insertion allows a less invasive mobilization of the iliac vessels above all approaching L4L5. Despite this is an apparent invasive surgery, all of the patients were able to walk the day after the operation and they were discharged after 2 or 3 days. We are very satisfied of this technique, even if a severe selection of the patients and a long learning curve is requested.

Figures

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Poster: 24

Diagnosis and Prevention of Venous Thromboembolism in Our Hospital

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[Introduction]

Venous thromboembolism (VTE) is one of important complications after total hip replacement (THR), which we have to pay full attention and prevent it. We examined the occurrence of VTE on the preventive anticoagulant therapy (fondaparinux, enoxaparin) cases and compared the VTE positive group (VTE+) with the VTE negative group (VTE-).

[Patients and Methods]

As the object of our present study, we took 246 patients whom underwent first THR during the two years from August 2007 to July 2009. 37 were men and 209 were women (mean age 62.9). After the operations on all of the patients, we took multi-detector row CT scan (MDCT) the next day and diagnosed the existence of VTE. 42 were VTE+ (17.1%) and others were VTE-. Then, we compared age, BMI, blood loss, operation time, plasma levels of two coagulation activation markers (SFMC[$\mu\text{g/ml}$], D-dimer[$\mu\text{g/ml}$]) between VTE+ and VTE-. Furthermore, we measured and evaluated the distance from the surface of proximal tibia to the point of deep vein thrombosis (DVT) in the calf of 35 DVT positive patients.

[Results]

The mean age was 66.7 in VTE+ and 62.1 in VTE-, which makes VTE+ older than VTE-. There were no significant difference in BMI, blood loss and operation time between VTE+ and VTE-. The day after the operations, SFMC was 20.6 ± 19.8 in VTE+, and 13.4 ± 22.6 in VTE-. The D-dimer of seventh postoperative day was 12.7 ± 7.0 in VTE+, and 10.0 ± 5.0 in VTE-. The scores of SFMC and D-dimer in VTE+ were higher than those of VTE- and there were significant difference in both scores ($p < 0.05$). Out of 35 DVT positive cases, one patient had thrombosis in a hemi-external iliac vein and the one patient had complicated pulmonary embolism. The distance from the surface of proximal tibia to the point of DVT in calf which was $123.5 \pm 52.1 \text{mm}$ (0~203mm).

[Discussion]

From August 2007, we are enforcing the preventive anticoagulant therapy after all operations except the cases that have severe complications. Because the SFMC of first postoperative day and D-dimer of seventh postoperative day were significantly different between VTE+ and

VTE-, we considered that the two coagulation activation markers are significant in evaluating VTE despite of whether or not enforcing preventive anticoagulant therapy. In this research, there were a lot of cases that had DVT in proximal calf. Therefore, there needs to be more exploitation such as producing intermittent pneumatic compression (IPC) device, which could reduce the occurrence of DVT in proximal calf.

Poster: 25

Multi-Center Study of Exeter Stem in Japan

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"Purpose" Exeter stem was introduced to Japanese market at 2000. Since then, owing to its excellent clinical results, the number of the stem used has been increased and more than 2000 stems have been implanted during the year 2009. The present study aims to prove its efficacy for Japanese patients by evaluating short term results of four major dedicated hip centers.

"Method" We present the short-term multi-center results of primary THA with Exeter stem used for the femoral side in 1000 hips. Mean postoperative follow up period was 5 (ranging 2 to 9) years. "Results" At final follow up, no radiolucent line at bone-cement interface or focal osteolysis was observed. Cortical hypertrophy was observed at Gruen zone 2, 3 4, 5, and 6 in 10%. Neither osteolysis nor loosening was observed in every case. Kaplan-Meier survivorship analysis predicted a rate of survival of the femoral component at 9 years of 100% with revision for aseptic loosening as the endpoint. "Conclusion" The present study revealed excellent short-term result was obtained using Exeter stem combined with modern cementing technique for Japanese patients.

Poster: 26

Fondaparinux Prevents DVT, but Not PE in Total Knee Arthroplasty With MDCT Analysis.

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Introduction

Deep venous thrombosis (DVT) and pulmonary embolism (PE) are serious complications after joint arthroplasty. We assessed DVT and PE after total knee arthroplasty (TKA) by 64-slice multi-detector row CT (MDCT), which can simultaneously detect DVT and PE within 1 minute. The first purpose of this study was to assess the prevalence of PE and DVT after TKA. Fondaparinux is a synthetic pentasaccharide and highly selective inhibitor of activated Factor Xa. The second purpose of this study was therefore to assess the prevention of PE and DVT by using fondaparinux after TKA.

Materials and Methods

We investigated 72 patients (9 male, 63 female) (88 knees; 79 OA, 9 RA) operated on between May 2006 and March 2009. Forty-four knees in the non Fondaparinux (nonFP) group equipped with a venous foot pump on both legs until walking and 44 knees in the FP group that received a subcutaneous injection of Fondaparinux and the venous foot pump were not significantly different between age, gender, and BMI. Compression stockings were routinely used for 2 weeks after walking in both groups. At day 7, patients underwent MDCT to detect DVT and PE, and the results were evaluated by a radiologist.

Results

In the nonFP group, DVT was revealed in 10 patients (22.7%), whereas PE occurred in 5 patients (11.4%). In the FP group, DVT was revealed in 4 patients (9.1%), whereas PE occurred in 6 patients (13.6%). The incidence of DVT in the FP group tended to be less than the nonFP group ($p = 0.08$). All patients were asymptomatic. Bleeding occurred in 7 patients (15.9%) in the FP group, whereas there was no bleeding in the nonFP group. We confirmed that a cutoff value of 8.0 $\mu\text{g/mL}$ for D-dimer was highly sensitive (86.7%), but had low specificity (45.2%), for the diagnosis of DVT. For the diagnosis of PE, D-dimer had low sensitivity (72.7%) and low specificity (41.6%).

Conclusion

Our results indicate that prophylaxis with a venous foot pump and Fondaparinux is a very successful strategy for prophylaxis against DVT in TKA, but not for PE. We concluded that D-dimer level on post operative day 7 appears to be an indication of the no occurrence of DVT after TKA. But D-dimer levels were not an indication of PE after TKA.

Accuracy of Acetabular Cup Positioning by Using a New Acetabular Reaming Guide in Total Hip Arthroplasty

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Introduction: The goal of total hip arthroplasty (THA) should be to reconstruct the acetabulum by positioning the hip center as close as possible to the anatomical hip center. However, the true position of the anatomic hip center can be difficult to determine during surgery on an individual basis. In 2005, we designed and produced an acetabular reaming guide to enable cup placement in the ideal anatomical position during THA. The purpose of the present study was to examine the accuracy of acetabular cup positioning using our acetabular reaming guide in 230 cases of THA.

Methods: At planning, the distance from acetabular edge to reaming center and from the center to perpendicular of inter tear drop line by AP X-ray was measured. In operation, each of cases was adjusted this reaming guide, indicated the reaming center and reaming with the process reamer. This guide was applied in 230 patients undergoing primary THA between April 2005 and June 2009. According to the Crowe classification, 188 patients were classified as Group I, 28 patients were classified as Group II, 10 patients were classified as Group III, and four patients were classified as Group IV.

Results: At planning, the position of hip center by AP X-ray was 18.1 ± 3.5 mm in vertical offset (VO : the vertical height to hip center from inter tear drop line) and 29.6 ± 3.9 mm in horizontal offset (HO : the horizontal distance to hip center from the vertical line through the middle of tear drop). After operation, the position of hip center was 18.1 ± 3.8 mm in VO and 29.9 ± 4.7 mm in HO. The absolute error between planning and post-operation was 2.7 ± 3.1 mm in VO and 2.9 ± 2.2 mm in HO. 199 cases (86.5%) were less than 5mm error with HO. 204 cases (89.6%) were less than 5mm error with VO. The vertical height from tear drop line to inferior edge of acetabular cup was 0.5 ± 3.5 mm. The cup inclination angle was 43.4 ± 3.5 °. The cup anteversion angle was 17.1 ± 6.7 °.

Discussion and conclusion: The use of our new reaming guide enabled an acetabular cup position to be obtained during THA that closely reproduced the preoperative planning position and the clinically ideal implantation position. Our original acetabular reaming guide is a very useful tool for performing reaming during THA and for ensuring accurate cup placement at the anatomical hip center.

Poster: 28

PRP or Steroids in Lateral Epicondylitis? RCT With Two Year Follow Up.

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Context: Platelet Rich Plasma (PRP) has shown to be a general stimulation for repair.

Objectives: To determine the effectiveness of PRP compared with corticosteroid injections in patients with chronic lateral epicondylitis.

Design: A double blind randomized controlled trial with a two-year follow-up between May 2006 and January 2008.

Setting: The trial was conducted in two teaching hospitals in The Netherlands.

Patients: 100 patients with chronic lateral epicondylitis were randomly assigned in the PRP group (n=51) or in the corticosteroid group (n=49). Randomization and allocation to the trial group were carried out by a central computer system.

Intervention: Patients were randomized to receive either a corticosteroid injection or an autologous platelet concentrate injection through a peppering needling technique.

Main Outcome Measures: The primary analysis included VAS and DASH scores.

Results: Successful treatment was defined as more than a 25% reduction in VAS or DASH score without a reintervention after 2 years. The results resembled the results after 1 year follow up (published in AJSM 2010) but the 51 % success in the corticosteroid group dropped to 25% and the 73 % success in the PRP group increased to 85%. These figures were significantly different from each other and from baseline measurements ($p < 0.001$).

Conclusions: Treatment of patients with chronic lateral epicondylitis with PRP reduces pain and increases function significantly, exceeding the effect of corticosteroid injection, not only in the 6 months and 1 year results, but also in the 2 year follow up, making PRP as a treatment more cost effective. After two years again no harmful effects were observed.

Trial registration: ClinicalTrials.gov. Identifier: 2007-004947-31.
<http://www.clinicaltrials.gov>

In Vivo Measurement of Pennation Angle of the Vastus Lateralis and Medialis Muscles in Knee Arthroplasty

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Impairment of muscle strength just after knee arthroplasty is predominantly due to failure of active muscle contraction. However, how the failure of muscle contraction during this period has not been well documented. Vastus lateralis (VL) and medialis (VM) are pennate muscle. In the pennate muscle, pennation angle between the deep aponeurosis and fascicle increases with muscle activation. Therefore, muscle activation can be roughly estimated by measuring the change of pennation angle of VL and VM using ultrasonography.

Nine knees in nine patients (mean age, 72.0 years; range, 61-82 years) who received knee arthroplasty were included in this study. All the patients were female. Seven patients were osteoarthritis and two patients were rheumatoid arthritis. Six patients who underwent TKA with the medial parapatellar approach and three patients who received UKA with the subvastus approach were measured before and at a week after surgery. Ultrasonic measurement was performed both at rest and maximal muscle contraction.

From all the subjects, we could clearly observe the fascicles and aponeuroses for measuring pennation angles in ultrasonic images obtained from both VL and VM [Fig. 1]. Preoperative changes of pennation angles from at rest to contraction were 5.23°, 4.16°, 4.96° and 5.95° on average for the VL operated, VL non-operated, VM operated and VM non-operated limb, respectively. These angles decreased by 25%, 11%, 33% and 14% at a week after surgery.

All the patients showed that the ability of quadriceps muscle contraction has decreased in the operated limb. Although we could not draw a specific conclusion in the present study because sample size was too small, this study demonstrated that quadriceps contraction ability just after knee arthroplasty could be measurable by using ultrasonography. Ultrasonography is superior to other methods in terms of availability and non-invasiveness. We believe that assumption of data using ultrasonography regarding how the failure of voluntary muscle activation just after the surgery will greatly contribute to develop the surgical techniques and rehabilitation methods.

Preliminary Clinical Results of Patient Specific Cutting Guides for Total Knee Replacement (TKR)

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Current techniques rely on conventional instrumentation, which result in the violation of intramedullary canals and their accuracy is questionable. The repeated use of their numerous pieces may lead to disease transmission and contamination. Navigation techniques still rely on conventional instrumentation and both may overload hospital inventory, sterilization services, surgeons' learning curve and theatre time.

A new technique of using computer assisted preoperative planning to produce patient specific templates (cutting blocks) for TKR was previously reported by the first author. The technique completely replaced conventional instruments including intramedullary guides and significantly reduced operative time and the need for surgical assistants. The previous experimental surgery on 45 cadaveric and plastic knees showed high accuracy and reproducibility that were comparable to navigational systems without the use of navigation or computer assisted devices in the operating room.

We report the preliminary clinical results of this technique on patients undergoing TKR. Rapid prototyping technology was used to transfer the CT-based virtual preoperative planning of patients into physical femoral and tibial cutting blocks that uniquely matched the geometry of articular surfaces and allowed bone cutting as planned. The results on straightforward cases of TKR showed that the most critical step of this technique was the intraoperative positioning of the femoral and tibial templates (cutting blocks) on the distal femur and the proximal tibia. The templates were patient specific and their positioning was based on surface matching with their respective bones. Malpositioning would most likely result in errors in bone cutting. However, templates could be easily positioned to match the surface geometry of distal femur and proximal tibia and act as cutting blocks. This patient specific positioning accurately maintained all required angles in coronal, saggital and transverse planes such as femoral valgus, femoral rotation and tibial posterior sloping as shown in postoperative radiographs. No intramedullary perforation, pin insertion, tracking or registration was required. All operations were successfully performed using the templates without resorting to conventional instrumentation. The operative time was halved and the procedure could be technically performed without surgical assistance.

The technique was also proved to be useful for complex cases of extra-articular deformities. In such cases the use of conventional TKR techniques including intramedullary guides would not be technically possible and has high risk of errors and complications.

The patient specific templating (custom made cutting guides) for TKR can be routinely used for both straightforward and complex cases with extra-articular deformities. It also has the potential to be used as a training tool, allowing complete planning of surgery with 3-D simulation that facilitates identification and correction of errors in real time. It appears that this technique has several advantages over conventional instrumentation technique and is a simple and practical alternative to navigation and robotic techniques for TKR.

Reference:

Hafez MA, Chelule KL, Seedhom BB, Sherman KP. Computer-assisted Total Knee Arthroplasty Using Patient-Specific Templating. *Clin Orthop Relat Res.* 2006;444:184-192

Figures

[Figure 1](#)

Clinical and Laboratory Validation of a Novel Technique of Patient Specific Templating (Cutting Guides) for Total Knee Replacement

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Abstract

A new technique using computer assisted preoperative planning to produce patient specific templates for total knee arthroplasty was previously reported. This technique replaced conventional instrumentation including medullary guides and has significantly reduced operative time and the need for surgical assistants in TKA. The femoral and tibial templates act as cutting blocks that match the surface geometry of the distal femur and proximal tibial. However, errors in bone cutting and alignment may occur as a result of incorrect positioning of these templates. The purpose of this study was to test the accuracy and reliability of positioning the femoral and tibial templates by 5 observers. Each observer performed the experiment 5 times using femoral and tibial templates that were produced for a plastic knee model based on CT scan data. A navigation system measured alignment and bone cutting level for all reference cuts (tibial, posterior femoral and distal femoral). The mean alignment error was 0.67° (maximum 2.5°). The mean error for bone cutting was 0.32 mm (maximum 1 mm). The positioning of the templates was reliable, as there was no significant intraobserver and interobserver variation. This study showed a satisfactory level of accuracy and reliability of this technique. It appears that patient specific templating technique has several advantages over conventional instrumentation and is a simple and practical alternative to navigation and robotic techniques for TKA.

Key words: Reliability, accuracy, computer-assisted TKA, patient-specific, templates, rapid prototyping, surface matching

INTRODUCTION

The current techniques for total knee arthroplasty (TKA) rely on conventional instrumentation that consists of numerous pieces of jigs and fixtures. These are cumbersome, as they require set up, assembly, dismantling and cleaning, which are time consuming. Alignment guides perforate medullary canals, leading to a higher risk of bleeding³, infection²⁵, fat embolism¹⁸, and fractures.⁵ Reusable instruments carry a theoretical risk of contamination and may overload hospital sterilization services.

The outcome of TKA is dependent on surgical techniques^{7,8,36} that require a high degree of accuracy and reproducibility. Component malalignment may lead to early failure and revision surgery.^{15,17,33,44} As little as 3° of varus/valgus angulation can significantly change the pressure distribution of the total load, and hence the pressure distribution in the medial and lateral compartments of the tibial component.⁴⁴ The accuracy of plane radiographs in planning and evaluation is limited.^{14,19,22,26} The accuracy of conventional instrumentation has been questioned by many authors.^{3,4,16,20,40} Malalignment errors of > 3° may occur as a result of using intramedullary or extramedullary alignment guides.^{33,40,41} The accuracy of using conventional instrumentation for selecting the size of the prosthetic components is also questionable.¹³ Moreover, conventional instrumentation is based on average bone geometry, which may vary widely between patients.²⁹

Several authors have reported the superior accuracy of computer assisted techniques, such as navigation and robotics.^{3,4,6,30,37,40} However, the broad clinical applications of such techniques are limited by cost, complexity, set up time, and a long learning curve.³¹ Recently, a new technique^{10,11} was reported where computer assisted preoperative planning was used to provide patient-specific templates (cutting blocks) for TKA. Surgery can then be performed without conventional instruments or medullary guides. The most critical step of this technique is the intraoperative positioning of the femoral and tibial templates (cutting blocks) on the distal femur and the proximal tibia. The templates are patient specific and their positioning is based on surface matching with their respective bones. Malpositioning would most likely result in errors in bone cutting. No reports have been published to test the reliability of positioning the templates, particularly by new users.

The purpose of this study was to validate the accuracy and reliability of positioning the femoral and tibial templates of the patient specific templating technique for total knee arthroplasty.

MATERIALS AND METHODS

This laboratory experiment was performed by 5 observers; a surgeon (MAH) who is familiar with the PST technique, and 4 engineers who were experienced in using computer assisted systems such as robotics and navigation, but not familiar with the templating technique. These new users were initially sceptical about the accuracy of PST. The experiment was conducted using only one plastic knee specimen (Foam Cortical Shell, Model # 1151). The planning for TKA was based on the PFC prosthesis (DePuy/Johnson and Johnson, Leeds, UK). The typical steps for the PST technique are illustrated in Figure 1), were applied to this knee model. This includes CT scanning, reconstruction of 3-D images, sizing and alignment of prosthetic components, surgical simulation, template designing and finally production of patient specific templates using rapid prototyping technology. The knee specimen was held rigidly in a specific leg holder. The primary outcome measure was alignment and level of bone cutting, as determined by the position of the templates. A navigation system was used as a tool to measure alignment and level of bone cutting for reference cuts, while placing the femoral and then the tibial templates by each observer.

Figure 1: Typical steps used for computer assisted patient specific templating for total knee arthroplasty

The navigation system used in this experiment was VectorVision (BrainLab, Heimstetten, Germany). The navigation was just used as a measurement tool, without playing any role in guiding the observers, while placing the templates, since observers were not facing the navigation monitor. The routine steps for using navigation systems in TKA⁴⁵ were adopted. Two tracking pins were inserted into the distal femur, about a handbreadth from the knee joint and another 2 pins were inserted into the proximal tibia about 2 handbreadths from the knee joint. The tracking pins were 2 mm each and they served as rigid bodies to which one femoral and one tibial tracker were inserted. Each tracker has at least 3 reflectors (spheres) to reflect the infrared light, which is emitted by an optical camera. This allowed the camera to track the position of the trackers in 3 planes. A continuous line of sight has to be maintained between the trackers and the camera. The optical camera was connected to the navigation system, where data were computed and relevant information was displayed in a computer monitor. Anatomical data of the plastic knee specimen were collected using a pointed probe that is attached to a tracker. These data included a series of landmarks such as the centre of the hip, knee and ankle joints to allow the calculation of the mechanical axis by the navigation system. The centre of the hip (centre of the femoral head) was kinematically calculated by the navigation system while the operator rotated the femur in a circular fashion (circumduction). The centre of the knee was determined by touching the midpoint of the distal femur by the tracking probe. The centre of the ankle was calculated by the navigation system after touching the medial and lateral malleoli. Epicondylar axis was used to determine the rotation of the femur. The operator collected data on the bone surfaces by sliding the pointed probe over the surfaces of the distal femur and proximal tibia. The navigation system used all data to create a model specific to the plastic specimen. This allowed the measurement of alignment, rotation and level of bone cutting in real time by tracking a tracking plate that was inserted one at a time into the slits of the templates that corresponded to the reference bone cuts. This step is typically performed during navigated TKA, where the tracking plate is inserted into the tibial, distal femoral and anterior femoral slits of the conventional cutting blocks to measure alignment and level of bone cutting, before actual bone cuts are performed.

Each observer was asked to position the tibial templates one at a time, with the tracking plate in-situ (Figure 2). The navigation system continuously tracked the position of the tracking plates and subsequently measured alignment (coronal and sagittal) and level of bone cutting, which were displayed on a computer monitor in real time. When the observer was satisfied with the template position, an independent assessor recorded the measurements that were displayed on the navigation monitor. These measurements were done before bone cutting, as is typically performed, when using navigation systems in TKA. The same process was repeated for the femoral template positioning, with 5 observers and 5 times each. However, in this case there were 2 reference cuts and the template was first positioned, with the tracking plate inserted into the distal femoral slit and then positioned again, with the tracking plate inserted into the anterior femoral slit. The distal femoral slit was meant to measure alignment (coronal and sagittal) and level of bone cutting and the anterior slit was for femoral rotation.

Figure 2: An observer is positioning the femoral template while a navigation system is tracking and measuring the alignment and level of bone cutting

It was planned to collect 175 observations; 25 sets of observations (5 observers X 5 times) for each of these 7 measurements: tibial coronal alignment, tibial sagittal alignment, level of tibial cutting, femoral coronal alignment, femoral sagittal alignment, femoral rotation and level of femoral cutting. However, it was only possible to collect 163 observations, representing complete (25) sets of observations for all measured parameters, except for femoral rotation, which had only 13 sets of observations from 3 observers. Tibial rotation was not measured in this experiment, because it is difficult to accurately quantify the angle of rotation, based on ill-defined landmarks, such as the medial third of tibial tuberosity.

These recorded measurements were compared to the recommended figures for alignment, rotation and level of bone cutting that have also been followed during preoperative planning of PST. Femoral and tibial coronal cut were zero° to mechanical axis, femoral sagittal was in 3° flexion, tibial sagittal was 5° in posterior slope, level of bone cutting was 10 mm from the healthy component in both femur and tibia. These recommended figures were used as control measurements (ground truth) to determine the deviation of recorded measurement in degrees and mm. The difference between the recorded and the control measurements was considered as an error. When the recorded measurement was equal to the control measurement, the error was considered zero. These errors were analysed to calculate the mean, standard deviation and maximum (outliers). To assess the reliability of the PST technique, both qualitative and quantitative data were used to measure interobserver and intraobserver agreement. Kappa statistics was used to analyse qualitative data and determine whether the recorded measurement was within 3° or 3 mm (agreement) or more than 3° or 3 mm (no agreement). The use of 3° as a limit was based on clinical studies that showed 3° to be the maximum error that could be clinically accepted^{15,17,33}.

Quantitative analysis was performed using Friedman's repeated measure non-parametric analysis of variance (ANOVA) and Kruskal Wallis analysis of variance (ANOVA). The recorded measurements from all observers (would be 175) were compared to a control measurement of zero° or zero mm. This control represents the ideal measurement (i.e. no error). Interobserver and Intraobserver concordance was tested using Kendall coefficient of concordance. Correlation between the results of the study observers was done using Pearson moment correlation test (*r*). A probability value (*p* value) less than 0.05 was considered significant. All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) statistical program.

RESULTS

The positioning of the templates and the alignment of the subsequent femoral and tibial bone cuts had a mean error of 0.67°. The maximum error was 2.5°, which was recorded for the posterior sloping of one of the tibial cuts for one observer. The mean error in positioning the templates for the level of bone cutting was 0.32 mm (maximum 1 mm). The mean, standard deviation and maximum errors were calculated separately for each alignment measurements (tibial coronal, tibial post slope, femoral coronal, and femoral sagittal) and for each bone cutting measurements (femoral distal cut and tibial cut) (Table 1).

Table 1: The reliability test: Errors & interobserver agreement

Alignment & bone cutting errors	Tibial coronal (in degrees)	Tibial post slope (in degrees)	Femoral coronal, (in degrees)	Femoral sagittal (in degrees)	Femoral distal cut (in mm)	Tibial cut (in mm)
Mean	0.36	1.24	0.90	0.18	0.38	0.26
St Dev	0.12	0.25	0.18	0.01	0.10	0.12
Range	0 to 0.50	0.5 to 2.50	0 to 1.50	0 to 0.40	0 to 1.00	0 to 0.50
Interobserver agreement (P value)	< 0.003	<0.014	<0.002	0.002	<0.039	<0.002
Interobserver agreement (concordance coefficient)	0.800	0.617	0.814	0.812	0.502	0.840

For qualitative analysis, it was apparent (without even using Kappa statistics) that all measured values were within 3° indicating complete interobserver and intraobserver agreement. For quantitative analysis using Friedman test and Kendall concordance coefficient, there was an overall significant agreement between the observers ($p < 0.05$). The concordance coefficient was high indicating a considerable interobserver agreement for all measured parameters except femoral cutting level that had a relatively low concordance coefficient (Table 1). Comparison between **different recorded measurements for the same observer** (intraobserver variation test) showed significant agreement (p value < 0.003) and the concordance coefficient was very high. This means that there was no difference after repeating the same test by the same observer and there was a considerable intraobserver agreement (Table 2).

Table 2: The reliability test: Intraobserver agreement

Observers	A	B	C	D	E
Intraobserver agreement P value	<0.0002	<0.0003	<0.0002	<0.0002	<0.0032
Concordance coefficient	0.9497	0.9278	0.9638	0.9662	0.7118

Based on the 13 observations for femoral rotation measurements, the mean error of rotation was 1.86° (the standard deviation was 0.02° and the maximum error was 2.84° of excessive external rotation), as compared to the preoperative planning of 3° external rotation. No analysis was performed to determine interobserver or intraobserver variation for femoral rotation because of the incomplete data and the reduced number of observers (only 3 out of 5 observers). The

observers were able to do the experiment without surgical assistants. They found the templates to be user-friendly and could be uniquely positioned, and held with one or 2 hands.

DISCUSSION

Many authors^{3,4,16,20,40} have questioned the accuracy of the surgical techniques for TKA, using conventional instrumentation. The outcome of TKA is dependent on surgical techniques^{7,8,36}, and technical errors such as malalignment, may lead to early failure.^{15,17,33,44} Variations in surgical performance and outliers in TKA still occur, and they may affect the outcome.^{15-17,41} Although the reported long-term implant survival for TKA in elderly patients is 90–95% after 10–15 years.^{12,32,33}, some authors have questioned the high success rates due, to pitfalls in outcome measurement.^{27,28} There is also a need to improve the relatively inferior outcome results of TKA for young, active patients, and revision surgery^{32,35,38}, where the accuracy of bone cutting is critical and errors can result in depletion of bone stock.

Navigation and robotic techniques have recently been introduced, and several authors reported their higher level of accuracy, compared with conventional instrumentations.^{3,4,6,30,37,40} However, navigation techniques still rely on conventional instrumentation for making the various bone cuts, and they require additional instruments and insertion of tracking pins. This double instrumentation system (navigation and conventional instrumentations) may overload hospital inventory, sterilization services, and operating room time. The need to improve ergonomics in the surgical workplace³⁹ would be more difficult with bulky navigation devices that require registration and continuous line of sight for tracking.

Patient specific templating is another form of computer-assisted surgery and is based on the application of rapid prototyping technology. The latter has been used in dentistry and maxillofacial surgery but its medical applications are still in their infancy.²⁴ Radermacher³¹ first reported this technique in orthopaedic applications, and there are few scattered reports^{2,9} in the literature describing its use for producing customized models and guides. A new generation of patient specific templating has been reported^{10,11}, where templates act as a complete set of instruments for TKA that replace conventional instrumentation. The results of using this technique in 45 experimental TKA procedures, on 16 cadaveric and 29 plastic specimens were reported¹¹. The templates eliminated medullary guides and significantly reduced operative time. The accuracy results were based on the analysis of postoperative CT scans for 6 random cadaveric specimens. However, there was concern about the accuracy and reproducibility of positioning patient specific templates, particularly for new users.

The technique of patient specific templating has its own drawbacks, as it requires CT scans, which are not a routine requirement for TKA. Unlike navigation, templating techniques do not normally provide intraoperative measurements, since sizing, alignment and bone cutting are determined preoperatively. This study also has some limitations. The measurements for femoral rotation were only done for 3 observers, and were not complete. This was justified in the Methods section. Measurements were also done before, rather than after bone cutting. This had the advantage of eliminating errors, which are surgeon-dependent, rather than template-dependent. Intraoperative measurements using the current navigation techniques are routinely performed before bone cutting, as the cutting process itself cannot be navigated due to the vibration of the saw blades. It was also found to be unnecessary to waste resources and time, by

allowing bone cutting to consume 25 specimens of plastic knee models.

The results of this study showed a satisfactory level of accuracy with a mean alignment error of 0.67° (maximum 2.5°). The mean error for bone cutting was 0.32 mm (maximum 1 mm). This study also showed that the positioning of the templates is reliable, as there was no significant intraobserver and interobserver variation for alignment, or levels of bone cutting, in both the femur and the tibia. This is comparable with the results of a postoperative CT scan that was done for the patient specific templating technique in a previous study¹¹, where the mean errors for alignment and bone cutting were within 1.7° and 0.8 mm, and maximum errors were less than 2.3° or 1.2 mm. The level of accuracy and reliability is better than what is reported^{33,40,41} for conventional techniques that had errors > 3°. This level of accuracy also compares favourably with the results of navigation^{3,4,6,30,40} (within 3°) but less than what is reported by robotic techniques (within 1°).³⁷

The patient specific templating has therefore the potential to be used as a training tool, allowing complete planning of surgery with 3-D simulation that facilitates identification and correction of errors in real time. Also, it allows the measurement of surgical performance, by comparing postoperative imaging with the recorded preoperative planning. Rapid prototyping machines can produce a patient specific model of the knee joint, based on the CT scan data of the patient. Thus, the surgeon can perform TKA on the patient's model and evaluate the results before operating on the real patient. The Patient-specific templating is suitable for patients with knee deformities, in which intramedullary rods cannot be used. This technique also has the potential to reduce the risk of infection, by shortening the operative time and eliminating medullary perforation, excessive bleeding and tracking pins (in the case of navigation techniques). Since it provides single use instruments, it may be useful in areas where there is a high risk of variant Creutzfeldt-Jakob Disease (vCJD) that requires an extraordinarily high level of sterilization.⁴² Other imaging modalities may be used in the future, such as MRI or 3-D radiographX-ray.³⁴ This templating technique has the potential to be used for other procedures, such as unicompartmental knee arthroplasty.

Conclusion:

This study showed a satisfactory level of accuracy and reliability of the computer assisted patient specific templating technique for total knee arthroplasty. It appears that the patient specific templating technique has several advantages over conventional instrumentation, as it eliminates medullary guides, reduces operative time, and provides better accuracy. We believe that this technique is a practical alternative to navigation and robotic techniques for TKA.

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Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#)

Poster: 32

Pelvic Flexion / Extension and Its Impact on Functional Acetabular Alignment and Stability Following Total Hip Replacement

***Mahmoud Hafez - October 6th - Cairo, Egypt**

Introduction: Dislocation following total hip replacement (THR) remains a significant clinical problem and can occur even with optimal implant alignment. Our hypothesis was that different patterns of pelvic flexion / extension during daily activities could influence acetabular alignment and contribute to impingement and instability following THR. **Methods:** This study aimed at identifying different patterns of pelvic flexion / extension that could be predictive for instability following THR. A range of motion (ROM) simulator was used to demonstrate the effects of different patterns of pelvic flexion / extension on ROM and impingement. The findings were applied to pelvic flexion / extension measurements obtained from 84 patients in standing and sitting positions. **Results:** Three different categories of pelvic flexion / extension were identified; normal, hypermobile and stiff. ROM simulator revealed that changes in pelvic flexion / extension had significant effects on ROM and impingement. Patients in the stiff pelvis category, even with “optimal” implant alignment, were more susceptible to implant impingement. **Conclusions:** The different patterns of pelvic flexion/ extension during daily activities could affect acetabular alignment and stability following THR. We propose a classification system that can identify different types of pelvic flexion / extension and predict their effects on the stability of THR. Patients with unfavourable pelvic flexion / extension who are susceptible to impingement may require modified cup alignment.

Table I: Classification of pelvic flexion / extension with suggestions for acetabular cup alignment.

	Type I	Type II		Type III	
Name	Normal	Hypermobile pelvis (Exaggerated response)		Stiff pelvis	
	Mobile	II-a Extension Type	II-b Flexion Type	III-a Extension Type	III-b Flexion Type
Pelvic flexion / extension in standing	Flex	Flex	Excessive Flex	Lack of Flex	Flex
Pelvic flexion / extension in sitting	Ext	Excessive Ext	Ext	Ext	Lack of Ext
Stability	Stable	Stable but sensitive to malalignment		Unstable even with optimal acetabular alignment	
		Weak anteriorly	Weak posteriorly	Anterior	Posterior

Flex = flexion Ext = extension Ant = anterior Post = posterior

Ext Rot = external rotation Int Rot = internal rotation ADL = activities of daily living

Rapidly Destructive Arthropathy of the Hip (RDAH): Clinical, Radiological and Pathological Evaluation

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Objective. To present the common features of a subset of advanced cases of RDAH and provide a diagnostic algorithm. **Design and Patients.** We retrospectively reviewed the clinical, laboratory, imaging and pathological features of advanced cases of RDAH in 12 patients (14 hip joints). These patients presented with marked destruction of the hip joints over a short duration mimicking serious conditions as sepsis, Charcot or neoplasia. **Results.** The common features for this subset of RDAH were pain (without stiffness), shortening of the affected leg, severe bone loss of the femoral head and acetabulum, a propensity for subluxation, lack of osteophytes and predominantly lateral disease. Prolonged usage of strong NSAIDs was a common association. All patients eventually underwent total hip arthroplasty (THA) except one patient who was unfit for surgery. **Conclusions.** Advanced cases of RDAH are an entity that deserves wider recognition if only to emphasise that severe radiological damage is not always caused by infection, Charcot or malignancy. The common features are identified and a diagnostic algorithm is proposed to help avoiding undue investigations and expedites THA before further loss of bone stock.

Figures: Fig. 1 [A & B]: [A] RDAH in case 1 with complete loss of the femoral head over 2 weeks time, between presentation and time of surgery. [B] RDAH in case 2 with progressive erosion over 3-month period then complete loss of the femoral head and neck in a week time.

Figures

[Figure 1](#) [Figure 2](#)

What Is the Blood Transfusion Rate Following Revision THA With Major Acetabular Reconstruction?

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Introduction: The aim of this study was to evaluate blood loss and blood transfusion rate following major acetabular reconstruction.

Methods: From a computer database, 27 cemented revision THAs (sepsis excluded) dealing with AAOS Type III acetabular defect performed by a single surgeon between January 2006 and December 2007 were indentified. The median age of the patients was 73 years (23 – 81) and the median BMI was 24.2 Kg/m² (16.6 – 34.1). In all cases, revision was performed on both the femoral and acetabular side, and structural fresh frozen allograft bone was used to achieve complete acetabular bone stock restoration. All patients received blood salvage measures including preoperative erythropoietin in 12 patients, intraoperative cell salvage in 17 patients, and fibrinolytic inhibitor in 22 patients.

Results: The median operative time was 330 minutes (150 – 435). The median blood loss volume was 4332 ml (1320 – 9498) while the median blood volume of the patients was 4300 ml (3092 – 6143). Blood loss was significantly correlated with the operative time ($R^2 = 0.197$, $p = 0.02$). Of the 27 patients, 21 (78%) required allogenic transfusion with a median of 3 units (0 – 17) of packed red blood cells. The number of allogenic units transfused was highly correlated with the estimated blood loss ($R^2 = 0.71$, $p < 0.0001$). No early medical or surgical complication was recorded.

Discussion and Conclusion: This study indicates that reconstruction of major acetabular deficiencies leads to a median blood loss close to patients' blood mass. However, although these patients frequently required allogenic transfusion, the use of adequate blood salvage measures was associated to a relatively low number of units required.

Patellar Clunk Syndrome in Mobile-Bearing Total Knee Arthroplasty

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The patellar clunk syndrome is one of the complications of posterior stabilized total knee arthroplasty and is related to the intercondylar box of the femoral component. The etiology of this syndrome is multifactorial. We investigated the incidence of patellar clunk syndrome after mobile-bearing posterior stabilized total knee arthroplasty and considered the causative factors of this syndrome.

A total of 243 patients (192 women, 51 men; average age, 74.1 years) in whom 330 consecutive mobile-bearing total knee arthroplasties were performed using Vanguard RP (Biomet, Warsaw, IN) were examined after the operation to check for the presence of patellar clunk during knee extension. The patella had been resurfaced in 252 knees and not resurfaced in 78 knees. Radiographic analysis was performed in patients with patellar clunk.

Six knees were diagnosed with patellar clunk syndrome (incidence, 1.8%). The patella had been resurfaced in all of these patients. The mean period of onset of symptoms was 4.5 months (range, 3 to 6 months), and the mean postoperative flexion angle was 120.8 degrees (range, 110 to 125 degrees). No specific joint line changes were observed, and the patellar height was within normal range. The mean tilting angle of the patella in patients with patellar clunk was 0.3 degrees (range, -3 to 2 degrees).

Vanguard RP allows hyperextension of 12 degrees and prevents post from impinging against anterior margin of intercondylar box. However, the position of the box seemed to be one of the factors affecting the patellar clunk syndrome. Further, an excellent range of motion is another important factor.

Effect of M/L Taper Kinectiv Stem to Reduce Impingement With DDH Patients During Primary Total Hip Arthroplasty

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Purpose:

Neck and cup impingement resulted in producing larger amount of wear debris and risk for

dislocation after total hip arthroplasty. DDH had more complex to adjust cup and femoral neck anteversion during surgery. Purpose of this study was to evaluate neck-cup impingement with neck changeable Kinectiv stem for DDH patients.

Materials & Methods;

Single surgeon analyzed neck cup impingement during 148 primary total hip surgeries with DDH. 25 hips in men, surgical approach were 81 mini-one antero-lateral, 56 mini- Watson-Jones, and 11 Hardinge. Acetabular cups were seated 20 degrees anteversion. Stem was inserted manually with standard technique. First trial was performed with straight type of neck and 26mm femoral head based on preoperative templating. At neck and head trial to evaluated antero-superior impingement with “flex+Add.+IR” and potero-inferior impingement with “ext.+add.+ER”. If the neck and cup impingement occurred even if no dislocation, necks were replaced different version or larger offset.

Results:

Neck trial was 2 to 3 times during surgery (ave. 2.5). Version was changed 85 cases. Surgeon selected larger offset in 46, 35 longer length, 29 shorter length. Larger offset with longer length in 29, 9 had larger offsets and shorter length compared to 2D templating before surgery. We had no dislocations or revisions. Averaged hospital stay was 7 (4-12) days.

Discussion:

One Kiective stem had 60 variety of necks based on 4 mm head center difference. Large amount of variation especially anteverted or retroverted neck selection might reduce neck-cup impingement compared to other straight type of femoral stems. Proper offset and leg length are also very important issues for the patients. This type of stem had more advantages than straight type monolithic stems to reduce wear and dislocation caused by impingement.

Poster: 37

Evaluation of Mechanical and Wear Properties of Low Temperature Degradation Free Zirconia Toughened Alumina Ceramic for Artificial Joint

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High purity alumina (Alumina) and 3 mol% yttria stabilized tetragonal zirconia polycrystalline (3Y-TZP) have been used for hip and knee joint prostheses because of their excellent wear property and biocompatibility. Especially, Ceramic-on-ceramic bearing has been applicable even to younger patients. Recently, various alumina and zirconia composites were developed and proposed as alternatives to Alumina and 3Y-TZP. It was reported that alumina and zirconia composites have superior mechanical properties compared with Alumina. However, it was also reported that changes in crystal structure of zirconia phase in some alumina and zirconia composites including commercially available zirconia toughened alumina (ZTA) under hydrothermal environment such as human body occurred. Consequently, it is necessary for longer reliability to improve not only mechanical properties but phase stability of zirconia phase concurrently. In our previous study, it was confirmed that newly-developed ZTA (BIOCERAM[®] AZ209) had good mechanical properties compared with Alumina. However, the relationship among mechanical and wear properties, phase stability and microstructure of BIOCERAM[®] AZ209 is still unclear. In this study, we evaluated these characteristics of BIOCERAM[®] AZ209 with different microstructures.

BIOCERAM[®] AZ209 powder, which composed of Al₂O₃ (79 wt %), ZrO₂ (19 wt %) and other oxides (2 wt %), were pressed into the solid form. Green bodies were sintered at various temperatures in air and then HIP (hot isotopic press) treatment was subjected. The dense specimens with over 99.9% of theoretical density were turned to prescribed shapes and five kinds specimens with several grain sizes and crystal structures were prepared. Microstructures of sintered bodies were checked by scanning electron microscope (SEM) and X-ray diffractometer. Mechanical properties were evaluated according to ISO standards. Besides, phase stability under hydrothermal environment and specific wear rate in ceramic-on-ceramic combination were evaluated. Alumina manufactured by Japan Medical Materials Corporation was used as comparative material of each evaluation.

In SEM observation, homogeneously dispersion of zirconia grains in alumina matrix and no agglomeration of zirconia grains were observed. From the result of X-ray diffraction, monoclinic fraction of zirconia phase was calculated by Garvie and Nicholson equation. Increases in both grain size and monoclinic fraction with increasing sintering temperature were observed. Besides, with increasing sintering temperature, fracture strength was declined from about 1300 to < 500 MPa and fracture toughness was increased from 3.8 to 5.0 MPa·m^{1/2}. Both grain size and stress induced phase transformation affected the fracture strength of BIOCERAM[®] AZ209, and the effect was larger in the former than in the latter. In all specimens, no significant change in crystal structure in saturated vapor at 134 °C was observed. It was confirmed that zirconia phase of BIOCERAM[®] AZ209 was stable as well as Alumina under hydrothermal environment. It was possible to support mechanical properties and phase stability at the same time. The relationship between wear property with squeaking under high load condition and mechanical properties will also be discussed in terms of microstructure of BIOCERAM[®] AZ209.

Intraarticular Injection of Tranexamic Acid Decreases Leg Swelling After Total Knee Arthroplasty via Blood Loss Reduction

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Purpose: Tranexamic acid (TXA) is an inhibitor of fibrinolysis, and known to inhibit blood loss after total knee arthroplasty (TKA). In this study, we performed randomized controlled trial to examine whether intraarticular injection of TXA decreases leg swelling by reducing the blood loss after TKA.

Materials and Methods: We performed one-hundred TKA with the patients of OA (men; 12 women; 88). At the closure, total of 2000 mg/20 mL TXA was injected into the knee joint through closed suction drain (TXA group). For the control group, same volume of physiological saline was injected (control group). The closed drain was gradually opened post 30 minutes after injection. Preoperative conditions of these patients were examined and post operative haemoglobin (Hb) level, blood loss through drain, D-dimer, and needs for transfusion were compared with these two groups. Furthermore, **circumferential measurements of the leg** (thigh, suprapatellar portion, and calf girth) were measured at pre, and post operation to investigate whether TXA influences the leg swelling post operation.

Results: Postoperative decrease in Hb level was significantly down-regulated in TXA group. Blood loss through drain were suppressed by 6 hours post operation in TXA group, however the total blood loss through drain was the same among these groups. Furthermore, **supra-patellar girth at 1 week and calf girth at 2 weeks** post operation were significantly thinner in TXA group than in control group.

Conclusions: The results in this study indicated TXA decreases leg swelling via reducing blood loss. TXA has possibility to decrease patients' discomfort via leg swelling reduction.

Reconstruction of the Acetabulum With Extensive Bone Defect

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Reconstruction of the acetabulum with extensive bone defect is troublesome. Kerboul or Kerboul type reinforcement acetabular device with allo bones grafting has been applied since 1996. Clinical results of the reconstructive procedure were evaluated.

Patients

One hundred and ninety-two consecutive revision total hip arthroplasties were performed with allograft bone supported by the Kerboul or Kerboul type reinforcement acetabular device from 1996 to 2009. There were 23 men and 169 women. Kerboul plates were applied to 18 patients, and 174 Kerboul type plates to 174. The mean follow up of the whole series was 5 years (one month – 13 years).

Surgical Technique

The superior bone defect was reconstructed principally by a large bulky allo block with plate system. Medial bone defect was reconstructed by adequate bone chips and/or sliced bone plates. After temporally fixation of bulky bone block with two 2.0mm K-wires, it was remodeled by reaming to fit the gap between host bone and plate, followed by fixation to the iliac bone by screws. Finally, residual space of the defect between host bone and the fixed plated was filled up with morselized cancellous bones, bone chips, and/or wedged bony fragments with impaction. This method is sufficiently applicable to AAOS Type I, II, and III bone defects. In case of AAOS Type I, the procedure was also available after repairing discontinuation between distal and proximal bones by connecting the gap by allografting with tibial bone plates or sliced femoral head.

Results

Eight patients (4.2%) required revision surgery due to infection 5, plate breakage 2, malalignment 1. The plate breakage was observed in 7 joints (3.6%). Five patients (71%) complaint pain and/or other symptoms after the breakage. Two required revision, but the other cases were carefully observed without additional surgical intervention.

The 10 years survival rate by Kaplan-Meier method was 97.6% when the endpoint was set by revision.

Conclusions

This study indicated that acetabular allograft reconstructions reinforced by Kerboul or Kerboul type acetabular device were able to recover bone stock with anatomic reconstruction of femoral head center, thus providing satisfactory clinical results in middle term period.

Poster: 40

Angiolieomyoma of the knee:Case Series and an Unusual Cause of Knee Pain

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Angioleiomyomas or vascular leiomyomas are rare, benign tumours arising from the vascular endothelium. Treatment of these tumours, especially around the knee is frequently delayed due to their late presentation and lack of awareness of this clinical condition. Although angioleiomyomas have a predilection for the lower extremity, there are only a few published case reports of these around the knee. We report a series of five cases of angioleiomyoma occurring around the knee joint. All four patients were of Afro-carribean origin. Although MRI scans (figures a-c) are helpful in locating and delineating the tumour, true diagnosis is only established by histopathology (figure d). All patients underwent surgical excision with complete resolution of symptoms with no recurrences seen at an average follow up of 16 months. We recommend a high index of suspicion in patients, especially of Afro-carribean origin presenting with painful hyperaesthetic subcutaneous swelling around the knee. Early investigation by MRI expedites the diagnosis and surgical excision results in complete resolution of symptoms.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#)

Poster: 41

2 Years Follow Up for Coflex@ Inter-Spinous Stabilization Device. a Prospective Analysis.

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2 years follow up for Coflex@ inter-spinous stabilization device. A prospective analysis.

Introduction:

We are presenting a prospective analysis for the assessment of the Coflex@ interspinous stabilization device with a 2 year follow up. The purpose of this study is to assess the efficacy and safety of the Coflex@ Posterior Dynamic Stabilization Implant and patient functional outcomes.

Methods:

A retrospective analysis was performed on 121 patients (176 devices) treated with the Coflex@ Interspinous Implant. Indication for the treatment was foraminal stenosis of the spinal canal with nerve root irritation +/- back pain.

Pre- and postoperative disability and pain scores were measured using Oswestry disability score well as the ROM of the operated levels.

Results:

Data analysis revealed a high rate of patient satisfaction

- 92% of patients are satisfied and will have the surgery again
- 81% of patients had major improvement of their leg symptoms.
- 72% of patients reported improvement of their back pain symptoms this was more noted in the decompression group.
- The mean Pre-operative ODS score was 61.8%
- The mean Postoperative disability scores was:
 - 48.6% at three months.
 - 36.25% at six months.
 - 26.73% at one year.
 - 25.87% at two years. (p<0.01)
- Two revision surgeries were carried out. One due to implant back-up and the second due to infection.

Conclusion:

The Coflex@ inter-spinous implant is a simple surgical treatment strategy with a low risk. Early results show a good improvement of both clinical and radiological parameters combined with patient satisfaction specially if combined with spinal decompression.

Poster: 42

The Exeter Universal Cemented Stem in Japan, Radiological Analysis at 2 to 9 Years, a STUDY of the FIRST 572 HIPS

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Abstract: We retrospectively reviewed 495 patients (572 hips) who had undergone primary total hip arthroplasty (563 hybrid THAs, 9 cemented THAs) between April 2001 and December 2007 using a collarless polished double tapered femoral component (Exeter universal stem) after two to nine years (mean 4.0). Preoperative diagnosis was osteoarthritis in 482 (84%), avascular necrosis in 48 (8.4%), rheumatoid arthritis in 22 (3.8%), fracture in 16 (2.8%), ankylosing spondylitis in three (0.5%), PVS in one (0.17%). There were 491 women and 81 men with a mean age at operation of 60.8 years (23 to 88). All stems were implanted by one surgeon (N.K.) with so-called second-generation cementing technique. We used Simplex cement with a distal cement restrictor (Exeter plug; Stryker Howmedica), pulsatile lavage, retrograde cementing with a gun and proximal pressurization. We did not use vacuum-mixing, or centrifugation. The sizes of femoral stems used were 33.0 mm offset in four, 35.5 mm in 122, 37.5 mm in 404, 44.0 mm in 41, 50.0 mm in one.

Radiological analysis was performed on calibrated plain radiographs taken in two planes.

All stems were inserted within 4° of neutral alignment in the AP plane. Three stems were in more than 3° of varus, and one was in more than 3° of valgus. Cementing grades (Barrack) were A in 59.1%, B in 36.6%, C in 0.5%. All the stems subsided at the stem-cement interface vertically. The mean total subsidence was 0.77 mm (0.14 to 2.17). 55 hips (9.6%) showed postoperative cortical hypertrophy: 48 in zone 5, 12 in zone 6, and nine in zone 3. Only one hip had ectopic ossification (Brooker grade 3). There was no radiolucent line in all hips. One patient showed focal osteolysis in zone 6. In 38 of the hips (6.6%) intramedullary cement leakage or plug migration were found.

There have been no revisions for aseptic stem loosening. Six stems required re-operation: five for infection, and one for recurrent dislocation. Other three hips required re-operation for recurrent dislocation, and one for cup loosening (all stems still survived). Survival for the stems with an endpoint of revision for aseptic loosening was 100%. Survival for the stems with an endpoint of revision for any reason was 98%. This study confirms that Exeter universal stems subside within the cement mantle but without loosening. However, occasionally Exeter universal stem is too long for a small Japanese patient, so that we need a shorter stem with larger offset.

Poster: 43

Total Hip Arthroplasty With a Custom-Made Stem Using CT Based Navigation System

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Introduction: A fracture is the biggest problem of insertion with a custom-made stem. To avoid intra-operative fracture, we improved the insertion method using CT based navigation system and individual rasp.

Methods: Nine hips after intertrochanteric femoral osteotomy were operated with this improved insertion technique. Intertrochanteric varus osteotomy was performed in 6 hips and Intertrochanteric valgus osteotomy in 3 about 30 or 40 years ago. The average preoperative femoral anteversion was 32.4 degrees (range, 15 to 46). Average age at the surgery was 68 years (range, 62 to 74). The Ti-6Al-4V stems designed with CT data were inserted using CT based navigation system and individual rasp.

Results: No fracture was occurred and all stems were inserted into femoral canals in satisfactory position confirmed with post-operative CT.

Conclusions: In conclusion, this improved insertion method was useful for a total hip arthroplasty with a custom-made stem.

Poster: 44

Fluoroscopic Analysis of Advanced Arthritic Knees: In Vivo Comparison of Three-Dimensional Kinematics Between Severe Varus and Valgus Deformity

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PURPOSE:

Numerous TKA designs have been introduced to reproduce kinematics of healthy knees. However, previous in vivo studies about TKAs have not concerned the influence of the preoperative knee kinematics and there currently is little information about kinematics of severely deformed arthritic knees. The purpose of this study is to investigate and compare in vivo kinematics for arthritic subjects with advanced varus and valgus deformities.

METHODS:

The three-dimensional(3-D) in vivo kinematics were assessed for 13 subjects before TKAs(6 varus knees, 7 valgus knees, mean age 72.7 years) with roentgenographic grades (Kellgren Lawrence Grades IV). The mean femorotibial angle(FTA) of varus and valgus knees were

198.5±5.5° and 157.0±7.5°, respectively. After provided informed consent, each subject was asked to perform a weight-bearing knee bend to maximum flexion under radiographic surveillance in the sagittal plane. The 3-D bone models of the femur and tibia, generated by segmentation from CT images, were projected onto the radiographic images and their 3-D positions and orientations were determined. We evaluated the following parameters: maximum flexion angle, tibiofemoral rotation, and antero-posterior translation of the medial and lateral femoral condyle.

RESULTS:

Maximum flexion for 6 subjects with varus deformity and 7 subjects with valgus were averaging 97.3±28.3° and 112.1±31.3°, respectively, however not statistically significant (p=0.95). 3 out of 6 varus knees showed small internal rotation pattern from full extension to maximum flexion and the rest of 3 knees exhibited paradoxical external rotation from mid flexion to terminal flexion. On average, tibial internal rotation was, 0.38±7.2° from full extension to maximum flexion. In addition, posterior translations of femoral condyles were confirmed in all cases and the averaging lateral condylar translation was slightly greater than medial condylar translation, 9.4±11.3mm and 7.7±7.4mm, respectively (p=0.41). However, paradoxical anterior translations were confirmed in 2 knees during mid-flexion. In contrast, 5 of 7 valgus knees experienced external tibial rotation patterns from full extension to maximum flexion and 2 knees showed reversed rotation patterns during mid-flexion. On average, the tibial external rotation was 4.7±7.6° from full extension to maximum flexion. Moreover, the average condylar translation was greater in the medial condyle than in the lateral condyle, 6.9±9.7mm and 3.9±13.8mm, respectively (p=0.23) and 4 knees exhibited paradoxical anterior translations during mid-flexion.

DISCUSSION:

According to previous reports, flexion of the nonarthritic healthy knee is associated with posterior rollback of the femoral condyle and internal rotation of the tibia. Our results of both varus and valgus knee kinematics were different from those seen in previous reports. In addition, there were few reports about the kinematics of osteoarthritic knees, in which the axial rotation were lost and the loss of rotation might be associated with the severity of arthritis. Our results of varus knee kinematics were high variable and were similar to patterns previously reported for osteoarthritic knees. However, the kinematics experienced in valgus knees were different from those reports. The result of this study suggests that these kinematics established in advanced arthritic knees might have influence postoperative kinematics.

Poster: 45

Hinged Knee Arthroplasty in Revision Knee Surgery: Still Up to Date

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Hinged Knee Arthroplasty in Revision Knee Surgery: Still Up to Date?

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The rate of revisions in knee arthroplasty is increasing by 10-13% annually according to various registries. Reasons for failure of the primary implants are manifold. They are considered to be either early or late failures. Reasons for late failure include aseptic loosening along with bone loss and osteolysis as well as late infections. Early failure mostly is reduced to malrotation of the components which then might lead to early reoperation of the patient.

With an increase in revision surgery, the choices of implants remain to be debated. While modular revision implants offer an excellent solution to provide correction of problems, the use of hinges at least in our institution has shown to provide a sufficient alternative in more severe and complex cases. Hinged devices over the past decades however have had a poor reputation due to the lack of longevity, higher complication rates as well as poor design. However, in recent reports in the literature there has been some suggestion that these devices might have to be re-visited in order to provide sufficient outcome for the patients in more severe revision cases.

In this lecture the author would like to discuss these issues and also include the treatment of periprosthetic infections installed in the author's institution in a way of single stage procedures using these implant devices.

Poster: 46

Mid-Term Results of Surgical Repair of Proximal Hamstring Tendon Tears

Introduction

The purpose of this study was to investigate the outcome of surgical repair of proximal hamstring tendon tears at mid term follow up.

Methods

46 patients were treated with surgical repair and intensive physiotherapy programme after complete tears of the proximal hamstring tendon. The average time between injury and surgical referral was 2 weeks (1 day to 3 weeks). MRI was used to confirm the tear and plan surgical repair in all cases. Primary repair using suture anchors to approximate the torn tendon to the ischial tuberosity was undertaken in all cases. Intensive physiotherapy was commenced in all cases with gradual increase in knee flexion based on the severity of the tear and the surgeon's assessment of the surgical repair at the time of surgery. Patient satisfaction and return to sports were used as measures of outcome.

Results

The average hospital stay was 1 day. Apart from local numbness around the scars, there were no post-operative complications noted in this group. High patient satisfaction was noted in all patients at final follow up (1 year) which was also noted at 4 years. The average time to return to sports was 6 months (5 months to 9 months). No re-tears were noted in any patients. In cases where dynamometer isokinetic muscle testing was undertaken, comparable results for operated and non-operated contra lateral sides were noted after 6 months.

Conclusion

At midterm follow up, early surgical repair and physiotherapy has been noted to be associated with a good outcome and enables an early return to sports after complete tear of the proximal hamstring tendons.

Distally Locked Long Stem Prosthesis for the Management of Infected Peri Prosthetic Fractures of the Femur

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Introduction

We describe our novel approach to managing infected periprosthetic fractures using a revision implant for temporary fracture stabilisation.

Methods

A series of 17 consecutive patients aged between 74 and 83 years (average age 81.51, SD 6.32) who presented with periprosthetic fracture and microbiologically proven infection, were managed by radical debridement and antibiotic therapy along with temporary implantation of a long stem cannulated, non-hydroxyapatite coated and distally locked femoral prosthesis (Cannulock, Orthodesign, Christchurch, UK in 12 cases and Kent Hip prosthesis in 5 cases). Post operatively patients were allowed to mobilise as allows and antibiotics were continued until biochemical markers returned to normal.

Results

A good clinical outcome and excellent functional outcome was noted in all 17 cases. There was one case of pulmonary embolism, which was treated. There were no instances of infections associated with prolonged immobilisation and hospital stay. Ten patients underwent a definitive revision hip replacement procedure within an average of 4.3 weeks (range 3.9 to 5.7, SD 2.15). Two patients required a second debridement and delayed definitive treatment due to persistently high inflammatory markers. In the rest of the cases, the implant has been accepted as permanent prosthesis

Conclusion

We believe that this novel approach significantly improves functional outcome in the management of infected periprosthetic fractures.

Poster: 48

Revision Hip Replacement in 55 Years of Age and Younger.

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Introduction

The purpose of this study was to assess the efficacy and complications associated with revision hip arthroplasty undertaken in patients under the age group of 55 years.

Methods

A review of our institutions revision hip database showed that 430 revision hip arthroplasties undertaken over the past 9 years had a minimum follow up of 2 years. 84 (56 female, 38 male) patients were under 55 years of age (range 2 to 8 years). The index procedures were performed at an average age of 46 years (range 15 years to 54 years). The single major etiology of failure was aseptic loosening (74%), followed by infection (8%) and recurrent dislocation (7%). In majority of cases uncemented implants were used at revision surgery (91% femoral stem, 100% acetabular cups). Bone grafts were necessary in 39% of cases.

Results

There was 1% incidence of DVT requiring treatment and 1% incidence of deep infection requiring a further revision hip surgery. There were no cases of dislocation in this series. At final follow up satisfactory progress was noted in all cases with a significant improvement in Harris hip score ($p < 0.05$).

Conclusion

Revision of hip arthroplasty in patients below 55 years is associated with improvement in function and patient satisfaction.

Validation of a Prognostic Classification System for Acetabular Cartilage Lesions

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Introduction

In recent years, there has been a significant advancement in our understanding of femoro-acetabular impingement and associated labral and chondral pathology. Surgeons worldwide have demonstrated the successful treatment of these lesions via arthroscopic and open techniques. The aim of this study is to validate a simple and reproducible classification system for acetabular chondral lesions.

Methods

In our classification system, the acetabulum is first divided into 6 zones as described by Ilizalithurri VM et al [Arthroscopy 24(5) 534-539]. The cartilage is then graded as 0 to 4 as follows: Grade 0 – normal articular cartilage lesions; Grade 1 softening or wave sign; Grade 2 - cleavage lesion; Grade 3 - delamination and Grade 4 –exposed bone. The site of the lesion is further typed as A, B or C based on whether the lesion is 1/3 distance from acetabular rim to cotyloid fossa, 1/3 to 2/3 distance from acetabular rim to cotyloid fossa and > 2/3 distance from acetabular rim to cotyloid fossa.

For validating the classification system, six surgeons reviewed 14 hip arthroscopy video clips. All surgeons were provided with written explanation of our classification system. Each surgeon then individually graded the cartilage lesion. A single observer then compared results for observer variability using kappa statistics.

Results

We observed a high inter-observer reliability of the classification system with a kappa coefficient of 0.89 (range 0.78 to 0.91) and high intra-observer reliability with a kappa coefficient of 0.91 (range 0.89 to 0.96).

In conclusion we have developed a simple reproducible classification system for acetabular cartilage lesions seen at hip arthroscopy.

Poster: 50

Porous Metal Surface Fragments Cause Third-Body Wear in Polyurethane-Aluminium Oxide Composite Materials in Total Hip Arthroplasty

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Introduction

Implants with surfaces of various porosities and pore sizes are in clinical use. Spongiosa Metal (ESKA Implants AG, Lübeck, Germany) consists of individual interconnecting hexapods of varying height (1-3 mm) and corresponding thickness (0.4-0.7 mm) (Figure 1). Each hexapod is attached to the core of the implant. Core and surface structure are made of cast cobalt–chromium–molybdenum (CoCrMo) alloy.

This case study demonstrates how macroscopic porous metal fragments can detach from the implant surface in total hip arthroplasty (THA) causing significant third-body damage such as deep scratches and indentations in implants' bearing surfaces.

Material and Methods

Radiographs prior to revision surgery due to aseptic loosening of the acetabular component revealed the presence of numerous small metal fragments approximately 1 to 2 mm in size in the periarticular area (Figure 2). The size, shape, and material of the metal fragments (cobalt–chromium–molybdenum [CoCrMo]) indicated that they originated from the porous metal surface. The components were explanted and visually examined. The femoral head was made of an aluminium oxide ceramic whereas the liner was made of a composite material consistent of two-thirds polyurethane and one-third aluminium oxide ceramic.

Results

The aluminium oxide femoral head, which had been in situ for 21 years, showed no signs of macroscopic indentations or scratches. However, the acetabular liner showed deep scratches and metallic fragments became embedded in the liner, causing accelerated wear (Figure 3).

Obviously, the composite material used for the acetabular liner is not comparable to traditional ceramic materials. The softer composite material seems to be very sensitive to third bodies whereas the conventional aluminium oxide material was not significantly affected by third bodies embedded in the counterface material.

Discussion and Conclusion

Implants with a porous metal structure can yield metallic third bodies. Those metal fragments can cause significant third-body damage, such as deep scratches and indentations, to bearing surfaces in particular if softer materials are involved as bearing surfaces.

In porous metal surface THA, ceramic-on-ceramic bearing couples should be considered due to their superior hardness to prevent excessive wear, including debris embedment and scratching of the bearing surfaces, especially in revision cases.

Figure 1: Surface structure of Spongiosa Metal.

Figure 2. Preoperative radiograph showing numerous metal fragments (1-2 mm, arrow) in the periarticular area.

Figure 3: Photograph showing indentations and scratches in the inferior region of the acetabular liner surface.

Figures

Poster: 51

Effect of Joint Laxity on Polyethylene Wear in Total Knee Replacement

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Abstract

Experimental simulator studies are frequently performed to evaluate wear behavior in total knee replacement. It is vital that the simulation conditions match the physiological situation as closely as possible. To date, few experimental wear studies have examined the effects of joint

laxity on wear and joint kinematics and the absence of the anterior cruciate ligament has not been sufficiently taken into account in simulator wear studies. The aim of this study was to investigate different ligament and soft tissue models with respect to wear and kinematics. A virtual soft tissue control system was used to simulate different motion restraints in a force-controlled knee wear simulator. The application of more realistic and sophisticated ligament models that considered the absence of anterior cruciate ligament lead to a significant increase in polyethylene wear ($p=0.02$) and joint kinematics ($p<0.01$). We recommend the use of more complex ligament models to appropriately simulate the function of the human knee joint and to evaluate wear behavior of total knee replacements. A feasible simulation model is presented.

Introduction

Wear of ultrahigh molecular weight polyethylene (PE) in total knee replacement (TKR) is a particularly important factor for the longevity of the implant (Argenson et al., 1992, Blunn et al., 1997, Engh et al., 1992). Wear debris has been shown to lead to cellular reactions that result in periprosthetic bone loss and loosening of implants (Amstutz et al., 1992, Revell et al., 1997). Preclinical wear testing of TKR is important for the provision of appropriate wear models and for the investigation of wear behavior. Knee simulators are used for such tests. Several factors that influence wear such as implant design, manufacturing, sterilization method, joint lubrication, patient weight, and activity level have been studied (Schmalzried et al., 1999). Wear is also highly dependent on kinematics; increased AP translation (anterior-posterior translation) and IE rotation (internal-external rotation) have been reported to raise PE wear in TKR (Kawanabe et al., 2001, McEwen et al., 2005). The motion of the natural knee is governed by active forces that originate from the muscles as well as dynamic and gravitational forces (Mikosz et al., 1988, Morrison 1970). These forces must be restrained by the passive structure of the joint. Due to their passive elastic behavior, the soft tissues, and in particular the ligaments, provide the restraining forces needed to balance the active forces during physiological motion (Ma et al., 2003, Shelburne et al., 2004). Several studies have described the soft tissue reaction in the human knee as a non-linear elastic material, and have highlighted the importance of the cruciate ligaments (Butler et al., 1980, Fukubayashi et al., 1982, Kanamori et al., 2002, Markolf et al., 1984, Shoemaker et al., 1985, Woo et al., 2002); in the absence of the anterior cruciate ligament (ACL) joint laxity is increased. This is of particular importance because the ACL is commonly sacrificed during the implantation of a TKR. Increased laxity will directly affect the joint kinematics (Walker et al., 2003). In wear simulator studies increased AP translations and IE rotations of the TKR have been reported when laxity was raised (Haider et al., 2006, White et al., 2006). However, the effect of increased laxity on implant wear is unknown. Furthermore, most wear studies to date have not sufficiently simulated the ligaments (D'Lima et al., 2001, Laurent et al., 2003, Tsukamoto et al., 2006). At best, mechanical springs were used to replicate the ligaments (Benson et al., 2001, Schwenke et al., 2005, Walker et al., 1997). However, the linear behavior of mechanical springs does not represent the asymmetric-nonlinear soft tissue motion restraint *in vivo*. Additionally, motion restraint caused by the springs used in those studies was too high and both physiological and postoperative joint laxity were not sufficiently represented (Butler et al., 1980, Fukubayashi et al., 1982, Kanamori et al., 2002, Markolf et al., 1981, Shoemaker et al., 1985, Woo et al., 2002).

This study was designed to demonstrate that applying a realistic asymmetric-nonlinear soft tissue motion restraint and including the absence of the ACL will 1) increase joint kinematics (AP translation and IE rotation) and thus 2) increase PE wear in simulator studies. To test these hypotheses, a wear study based on two different soft tissue models was performed using a force-controlled knee simulator.

Materials and Methods

Two wear tests were performed to investigate the effect of different laxities on PE wear and joint kinematics. For the first test linear motion restraints of 30N/mm for AP translation and 0.6Nm/° for IE rotation, according to ISO standard 14243-1:2002(E), were chosen to simulate

the intact cruciate ligaments. For the second test, asymmetric-nonlinear motion restraints were adopted from biomechanical studies that simulated the clinical situation of a sectioned ACL (Fukubayashi et al., 1982, Kanamori et al., 2002). The ligament models are shown in Figure 1 (AP translation) and Figure 2 (IE rotation).

Motion restraints for sectioned ACL were implemented according to the following polynomial equations:

For AP motion the restraining force (RF_{AP}) is valid in a specific value range (V_{AP}) and depends on the AP displacement (x_{AP}):

$$RF_{AP} = 5.66 \hat{a}^{TM} 10^{-4} \text{ (N/mm}^5\text{)} \hat{a}^{TM} x_{AP}^5 - 2.02 \hat{a}^{TM} 10^{-2} \text{ (N/mm}^4\text{)} \hat{a}^{TM} x_{AP}^4 + 0.27 \text{ (N/mm}^3\text{)} \hat{a}^{TM} x_{AP}^3 - 1.09 \text{ (N/mm}^2\text{)} \hat{a}^{TM} x_{AP}^2 + 2.60 \text{ (N/mm)} \hat{a}^{TM} x_{AP} + 1.90N$$

$$\text{with: } V_{AP} = \{x_{AP} \tilde{N}'' IR \hat{a}'', -10 < x_{AP} < 20\}$$

For IE motion the restraining torque (RT_{IE}) depends on IE rotation (x_{IE}), valid for a specific value range (V_{IE}):

$$RT_{IE} = 0.20 \hat{a}^{TM} 10^{-5} \text{ (Nm/deg}^5\text{)} \hat{a}^{TM} x_{IE}^5 + 0.25 \hat{a}^{TM} 10^{-4} \text{ (Nm/deg}^4\text{)} \hat{a}^{TM} x_{IE}^4 - 4.13 \hat{a}^{TM} 10^{-4} \text{ (Nm/deg}^3\text{)} \hat{a}^{TM} x_{IE}^3 - 2.32 \hat{a}^{TM} 10^{-3} \text{ (Nm/deg}^2\text{)} \hat{a}^{TM} x_{IE}^2 + 0.31 \text{ (Nm/deg)} \hat{a}^{TM} x_{IE} - 1.68Nm$$

$$\text{with: } V_{IE} = \{x_{IE} \tilde{N}'' IR \hat{a}'', -20 < x_{IE} < 20\}$$

The only parameter to be altered in both tests was the motion restraint. This allowed different motion restraints to be investigated separately.

For each wear test, three wear specimens and one soak control specimen were used. An ultracongruent fixed bearing design (Columbus[®] UC, Aesculap AG, Tuttlingen, Germany) was evaluated in this study (Figure 3). The medium-sized components were manufactured in a similar manner: the femoral components and tibial trays were made of cast CoCr29Mo6 alloy according to ISO 5832-4:1996(E) and tibial inserts were made of UHMWPE (GUR 1020) according to ISO 5834-2:2006(E). The thickness of the γ -irradiated (Dose: ~30kGy) tibial inserts was 10mm. Force-controlled simulation according to ISO 14243-1:2002(E) was carried out on a modified (Kretzer et al., 2008) AMTI knee simulator (Model KS2-6-1000, Advanced Mechanical Technology Inc., Watertown, MA, USA) (Figure 4). A virtual soft tissue control system according to White et al. (2006) was used to simulate the different motion restraints. The virtual soft tissue control system embodies the relationship between configuration and restraint force in a real-time, cubic-spline algorithm for each controlled degree-of-freedom. The cubic-spline can be modified so as to permit the settings of different input-output relationships such as linear, nonlinear, and asymmetric relationships, which represent the desired characteristics of soft-tissue restraint.

The following test parameters were employed according to the ISO 14243-1:2002(E) standard: a maximum load of 2600N, a flexion angle of 0° to 58°, an AP force of -265N to 110N, and an IE torque of -1Nm to 6Nm. Compressive load was offset medially 5.2mm from the varus-valgus rotational axis to create higher forces on the medial compartment (Andriacchi et al., 1986, Harrington 1983, Kretzer et al., 2008). Simulation lasted for a total of 5,000,000 loading cycles at a frequency of 1Hz. Prior to simulation, the tibial inserts were presoaked in serum and gravimetrically measured at weekly intervals until the incremental mass change of the inserts was less than 10% of the cumulative mass change. Only compressive load was applied to the soak control specimens during the course of the simulation. Magnitude and frequency of the compressive load were the same for the soak control and wear specimens. After every 500,000 cycles, all components (wear specimens and soak controls) were cleaned and gravimetrically measured according to ISO 14243-2:2000(E). The weight change of each wear specimen was corrected for fluid absorption by subtracting the weight gain of the load soak control at each

measurement interval. The wear rates of the wear specimens were calculated based on linear regression (weight change as function of cycles). To minimize inter-station variability, tibial inserts were rotated between wear stations every 500,000 cycles. Simulation was carried out in recirculated diluted calf serum (PAA Laboratories GmbH, Pasching, Austria), maintained at 37°C in sealed chambers. Sodium azide and ethylenediamine tetraacetic acid (EDTA) were added to retard bacterial growth and minimize layers of calcium phosphate on the implant surfaces. A protein concentration of 30g/l was chosen according to Noordin et al. (1997). Serum was replaced every 500,000 cycles. Kinematic implant data (AP translation and IE rotation) were recorded during simulation to evaluate the mobility of the implants. Wear scars were documented photographically after 5,000,000 load cycles. Student's t-test for two independent parametric samples was used to compare wear rates, AP translation and IE rotation of both ligament models. The level for statistical significance was set at $p \leq 0.05$. All statistical analyses were performed using SPSS[®] (SPSS[®] for Windows 16.0.1, SPSS Inc., Chicago, USA). All data is presented as the mean \pm 95% confidence interval (CI).

Results

In the absence of the ACL, simulating asymmetric-nonlinear soft tissue motion restraint increased AP translation by 38% and IE rotation by 47%. The total AP translation significantly increased from 2.98mm (CI: ± 0.12 mm) to 4.82mm (CI: ± 0.13 mm) when nonlinear soft tissue motion restraint was introduced ($p < 0.01$). Similarly, total IE rotation significantly increased from 4.09° (CI: ± 0.10 °) to 7.69° (CI: ± 0.46 °) ($p < 0.01$).

In the absence of the ACL, wear rates increased by 40% compared to ISO 14243-1:2002(E) conforming linear motion restraints. Allowing for the weight increases of the soak-control inserts, an average wear rate of 4.8mg/10E6 cycles (CI: ± 1.9 mg/10E6 cycles) was measured (nonlinear soft tissue motion restraint). In contrast, ISO 14243-1:2002(E) conforming linear motion restraints resulted in an averaged wear rate of 2.9mg/10E6 cycles (CI: ± 0.7 mg/10E6 cycles). This difference was statistically significant ($p = 0.02$).

Increased IE rotation and AP translation as well as increased wear resulted in larger wear scars on the superior surface of the tibial inserts (Fig. 5). Polishing and burnishing were the dominant wear mechanisms.

Discussion

For the preclinical wear evaluation of TKR, proper simulation conditions that are as close as possible to the physiological situation are essential for obtaining experimental wear rates that are comparable to clinical wear rates. However, even with the same implant design, clinical wear rates are often reported to be higher than those from simulator studies (Kop et al., 2007, McEwen et al., 2001). This discrepancy may be related to different patient activities, surgical alignment or the ageing condition of the PE. DesJardins et al. (2007) investigated kinematics after TKR surgery using fluoroscopic analysis, and compared these results with kinematics from force-controlled wear simulation on the same implant design. They generally reported good agreement between clinical and simulator kinematics. However, AP translation was 41% higher in the clinical situation compared to simulator data. Their results points out the important difference between vivo and in vitro kinematics in TKR.

To the authors' knowledge this study is the first to investigate the effect of different joint laxities on PE wear by analyzing different motion restraint models in a knee wear simulator. Although, the sample size was small, with three wear specimens in each group, this knee simulator study showed that the PE wear rates and kinematics were significantly increased when more realistic soft tissue motion restraints were applied that considered the absence of the ACL.

When the absence of ACL was simulated in this study, the AP translation increased by 38% and

IE rotation by 47%, which agrees well with clinical findings. Depending on the knee flexion angle, Markolf et al. investigated the AP translation for ACL-deficient knees compared to healthy knees. They reported an increase of between 34% and 57% in AP translation depending on the flexion angle (Markolf et al., 1984). Similarly, Samukawa et al. reported an increase in IE rotation between 29% and 39% in ACL-deficient knees (Samukawa et al., 2007). These clinical findings support the results of the present study. Increased AP translation and IE rotation with increased laxity have also been reported from experimental simulator studies (Haider et al., 2006, White et al., 2006).

In this study, a virtual soft tissue control system was used to simulate the different motion restraints. This was capable of tracking the desired forces, motion and motion restraints with an RMS error of less than 2% (White et al., 2006). The soft tissue motion restraint model was adopted on the basis of the data given by Fukubayashi et al. (1982) and Kanamori et al. (2002). Fukubayashi et al. investigated the AP translation as a function of the AP force in human knee specimens for intact and sectioned ACL (Figure 1). In the neutral zone (displacement close to zero) the force needed to cause a relative motion between the femur and tibia is low for both intact and sectioned ACL. Isolated section of the ACL clearly increased joint laxity. Figure 1 also presents the motion restraint according to 14243-1:2002(E). Close to the neutral zone, the slope of the ISO curve is magnitudes higher compared to the data given by Fukubayashi et al. (1982). In Figure 2 motion restraints for IE rotation according to Kanamori et al. (2002) and 14243-1:2002(E) are shown. Close to the neutral zone the motion restraints for an intact or sectioned ACL act in an almost linear manner. Again, the slope of the curve according to the 14243-1:2002(E) standard is higher compared to the data given by Kanamori et al. (2002). This discrepancy is also supported by other biomechanical studies on the function of the ligaments and soft tissues in the knee joint (Butler et al., 1980, Markolf et al., 1995, Shoemaker et al., 1985).

PE wear in TKR is influenced by many parameters. For example the type of PE (e.g. crosslinked vs. conventional) (Muratoglu et al., 2007), the conformity of the inlay and the loading conditions (Galvin et al., 2009), as well as the implant concept (e.g. fixed vs. mobile) (Haider et al., 2008) have an effect on PE wear. Additionally implant kinematics are important. Higher AP translation and IE rotation have been shown to increase PE wear in TKR (Kawanabe et al., 2001). In the absence of the ACL, AP translation increased by 38% IE rotation by 47% and the PE wear rate by 40% in our study. Thus, our study underpins the effect of implant kinematics on PE wear. The mean wear rate for the inlays tested in accordance to ISO 14243-1:2002(E) (linear motion restraint) was 2.9mg/10E6 cycles in the current study. Grupp et al. investigated the same implant design using a deep dished PE inlay (Grupp et al., 2009). Their study was also performed in accordance with ISO 14243-1:2002(E) and they reported a mean wear rate of 2.2mg/10E6 cycles. Although the congruency of the inlay in the study by Grupp et al. (Grupp et al., 2009) was slightly different to the present study (ultracongruent inlay) agreement between both studies can be confirmed.

To date, increased laxity due to the absence of the ACL and asymmetric-nonlinear motion restraints has not been sufficiently taken into account in other simulator wear studies. Mechanical springs have mostly been used so far (Benson et al., 2001, DesJardins et al., 2007, DesJardins et al., 2000, Schwenke et al., 2005, Walker et al., 1997). However, mechanical springs are known to act linearly and therefore do not represent the asymmetric-nonlinear in vivo soft tissue motion restraint. Additionally, the stiffness of these springs is often too high to represent a sectioned ligament, which commonly exists when implanting a TKR (Benson et al., 2001, Schwenke et al., 2005). Haider et al. (2008, 2006, 2002) proposed a triphasic spring model to simulate the knee laxity. They recommended a gap in the AP direction to remove stiffness around the neutral position. However, the mechanical arrangement of the springs by Haider et al. (2008, 2006, 2002) leads to coupled motion restraints for AP and IE. Thus, stiffness is also completely removed around the neutral zone for IE rotation. In fact, for AP direction ligament stiffness is reduced around the neutral position but the stiffness is not zero and for IE direction ligament stiffness is not particularly reduced around the neutral zone (Butler et al., 1980, Fukubayashi et al., 1982, Kanamori et al., 2002, Markolf et al., 1981, Markolf et al., 1984, Shoemaker et al., 1985). Since November 2008 a revised version of ISO 14243-1:2002(E) has been available as ISO/DIS 14243-1(2008). This draft defines a triphasic

spring model for AP translation and IE rotation as described by Haider et al. (2008, 2006, 2002). However, the use of an asymmetric-nonlinear soft tissue motion restraint model that is independent for AP translation and IE rotation seems to be more advisable.

In Figure 5 the wear scar areas on the superior surface of the tibial inserts are shown. These surface alterations do not solely represent surface wear because they may also be related to creep. Thus, the dimension of these areas should be interpreted carefully with respect to wear and kinematics. The simulation is limited to level walking in the current study. Patient activities such as climbing the stairs and getting up from a chair may substantially influence in vivo knee wear behavior. The authors believe that the surgical technique used, and in particular the alignment, also plays a major role in kinematics, wear and long-term stability. Consequently, clinical studies are needed to verify the results of this experimental study. Furthermore, the conformity of the implant may cause changes in kinematics and PE wear. Follow-up studies are therefore needed to assess the influence of different implant concepts, in combination with realistic joint laxities, on PE wear and joint kinematics.

Conclusion

Care should be taken when simulating the complex mechanism of the human knee joint, as ligament motion restraints strongly influence joint kinematics and PE wear in simulator wear studies. Therefore, appropriate ligament models should be used to evaluate the wear behavior of TKR. This study provides a mathematical ligament model that accounts for the absence of the ACL. Further experimental studies examining the influence of surgical technique, alignment and implant design may prove to be essential.

Figures

Figure 1: Motion restraint for AP translation according to 14243-1:2002(E) is based on a linear approximation of the tibial anterior-posterior displacement when the ACL is intact. A sectioned ACL increases tibial anterior-posterior displacement. In the neutral zone (displacement close to zero) the slope of the curve according to the 14243-1:2002(E) standard is much higher compared to the asymmetric and nonlinear curves given by Fukubayashi et al. (1982) even for an intact ACL.

Figure 2: Motion restraint for IE rotation according to 14243-1:2002(E) is based on a linear approximation of the tibial IE rotation. Close to the neutral zone the motions restraint for an intact or sectioned ACL is almost linear. Nevertheless, the slope of the curve according to the 14243-1:2002(E) standard is much higher compared to the curves of an intact or sectioned ACL as given by Kanamori et al. (2002).

Figure 3: The ultracongruent fixed bearing TKR implant used in the study (mounted in a wear station of the simulator).

Figure 4: Experimental setup: AMTI knee simulator with wear and soak control stations as well as serum circulation system.

Figure 5: Wear scars on the superior surface of the tibial inserts are larger when simulating nonlinear soft tissue motion restraints (a), compared to 14243-1:2002(E) conforming linear motion restraints (b).

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Figures

Development of a Constant Load Dynamic Gap Measurer for Soft Tissue Balancing in Total Knee Arthroplasty

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Flexion-extension gap balancing is recognized as an essential part of total knee arthroplasty (TKA). Although several devices (spreader or tensor) for assessing flexion-extension gap have been described, these devices limit assessments to knees in full extension and in 90° flexion only. Manual distraction force applied to the device can also vary by time or surgeon. We developed a new device for dynamic gap balancing which can offer constant load to the gap between femur and tibia using pneumatic pressure during range of motion. The purpose of this study was to determine distraction force to apply and to evaluate reproducibility of the new device.

Biomechanical tests were performed to evaluate the variations among experienced orthopaedic surgeons in manual force for distracting the existing spreader. A spreader device (Aesculap, Tuttlingen, Germany) was mounted on Instron materials testing machine (Instron 5567, MA, USA). Three experienced surgeons distracted the spreader device using a clamp with manual maximal force 5 times each. Reliability test for the new device was performed using 5 cadaveric knees by the same surgeons. Intraclass correlation coefficients (ICCs) were calculated.

The mean force applied to the spreader device was 148N (127-169N). A new device, constant load dynamic gap measurer, was developed on the basis of the biomechanical tests. This device can load constant distraction force up to 200 N. The ICCs of the cadaveric feasibility testing using the new device ranged from 0.712-0.740.

The constant load dynamic gap measurer can enable the surgeon to properly evaluate the soft tissue balance throughout the range of motion during TKA with acceptable reproducibility. This measurer was applied for a Korean patent 10-2009-0112146.

The Innovative EOS System for the Study of Total Hip Arthroplasty Patients : A Pioneering Experience in 200 Cases

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Introduction

Routine radiological study of THA patients is based on standing AP radiographs. The EOS® system provides simultaneous AP and lateral with low dose high definition images. For the first time the authors report data on standing and sitting positions in THA patients

Material and methods

200 asymptomatic THA patients were enrolled in the study. Two independent observers performed the measurements in standing and sitting positions (frontal and sagittal cup inclinations , incidence angle , pelvic tilt angle, sacral slope angle, Lewinnek angle, cup anteversion according to Pradhan method). The axial torsion of the pelvis was assessed with a dedicated software.

Results

Intra and inter-observer reproducibility was excellent for the different parameters . New informations could be obtained about the sitting position. Anterior pelvic plane or Lewinnek angle was 0° in standing position (SD: 7,6°) but 23,5° sitting (SD: 9,9°) . Sacral slope standing was 40,9° (SD:9,3°) and 19,9° sitting (SD: 11,2°) . Variations of cup inclination and anteversion could be clearly correlated to the pelvic tilt changes.

6% of the patients were sitting in a femoral posterior version despite a standard femoral anteversion standing.31% of the patients demonstrated a reproducible axial torsion of the pelvis in standing position or in sitting position .

Conclusion

The EOS® system allows the global assessment of functional anatomy of the pelvic area, providing new data on the cup-stem relationships .Such informations can be useful in case of recurrent dislocations or abnormal wear .

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INTRODUCTION:

Although total knee arthroplasty (TKA) provides excellent mid-term and long-term results, failure of patella component was still one of the most serious problems for TKA. Recently, morphology data analysis revealed significant anatomic differences in the shape and size of female knees compared with male knees. These studies suggested that, for any given anterior-posterior (AP) femoral dimension, women tend to have a narrower medial-lateral (ML) dimension than men. And more, several studies have suggested that gender specific-prosthesis is needed for total knee arthroplasty (TKA) to accommodate such anatomical differences between males and females. Some manufacturers provided femoral component for female with narrower width and with different shape and angle of patellar groove.

Establishing the appropriate size and shape of the patellar component will be one of the important steps for success in TKA. To our knowledge, however, there have been no studies on the gender difference of the shape of patella supposing the patellar component design. We performed the 3D-CT analysis of patellar morphology and evaluated the gender difference.

METHODS:

3D-CT data of the knee joint was obtained from 69 knees (30 males, 39 females) of TKA candidates. Bone cut surface following Subchondral bone method for patellar component was evaluated using 3-D template system (3-D template system, JMM, Japan). We measured the position of the central ridge and medial-lateral width (W), longitudinal length (L) of the bone cut surface (Fig. 1,2). Furthermore, we investigated correlation W/L to L and position of the central ridge to L. The results were assessed statistically with a Pearson's correlation coefficient.

RESULTS :

The mean L of the bone cut surface was 39.2 ± 3.4 mm in male, 36.1 ± 3.2 mm in female. The mean W was 46.7 ± 3.4 mm in male, 43.3 ± 3.1 mm in female. The mean central ridge position was located 19.7 ± 2.2 mm ($42.1 \pm 3.7\%$) in male, 18.8 ± 2.3 mm ($43.4 \pm 3.5\%$) in female from the medial border. The size (W and L) was larger in male than in female ($p < 0.001$). W/L ratio was significantly correlated to L in male ($W/L = -0.02 \times L + 1.99$, $R = 0.69$, $p = 0.001$) and female ($W/L = -0.02 \times L + 1.87$, $R = 0.63$, $p = 0.001$) (Fig. 3). However, there was no significant difference in the regression lines of W/L ratio and L between male and female. Central ridge position was slightly medial in male and female. Central ridge position/L ratio was not significantly correlated to L in male (Central ridge position /L = $0.29 \times L + 27.2$, $R = 0.27$) and female (Central ridge position /L = $0.085L + 32.5$, $R = 0.092$) (Fig. 4).

DISCUSSION:

There was no gender difference but size difference in shape of patella. The current study showed that smaller patella needed more oval-shaped component and larger patella needed more round-shaped component.

Figures

Effect of Surface Modification on Biomechanical Properties of Titanium Alloy Ti6Al4V

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Abstract

A satisfactory clinical outcome in cementless total hip arthroplasty depends on the primary stability for rapid osseointegration. While the geometric design of an implant contributes to mechanical stability, the nature of the implant surface itself is also of critical importance. The purpose of this study is to compare implant osseointegration with the following surface modifications made to the titanium alloy Ti6Al4V: machined, grit-blasted, acid etched (SLA), and micro-arc oxidation (MAO). Cylindrical Ti6Al4V implants of the same geometry but with the four different surfaces were tested in vivo in a beagle dog model (femur). The implant – bone shear strength was evaluated by push-out tests undertaken at 24 weeks after insertion into the femur, and the four different Ti6Al4V surfaces were examined histomorphometrically. All the Ti6Al4V implants were well integrated at the time of sacrifice. X-rays revealed that there was no osteoporosis, bone resorption, or osteolysis around the implant. The mean bone-to-implant contact percentages were 22.1% for the machined group, 52.7% for the grit-blasted group, 61.3% for the SLA group, and 64.5% for the MAO group. The variation in the interfacial shear strength was statistically significant between the machined group compared to the grit-blasted, SLA, and MAO groups. The results of the mechanical testing indicated that the MAO and SLA surface treatments have the potential to enhance peri-implant bone healing.

Keywords: micro arc oxidation, grit blasting, acid etching, titanium alloy

Introduction

The majority of implants used in orthopedic and dental fields are fabricated from Ti alloys, owing to minimal tissue reaction, strength, and especially acceptable biocompatibility resulting in strong osseointegration with osteoblasts.¹⁻³ The thermodynamically stable oxide film naturally formed on the surface is regarded as the most influential factor for promoting and accomplishing osseointegration, and surface modifications are known to affect mechanical bonding with bone tissue.⁴⁻⁶

In orthopaedic surgery, various surface treatments, including grit blasting and hydroxyapatite

coating, have been developed with the aim of promoting bone ongrowth of cementless femoral stems. These two methods are widely used, and the long-term clinical survival rates are 66% to 100% at a 10-year follow-up.⁷⁻⁹ In the dental field, acid etching and anodized surface modification methods have recently been developed to enhance osseointegration. Etching with strong acids, such as HCl, H₂SO₄, HNO₃, and HF, is used to modify the surface of Ti dental implants, and results in micro pits on the Ti surface with diameters in the range 0.5 – 2 μm.^{10,11} Such etching has been shown to greatly enhance osseointegration.¹² Micro-arc oxidation (MAO) leads to nanoporous pits, thick oxide layers, and the incorporation of calcium and phosphorus into the coating layer, which results in improved osteoblast cell responses.^{6,13-15} The TiO₂ layer generated by the MAO treatment has been found to significantly improve the cellular activities of Ti in vitro, as well as the bone-implant bonding properties in vivo.¹⁶⁻¹⁸

Clearly, there are many potential candidates for the “optimal” surface of a cementless implant; however, there is a lack of comparative data. The purpose of this study is to provide a biomechanical comparison of the implant osteointegration of four surface modifications to the Ti alloy Ti6Al4V: machined, grit-blasted, acid etched (SLA), and MAO.

Materials and Methods

1. Specimen Preparation

We used 32 Ti6Al4V discs, measuring 4 mm in diameter and 10 mm in length, to create eight specimens of each of the four different surface modifications. Grit blasting was achieved using Al₂O₃ particles with a diameter of 200 – 500 μm in a high-velocity air stream (KSSA-5FD; Kumkang Tech, Seoul, Korea). The roughness of the grit-blasted specimens was in the range 5 – 7 μm. The SLA specimens were prepared by grit blasting with 200 – 500-μm-diameter particles and subsequent acid etching with HCl/H₂SO₄, as used in clinical practice. To create the MAO specimens, the Ti6Al4V discs were placed in an electrolytic bath, forming the anodes, and stainless steel plates were used as cathodes. The Ti6Al4V plates were ground with abrasive papers, ultrasonically washed with acetone and distilled water, and dried at 40°C. A fresh electrolyte was prepared by dissolving reagent-grade Ca (CH₃COO)₂ · H₂O (6.3 g L⁻¹), Ca(H₂PO₄)₂ · H₂O (13.2 g L⁻¹), EDTA-2Na (15 g L⁻¹), and NaOH (15 g L⁻¹) in deionized water. The applied voltage, frequency, duty cycle, and oxidizing time were 230 V, 600 Hz, 8%, and 5 minutes, respectively. All implants were packed and sterilized using gamma radiation.

The highest surface roughness (Ra values) was that of the MAO group (mean ± standard deviation, 6.5 ± 0.13 μm), followed by grit blasted (5.0 ± 0.24 μm), SLA (3.1 ± 0.11 μm), and machined (1.8 ± 0.13 μm). Scanning electron microscopy (SEM) images (JEOL JSM-6700F; JEOL Ltd, Tokyo, Japan) were used to examine the surface morphologies. The grit-blasted surface was finely textured (Fig. 1A). The SLA surfaces showed 1 – 2-μm micropits but no pore (Fig. 1B). The MAO surface showed a multilayered porosity of 0.6 – 7.1 μm (average, 3.0 μm) (Fig. 1C).

2. Surgical Procedures

Eight full-grown beagles over 15 kg in body mass (16.5 ± 0.75 kg) were assigned as the experimental subjects. The animals were purchased from the Orient Bio Company (Sungnam, Korea). All experimental procedures were approved by the “Animal Experimental Committee of the Catholic University of Korea”. There was a one-week-long adaptation period before the experiment began. The operations were performed after intravenously administered general anesthesia. Painting and draping was carried out using aseptic techniques after the skin preparation of the thigh. The femur shaft metaphysis was obtained by the anterolateral approach resecting the femoral iliotibial band and the musculus vastus lateralis, and meticulous hemostasis was performed. A 4-mm-diameter drill was used to create a recess in the lateral cortical bone of the femur; and the hole was drilled with caution in order to avoid medial

cortical bone damage. The drilling depth was 6 mm, and the bone fragments that were produced were removed by irrigating with normal saline. When inserting the specimens, the sequence was decided by random sampling for statistical reliability, and the specimens were press-fitted (Fig. 2A).

After the surgery, cefazolin, 25 mg/kg, was intramuscularly injected for one week to prevent infection, and acetachlorphenac sodium, 0.5 mg/kg, was intramuscularly injected for 24 hours postoperative to minimize pain. The eight beagles were sacrificed 24 weeks postoperative, and radiologic examination and push-out tests were carried out (Fig. 2B).

3. Push-out Biomechanical Analysis of the Interfacial Shear Strength

The soft tissue sample was removed from the femur 24 weeks postoperative; the proximal contact tissue including the metal material was amputated 20 mm of the major axis. The amputated sample was inferiorly fixated with the bone cement. The substance tester, INSTRON 6022 (Instron, Canton, MA), was used to assess and to prevent the dry-out of the sample; normal saline was applied during the tests. After placing the specimen on the test strip, an intrusion/extrusion velocity of 0.5 mm/hr was applied. The bone – metal interfacial shear strength was measured from the load – displacement curve.

4. Histomorphometric Analysis

The soft tissues were removed to expose the edentulous areas of the femur, with four integrated implants per side. The details of the histological processes have been described previously.¹³ The block specimens with the implants were immersed in a solution of formaldehyde (4%) combined with CaCl_2 (1%). The specimens were dehydrated and embedded in methylmethacrylate. Using a low-speed diamond saw with coolant (Leco Corporation, St. Joseph, MI, USA), the specimens were cut in the bucco-lingual direction and parallel to the axis of the implants, resulting in three 500- μm -thick undecalcified sections per implant. Subsequently, the sections were glued with acrylic cement to opaque Plexiglas, ground to a final thickness of 80 μm , and stained superficially with toluidine blue followed by basic fuchsin. The specimens from each implant were analyzed by determining the percentage of direct contact between mineralized bone and the Ti surface from intersection counting, using an integrative eyepiece with parallel sampling lines at a magnification of 100.

5. Statistical Analysis

We compared the mean interfacial shear strength and bone-to-implant contact percentage of the four different surfaces using a Wilcoxon signed-rank test. Statistical analysis was performed using SPSS® 11.5 software (SPSS, Inc., Chicago, IL.).

Results

1. Radiologic Examination

Through the radiologic study performed at 24 weeks postoperative, there was no finding of osteoporosis, bone resorption, or osteolysis around the implants. There was no significant difference among the four groups of surface modifications (Fig. 3).

2. Histomorphometry

Using phase contrast microscopy, new bone formation could be seen around the metal surface regions, and lamellar bone formation and peri-implant osseointegration were observed from the dye sample. The mean bone-to-implant contact percentages were 22.1% for the machined group, 52.7% for the grit-blasted group, 61.3% for the SLA group, and 64.5% for the MAO group (Fig. 4). The difference between the machined group and other three groups was statistically significant ($P < 0.01$); however, no statistically significant differences between the grit-blasted, SLA, and MAO groups were found ($P > 0.05$).

3. Push-out Biomechanical Analysis

Measurement of interfacial shear strength revealed statistically significant differences between the grit-blasted, SLA, and MAO groups compared to the machined group ($P < 0.01$), and there was also a statistically significant difference between the grit-blasted and MAO groups ($P = 0.023$). However, there was no statistically significant difference between the SLA and MAO groups ($P = 0.182$) (see Fig. 5).

Discussion

The effect of four different implant surface preparations on peri-implant bone healing was evaluated *in vivo* by comparing the biomechanical strength of the bone – implant interface and histomorphometric analyses.

For all implant surfaces tested, SLA and MAO treatments enhanced bone healing around the Ti alloy implants in comparison to the machined Ti alloy. In particular, the MAO group was statistically superior to the grit-blasted group in interfacial shear strength. There was no statistically significant difference between the MAO and SLA groups.

We note several limitations to this study. First, the number of dogs was too small to compare the mechanical testing as a function of the postoperative time period. Future studies are needed to determine whether there are differences in mechanical testing with the time interval between various treatments of surfaces of Ti alloy. Second, a comparison with porous coated implants was not performed. In the grit-blasted, SLA, and MAO implants, the osseointegration was characterized by bone ongrowth. In contrast, with porous-coated implants, the osseointegration was characterized by bone ingrowth. Because of this difference, we chose not to compare with porous coated implants.

Roughened Ti surfaces are effective in enhancing the interfacial biomechanical properties of bone-anchored implants by providing a mechanical interlock.¹⁹ Interfacial bone formation may also be promoted by roughened surfaces, as a significantly greater percentage of bone-to-implant contact has been observed in micro-roughened Ti surfaces in comparison to machined or polished Ti surfaces.^{20,21} However, too much surface roughness may cause an increase in peri-implant inflammation and in ionic leakage.²² Therefore, the optimal average roughness of cementless stems is reportedly 5 – 7 μm .²³ The results of this study confirm the benefits of grit-blasted, SLA, and MAO surfaces, and as such, these surface treatments may still be considered the “gold standard”.

Different implant treatments have been evaluated previously, and have been shown to promote firmer bone anchorage.^{24,25} CaP is the logical choice for biomimetic coatings, as the CaP-reinforced chemistry of such coatings enhances the rate of early bone formation.^{18,26,27} The present study demonstrated that MAO treatment was superior to grit-blasted treatment in terms of interfacial strength. Recently, a MAO method was successfully applied to form a roughened TiO₂ layer on Ti surfaces in the dental field. MAO forms a relatively thick TiO₂ layer by applying a positive voltage to the Ti.¹⁶ In this process, the repeated breakdown and regeneration of TiO₂ results in porous and roughened surfaces.^{16,28} Components of the surface commonly consist of calcium phosphate and contain a porous structure with pores of approximately micron or submicron diameter, which facilitates osseointegration.^{3,6,28–30} The properties of the oxide layer, including thickness, microstructure, roughness, and concentration of Ca and P, are easily controllable by adjusting the voltage, current, processing time, and the formulation of the electrolyte during the MAO process.^{6,31} Despite these structural characteristics and chemical advantages, MAO has not yet been introduced, and is currently being used for the surface treatment of cementless stems.¹⁵

In summary, a variety surface modifications for orthopaedic cementless Ti implants were

evaluated in an in vivo study, using mechanical testing of the bone – implant interface strength and histomorphometric analyses. The results of the mechanical testing indicate that the MAO and SLA surface treatments have potential to enhance peri-implant bone healing; however, a statistically significant difference in the performance of the SLA and MAO surface treatments was not shown.

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Figure Legends

Fig. 1A–C SEM images of the surfaces of (A) grit-blasted (x 2000), (B) SLA (x1000) and (C) MAO (x1000) specimens. (A) The grit-blasted specimen shows a finely textured surface. (B) The SLA specimen shows 1 – 2- μ m micropitting, but no porous structure. (C) The MAO specimen shows a multilayered porosity of 1 – 5 μ m.

Fig. 2A-B (A) Intraoperative photograph showing the transcortical cylindrical implants inserted in the femoral cortex. (B) The beagles were sacrificed at 24 weeks postoperative for histomorphometry and biomechanical analyses.

Fig. 3 Radiologic images of the femur at 24 weeks postoperative. There was no significant difference among the four groups of surface treatments.

Fig. 4 The percentage of bone-to-implant contact was calculated from the analysis of eight specimen sections. The MAO group shows the highest degree of bone osseointegration among all surface treatments, followed by the SLA, grit blasted, and then machined groups.

Fig. 5 Interfacial shear strength 24 weeks postoperative (n = 16, P < 0.05). The MAO group shows a statistically significant increase of the interfacial strength when compared to the others.

Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#) [Figure 4](#) [Figure 5](#) [Figure 6](#) [Figure 7](#) [Figure 8](#)

Poster: 56

Meralgia Paresthetica: A Cause of Anterior Thigh Pain After a Dissociated Pelvic-Sacral Joint; Management and Literary Review

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Meralgia paresthetica is an entrapment neuropathy of the lateral femoral cutaneous nerve (LFCN). When the LFCN is entrapped, paresthesias and numbness of the upper lateral thigh area are the presenting symptoms. In most cases, the cause is considered to be idiopathic entrapment of the lateral femoral cutaneous nerve. These causes of meralgia paresthetica have ranged from chronic disturbance of the nerve due to a tense inguinal ligament in the case of a leg-length discrepancy; tight trousers; wallet carried in front pants pockets; obesity or pregnancy; or a mass compressing the nerve. In the case presented here, a trauma induced pelvic fracture and displaced pelvic-sacral made a complicated problem after an operation for reduction. This case with symptoms of meralgia paresthetica underwent local injection and nerve release then symptom relief.

Materials and Results A 49-year-old female suffered from a pelvic fracture after a traffic accident. Pelvic fracture with displaced was diagnosed and then underwent reduction operation.

However, she then suffered from severe thigh pain and temporary numbness. Examination revealed decreased touch and pain sensation in the anterolateral aspect of left thigh, forceful palpation over a point 2 cm distal and 2 cm medial the right anterior superior iliac spine produced pain and numbness, consistent with a left neuropathy of the lateral femoral cutaneous nerve. In our hospital, a local injection with Rinderon mixed with Lidocain was performed at the iliac fracture lesion and nerve release by approach from last operative site. After these management, temporal pain relief but little numbness was still noted. After 4 weeks local injection, the all symptoms were relief.

Discussion Meralgia paresthetica this term from the Greek "meros" for thigh and "algia" for pain consists of unpleasant burning pain. Entrapment neuropathy of the lateral femoral cutaneous nerve was first described by Hager in 1885 and termed meralgia paresthetica" by Roth in 1895. Since then, many clinical reviews have been published regarding the reasons for irritation over the lateral femoral cutaneous nerve. However, many articles on meralgia paresthetica were published during the first half of the 20th century, but despite such early and widespread recognition, it has since become an obscure diagnosis. Few practicing physicians today seem to be aware of the condition or recognize the symptoms. Diagnosis is mainly based on history and physical examination. Patients typically describe burning, coldness, lightning pain, deep muscle aching, tingling, frank numbness, or local hair loss on the anterolateral thigh. The symptoms may be mild and may resolve spontaneously or they may severely limit the patient for many years. Macnicol and Thompson reported that surgical treatment would provide satisfactory results as long as it took place within 18 months from the beginning of the symptoms. Edelson and Stevens reported that nonoperative treatment did not lead to long-lasting relief, whereas surgical decompression led to excellent or good results. In our experience, the differential diagnoses is important and sometimes the lumbosacral disk syndromes need to be considered. Local injection was pain relief but surgical decompression if nonoperative treatment failed.

Poster: 57

Irreducible Acute Anterior Shoulder Dislocation Due to Rotator Cuff Tear and Associated Fracture of the Greater Tuberosity : The Double Row Repair Technique

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Introduction Difficulty in reduction of close shoulder dislocation is often seen in ER or OPD, not well sedation or pain control to patient is a impact factor for succeed close reduction. However, failure in closed manipulative reduction of an acute anterior shoulder dislocation is rare. This condition is usually due to a structural block happened in shoulder joint by bony defect or soft tissue impingement. We reviewed 8 cases of anterior shoulder dislocation with associated rotator cuff tear and fracture of the greater tuberosity. These dislocations was irreducible using standard closed methods. We use a double row repair for rotator cuff tear and fracture of great tuberosity.

Materials and Methods

A 60-year-old female visited our ER following a fall down from motorcycle. Several attempts at closed reduction under sedation, failed in the emergency room. X-ray showed great tuberosity fracture with anterior dislocation. So operation was performed. The shoulder was explored through a muscle splitting incision to a standard deltopectoral approach. On exposing the humeral head, a complete avulsion of the supraspinatus tendon with bony attachment was found. An avulsion of the greater tuberosity fragments was also noted. The posterior periosteal sleeve was intact. The reason of irreducible anterior dislocation of shoulder is due to anterior glenoid rim had deeply wedged into a triangular defect in the posterior humeral head. Then the dislocation was reduced the fractured tuberosity and the rotator cuff avulsion was repaired using a double row repair technique. (The anchors and screw with multiple oblique Ethibond No. 2 mattress sutures to the rotator cuff). Since 2008.July to 2010.Jan, 8 patients was diagnosed dislocated with greater tuberosity fracture and difficulty in reduction under regular technique. double row repair technique was performed and then follow up in outpatient department.

Results

All patients were recovery to 85-96% ROM under average follow-up 7 months. X-ray showed well union for fracture and good to excellent pain recovery.

Discussion

Closed reduction of an acutely dislocated shoulder is usually successful. The reported causes of irreducible dislocation include bowstringing of the subscapularis or bicipital tendon; impaction of the greater tuberosity into a Hill—Sachs lesion; interposition of a ruptured subscapularis in the glenoid rim. We reviewed 8 cases of irreducible anterior shoulder dislocation and repair both rotator cuff tear with great tuberosity fracture using double row repair. We found this technique is useful and easy in fixation of greater tuberosity fracture with repairing rotator cuff tear.

Figures

Poster: 58

Double Acetabular Wall: A Misleading Point for Hip Arthroplasty

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Despite the great attention focused on cup positioning in primary total hip arthroplasty (PTHA), it is surprising to find so few studies that have dealt with cup placement. One common problem thwarting the correct cup placement during PTHA is the existence of osteophytes which obscure the anatomical landmarks. We evaluated 276 patients with hip complaints, using their plain x-rays and CT-scans. Among these, 57 underwent surgery. We developed a staging system for

central osteophytes in hip osteoarthritis based on the radiographic and anatomical findings of our patients. In cases where multiple consecutive radiographies fail to reveal the geography of acetabulum, it is helpful to obtain pre-operative CT-scan especially by the young inexperienced surgeon. Thus reducing the risk of failure resulting from the interrupted acetabular landmarks.

Poster: 59

Clinical Results of Reserved v-Shaped High Tibial Corticotomy Wuth Minimally Invasive Surgery Without Internal Fixation Devices

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Genu varum is among the most common orthopaedic problems which mostly leads in osteoarthritis. High tibial osteotomy (HTO) is a way for prevention and treating knee osteoarthritis . Various models of HTO have been proposed and in parallel, HTO-associated problems.. The purpose of this study was to investigate the clinical results of a new innovative method of HTO named MIS reversed V-shaped high tibial corticotomy in a follow-up period of 3-13 years.

Methods

Between 1996 and 2006, 293 patients with medial compartment osteoarthritis and or genu varum were operated on, using our new method. Patients were examined and interviewed before and 6 months after surgery and clinical examination recordings and post-operative complications were registered. Also at the final follow up limb alignment and patients' satisfaction was reassessed.

Results

The early post operative complications were varus recurrence, knee pain and no sign of tibial non-union or infection were observed. In final follow up the only observed complications were few cases of mild genu recurvatum, knee pain and loss of correction. There was no relationship between the underlying pathologies and loss of correction in this study and no significant difference between age groups regarding loss of correction was observed

Conclusion

This method can be a feasible alternative for correction of genu varum because of a small incision, being soft tissue friendly, a corticotomy instead of osteotomy, no internal fixation devices, shorter duration and an acceptable rate of complications and recurrences and finally higher patient satisfaction.

Poster: 60

Tissue Engineering With Stem Cells and Cartilage Repair: Experimental Study.

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Articular cartilage regeneration is limited. Embryonic stem (ES) cell lines provide a source of totipotent cells for regenerating cartilage. Anatomical, biomechanical, physiological and immunological similarities between humans and sheep make this animal an optimal experimental model. This study examines the repair process of articular cartilage in sheep after transplantation of ES-like cells isolated from inner cell masses (ICMs) derived from embryos. Thirty-five ES-like colonies from 40 IVP embryos, positive for stage-specific embryonic antigens (SSEAs), were pooled in groups of two or three, embedded in fibrin glue and transplanted into osteochondral defects in the medial femoral condyles of 14 ewes. Empty defect (ED) and cell-free glue (G) in the controlateral stifle joint served as controls. The Y gene sequence was used to detect ES-like cells in the repair tissue by at 1 month post-operatively, three each at 2 and 6 months and four at 12 months. Repairing tissue was examined by biomechanical, macroscopic, histological, immunohistochemical (collagen type II) and ISH assays. Scores of all treatments showed no statistical significant differences among treatment groups at a given time period, although ES-like grafts showed a tendency toward a better healing process. ISH was positive in all ES-like specimens. This study demonstrates that ES-like cells transplanted into cartilage defects stimulate the repair process to promote better organization and tissue bulk. However, the small number of cells applied and the short interval between surgery and euthanasia might have negatively affected the results.

Poster: 61

Full Thickness Defects of Articular Cartilage and Experimental Surgery

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Aim:

Numerous preclinical projects of various articular cartilage repair procedures was performed in Orthopaedic Dpt. of Sassari to obtain a scientific model useful for human race.

Materials and methods: a condral lesion of medial femoral condyle in a sheep experimental model was performed; we resurface articular cartilage by using periosteum flap, chondrocytes culture, adipose corpus of Hoffa and embryonic stem cells. The obtained data are compared with histological-immunohistochemical data and we employed the Artscan 200 to asses and compare regenerative cartilage tissue stiffness.

Results

Parametres that affected final results are:

- 1) **Animals models:** (joint mechanics, weightbearing, thickness of articular cartilage).
- 2) **Surgical approach:** critical size defect that do not penetrate the calcified cartilage versus those that do is crucial: other factors are: contained lesion, cells, matrices, and soluble regulators.
- 3) **Methods of evaluation:**
 - a) **Histology findings:** the types of tissue filling the defect (including cell and extracellular matrix characteristics) attachment to adjacent structures (articular cartilage, calcified cartilage or bone like overgrowing bone and tide mark) and health of the adiacent tissue; these findings can reveal structural information primarily collagen organization which give a general idea of a functionality of the reparative tissue.
 - b) **Scanning electron microscopy:** useful for detect the surface and neighboring tissue
 - c) **Biochemistry analysis:** several staining methods are specific to sulphated glycosoaminoglycan (Safranina O, alcian blue) where immunoistochemical stains can be used to show collagen type and other cartilage specific protein.
- 4) **Biomechanical tests:** the biomechanical analysis usually is focused on synthesis of major components of the cartilage extracellular matrix:collagen and proteglycan; the weakness is due to variation in mechanical properties of articular cartilage between different species, due to variation in cartilage thickness, inaccessible areas due to joint geometry, instrument size and shape, loss of surface integrity, not easy contact between the indenter ending and cartilage surface, ease to slide by indenter on the articular surface with possibility action destructive of probe.

5) Postsurgical treatment.

Conclusions: In the current study the primary outcome variable was histology, whereas in clinical work it is pain relief. The advantage of second look in experimental model should be interpreted with caution and efforts should be made to verify them in human studies, but these findings may inform future strategies for cartilage repair.

Poster: 62

Outcome of High Tibial Osteotomy in the Saudi Patient Population

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32 patients, 24 males , 8 females , undergoing open wedge high tibial osteotomy were involved in this study to assess their functional outcome.

Pre operative KOOS scores were recorded, the mean pre op KOOS score was 28.5.

Post op KOOS scores were recorded at 6 months and one year post op, and 2nd year post op.

It was found that all patients had a significant improvement in their KOOS scores @ 6 months 80 ,and one year , 92 ,respectively , $P < 0.005$ post op scores.

Their scores did plateau at one year without much improvement noticed after that.

Poster: 63

Incidence of Patella Baja in TKR by Two Methods of Measurement

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46 patients with 73 consecutive knees undergoing TKR were recruited in the study.

Their knee plain x-rays, lateral view taken in 30 degree of flexion were analyzed for patella and patellar tendon height

We used both measurements, the Insall-Salvati and Blackburne-Peel ratio.

The median for the Insall Salvati method was 0.95 with std deviation of 0.195

The median for the Blackburne peel method was 0.78 with std deviation of 0.24

Any ratio lower than (Median - 1 SD) was considered Patella Baja

Based on above measurement we had the following results ;

Insall Salvati method: 12 Patella Baja cases 8.76 % ,

Blackburne peel method: 15 Patella Baja cases 10.95%

Poster: 64

The Influence of Pre-Operative Deformity on Intra-Operative Soft Tissue Balance in Total Knee Arthroplasty

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[Purpose] Total knee arthroplasty (TKA) has succeeded in developing to relieve pain and improve function. Whereas severe pre-operative varus deformity needs substantial soft tissue release on the medial side during TKA, what extent to be released along the medial structures is still controversial. Using a tensor for TKA that is designed to facilitate soft tissue balance measurements throughout the range of motion with a reduced patello-femoral (PF) joint and femoral component in place, we examined the influence of pre-operative deformity on intra-operative soft tissue balance during posterior-stabilized (PS) TKA. [Methods] From a group of 60 consecutive osteoarthritic females performed the same type of implant received (NexGen LPS Flex, Zimmer, Inc., Warsaw, IN), we retrospectively divided into three groups depending on the pre-operative coronal plane alignment; 20 patients with less than 10 degrees of pre-operative varus alignment, 20 patients with more than 10 degrees and less than 20 degrees of pre-operative varus alignment, and 20 patients with more than 20 degrees of pre-operative varus alignment. After excluding patients with valgus deformity and severe bony defects predicting the possibility of the use of augmentation block or bone graft, each remaining patient had a varus deformity, with an average pre-operative coronal plane alignment of $4.6 \pm 0.6^\circ$ in the varus alignment $< 10^\circ$ group, $14.2 \pm 0.3^\circ$ in the $10^\circ < \text{varus alignment} < 20^\circ$ group, and $23.3 \pm 1.0^\circ$ in the varus alignment $> 20^\circ$ group. Surgeries were performed with measured resection technique by a single senior surgeon. Following each osteotomy, we removed osteophytes, released the posterior capsule along the femur, and corrected any ligament imbalances that occurred in the coronal plane by releasing soft tissues along the medial structures of the knee according to the following criteria; (1) more than 20 mm of medial gap between the cutting

surfaces of the femur and the tibia, (2) more than 10 mm of joint component gap, and (3) less than 5 cm of MCL release from the joint surface. In all knees with varus deformity, step by step appropriate release of medial side soft tissue (posteromedial capsule, medial collateral ligament (MCL), semimembranosus, and pes anserinus tendons) was performed with a spacer block, in which residual lateral laxity especially at flexion was allowed. Finally, joint component gap and varus angle were assessed at 0, 10, 45, 90 and 135° of flexion with femoral trial prosthesis placed and PF joint reduced. [Results] Joint gap measurement showed no significant difference regardless the amount of pre-operative varus alignment (Fig.1). With the procedures of soft tissue release avoiding joint line elevation, however, intra-operative varus angle with pre-operative varus alignment of more than 20 degrees exhibited significant larger values compared to those with pre-operative varus alignment of less than 20 degrees throughout the range of motion ($p < 0.05$) (Fig.2). [Conclusion] Accordingly, we conclude that pre-operative severe varus deformity may have the risk for leaving post-operative varus soft tissue balance during PS TKA.

Figures

Poster: 65

Mobile Bearing TKA Increased the Peri-Prosthetic Bone Mineral Density Around the Femoral Component

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Bone mineral density (BMD) around the femoral component decreases after TKA, because of stress shielding. It was reported that design of articulating surface influenced on postoperative BMD change around the femoral component. However, there have been no reports on the postoperative BMD change after mobile bearing TKA. We hypothesized that mobile bearing mechanism would prevent postoperative BMD loss due to stress shielding around the femoral component.

28 knees receiving mobile bearing PS prosthesis and 28 knees receiving fixed bearing PS prosthesis had dual energy x-ray absorptiometry (DEXA) scans at preoperatively and 2 weeks,

3, 6, 12, 18, and 24 months post-operatively, to assess postoperative peri-prosthetic BMD change. All the femoral components were fixed with cement by a single surgeon.

Preoperatively, the difference between gender, diagnosis, age, BMD in femoral neck, wrist, lumbar spine, and knee between two groups were not significant. In fixed bearing group, BMD around the femoral component decreased postoperatively (-1 to -15%). In mobile bearing group, however, BMD increased postoperatively (8 to 11%). The difference of postoperative BMD change between two groups was significant ($p < 0.05$).

To our knowledge, this is the first report on BMD change after mobile bearing TKA. Our DEXA study revealed that mobile bearing PS prosthesis reduced postoperative BMD loss comparing to fixed bearing PS prosthesis. The mobile bearing mechanism might change load transmission pattern around the femoral component and prevent the stress shielding around femoral component.

Poster: 66

Femoral Head Augmentation With Metal-on-Metal Hip Resurfacing Is Effective for Severe Dysplasia

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Metal-on-metal hip resurfacing (MOMHR) is a good surgical indication for young active patients. However, it cannot be used in patients with severe congenital dysplasia of the hip (CDH), and in particular, in patients with an insufficient head/neck. To address these cases, a new surgical technique consisting of augmentation of the femoral head with impacted morcellized bone grafts has been developed.

32 osteoarthritis patients following severe congenital insufficiency of the femoral head/neck were treated with MOMHR combined with femoral head augmentation. The required amount of augmentation was calculated on preoperative X-rays and confirmed during surgery. Using special instrumentation, bone chips produced while reaming the socket and trimming the head were impacted on the head to achieve the desired reconstruction and lengthening. Finally, the femoral component was cemented.

Mean patient age was 49 ± 9 years (18-66). Median head lengthening was 12 ± 2 mm. Mean follow up is 4.2 years (3-6). Mean preoperative Harris hip score (HHS) was 58 and at follow-up 95 ($p < 0.05$). Mean leg lengthening was 2.2 cm ($p = 0.001$). In all Gruen zones, bone mineral density (BMD) decreased during the first 3 months. At 2 years in zone 1, mean BMD increased to 96.8% ($p = 0.009$), and in zone 7 to 102.1% ($p = 0.05$). A correlation was found between valgus positioning of the femoral components and increased BMD ($p = 0.005$).

This impaction bone grafting technique extends the use of MOMHR to patients with severe congenital hip dysplasia leading to a more anatomical reconstruction with a full recovery of function and BMD.

Poster: 67

Allergic Reaction to Bio Absorbable Screws in ACL Reconstruction , Case Report

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allergic reaction to bio absorbable screws in ACL surgery

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Background:

After introducing BIO Absorbable screws wide acceptance due to following reasons has achieved :

Biphasic, Biocompatible, Bioactive, Biodegradable, Sterilizable, Ability to withstand the forces.

From chemical point of view there are four different bio screws:

1- PLLA (poly-L-Lactic acid) / 2- PGA (polyglycolic acid) / 3- PLGA (poly Lactic – Co – Glycolic acid) / 4- PLLDA (Poly – L – D – Lactic acid).

The arrangement of the PLLA creates highly crystalline structure, while the PLLDA polymer is

amorphous and degrades faster in the body. However, the makeup of PLGA is typically random. The ratio of lactic to glycolic acid also affects the mechanical properties and degradation rate of polymer plastic. While PGA degrade faster than both poly (lactic) , the copolymer composition of the plastics (PLGA) does not have a linear relationship to the degradation rate. Polyglycolide degrades to glycolic acid and polylactide to lactic acid and eventually to pyruvic acid which forms acetyl coA for a tricarboxylic acid cycle to yield energy and to form H₂O and CO₂.the main route for elimination is respiration but partly also through urine.

In living tissue, the first hydrolytic scission occurs when PLGA exposed to H₂O and oligomers and monomers are formed (**Hollinger and Battistone, 1986**). Histologically a capsule of fibroblasts is first formed around the implant (seven days postimplantation); then a non-specific foreign-body reaction can be seen (large mononuclear cells, giant cells of mononuclear type, lymphocytes, few polymorphonuclear leucocytes). At 80 days post implantation, connective tissue invades the screw, and phagocytic cells with polymeric debris can be seen. At 250 days postimplantation, the screw is biodegraded and replaced largely by connective tissue (**Böstman et al. 1992c**). In another study, at 36 weeks, approximately one third of the implant was replaced by new trabecular bone, the major component being connective tissue, and the polymeric debris had disappeared (**Böstman et al. 1992a**). Increased pH accelerates degradation of PGA (**Chu 1981**). The degradation time (hydrolysis) also depends on the initial molecular weight, porosity, size, and shape of the implant (surface area/weight ratio) (**Nakamura et al. 1989**).

Polyglycolic acid is immunologically inert, but it leads to slight non-specific lymphocyte activation, as it induces inflammatory mononuclear cell migration (**Santavirta et al. 1990**).

Non-specific inflammatory reactions in living tissue associated with the degradation of the implant sometimes lead to a clinical complication, either to small fluid accumulation under the skin needing **no** treatment, or to painful fluid accumulation under the skin treated by aspiration with a needle or to sterile sinus formation.

Because semi-crystalline absorbable polymers such as PGA or PLLA degrade much faster in the amorphous than in the crystalline phase, these polymers degrade inhomogenously losing mechanical strength as the amorphous phase degrades, followed by mass loss of slowly degrading insoluble crystallites that may give rise to a tissue reaction, and possibly accumulate in the lymph nodes. *Therefore, absorbable polymers with a low to moderate degree of crystallinity should be favored for medical applications.*

During Survey In literature there are some reports about sterile cyst formation following using bioabsorbable screws in knee with granulation tissue reaction

Method:

I report a case of an osteolytic tibial enlargement in association with a pretibial cyst formation 8 months after successful anterior cruciate ligament reconstruction with 5 strand hamstring graft and fixation with a PDLA interference screw. There was No joint inflammatory reaction, NO graft insufficiency, and NO functional problem. The operation was done in may 2008 with good function in follow up , followed a cystic mass in entry of tibial tunnel in December , 2008 .

The patient underwent cyst excision and curettage & bone graft of the tibial tunnel

Result:

2 months after the revision surgery, full recovery and return to pre injury level of activity was achieved.

Clinically there was no swelling or tenderness. Radiological evaluation showed bony healing.

Conclusion:

To my knowledge, the reported complication is a few obvious adverse reactions to a poly-D-L-

lactide interference screw in anterior cruciate ligament surgery and in future if there will be more reports about such complication, it will be a place for debating bio screws usage.

Poster: 68

Change of the Femoral Offset (FO) and CCD Angle After Implantation the Short-Stem Prosthesis in Total Hip Arthroplasty

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Background: The relationship between the femoral offset (FO) and the abductor moment arm and the polyethylene wear, loosening, instability, persistent limp due to gluteus medius insufficiency, even dislocation, leg discrepancy are well known. The short stem prosthesis are recently introduced as a bone saving procedure which allows later easy and save revision. In contrast to modular neck system which proved to be useful for the correction of anteverted femur, the short stem prosthesis did not possess this advantage which may consequently affect the long term results of the prosthesis.

We study the influence of using a short stem series (NANOS-Smith and Nephew) on the hip geometry concerning the offset and CCD angle change after implantation

Material and methods: From July 2005 to March 2009 a total of 113 (70 males, 53 female) uncemented Nanos-short-stem prosthesis were implanted in 100 patients. The patients' average age was 53 years (33-73). The indication for this procedure was predominantly coxarthrosis. In all cases a minimal invasive posterior approach was used. The patients were assessed using Harris Hip Score and radiologically (true ap-axial) to determine CCD angle, Offset, any bone changes, the stand of the prosthesis and peri-articular ossifications. The contralateral hip was used as a parameter. Patients with severe osteoarthritis, malformations or previous operation were excluded from the study.

Results: The perioperative Harris Hip Score was 53 (28-77), postoperative was 94 (86-100). Radiological follow up examinations showed an increased femoral neck offset preoperative 50.01mm (39-68), postoperative 55.8 (42-72). Also the value of CCD angle changed and in most cases were associated with increased angle. There is no evidence of any loosening or migration of the prosthesis. Calcification was noted in 8 cases (Grad 1), 4 cases (Grad 2), 1 case (Grad 3). No luxation was observed.

Conclusion: the longevity of hip arthroplasty is an important factor in gauging the success of an implant. Increasing the femoral offset should result in a reduction in joint reaction force. This should decrease the polyethylene wear. It can be concluded that this stem is now able to satisfy the aim of reconstructing the normal anatomy of the hip joint and therefore improve joint biomechanics.

Poster: 69

Patient-Specific Mechanical Navigation of Acetabular Component Orientation Based on Conventional Radiography

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PATIENT-SPECIFIC MECHANICAL NAVIGATION OF ACETABULAR COMPONENT ORIENTATION BASED ON CONVENTIONAL RADIOGRAPHY

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Introduction: Acetabular component malposition is associated with wear- induced loosening and instability, the two most common reasons for revision THA. A novel mechanical navigation instrument, adjusted uniquely for each patient, has already been shown to produce acceptable cup position in 70 of 70 hips when planned using preoperative CT surface modeling. The current study compares the accuracy of adjusting the instrument with information derived from statistical models based on individual patient AP and lateral radiographs to 3D models from CT imaging.

Methods: 402 hips were used for this study (207 male, 195 female). All had both preoperative CT and radiographic imaging before hip arthroplasty. Inclusion criteria were the absence of prior surgery or gross pelvic asymmetry. Surgery using the mechanical navigation device was planned for each hip both using CT imaging and using statistical models based on AP and Lateral pelvic radiographic images. Cup orientation errors that would result from planning the surgery using radiographs instead of CT were calculated.

Results:

The error resulting from planning the HipSextant using plain radiographs instead of planning on a 3D model from CT imaging is listed in the four tables below.

Men	Right	N=111
Abduction	Flexion	Anteversion
Mean Error: 1.6 ⁰	Mean Error: 1.8 ⁰	Mean Error: 2.6 ⁰
SD: 1.1 ⁰	SD: 1.4 ⁰	SD: 1.7 ⁰
Max Error: 4.9 ⁰	Max Error: 6.7 ⁰	Max Error: 6.7 ⁰

Women	Right	N=94
Abduction	Flexion	Anteversion
Mean Error: 1.3 ⁰	Mean Error: 1.5 ⁰	Mean Error: 2.0 ⁰
SD: 0.8 ⁰	SD: 1.1 ⁰	SD: 1.4 ⁰
Max Error: 3.7 ⁰	Max Error: 4.8 ⁰	Max Error: 5.6 ⁰

Men	Left	N=96
Abduction	Flexion	Anteversion
Mean Error: 1.5 ⁰	Mean Error: 1.5 ⁰	Mean Error: 2.0 ⁰
SD: 1.0 ⁰	SD: 1.0 ⁰	SD: 1.5 ⁰
Max Error: 4.3 ⁰	Max Error: 4.3 ⁰	Max Error: 5.6 ⁰

Women	Left	N=101
Abduction	Flexion	Anteversion
Mean Error: 1.4 ⁰	Mean Error: 1.7 ⁰	Mean Error: 2.3 ⁰
SD: 1.1 ⁰	SD: 1.2 ⁰	SD: 1.7 ⁰
Max Error: 5.3 ⁰	Max Error: 4.8 ⁰	Max Error: 6.3 ⁰

Discussion and Conclusion: The current study demonstrates that for routine circumstances, plain radiographs may be used for predicting the adjustment of a simple mechanical navigational device used for cup positioning.

Poster: 70

Outcome of Ceramic-Ceramic Total Hip Arthroplasty in Patients Younger Than 50 Years

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Outcome Of Ceramic-Ceramic Total Hip Arthroplasty In Patients Younger Than 50 Years

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Introduction: Historically, patients who are less than 50 years old at the time of total hip arthroplasty (THA) have had higher failure rates than older patients. The current investigation prospectively assessed the survivorship and clinical results of alumina ceramic-ceramic THA in patients younger than 50 years.

Methods: 267 consecutive hips in 228 patients with a mean age at operation of 41 years (range 18 to 50 years) underwent alumina ceramic-ceramic THA. The preoperative Merle d'Aubigné score was 11.1 ± 1.6 (6 to 15). The preoperative diagnosis included primary osteoarthritis or impingement (128 hips, 48%), developmental dysplasia of the hip (85 hips, 32%), osteonecrosis of the femoral head (19 hips, 7%), posttraumatic osteoarthrosis (19 hips, 7%), and others (16 hip, 6%). The mean cup diameter was 51.8 ± 3.7 (range, 46 to 60 mm). 73 (31%) bearings were 28 mm and 165 (69%) bearings were 32 mm.

(31%) bearings were 28 mm and 165 (69%) bearings were 32 mm.

Results: At mean follow-up of 6.1 years (range 2 to 12 years), the mean Merle d'Aubigné score was 17.4 ± 0.9 (14 to 18). There were no radiographic signs of osteolysis. There were 5 revisions for implant-related complications (0.2%): 1 acetabular liner fracture, 1 femoral head fracture (poly-trauma), 2 failures of osseointegration (1 stem and 1 cup) and 1 cup dislodgement. The 10-year Kaplan Meier survivorship is 97.6% (95% confidence interval 95.4-99.8%). There were no hip dislocations.

Discussion and Conclusion: Results of THA in patients less than 50 years using alumina ceramic-ceramic bearings at two to twelve years follow-up are promising with no case of osteolysis or dislocation.

Poster: 71

TriLobe TDR Design Promotes Intrinsic Biomechanical Stability and Physiologic Kinematics

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Introduction: The anatomic center of rotation (COR) for a spinal motion segment is not fixed and moves, as an instant COR, in a domain located inferior and posterior to the center of the intervertebral disc while load transmission is through the center of the disc. Current articulating designs for TDR depend primarily upon a fixed center of rotation (COR). To maximize motion, the COR must be placed at the posterior disc space off the load transmission axis with a tendency to fall into kyphosis. Stacking multiple TDR levels tends to result in further deformities. The purpose of this study was to design and evaluate a TDR which restored physiologic kinematics while providing coaxial load support, and which was biomechanically stable enabling stable multiple level TDR. The TriLobe [Fig. 1] is a radical cervical TDR designed with self-centering articulating geometry. It features three incongruent self-centering hard-on-hard articulations arranged in a tri-pod configuration. The diameter and spacing of these articulations determines a kinematic envelope designed to match the 6D anatomic motion data from published sources. It couples motion in a physiologic manner. In cadaver kinematic studies presented last year, we demonstrated its reproduction of kinematics closely matching the normal motion segment and demonstrated its tolerance to wide placement variations.

Materials and Methods: The “tripod” structure of the Tri-Lobe TDR is a broad-based support platform around the center of axial load support through the vertebral body. Perturbations of this load axis within this zone will tend towards intrinsic stability. Placing the dual lobes on the anterior aspect serves doubly to prevent anterior/lateral kyphotic instability, and to mirror posterior facet stability. With coupled motion, the dual anterior lobes move forward in translation with flexion as a “moving fulcrum,” increasing the moment arm of the restraining

posterior structures (facets and facet capsule, and posterior muscles and ligaments), proportionately increasing their mechanical advantage. Finally, the combined three lobe-in-dish articulation is at its lowest energy point when at rest in a neutral position. Any angular rotation results in distraction, effectively moving against the axial loads imposed by gravity and muscle force. This provides an important additional stabilizing influence on the TDR construct. A geometric simulation was used to project the combined effects of this intrinsic “energetic stability” and cadaveric testing used to evaluate and compare its stability to a control ball-in-trough TDR.

Results: The force-displacement diagram [Fig 2] shows the centering of the lowest energy points for all physiological rotations and translations to reside at the neutral position for the Tri-Lobe articulation. The single non-physiologic component to this stabilizing kinematic effect is that there is a slight degree of distraction of 0.7 mm. We have been unable to determine any deleterious effect from this effect which otherwise contributes to stability. This stability and coupling of motions was confirmed in cadaveric kinematic studies.

Discussion: The Tri-Lobe TDR possesses intrinsic biomechanical stability as a result of several critical design elements. It has the potential to provide a platform for stable, multi-level disc replacement, while restoring normal kinematics.

Figures

[Figure 1](#) [Figure 2](#)

Poster: 72

The Impact of Launch Strategies on the Survivorship of New Devices

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Introduction

One of the potential attractions of Joint Registries is early identification of defective implants. However, new technologies are often associated with a learning curve which necessarily leads to inferior early results. This study examines the effect of different methods of introduction of a new implant on its early survivorship.

Materials and Methods

We modeled a database of 6000 operations performed using a new implant over a 5 year period. We assumed an average revision rate of 3.4% based on survivorship for hip resurfacing. Four different scenarios were modeled corresponding to the manner of introduction of this device to the community. The "Standard" scenario assumed that 165 surgeons gradually adopted the

device over a 5 year period based on the initial favorable experience of a small pilot group. Alternative scenarios were modeled, including limited release of the device (65 surgeons/64 cases each), increased distribution (310 surgeons\20 cases), and rapid early promotion (250 surgeons\24cases). Computer routines were utilized to predict the expected failure rate of each procedure using a standard survivorship curve based on surgeon experience.

Results

The method of introduction of the implant had a significant effect on its survivorship. Limited distribution to a smaller number of higher volume surgeons reduced the revision rate by 10% from 3.43% to 3.09% at 5 years. Conversely, early use of the device by twice the number of surgeons reduced survivorship by 4%. The greatest effect was observed with rapid early promotion of the new implant which led to a 23% increase in revisions at 5 years.

Discussion

This approach, using a "synthetic" database, predicts that the rate of commercial introduction of new devices can affect the survivorship data reported by joint registries. Because of the effect of the learning curve on implant survivorship, staged introduction of new devices is recommended to reduce adverse effects of inevitable early failures.

Poster: 73

Metallosis and Third-Body Wear on Cross-Linked Polyethylene and Cobalt Chromium Following Revision Total Hip Arthroplasty

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Fractured ceramic-on-ceramic hip replacements in vivo can create third-body abrasive wear particles that reduce the longevity of following revision arthroplasties. The present case study reports on the effects of third-body wear on a cross-linked polyethylene (XPE) acetabular liner and a cobalt chromium (CoCr) alloy femoral head due to ceramic particles.

A thirty-four year old female patient received a ceramic-on-ceramic total hip replacement for treatment of osteoarthritis in her left hip (BioloX, Ceramtec AG, Plochingen, Germany; Transcend, Wright Medical, Memphis TN). After sixty-five months of implantation, the patient suffered a fall and developed severe pain. The patient experienced difficulty walking and noticed squeaking and a grinding sensation and underwent her first revision hip arthroplasty. Intraoperatively, the patient was found to have experienced a fracture on the rim of the acetabular ceramic liner. The ceramic-on-ceramic hip was revised with a XPE acetabular liner and a 36 mm CoCr alloy femoral head (Longevity, Zimmer Inc., Warsaw IN). The retrieved total hip implants were assessed using gravimetric techniques, scanning electron microscopy, and non-contact profilometry.

After thirty-eight months in vivo, the patient underwent her second revision hip arthroplasty. Although thorough irrigation had been carried out at the time of the first revision arthroplasty with six litres of saline solution through a pulse irrigator, ceramic particles which remained in the periprosthetic tissues later migrated to the articulating surfaces, thus producing third-body wear. The ceramic particles caused severe third-body abrasive wear on the CoCr alloy femoral head which was no longer of spherical shape. Approximately 9% (14.3g) mass was lost from the CoCr femoral head due to the articulation against the ceramic particles which were embedded into the XPE acetabular liner causing grooving wear. This large amount of mass removed caused symptomatic metallosis in the patient. The XPE acetabular liner did show obvious wear and its rim had fractured in vivo.

In vivo fracture of a ceramic-on-ceramic total hip replacement has shown to create highly abrasive third-body wear particles that can not be removed completely by irrigation during revision surgery. Some ceramic particles remained within the periprosthetic tissue and have shown to migrate to the articulating surfaces and became embedded in the XPE acetabular liner. The embedded ceramic particles were approximately 6-times higher in hardness than the CoCr alloy of the femoral head and thus, accelerated third-body abrasive wear. Consequently, the patient underwent a second revision hip arthroplasty after thirty-eight months. The patient received a second ceramic-on-ceramic total hip replacement (BioloX, Ceramtec AG, Plochingen, Germany; Trident, Stryker Inc. Mahwah, NJ) and has been doing well after her latest follow-up at twenty-four months. To avoid excessive third-body wear of the cross-linked PE, the CoCr femoral head and thus metallosis, fractured ceramic-on-ceramic hip replacement should only be revised with a new ceramic-on-ceramic articulation.

Poster: 74

Anteversión Angle of THA With Navigation System Based on the Time Course of the Pelvic Inclination

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Objectives

It is difficult to evaluate the optimal angle of the cup in total hip arthroplasty. Especially the inclination of pelvis changes with posture and time course. We place the component considering with the change of inclination of pelvis with its posture by CT-based navigation system. We analyze the perioperative pelvic inclination angles with posture change.

Materials and Methods

We treated 50 hips in 50 patients (9 male and 41 females) with cementless total hip arthroplasty (THA) in our hospital. 42 osteoarthritis hips, 4 rheumatoid arthritis hips and 4 idiopathic osteonecrosis hips were included. All patients were performed THA with VectorVision Hip 2.5.1 navigation system (BrainLAB). We used AMS HA cups and PerFix stems (Japan Medical Materials, Osaka). The mean age of surgery was 63 years (43-81 years). The pelvic inclination angles were measured with anteroposterior radiography 2 months and 1 year after surgery obey the Doiguchi method.

Results

According to preoperative planning, the average pelvic inclination angle was 1.2 degrees anteversion (15.3 degrees anteversion to 25.6 degrees retroversion). The amount of change between supine and standing position was 3.8 degrees prior to surgery, 1.0 degree at 2 months after surgery and 1.3 degrees at 1 year after surgery. 8 patients prior to surgery, 1 patient at 2 months after surgery and 1 patient at 1 year after surgery changed more than 10 degrees between supine and standing position. The pelvic inclination angle of 9 patients prior to surgery, 22 patients at 2 months after surgery, 24 patients at 1 year after surgery changed in the anteverted direction with posture, it tended to increase after surgery.

Conclusions

When we place the acetabular component, it is important that the pelvic inclination angle in supine position according to preoperative planning and the change of pelvic inclination angle with posture. The amount of change of pelvic inclination angle tended to decrease at 1 year after surgery compared to 2 months after surgery. However, we experienced some patients the amount of change of pelvic inclination angle between supine and standing position changed more than 10 degrees. When the pelvic inclination angle changes widely, it requires more attention because of a narrow safe margin for placing the acetabular component.

Poster: 75

Influence of Impaction Forces of Ceramic Ball Heads on Proper Seating on Metal Stems for Hip Implants

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INTRODUCTION:

The advantage of a modular system is that the surgeon is able to choose the stem and a ball head of appropriate sizes from a series of components and assembly them by using a standardized connection. Herewith, the implant can be adapted to the individual patient. In the preoperative planning the appropriate combination is chosen but also during the surgery it is possible to select the ideal combination. Beside the benefit of a modular connection,

disadvantages are provided by this connection technique as well. The ceramic ball head is recommended as being manually assembled during surgery on a dry and clean taper with a quarter of a rotation to ensure that the ball head is centered on the stem. To assure a secure connection between the ball head and the stem a slight axial tap using a plastic impactor should be applied to the ball head. According to investigations related to current surgical practice, it has been found that during the intraoperative assembly of the ball head and the taper, the forces applied by the surgeon show a large deviation. In some cases, the surgeons even avoided the impaction.

This study shows the importance of an impact for the connection strength and particularizes and quantifies the necessary assembling force.

METHODS:

Ceramic ball heads made of pure alumina have been assembled in an in-vivo like test setup using static and dynamic forces. Four different dynamic force values of 1 kN, 2.2 kN, and 4 kN have been applied using a drop weight. The values have been derived from the previously mentioned investigations of current surgical practice¹. Additionally, an experimental group was tested using multiple impacts. As a control group, ceramic ball heads were mounted on the metal stems using just manual pressure with a light twist. Here, several axial forces were used: slight axial force (74 N), normal axial force with pressure coming from the forearm (94 N), and strong axial force (124 N) using the body weight to produce the axial force. The measured force values as well as the force necessary to pull-off the ball heads were used to evaluate and assess the results.

RESULTS:

The dynamically mounted parts show a linear correlation between the applied impaction force and the pull-off force, see figure 2. In comparison to the statically mounted parts, the pull-off force of the impaction with 1 kN is about 33% higher.

Figure 2: Pull-off forces for statically and dynamically assembled parts

Those parts having been mounted manually with a slight and a normal axial force do not comply with the acceptance criterion for the pull-off force according to ASTM F 2009, see figure 3. Furthermore, it can be seen that even the manually with a strong axial force mounted ball head is just above the acceptance criterion.

Figure 3: Pull-off forces for manually assembled parts with different axial forces

The investigation concerning multiple impacts exhibit that a second or third impact does not significantly increase the pull-off force but has also no adverse effects on the connection.

DISCUSSION:

The investigation clearly shows that an impaction after inserting the ceramic ball head with a light twist while applying manual pressure is necessary to obtain a secure connection between the metal taper and the ceramic ball head. A second impact has no adverse influence, it might reduce the risk of an insufficient impact by a non-axial first impact. The intraoperative fixation of a ceramic ball head on the metal stem should be performed on a dry and clean metal taper. In order to avoid a loosening of the connection assembly under eccentric or dynamic in-vivo loads, the ball head should be impacted with one or more light taps on the plastic impactor.

REFERENCES:

¹ Nassut, R.; Mollenhauer, I.; Klingbeil H. In: Biomedizinische Technik, H. 51, S. 103-109B, 2006.

Figures

Poster: 76

Influence of Tilting of Ceramic Liners on Their in-Vivo Safety

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INTRODUCTION:

Looking at the design developments of hip prostheses, several tendencies can be observed., especially for the acetabular components. The mean patient age decreases more and more, in contrast the patients' requirements regarding performance are increasing. This implicates that not only the mechanical safety has to be ensured but also the requirements concerning the range of motion (ROM) necessary for the patients' various activities. Besides design specific changes, this can be reached by increasing the bearing diameter. Because the anatomical conditions do not allow for an arbitrary increase of the implant size, the tendency to lower the wall thickness of the acetabular components can be observed, especially for the metal shells. Furthermore, the bone density of young patients is in general higher leading to an increase in bone stiffness compared to the average patient in the times of Charnley. This results in increased press-fit forces on the metal shell during and after impaction, leading to large deformations of the metal shells in some cases.

Hence, experience shows that intraoperatively difficulties arise to implant the ceramic inserts properly in the metal shell which has already been impacted in the human bone. Due to the mentioned large deformation of the metal shell, it is more difficult for the surgeon to implant the insert correctly. As a result, a tilted insert is subjected to line or point loading which may lead to chip-offs or even fracture [1].

As mentioned there, impacting of an insert starting from tilted position achieved by manually insertion, is only possible above a certain tilting angle of several degree. Inserts tilted around less than this certain angle tend to self-centering during impaction as can be affirmed from our own lab experience.

Nevertheless surgeons report chip-offs during impaction of inserts even after carefully checking the proper and untilted seating. Beside other hypotheses the presence of soft tissue disturbing the taper-locking surfaces of the connected parts was found as a possible reason for

chipping of the insert. Therefore a test set-up was developed where an almost slightly tilted seating of an insert in a metal cup is caused by a soft particle to show the possibility of disturbed but nearly untilted seating and examine its effect on burst strength of the ceramic part.

METHODS:

From a technical point of view the soft tissue, e.g. fat tissue, muscle fibres, ligaments etc., consists of a lot of different materials with differences in their mechanical properties. Due to the fact that the stiffness of soft tissue is extreme low in comparison to metal alloy and ceramics a direct load transfer by the soft tissue leading to point loading and a fracture of the ceramic insert seemed to made less sense. Instead, the deformation while keeping a constant volume, which is common to soft tissue due to its large content of water, seemed to have a larger effect. Therefore a soft material with volume constant deformation properties was chosen for the in-vitro modelling. The soft tissue disturbing the taper-locking surfaces was simulated by pieces of silicone rubber. For the experiments a silicone rubber of a hardness of 30 (Shore A) was selected. Rubber of this hardness is strong enough to be easily cut in appropriate small pieces of $1 \times 1 \times 2 \text{ mm}^3$ and placed between insert and metal cup taper. On the other hand the material is soft enough for representing soft tissue during mechanical loading of the insert.

Figure 1: left: Ceramic insert with silicone particle enforcing a slightly tilted implant situation; right: magnified view

The burst testing was done by realizing a load angle of 80° instead of 90° according to ISO 7206-10. The shifting of the load angle was done to maximize the stresses in the rim of the ceramic insert. Assuming a contact of insert and metal cup at the upper taper end under normal conditions and at the lower taper end in the area of the soft tissue contamination the line of contact between the parts is tilted around 10° degrees with respect to the front surface of the insert. Shifting the load angle for the same 10° degrees leads to a loading perpendicular to the zone of contact, which maximizes the stresses in the parts.

Figure 2: Test set-up

RESULTS:

The average of the burst loads is far below the values known from the standard burst testing according to ISO 7206-10. In some cases single values are below the minimum limit of 20 kN of the "FDA guidance document for the preparation of premarket notifications for ceramic Ball HIP systems, draft from 10th January 1995".

Burst testing according to ISO 7206-10 leads to nearly symmetric fracture patterns. In contrast to that, the fracture patterns of burst testing with soft particle disturbing the taper-lock show a half-moon-like shape which is comparable to chip-off fractures which occurred intra-operatively.

Figure 3: Fracture pattern

DISCUSSION:

The burst tests with the tilted inserts showed a clear drop of the burst load compared to the correctly impacted inserts which underlines the significance of an untilted impaction. The large standard deviation shows that even in case of impacting the insert in tilted state without fracture occurrence the remaining risk of an in-vivo fracture later on may be on a very high level.

Further examinations should be done concerning the influence of weakness, better reproducibility and especially fatigue loading.

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Figures

Poster: 77

Influence of Impacting Ceramic Inserts on Proper Seating in Acetabular Cups for Hip Implants

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INTRODUCTION:

The advantage of a modular system is that the surgeon is able to choose the metal cup and insert to adapt the implant system to the individual needs of a patient. During preoperative planning an appropriate combination is chosen. During surgery facing deviant conditions it is possible to change decision choosing another insert size or material. Beside the benefit disadvantages exist caused by a modular connection technique. The ceramic insert is recommended as being manually assembled during surgery into a dry and clean metal cup by pushing it in along the metal taper. Furthermore, a slight axial tap using a plastic impactor should be applied onto the insert to assure a secure connection. According to investigations related to current surgical practice, it has been found that during the intraoperative assembly of insert and metal cup, the forces applied by the surgeon show a large deviation. In some cases, the surgeons even avoided the impaction¹. In some cases surgeons even avoided the impaction.

Under in-vivo conditions adhesion forces generated between ball head and insert due to the synovia fluid might transfer tension forces between ball head and inserts. Occurring micro separation of the head consequently leads to pull-out loading of the insert.

This study shows the importance of a slight axial tap for a secure connection by examining the effects of occurring adhesion between ball head and insert.

METHODS:

Metal cups, embedded in a cast resin, have been used in an appropriate adhesion test setup. Ceramic inserts made of BIOLOX[®]*delta* were assembled with the cups by applying three different methods:

1. three inserts pressed-in manually
2. three inserts statically pressed-in by use of a 10 kg weight (100 N)
3. three inserts impacted manually with a light axial tap (peak force measured during impaction: 2800 N)
4. A ball head (diameter 36 mm, BIOLOX[®]*delta*) is set into the insert calotte which is contaminated with 3 ml of a 25% Di-H₂O-new born calf serum solution. Performing the test a 20 kg falling weight (equivalent to a swinging leg) is accelerated to a velocity of 3 m*s⁻¹ and is suddenly pulling the ball head out of the insert. The adhesion forces acting at the moment of separation of head and insert have been recorded by a load cell fixed between embedding pot and supporting frame

Figure 1: Experimental set-up for pulling the ceramic ball head out of a ceramic insert

RESULTS:

The taper connection of every insert pressed-in manually or pressed-in statically by a mass of 10 kg failed, the inserts were pulled out off their appropriate metal cups, see figure 2 a-b.

The adhesion forces caused a strong attachment between ceramic insert and ball head. The strength of the taper connection of impacted parts withstood the adhesion forces. The impaction forces generated by a slight tap could be evaluated as sufficient, that the ceramic inserts remain in their metal cups, see figure 2 c.

Figure 2 a-c High speed pictures made in the moment of separation: insert pressed-in manually; b: insert pressed-in with 100 N; c: insert impacted: insert remains in the metal cup!

The parts pressed-in manually or with 100 N force fail at low tension forces of appr. 80 N, see figure 3. The tests with the impacted inserts show maximum adhesion forces of 150..200 N.

Figure 3: Maximum tension forces measured during separation of ball head and insert

DISCUSSION:

The results show that manual pressing-in of inserts does not lead to sufficient connection strength. Not even pressing-in with 100 N (comparable to a mass of 10 kg) assures a secure connection. Only a slight axial tap using a plastic impactor after inserting the ceramic insert delivers sufficient locking strength of the parts. In conclusion it is necessary that every implanted insert should be impacted with at least one slight axial tap using the plastic impactor.

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¹:Beaver, McCormick, Kop; Fractures in Misaligned Ceramic Acetabular Liners: A Laboratory Study; 7th International Biolog Symposium 2002; Thieme Verlag

Poster: 78

Patient Satisfaction When Completing Hip and Knee Replacement Followup Questionnaires on a Touch-Screen Kiosk in an Orthopaedic Clinic

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Background: Current practice requires that all post-operative hip and knee arthroplasty patients complete a series of clinical questionnaires at each visit. The patients' responses to these questionnaires are used as a clinical evaluation tool for the surgeons to assess functionality, satisfaction and pain at routine pre and post-operative visits. The recent installation of four touch screen computer terminals, located within the patient waiting area, has created the opportunity to have the patients complete the required questionnaires by using only the touch screen entry system. This will eliminate the need for the clinic staff to manually enter the patient's responses from their paper questionnaires, into the clinic's database, eliminate potential data entry errors, and will significantly reduce the amount of time and paper that is required to prepare the questionnaires for each patient. In addition to possibly increasing the volume of data we can collect in our clinic, this also allows the surgeon to have immediate access to the patients' responses which can be reviewed prior to seeing the patient in the office.

Objective: To determine the overall level of patient satisfaction with using the new touch screen direct entry system, the efficiency of completion and the quality of data entry occurring from the direct entry system.

Methods: During the month of April, 2010, a consecutive series of 100 randomly selected patients entering the orthopaedic clinic, were directed to the touch screen kiosks to complete the required questionnaires (SF-12, Oxford Knee/Hip, Harris Hip/Knee Society Score, and the Patient Satisfaction Survey). Once the patients had completed the touch screen questionnaires they were asked to complete a printed copy of the Touch Screen Satisfaction Questionnaire. This questionnaire asked 6 questions regarding their satisfaction with the touch-screen system, the ease/difficulty of use, and which method they would prefer to complete such questionnaires if given a choice.

Results: Our randomly selected sample resulted in a mean age of 68.5 years (range 41.7 to 93.8 years), with a gender breakdown of 53 females and 47 males. Ninety-six percent of patients who used this system reported they had never used a touch-screen for health purposes, 71% found it very easy to use, and 49% reported that it was very quick to use. When polled

about their preferences regarding filling out questionnaires, 82% of patients preferred to use the touch-screen system, over filling out paper copies (2%), using an external internet site from home (1%) and 15% reported having no real preference to any of the above mentioned methods. Patients were unable to continue without answering all questions, therefore this method of data collection prevents the occurrence of missing values and incomplete records.

Conclusions: Our results support our initial hypothesis that the new touch-screen system may be a superior tool for obtaining clinically relevant patient information regarding function, pain and satisfaction in an effective and timely manner. These findings support our decision to integrate touch-screen systems into the information flow in an orthopaedic clinic.

Poster: 79

What Is the Financial Cost of Treating Periprosthetic Hip Fractures?

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Introduction

Periprosthetic hip fractures represent a complex clinical problem. No previous published data exists regarding the financial costs of treating this challenging group of patients.

Objective

To compare the mean financial cost of treatment of periprosthetic fractures and to compare the findings with the money received through the tariff payment system.

Methods

Patients were identified from a prospective database of all hip fractures at the Queen's Medical Centre, Nottingham in the United Kingdom over a ten-year period from 1999 to 2009. Hospital notes were independently reviewed and data retrieved using a standardised proforma to record the treatment of the fracture and for all subsequent related admissions for further treatment and complications. Using a method previously published at our institution, costs were calculated together with assistance from the finance department in relation to their theatre, ward, implant and investigation costs.

Finally, the money recovered by the trust for the treatment of each individual patient was recorded and compared to the actual cost.

Results

Data was retrieved for 146 patients. 62% were female at a mean age of 79 years. Fractures occurred around THR in 63 cases, revision THR in 27 cases and hemiarthroplasty in 56 cases. Vancouver classification A (n=14), B1 (n=54), B2 (n=49), B3 (n=22), C (n=7). Fixation of the fracture was performed in 61 cases, revision arthroplasty in 62 cases and 23 were treated non-operatively. Mean length of stay 39 days.

The total cost of treatment for all patients was £3,426,483 (\$5,232,517) at an average cost of £23,469 (\$35,839) per patient (range £615 to £223,000).

There were a number of outliers. To adjust for this the most and least expensive 5% (n=14) were excluded from analysis. The average total cost with outliers excluded was £20,172 (\$30,825).

Ward costs were responsible for 80.3%, theatre costs 5.7%, implants 6.7% and investigations 7.3%.

The money recovered by the trust from available HRG (Human Resource Group) data was an average of £3,702 (\$5,652) per patient (p<0.001), around 1% of the total cost to the hospital.

When costs were compared with each treatment group (Figure 1), the difference was statistically significant when further surgery was required (p=0.01) and length of stay was greater than 30 days (p<0.001).

Discussion

This study has revealed that in the United Kingdom, the tariff payments received do not reflect the true financial cost of treating these complex problems. The lengthy rehabilitation required after periprosthetic fracture is reflected in the high costs. The disparity between costs and money received must be addressed or large, specialist units will be at significant financial disadvantage.

Figures

Poster: 80

Periprosthetic Femoral Fractures Around Hip Hemiarthroplasty After Previous Hip Fracture: Demographics, Outcomes and Mortality. a Single-Centre Consecutive Series of 57 Patients

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A periprosthetic femoral fracture around a hip hemiarthroplasty represents a complex management problem. Patients are often elderly with multiple comorbidities. There is little published data regarding the outcomes of this cohort of patients.

Between 1999 and 2009, 3,246 patients with intracapsular hip fractures were treated at Queen's Medical Centre, Nottingham, a large United Kingdom teaching hospital, with hip hemiarthroplasty. During this time period, 57 patients (incidence 1.8%) were treated for a post-operative periprosthetic fracture around the hip hemiarthroplasty.

Prospective data was collected on all patients by audit officers at time of periprosthetic fracture. Hospital notes were independently reviewed and data retrieved using a standardised proforma to record the treatment of the fracture and all subsequent, related admissions for further treatment and complications.

Patient outcomes were determined according to fracture union, death and loss of follow-up. Failure was defined as fracture non-union and/or requirement for further revision surgery.

The mean age was 84 years. 72% were female. The mean time from hip fracture surgery to periprosthetic fracture was 35 months (0-420). 33% of patients sustained their fracture within 1 month of their hip fracture surgery. 44 (77%) occurred around uncemented prostheses (Austin Moore n=43; Thompson n=1). 13 occurred around cemented prostheses (Hastings n=8; Exeter stems n=3; Thompson n=2). Mean length of hospital stay was 35 days (7-88).

Vancouver classification was as follows: (n=15), B2 (n=18), B3 (n=5) and C (n=4). The remainder were type A fractures, one of which was treated operatively. 47 (82%) underwent surgical fixation or revision. 21 patients underwent fixation and 27 underwent revision. In those revised, bipolar heads were used in 22 cases (74%).

The mean time to fracture union was 3.8 months. 12 patients died before union. Further revision surgery was performed in three patients (5%; two for infection, one for loosening). Deep infection occurred in three patients (5%). Wound washout was performed for three further patients to treat superficial infection. No patients developed non-union or dislocation.

Mortality rate was 9% within one month of periprosthetic fracture, 32% within 1 year and 59% within 3 years. Mortality rates have been compared with mortality rate at our institution after hip fracture, which reveals similar mortality rates (Figure 1). 15 patients are still alive with a mean follow up of 65 months; none lost to follow-up.

Pre-fracture confusional state increased risk of mortality at 3 months ($p=0.05$), 1 year ($p=0.04$) and 2 years ($p=0.03$) (Fisher's exact test). Living in institutional care prior to periprosthetic fracture increased the risk of mortality at 1 year ($p=0.02$) and 2 years ($p=0.01$). Post-operative medical complications also increased the risk of mortality at 3 months ($p<0.001$), 1 year ($p=0.002$) and at two years ($p=0.003$).

We have been able to identify the incidence of periprosthetic fracture after hip hemiarthroplasty (1.8%). Our data demonstrates that these are a high-risk group of patients with a high risk of mortality, especially in the presence of confusion and after post-operative medical complications.

However, high rates of union can be achieved with low rates of infection, dislocation and re-revision surgery.

Figures

The Treatment of 83 Vancouver B2 and B3 Periprosthetic Fractures Around Loose Femoral Implants: Methods and Outcomes

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Periprosthetic fractures around loose femoral implants represent a challenge to the surgeon. We have identified a cohort of 83 patients who have been admitted to the Queen's Medical Centre, Nottingham since 1999 with Vancouver B2 or B3 periprosthetic fractures. Patients were identified via a prospective database of all trauma admissions and hospital notes were independently reviewed and data retrieved.

We have examined the treatment methods and implants used, and identified their outcomes in relation to union, further revision surgery and mortality.

The mean age was 81 years and 55% were female. Fractures were classified as B2 (71%, n=59) and B3 (29% n=24). 65% occurred around a total hip replacement; 35% around a hip hemiarthroplasty after previous hip fracture. Periprosthetic fracture occurred around a Charnley stem (n=25), Austin Moore (n=20), Hastings (n=8), Exeter (n=7), other (n=10). 13 other patients had undergone previous revision surgery.

The mean time from index surgery to fracture around primary stems was 104 months (median 85); revision surgery to fracture 74 months (median 72). Mean length of stay 37.5 days (range 5-157).

The stem was revised in 83% of cases (n=69: THR 44, Hemi 25). The acetabulum was revised in 49% of cases. The choice of revision stem was a long uncemented modular stem in 51% of cases (n=35: ZMR 24, Solution 9, Echelon 1), cemented stem in 26% of cases (n=18: Exeter 13, Charnley 1, Thompson 1, Elite 5), long uncemented distally locked stem in 10% of cases (n=7: Reef 5, Huckstep 1, unknown 1), proximally and distally locked stem in 4% (n=3: Kent), proximal femoral replacement in 4% (n=3), and the original stem was reinserted in 3% (n=2).

The fracture underwent fixation in 12% of cases (n=8 cases: THR 5, Hemi 3). 5 cases were double-plated. Fixation was chosen in 5 patients as they were considered too unwell to tolerate major revision surgery. In two cases the stem was revised and the fracture was also plated. 5% of patients (n=4) were too unwell to undergo surgery.

44 (53%) patients have subsequently died. Two others (2%) are lost to follow up and one is awaiting fracture union. Those alive have a mean follow up of 48 months (median 54).

14 cases (17%) died before fracture union. One non-union occurred (deep infection prior to periprosthetic fracture). 5 cases (6%) had deep infection at time of the periprosthetic fracture. A further two new deep infections occurred (3%). Dislocation occurred in 4 cases (5%).

Superficial wound infection occurred in 9 cases (11%).

12 cases (14%) required further surgery: washout of a superficial infection (n=4), re-revision procedures (n=4), 2nd stage revision for infection (n=2), washout for deep infection (n=2).

Mortality at 3 months was 19%, 1 year (25%), 3 years (40%) and 5 years (49%; THR 37%; Hemi 72%; Fisher's Exact Test p=0.003).

This study has revealed that high rates of union can be achieved through the treatment of periprosthetic fractures around loose implants using revision prostheses. Implant choice depends upon the fracture configuration and available bone stock.

Poster: 82

Principles of Revision Total Knee Arthroplasty

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With the increase in the numbers of total knee arthroplasty (TKA) there are bound to be increase in revision surgeries. In this paper we enumerate the principles of revision. The most important principle on which depends the success of surgery is determining the cause of failure. Secondly one must dispense with the practice of single component revision surgeries. When an implant fails it invariably is due to a contribution of all the components. A thorough clinical examination and laboratory and radiological investigation must be performed in the run up to the surgery and infection must be ruled out or confirmed. Infected TKA are presently treated by two stage revision protocol. In the first stage the implant and all devitalized tissue are removed and an antibiotic impregnated cement spacer is put in. Intra-venous antibiotics are prescribed for a period of 6 weeks and when the ESR and CRP levels are within normal levels the second stage is performed. The intra-operative technique in both types of revision surgery remains largely the same. Meticulous pre-operative planning, templating and making available all the implant options in the operating room go a long way in ensuring success of this difficult procedure. Intra-operatively establishing the tibial plateau is the first step. A tibial stem is preferred. Care must be taken to re-establish the original joint line at this stage. The femur is then sized and a decision is taken regarding the use of constrained or non-constrained options at this stage. This decision is based on the status of the ligaments in the knee namely the medial and lateral collateral ligament. A non – constrained option is indicated when the medial and lateral collateral ligaments are intact. A constrained condylar type of knee may be used if the medial collateral ligament is compromised. In case of poly-ligamentous instability a rotating hinge type of implant may be needed. Adequate component sizing and proper implant selection will give us a stable knee joint which will function well in the long term.

Poster: 83

Defect Management in Total Knee Arthroplasty

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With the increase in the numbers of revision total knee arthroplasty (TKA) we encounter increased instances of bone defects. Defects are classified based on their location, whether contained or not, and their size. The principles of managing defects in the femur and tibia are similar and are described together. Contained defects can be dealt with by using bone cement or bone graft. If the defect involves more than 1/3 of the tibial plateau then a tibial stem is inserted. Large defects with one column intact are amenable to reconstruction by use of impaction bone grafting or trabecular metal augments. For massive defects involving both the columns the choice is between trabecular metal augments and allografts. An intra-medullary stem, mesh or locking plates can be used to achieve stability. Bony defects in the patella are difficult to manage. If the implant is well fixed at the time of revision then it is best left alone. Patellar defects if contained can be bone grafted, if not contained then a smaller patellar implant can be used. In case of large defects a patellectomy is done or extensor mechanism allografts are indicated.

Poster: 84

Stem Cells in Orthopaedic and Traumatology: Clinical Results.

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Aim of this presentation is to show the experience that our working group has developed with the implantation of adult stem cells and growth factors in some orthopaedic and traumatic pathologies.

International scientific literature is full of articles that explain the characteristics and the use of stem cells much more than their clinical effects and results.

Friedlander (1) studied 122 patients with tibia pseudoarthrosis who underwent to implant of rh-OP1/collagen type 1, showing both clinical and radiographic efficacy.

Capanna (2) with his experience, shows that for the reparation of big bone loss and for pseudoarthrosis treatment, association of bank bone innest and stem cells can be a good resolution: he treated 27 patients, with neoplastic, post traumatic pathologies, aseptic necrosis of the hip, and he realized that the time of recovery was halved (3 months in front of 6 m.). Hernigou (4) studied 116 patients with osteonecrosis of the hip and who were treated with autologous bone marrow implantation: higher the number of innested cells higher the quality and the quantity of the osteogenesis.

During the 2008 and 2009 we have applied stem cells and growth factors to 36 patients. All the cases have been controlled using clinical and radiographical parameters. Clinical evaluation considered subjective index as pain and objective index as functional limitation.

For radiographic evaluation we have done standardx-ray in two positions in the immediate post operative period and after 1,3,6, and 12 month.

Our results are: in recent fracture there has been observed an halved time of consolidation (60 days in tibia and humerus fractures in front of the "classical"150 days); in hypertrophic pseuroarthrosis the healing was after 30-90 days. In recent fractures the application of combined stem cells and growth factors has the aim to transform the "adult fracture" in "child fracture": reparative process is faster and full of material because the number of stem cells present in the red bone marrow is higher in children. When the childhood is finished the red bone marrow become fat and it looses its capacity both hematopoietic and osteogenesis. Another fact is that stem cells will diminish with the growth.

Our casuistry has to be improved but in order to our experience we can affirm that this new biological technique can be a good promise for the future: the high percentage of good results, the halved rehabilitation time and the possibility to ménage the bone loss can authorized us to be positive to continue in this way.

Poster: 85

Use of Total Femur Prosthesis in Bone Tumor Treatment: The Rizzoli Institute Experience

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Objectives: aim of this study was to review a series of total femur prosthetic reconstructions for

bone tumors, to determine implant survival, complications and functional outcome.

Methods: Twentythree total femur megaprotheses implanted between 1987 and 2006 for bone tumors were retrospectively analysed: 22 large sarcomas and 1 metastatic osteosarcoma in previous distal femur resection. Two patients lost at follow-up were excluded, the remaining 21 included 15 males and 6 females, mean age 21 yrs. with histologic diagnoses: 12 osteosarcomas, 7 Ewing's sarcomas, 1 angiosarcoma, 1 fibrosarcoma. All patients were routinely followed in outpatient clinic. Mean follow-up was 62 months. Functional results were assessed according to MSTS system.

Results: Oncologic outcome showed 7 patients CDF at 148 months (all had neoadjuvant chemotherapy), 1 patient NED after treatment of relapse at 53 months, 13 patients DWD at mean time of 17 months (6 osteosarcomas, 5 Ewing's sarcomas, 1 angiosarcoma and 1 fibrosarcoma), 7 of these had preoperative chemotherapy with poor response. Major complications were 1 vascular complication requiring hip disarticulation, 1 infection, 1 detachment of trochanteric reattachment device. Two growing patients had multiple mini-invasive procedures for elongation of the implants. One patient had polyethylene change at 53 months. Functional results in 15 evaluated patients were excellent in 4, good in 8 and fair in 3.

Conclusions: Total femur replacement is a valuable salvage procedure in tumors involving entire femur. Prognosis of these tumors is poor; prosthetic reconstruction allows satisfactory function with a low rate of major complications.

Poster: 86

Gap Balancing vs Measured Resection Technique in Computer Assisted Surgery

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Navigation is a new tool that makes possible the accurate and reproducible performance of a total knee procedure. Two surgical strategies are possible: (1) a measured gap resection approach, or (2) a gap balancing approach. The purpose of this paper is to compare the 2 different methods using computer-assisted navigation total knee arthroplasty. Thirty patients who underwent navigated assisted TKA were studied. The PS balanced group gap consists of 20 patients: the arthroplasty was performed with a navigated gap balancing technique using a posterior stabilized (PS) prosthesis (10 patients) or a cruciate retaining prostheses (CR), (10 patients). The CR measured resection group consist of 10 patients where a cruciate retaining prosthesis was implanted with a measured resection navigated technique. The navigation utilized was the OrthoPilot™ 4.2 system (Aesculap, Tuttlingen, Germany) and the implant used were Columbus (BBraun, Tuttlingen, Germany). In both gap groups the adequate soft tissue releases was obtained to achieve collateral balancing. The goal was to adjust the collateral so that they

were balanced to within 2° to 3° in extension. A distractor with 2 flat independent plates was applied to measure the gap into both medial and lateral compartments of knees in extension and then in flexion, and gaps were measured and recorded. In measured group we started the procedure on the tibia referencing to Witherside. The trial components were inserted and the knee tested throughout a complete range of motion: then, whatever ligament balancing was necessary, was performed. Final balance, alignment, and range of motion were measured and recorded using the navigator. The difference between the pre-operative and post-operative joint line (JL) was considered as primary outcome for comparison between the groups. The joint line (JL) was calculated as the perpendicular distance from the tibial tubercle to the tibial plateau (pre-operative JL) or a line parallel to the weight-bearing surface of the prosthetic tibial component (post-operative JL), on lateral radiographic view. The long-leg x-Ray the hip-knee-angle (HKA), the frontal femoral component (FFC) angle and the frontal tibial component (FTC) angle were recorded. The lateral femoral component (LFC) angle and the lateral tibial component (LTC) angle were measured. All radiographs were recorded by five physicians. No complications related to the navigation system occurred. Statistical analysis comparing the ratio of the preoperative and postoperative joint line showed no differences between the groups in terms of repeatability, but comparing the Gap balanced groups (PS and CR) with CR Measured Group using the differences between the pre-operative and post-operative joint lines, a significant prevalence (P= 0.016) of measured resection technique in preserving the JL original value was observed. The mean raising of the joint line was 3.2 mm (\pm 1,6) in the gap groups and 2.1 mm (\pm 1,2) in the measured group. We observed a significant difference in the joint line position postoperatively between the 2 techniques. The measured resection technique maintained a post-operative level of joint line closer to the original preoperative value. However, the amount of modification was moderate with both surgical approaches. There is no published evidence in the literature that shows that minor changes such as these in the joint line position in primary TKA have an effect on the clinical outcome.

Poster: 87

In Vitro Tests in Order to Evaluate the Effect of a Femoral Stem With an Intertrochanteric Plate

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Introduction To prevent loosening during the long-term use of femoral stems, stems with a plate or collar for mechanical fixation have been developed. The advantage of femoral stems with a collar is force transmission in the proximal area, but their appropriate contact with bone is difficult to achieve. There is a possibility that this problem can be overcome using an intertrochanteric plate devised by Dr. Maezawa in 1968. Contact between bone and joint prostheses is difficult to interpret because the general contact theory cannot be applied to this contact. Therefore, in this study, pressure, stress, and micromotion were used as parameters for

the evaluation of fixation, and the plate and its function were evaluated employing two approaches, i.e., measurement and analysis. To contribute to the development of stems in the future, the effects of the plate, which has become infrequently used in clinical practice, were re-evaluated. **Methods** In this study, to clarify the usefulness and effectiveness of an intertrochanteric plate, we evaluated the following three items: (i) Pressure measurement was performed using stems with and those without a plate (collar stems), and the pressure distribution was compared between the two types of stem. (ii) Two finite element (FE) models with or without a plate were constructed, and the pressure immediately below the plate was compared between the two models by finite element analysis (FEA). (iii) Two FE models with a plate that is slightly movable or immovable were constructed, and the stress distribution and relative micromotion were compared between the two models by FEA. **Findings and Interpretation** The results showed that the intertrochanteric plate markedly lowered the maximum pressure compared to a collar. The plate, which is added under the collar, can disperse the pressure on bone like a washer under a screw. The pressure was lower than the value that may cause stem fracture. The results were verified by FE analysis under similar measurement conditions (Figure 1). Therefore, we speculated that the plate absorbed and scattered the load applied on the femoral head, reducing pressure at the bone-stem interface, and also reduced radial pressure in the stem axis direction, preventing excessive pressure concentration through its micromotion. The micromotion was lower for the model with a movable than for that with a fixed plate, suggesting that the former is not prone to loosening. Thus, micromotion of the intertrochanteric plate is effective for fixation. The movable intertrochanteric plate is useful to avoid excessive stress concentration and loosening. We judged the intertrochanteric plate to be useful for primary stem fixation.

Figures

Poster: 88

Trafermin and Sugar Therapy for Infection and Skin Ulcer After Total Knee Arthroplasty.

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Bacterial infection and skin ulcer are major problems in Total Knee Arthroplasty (TKA). Sugar (sucrose) has been used for wound care in many countries because it absorbs fluid, stimulates granulation, and suppress growth of bacteria. Trafermin (basic fibroblast growth factor : bFGF) accelerates granulation and improves quality of wound healing. We have used Trafermin and sugar for treatment of skin ulcer and infection after TKA, and followed up for minimum one year.

Four infected TKA with skin ulcer were treated with Trafermin and sugar. Two were osteoarthritis and two were rheumatoid arthritis knees. Implants were removed in two cases

because of deep infection. One was male and three were female, average age was 59.1 years old ranged 43 to 74. Follow-up period were one to 3 years. Two cases were MRSA infection. Sugar treatment were performed for two to 23 weeks and Trafermin was sprayed once a day for two to 16 weeks.

In two deep infected TKA cases, infection ceased in one to 4 month and revision TKA were performed. In other two cases, infection were ceased in two to 16 weeks. No VTE were observed

Combination of Trafermin and sugar is useful for management of infection and skin ulcer after TKA.

Poster: 89

Minimal Invasive Surgery Is a Fact or Fiction

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the article sent in power point by figure format.if there is any problem,please let me know.

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Poster: 90

Ultra Clean Air Laminar Flow Theatre and Vascular Graft Surgery- Lessons to Be Learnt by the Orthopaedic Team

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Introduction

Infection is a catastrophic event following any joint replacement surgery. A number of techniques have been adopted to reduce the risk of perioperative infection, one of which being the use of ultra clean air laminar flow theatres. Although their use would appear to be a valuable adjunct against infection and “recommended” by national orthopaedic associations, there is little high quality evidence available confirming infection reduction. There is even recent evidence reporting a paradoxical effect, with use causing an associated increased infection rate. In the UK, high-level comparative evidence assessing the effectiveness of these theatres will be difficult to obtain for joint replacement surgery with clinical reluctance and probable ethical impossibility to perform such cases in a standard theatre. This is however not the case for the allied specialty of vascular surgery. Although also using prosthetic implants there is no such recommendation for the use of clean air theatres and therefore provides an opportunity to perform investigation into their effectiveness.

Methods

A retrospective review of prospectively collected data of a single vascular surgeon’s experience was undertaken. Over a 2-year period a total of 172 procedures were performed with 77 involving vascular graft insertion. Procedures were performed in both laminar flow and conventional theatre environments, with allocation randomized via the waiting list to one of three weekly scheduled lists. One list was regularly in laminar flow, the remaining 2 lists alternating between conventional and laminar flow theatres. All patients received a uniform anaesthetic & surgical technique, perioperative antibiotics and rehabilitation with a minimum follow up of 1 year.

Results

A total of 46 grafts were inserted in a conventional theatre and 31 in a laminar flow. 19 patients suffered postoperative graft infection (25%) of which 9 were diagnosed as deep graft infections. 16 infections occurred following operation in a conventional theatre and 3 infections occurring in the laminar flow theatre ($p=0.0042$) with all 9 deep infections occurring in the conventional theatre group. All other risk factors and co-morbidities were comparable between the groups.

Conclusion

This study demonstrates conclusively that vascular graft infections occur more commonly in non-laminar flow theatres. Given the principles of vascular grafts and orthopaedic implants are the same, we conclude that this data strongly suggests laminar flow should be made an essential, not “recommended” augment to routine orthopaedic surgery. This further reinforces how it would be unethical to undertake an identical study in orthopaedics and should probably raise similar concerns in vascular surgery.

So Are Sutures Actually Better Than Staples in Prevention of Superficial Wound Infections After Primary Total Hip Replacement?

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Introduction:

A meta-analysis (BMJ 2010;340:c1199) was published recently which concluded that the risk of superficial wound infections with staples was four times greater than with sutures after hip surgery. This was a significant finding and before deciding to change our practice we decided to do a baseline audit. The aim of this audit was to assess our preferred choice of skin closure following a Total Hip Replacement (THR) and the resulting superficial infection rates.

Methods:

80 patients undergoing a primary THR before the publication of the meta-analysis were identified. All primary hips of all ages and risk factors were included in the audit. Data was then obtained from paper and electronic records.

Results:

Of the 80 patients that had a THR, 16 had their wounds closed with sutures and 64 with metal clips/staples. Nearly half of the procedures were performed by trainees as we are a teaching hospital. In the suture group none had any wound complications, however in the staples group 6 out of the 64 developed wound complications. 4 of these patient's required oral antibiotics for oozy/infected wounds and all 4 grew organisms on wound swabs. 1 patient required Intra-venous antibiotics for 24 hours for wound dehiscence; the wound swab however did not grow any organisms. 1 patient required a wound washout and intra-venous antibiotics for 6 weeks; he had a heavy growth of mixed organisms. The infections in all patients were successfully eradicated and all wounds had healed at last follow up. Thus the wound infection rate in the staples group was 7.8% and in the suture group 0%.

Discussion:

The objective of good wound closure is rapid skin healing and an acceptable cosmetic result while minimising wound complications like dehiscence or infection. The meta-analysis looked at 683 wounds and concluded that superficial wound infection rates were 3 times higher with staples in Trauma & Orthopaedic surgery as compared to sutures and 4 times higher if only post-operative hip surgical wounds were considered. The difference in infection rates was statistically significant, but there was no difference in the incidence of inflammation, discharge,

dehiscence or allergic reactions. The limitation of this meta-analysis was that out of the 6 included studies, only one was methodologically well designed and reported.

The findings from our baseline audit also support the findings from this meta-analysis, however we need to be careful in our interpretation of these significant findings. It is well known that certain patient factors like smoking, obesity, diabetes and steroid use increase incidence of infections. Of our 5 patients with infected wounds one had a preceding chest infection, one suffered from recurrent UTI's and another one was an immunosuppressed renal patient. Thus staples cannot be blamed for all superficial wound infections.

Our aim now will be to present these findings and to either initiate a well designed randomised control trial to answer this debate between staples and sutures, or to accept the findings and change our practice by closing all skin wounds with sutures and re-audit in 6 months time.

Poster: 92

Modified Fulkersons Procedure, Combined With Microfracture for Patello-Femoral Arthritis in the Younger Patient

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We report the results of a modified Fulkerson technique of antero-medialisation of the tibial tubercle, combined with microfracture or abrasion arthroplasty in patients under 60 with patello-femoral osteoarthritis.

All patients operated on between September 1992 and October 2007 were reviewed by an independent observer in clinic or by postal questionnaire, using the Oxford Knee Score, Melbourne Patella Score and a Satisfaction Score. Only patients with Outerbridge Grade 3 – 4 osteoarthritis of the patello-femoral joint were included. They were assessed pre-operatively with plain x-rays, MRI scans (as well as tracking scans in the last 10 years) and arthroscopically. All patients with tracking scans showed lateral subluxation of the patella.

The surgical procedure was a modification of Fulkerson's tibial tubercle osteotomy, with an advancement of 1-1.5 cms and a medialisation of 1.5 cms. The exposed bone of the patella and trochlea was drilled in the early cases and in the later cases an arthroscopic microfracture or abrasion using a power burr was carried out.

Between September 1992 and October 2007, 103 procedures were carried out in 84 patients, 19

patients having staged bilateral procedures. The mean follow up was 84 months (range 24 – 204 months). The mean age was 45 (range 26 – 59) and the female to male ratio was 7.6:1. 70 patients were reviewed giving a follow up rate of 82%. The mean Oxford Knee Score was 18.5 pre-operatively (range 3- 32) and 34.3 post-operatively (range 11- 47). The Melbourne Patella Score was 9.6 pre-operatively (range 3- 30) and 20 post-operatively (range 11- 30). Patient Satisfaction Scores were excellent (54%), good (29%), fair (8.5%) and poor (8.5%). 4 knees in 3 patients were converted to a patello-femoral arthroplasty, giving a 10 year survival rate of 96.1%.

This procedure offers an alternative to patello-femoral arthroplasty for younger patients with isolated patello-femoral arthritis.

Poster: 93

Post-Operative Morbidity and Mortality Associated With Primary Total Knee and Unicompartmental Knee Arthroplasty

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INTRODUCTION: The purpose of this study was to compare the incidence of post-operative complications (within 90 days) following primary total knee arthroplasty (TKA) as compared to unicompartmental knee arthroplasty (UKA).

METHODS: 1,067 Consecutive patients were retrospectively reviewed over 5 years at a single institution; 853 underwent primary TKA and 214 underwent UKA. Bilateral procedures and diagnoses other than osteoarthritis were excluded. Both groups were matched for age, however there were more females in the TKA group (72% vs. 57%; $p = 0.021$). Body mass index and Charlson Co-morbidity index scores were significantly higher in the TKA group (33.1 vs. 28.6; $p < 0.001$ and 0.78 vs 0.47; $p < 0.01$, respectively).

RESULTS: Seventy-four (9%) TKA patients had a major post-operative complication compared to four (1.9%) UKA patients ($p < 0.001$). Manipulation under anesthesia (4.8% vs. 0.5%; $p = 0.0013$), blood transfusions (4.8% vs. 0%; $p < 0.001$) and admission to an intensive care unit (2.4% vs. 0%; $p=0.01$) were more common following TKA than UKA. Seventeen TKA patients (2.0%) required a re-operation compared to one UKA patient ($p < 0.001$) and 61 TKA patients (7.2%) were re-admitted to the hospital for a secondary intervention compared to two (1%) ($p < 0.001$) UKA patients. Length of stay was longer following TKA (4.1 days vs. 2.0

days; $p < 0.001$). The prevalence of deep vein thrombosis (1.8% vs 0.5%; $p = 0.22$), pulmonary embolus (1.1% vs. 0.5%; $p = 0.69$), deep infection (0.8% vs. 0.5%; $p = 1.00$), and death (0.5% vs. 0.5%; $p = 1.00$) were similar in the TKA and UKA groups.

CONCLUSION: The morbidity of TKA is significantly higher than UKA although patients in the UKA group had a lower BMI and Charlson Co-morbidity index which may be related to the selection criteria for UKA.

Poster: 94

An Algorithmic Approach to the Treatment of Osteolysis Around a Well-Fixed Acetabular Component

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Osteolysis is the second most common cause of long-term aseptic failure of well-fixed total hip arthroplasty (THA) components. Treatment is predicated on patient symptoms and the severity of polyethylene wear and associated bone loss.

Mild osteolysis is typically asymptomatic. With increasing severity of bone loss, symptoms may develop secondary to debris-related synovitis, hip instability, and eventual component loosening. Polyethylene wear should be assessed by noting the degree of eccentricity of the femoral head on plain radiographs. Complete wear-through of the polyethylene results in femoral head articulation with the acetabular shell, which may lead to metallosis and rapid progression of bone and soft tissue destruction. Asymptomatic patients with moderate to severe eccentric wear are often operative candidates because a timely head and liner exchange can stave off a more comprehensive revision that may be required if prolonged wear and resulting osteolysis go unchecked.

All patients must be evaluated pre-operatively with an erythrocyte sedimentation rate and a C-reactive protein to exclude infection. Elevated values should prompt pre-operative hip aspiration for cell count and culture (aerobic and anaerobic).

Pre-operatively, it is imperative to identify the type and size of components that are in place. Obtaining the previous operative report is helpful. The following elements should be known prior to operative intervention: (1) component manufacturer, (2) size of the shell, (3) type of acetabular component (monoblock versus modular), (4) shape of the shell (hemispherical versus elliptical), (5) presence of screws/screw holes, (6) type of locking mechanism, (7) the ability of the shell to accept a constrained liner, (8) and the track record of the acetabular component.

The inclination of the acetabular component is assessed on AP radiographs. The version of the component can be assessed with a shoot-through lateral radiograph or a CT-scan of the pelvis. Pre-operative identification of the location and severity of osteolysis is also critical. Plain

radiographs often underestimate the severity of osteolysis that is seen intra-operatively. As such, pre-operative radiographic evaluation requires a minimum of 3 views of the hip. Computerized tomography is more accurate than plain radiography at delineating the extent of osteolysis.

Intra-operatively, the complete acetabular rim must be exposed. The integrity of the locking mechanism, the screws, and the fixation of the acetabular component must be evaluated; well-fixed components do not require removal. Component position should be assessed to ensure that the combined acetabular and femoral version is adequate to minimize post-operative instability. A constrained liner should be considered if the abductor complex is found to be deficient.

Determination should also be made as to whether bone grafting of osteolytic lesions is necessary. There are several techniques for bone-grafting retroacetabular lesions. Ischial and pubic rami lesions are more difficult to graft because it is not possible to contain the bone graft material within these lesions and thus prevent the graft material from gaining access to the bearing surface. In general, removal of the wear generator is often adequate for treatment of osteolysis around a well fixed acetabular component, and bone grafting is not required.

Poster: 95

In Vivo Post-Cam Kinematics of a High Flexion Posterior-Stabilized Total Knee Arthroplasty

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Background: In deep knee flexion of posterior stabilized (PS) TKA, the interaction between femoral cam and tibial post substitutes for the posterior cruciate ligament by providing anterior-posterior stability to the knee. The post-cam mechanism can induce femoral posterior translation (bicondylar rollback) with knee flexion. The objective of this study is to clarify the post-cam kinematics pattern in deep knee flexion of a high flexion PS TKA under weight-bearing conditions.

Patients and methods: We investigated the in vivo knee kinematics of 16 knees (13 patients) implanted with LPS-FLEX Fixed Bearing TKA (Zimmer). Under fluoroscopic surveillance, each patient did a deep knee flexion under weight-bearing condition. Femorotibial motion including tibial polyethylene insert were analyzed using 2D/3D registration technique, which uses computer-assisted design (CAD) models to reproduce the spatial position of the femoral,

tibial components from single-view fluoroscopic images. Closest distances between femoral cam and tibial post were measured. A distance of separation <0.5 mm was considered to indicate post-cam engagement. We evaluated the knee flexion angle at initial post-cam engagement and post-cam contact kinematics pattern.

Results: The mean maximum flexion angle was $121.0 \pm 10.7^\circ$. The mean knee flexion angle at initial post-cam engagement was $93.4 \pm 3.1^\circ$. When the post-cam engagement occurred, the contact point of the cam moved 2.1 ± 0.9 mm down the tibial post. At maximum flexion, the mean jump height distance from the top of tibial post to the center of post-cam contact was 12.1 ± 0.3 mm. Once the post-cam engagement began, both condyles continued to move posteriorly, femoral cam and tibial post were never separated until maximum flexion.

Discussion: In this study, we evaluated the in vivo sequential motion of a high flexion PS TKA including tibial polyethylene insert. This technique makes it possible to visualize and evaluate the contact of post-cam. Once the post-cam engaged, the femoral cam translated downward on tibial spine. At high flexion angles, the femoral cam was sitting low on the tibial post. This provides greater stability in flexion by creating a greater jump distance and reduces a stress on the tibial post.

Poster: 96

The Use of Fluoroscopy in Screwless Acetabular Cup Fixation With Metal on Metal Total Hip Arthroplasty in Osteoporotic Patients

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INTRODUCTION

As the average life span increases, the average patient age of total hip arthroplasty (THA) is becoming higher than ever before. Recently, large diameter metal head system is available allowing a larger range of motion of the hip, and to reduce dislocation rate. However, most large head metal on metal THA systems have no screw fixation hole on the acetabular component, and screwless cup fixation is required. In elderly age cases, the acetabulum is often osteoporotic and careful cup fixation is necessary. To facilitate accurate acetabulum cup screwless fixation in elderly age and osteoporotic patients, we utilized fluoroscopy during cup insertion to determine the optimal cup position. The purpose of this paper is to evaluate the effectiveness of fluoroscopy in osteoporotic patients during screwless acetabular cup fixation with metal on metal THA.

PATIENS AND METHODS

A total of 7 osteoarthritis hip were operated with M2a-Magnum large metal femoral head with Bi-Metric XR femoral stem (Biomet). All cases were female with average age 77.6 (range 68-85). The average diameter of the femoral head is 43.7 mm (range 40-48). All acetabular cups were fixed without any acetabular screws and cups with three spikes were chosen to obtain an initial rigid fixation on the osteoporotic acetabulum. Acetabular cups of the first 4 cases were fixed by traditional method without fluoroscopy and acetabular cups of the remaining 3 cases were fixed under fluoroscopy (Figure 1). The maximum gap width between acetabulum and acetabular cup surface were evaluated on antero-posterior X-ray images. Comparison between postoperative acetabular cup position with preoperatively planned ideal cup position was performed.

RESULTS

All the results are shown in Figure 2. In the first 4 cases with traditional cup fixation, 2 cases demonstrated a lateral position with 2 mm gap. One case demonstrated 0 mm gap and another with slightly medialized position. In the fluoroscopy group, all 3 cases demonstrated neutral position with 0 mm gap. No critical complication was observed in all cases.

DISCUSSION

As acetabular cup screw is not available in metal on metal THA system utilizing larger femoral head, the initial impaction and fixation of the cup is crucial. Particularly in osteoporotic cases, it is often difficult to fix the cup firmly at optimum position due to acetabulum bone fragility. To reduce the risk of mal-positioning of the acetabular cup, we utilized fluoroscopy when impacting the acetabular cup. It is concluded that cup impacting is performed easier and safer under fluoroscopy especially in the elderly aged osteoporotic patients. While this method is useful to determine the gap between cup surface and acetabulum, cup anteversion and abduction angles cannot be precisely determined due to pelvic tilting during surgery.

Figures

Poster: 97

Supracondylar Femoral Fracture After Total Knee Arthroplasty in Elderly Cases

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INTRODUCTION

As the number of elderly age patients who undergo arthroplasty increases, periprosthetic fracture occurs more frequently and its treatment often requires various fixation techniques due to severe osteoporosis. Many effective devices and methods have been reported to treat periprosthetic fractures. The purpose of this paper is to evaluate the effectiveness of intramedullary supracondylar (IMSC) nail utilized in the supracondylar femoral fracture following total knee arthroplasty (TKA) in elderly age patients.

PATIENS AND METHODS

A total of 3 supracondylar femoral fracture patients with TKA history were operated with IMSC nail. All cases were female and the average age at the time of the fracture was 84.6 (range 77-91). The fracture occurred on average 4 years after TKA(range 2.9-4.7). We investigated the patients' pre and postoperative ambulatory status and the duration till femoral fusion after the surgery.

RESULTS

All results are shown in Figure 1. A total of 2 patients who were ambulatory before fracture maintained ambulate status with or without T-cane after surgery. The remaining one case was a 91 years old and had no ambulatory status before surgery. The average duration till fusion was 9 weeks (range 6-12).

DISCUSSION

Recently, various surgical options for the treatment of periprosthetic fractures were suggested, such as intramedullary nail, minimally invasive plate osteosynthesis (MIPO). When IMSC nail is selected, the size, intercondylar distance of the femoral component, and the location of the fracture site should be investigated preoperatively. A minimum of 11 mm for intercondylar distance is usually required to insert the nail. Almost all femoral components have enough intercondylar distance and space for determining the insertion point of the nail. Moreover, extra care on preoperative implant retrieval is necessary on some femoral implants with intercondylar closed box design.

Each total knee system has different component design in anterior-posterior, medial-lateral dimension of the intercondylar space, the location and height of the tibial polyethylene insertion post. These factors pose considerable limitations on the insertion point and angle of the nail. Often, knee after IMSC nail fixation tends to hyper-extend slightly due to the limitations abovementioned. MIPO could be performed to reduce this postoperative deformity. This method makes anatomical reduction possible regardless of the femoral component design and comparative rigid fixation can be obtained utilizing locking screws in osteoporotic patients. In cases with wide knee range of motion (ROM), MIPO is considered first choice to maintain the postoperative ROM. In this series, all patients did not have active ambulate status and wide knee ROM. Thus, IMSC nails were preferred for its simplicity.

Various factors such as patient's preoperative activity, fracture type, and implant design should be carefully evaluated preoperatively case by case for optimum treatment.

Figures

Appropriate Spatial Design With Titanium Oxide Layer Enhances Bone Formation and Its Maturation in Vivo

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Surface modification of the prosthesis is one of the important factors to achieve successful outcome on total hip and knee arthroplasty. Many researchers have been proposed surface chemical treatments for providing titanium and its alloys with the apatite-forming ability because the formation of apatite layer on the implant surface is an important events to show osteocompatibility. The authors previously reported that Ti-15Zr-4Nb-4Ta with 0.5 mm groove deep and wide, and thermal oxidation at 500°C for 1 h provides effective surface to deposit a bone-like apatite at the internal surface of grooves in the simulated body fluid. The purpose of this study is to evaluate *in vivo* osteocompatibility of Ti-15Zr-4Nb-4Ta alloy with 0.5 mm deep and wide grooves thermally oxidized at 500°C (GRAPE group), compared with Ti-15Zr-4Nb-4Ta alloy without that modification (SMOOTH group). Cylindrical Ti-15Zr-4Nb-4Ta specimens were cut spiral groove with deep and wide, and then thermally oxidized at 500°C for 1 h in air. Male Japanese white rabbit weighting approx. 3.0 kg were anesthetized with Ketamine containing Celactar. The defects 4.5 mm in diameter were made through the femoral condyles of each femur, and then sterilized specimens were implanted to its defects. The rabbits were sacrificed by overdose of sodium pentobarbital after 2, 4 and 8 weeks operation. The extracted specimen with around tissue were fixed using a neutrally buffered formaldehyde aqueous solution, and then dehydrated, embedded in acrylic resin and cut to obtain thin sections. These sections were subjected to toluidine blue staining. Direct contact ratio between bone and materials were measured using Image J, and measured values were statically examined with Mann-Whitney U test ($p < 0.05$). All of animal study was conducted under the guideline for animal experiment of Okayama University (Approval # OKU-2007324). Even after 2 weeks implantation, newly formed bone was observed on the surface of grooves of GRAPE group, but not on the surface of SMOOTH group. Figure shows the macroscopic observation around the interface between bone and Ti-15Zr-4Nb-4Ta alloy with 0.5 mm deep and wide grooves thermally oxidized at 500°C (GRAPE group) after 8 week operation. Not only bone ingrowth but also matured osteonal bone could be observed in grooves of GRAPE group after 4 and 8 weeks operation. After 4 and 8 week implantation, direct contact ratio of GRAPE group between bone and specimen showed significantly larger than SMOOTH group by image analysis ($p < 0.05$). These data suggested that Ti-15Zr-4Nb-4Ta with 0.5 mm groove deep and wide, and thermal oxidation at 500°C for 1 h could not only enhance the osteocompatibility of titanium alloy but also induce the maturation of bone tissue *in vivo*. Titanium-based implant with this type of extremely simple modification is expected to achieve strong fixation from early implantation periods.

Poster: 99

Dislocation After Bipolar Hemiarthroplasty in Patients With Neuromuscular Diseases

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Aims: The patients with neuromuscular disease are known for having higher incidence of postoperative dislocation after bipolar hemiarthroplasty. In this study, the incidence of postoperative dislocation and its prevention after bipolar hemiarthroplasty were reviewed in patients with neuromuscular disease. **Methods:** Among the patients who underwent bipolar hemiarthroplasty due to fractures of the femoral neck between 1996 and 2008, 42 patients with neuromuscular disease, including cerebral infarction (24 patients), dementia (8 patients), Parkinsonism (7 patients), and poliomyelitis (3 patients), were chosen for comparative analysis against 148 patients with no history of neuromuscular disease. Leg length and femoral offset were adjusted in order to fulfill the real size of non-lesion side leg by preoperative templating. Intraoperative stability was tested, and posterior soft tissue repair was performed in all patients. **Results:** The incidence of dislocation in patients with neuromuscular disease and patients without neuromuscular disease were 2/42 (4.8%) and 3/148 (2.0%), respectively, which had no statistically significant difference ($p=0.330$). The postoperative leg length discrepancy of two groups was -1.7 mm and -0.7 mm, respectively, with no statistically significant difference ($p=0.586$). Femoral offset was 2.3 mm and 1.6 mm, respectively, which had no statistically significant difference ($p=0.762$). Manual reduction of dislocated hip was done under condition of general anesthesia to gain appropriate muscle relaxation. All reduction was successful done without complications of bipolar hemiarthroplasty dissociation and neither had the re-dislocation occurred. **Conclusions:** Incidence of dislocation after bipolar hemiarthroplasty in patients with neuromuscular disease can be lowered by delicate preoperative planning, intraoperative stability testing, and recovering tensile strength of soft tissue using posterior soft tissue repair.

Total Hip Arthroplasty in Patients With Diabetes Mellitus

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Aims: In various orthopaedic procedures including total hip arthroplasty, diabetes mellitus is known to be related with various complications. The purpose of the current study is to analyze the incidence and the predisposing factors for postoperative complications that patients with diabetes mellitus suffer after undergoing total hip arthroplasty. **Methods:** Among the 379 patients (440 hips) who underwent primary cementless total hip arthroplasty from September 1998 to February 2007, fifty-nine patients (62 hips) who had diabetes mellitus were selected and the other 320 patients (378 hips) without diabetes mellitus were set as a control group to perform comparative analysis. The mean follow up period was 36 months (range, 12-117 months) and the mean age of patients was 55.5 years (range, 16-79 years). The preoperative and annual postoperative Harris hip score was measured and the postoperative complications were evaluated. We analyzed the factors that were associated with the incidence of postoperative complications in patients with diabetes mellitus. **Results:** The diabetes mellitus group had a higher incidence of urinary tract infection and a longer admission period than did non-diabetic group ($p=0.001$ and $p=0.002$). The Harris hip score was 52 and 53 ($p=0.185$), respectively, for the patients with diabetes mellitus and the non-diabetic patients preoperatively, and it was 93 and 95 ($p=0.467$), respectively, at the last follow up. The predisposing factors for postoperative complications in patients with diabetes mellitus are a high hemoglobin A1c level and comorbidities. **Conclusions:** Total hip arthroplasty in patients with diabetes mellitus is associated with a higher incidence of postoperative complications and a prolonged admission period. A high hemoglobin A1c level and comorbidities are considered to have significant associations with these complications.

Tranexamic Acid in Total Hip Replacements: A Meta-Analysis

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Introduction

Total hip replacements (THR) are associated with significant blood loss that requires the transfusion of allogeneic blood. Although safer than ever, allogeneic blood transfusion is still associated with risks to the recipients.

Tranexamic acid (TXA) is a fibrinolytic inhibitor which has been used to reduce blood loss and transfusion in hip and knee arthroplasties, with variable results.

This meta-analysis aims to investigate the efficacy of TXA in reducing blood loss and allogeneic blood transfusion after THR and to assess whether its use is associated with a higher risk of developing complications such as deep venous thrombosis (DVT), pulmonary embolism (PE), infection, ischaemic heart diseases and mortality.

Methods

A systematic review and meta-analysis of published randomised controlled trials (RCTs) which used TXA to reduce blood loss and transfusion in hip arthroplasty were conducted. The data was evaluated using the generic evaluation tool designed by the Cochrane Bone, Joint and Muscle Trauma Group.

Results

We identified 11 clinical trials which were considered suitable for detailed data extraction. There were no trials which utilised TXA in revision THR.

Blood loss: Seven studies (350 patients) were eligible. Using TXA reduced intraoperative blood loss by an average of 104 ml (95% Confidence Interval (CI) -164 to -44, P-value 0.0006, Heterogeneity I^2 0%), postoperative blood loss by an average of 172 ml (95%CI -263 to -81, P-value 0.0002, Heterogeneity I^2 63%) and total blood loss by an average of 289 ml (95%CI -440 to -138, P-value <0.0002, Heterogeneity I^2 54%).

Blood transfusion: Seven studies (346 patients) were eligible. TXA led to a significant reduction in the proportion of patients requiring allogeneic blood transfusion (Risk Difference (RD) -0.20, 95%CI -0.29 to -0.11, P-value <0.00001, Heterogeneity I^2 15%).

Other outcomes: There were no significant differences in DVT, PE, infection rates or other complications between the study groups.

Discussion and Conclusion

The use of TXA in THR results in significant reduction of blood loss and blood transfusion without significant complications.

Aggressive Early Debridement Can Be Successful for Infected Total Knee Arthroplasty

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Introduction

Up to 2% of total knee arthroplasties (TKA) are still complicated by infection. This leads to dissatisfied patients with poor function, and has far-reaching social and economic consequences. The challenge in these cases is the eradication of infection, the restoration of full function and the prevention of recurrence. We report the outcome of prosthesis sparing early aggressive debridement in the acutely infected TKA.

Methods

We studied 29 consecutive patients referred with acutely infected TKA (18 primaries, 11 revisions) which occurred within 6 weeks of the index operation or of haematogenous spread. Microbiology confirmed bacterial colonization in all cases with 20 early post-operative infections and 9 cases of acute haematogenous spread. All patients underwent aggressive open debridement, a thorough synovectomy and a change of insert. Antibiotics were continued until inflammatory markers and the plasma albumin concentration returned to within normal limits.

Results

Three patients required multiple washouts. 8 patients needed a two stage revision. 21 patients returned to their expected functional level without removal of the implants and with no radiographic evidence of prosthetic failure. At a minimum 2 years follow-up, we had a 72% infection control rate. The outcome was significantly better in patients treated in the first 120 hours after presentation.

Discussion and Conclusion

Our data suggests that there is a role for early aggressive open debridement in acute infections after TKA with an excellent chance of prosthesis salvage.

Comparison of the Mid-Vastus and Median Parapatellar Approaches for Primary Total Knee Arthroplasty: A Meta-Analysis

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Proponents of a mid-vastus (MV) approach for primary total knee arthroplasties (TKA) stress its importance in preserving function of the extensor mechanism with earlier rehabilitation and decreased prevalence of lateral release.

We conducted a systematic review and meta-analysis of randomised and quasi-randomised trials comparing the standard median parapatellar (PP) and MV approaches in primary TKA to substantiate the validity and relevance of this contention.

Methodological features were rated independently by two reviewers. We included 15 studies involving 1129 patients with mean age and standard deviation of 69.4±12.75 for the MV and 68.6±11 for the PP groups. Using a MV approach led to significant increase in flexion at 1 and 12 weeks postoperatively (mean difference (MD) 9.90 (95% confidence interval (CI) 7.94 to 11.86, P<0.000001) and 1.35 (95%CI 0 to 2.7, P=0.05) respectively, significant improvement in visual analogue scale (VAS) scores at 1,3 and 15 days postoperatively with MD -0.67 (95%CI -0.98 to -0.36, P<0.0001), -1.72 (95%CI -2.08 to -1.36, P<0.00001) and -0.18 (95%CI -0.32 to -0.05, P=0.009) respectively, significant decrease of days to straight leg raise (MD -2.02, 95%CI -3.72 to -0.31, P=0.02), and significant reduction in number of lateral releases (odds ratio (OR) 0.56, 95%CI 0.37 to 0.86, P= 0.008) with no increase in complication rates. MV approach lengthened duration of surgery by MD of 8.48 minutes (95%CI 0.52 to 16.44, P=0.04).

Poster: 104

Surgical Wound Infection as a Performance Indicator in Total Knee Replacement: A Comparison Between Common Definitions

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Introduction:

Wound surveillance has been reported to result in a significant fall in the incidence of wound sepsis in total knee arthroplasty (TKA). However, there is currently little guidance on the definition of surgical wound infection that is best to be used for surveillance. The purpose of

this study was to assess the agreement between three common definitions of surgical wound infection as a performance indicator in TKA; (a) the CDC 1992 definition, (b) the NINSS modification of the CDC definition and (c) the ASEPSIS scoring method applied to the same series of surgical wounds.

Methods:

A prospective study of 500 surgical wounds in patients who underwent knee arthroplasties between May 2002 and December 2004 from a single tertiary centre were assessed according to the different definitions of surgical wound infection.

Results:

A total of 500 wounds were assessed in 482 patients. Mean age of patients was 70+/-11 years, 61.6% were females, duration of surgery was 101+/-49 minutes and mean follow-up was 35.2+/-25.7 months. The most commonly isolated species were Coagulase negative staphylococci (33.3%), *Staphylococcus aureus* (25%) and *Pseudomonas aeruginosa* (16.6%). The mean percentage of wounds classified as infected differed substantially with different definitions: 5.8% with the CDC definition, 3.6% with the NINSS version and 2.2% with an ASEPSIS score > 20. When superficial infections (according to CDC category) were included, 5.2% (26) of all observed wounds received conflicting diagnoses, and 1.4% (7) were classified as infected by both ASEPSIS and CDC definitions. When superficial infections were excluded, the two definitions estimated about the same overall percentage infection (2.2% and 2.6% respectively), but there were almost three times as many conflicting infection diagnoses (n = 14) as concordant ones (n = 5).

Conclusion:

Distinctions in surgical wound infection definitions contribute to notable differences in how infections are classified after TKA. Even small changes made to the CDC definition, as with the NINSS version, caused major variation in estimated percentage of wound infection. A single definition used consistently can show changes in wound infection rates over time at a single centre. However, differences in interpretation prevent comparison between different centres.

Poster: 105

Comparison of MIS-THA Versus Conventional-THA in Postero-Lateral Approach

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Objectives: Since March 2004, we have been performing THA operations using MIS postero-lateral approach. Recently, though, there is an argument that postero-lateral approach with muscle release should not be considered minimally invasive. This study is to compare MIS-THA with conventional THA which we had performed up until March 2004, and discuss the key factors in MIS-THA.

Patients and Methods: We reviewed 253 patients (278 joints) with coxarthrosis who underwent cementless THA, including 77 patients (83 joints) who had conventional THA (group C), and 176 patients (195 joints) who had MIS-THA, the method we have started to use aiming for less than 10cm skin incision (group MIS). Group MIS is further classified into two groups: cases from 2004-2006 (group M1), and from 2007-2008 (group M2). Each group was evaluated and compared based on the patient's age, BMI, length of skin incision, operation time, blood loss, implant placement angle, levels of CRP and CPK, the period up to ambulation and discharge, postoperative infection, and dislocation. In all cases, we used postero-lateral approach for release and re-suture of short external rotator muscles to greater trochanter.

Results: The average length of skin incision of each group was 18.0cm (group C), 9.4cm (group M1), and 8.7cm (group M2), the average operation time was 105.8 minutes (group C), 83.4 minutes (group M1), and 68.4 minutes (group M2), and the average amount of blood loss during the surgery was 470.9ml (group C), 374.3ml (group M1), and 339.2ml (group M2). The average period up to ambulation was 9.4 days (group C), 4.9 days (group M1), and 3.2 days (group M2), and the average period up to discharge was 35.7 days (group C), 28.6 days (group M1), and 22.9 days (group M2). Postoperative infection or dislocation was found in two cases from group C, and in one case from group MIS.

Discussion: MIS-THA has been firstly reported in 1998, and now became a very common method. In these days, new approaches have been reported, including mini incision, minimally invasive, and even more improved approaches without muscle release, such as direct anterior approach and antero-lateral approach. We adjust the length of skin incision according to each case, make it wide even when it is needed, but surgical invasion has still been minimized year by year. We think the major factors in MIS are improvement of familiar surgical techniques with a better team work, and development in the postoperative management and in rehabilitation procedure, with continuous effort and a will to make a progress.

Poster: 106

Calcar Bone Graft to Restore Limb Length in Comminuted Intertrochanteric Fractures Treated With Cemented Bipolar

Hemiarthroplasty - an Innovative Method

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Introduction: Management of unstable comminuted intertrochanteric fractures with cemented bipolar hemiarthroplasty in elderly patients with osteoporosis is an established method which allows early mobilization. However in intertrochanteric fractures, the medial calcar support is lacking. We have devised a method of using bone from the calcar as a graft, with cemented bipolar hemiarthroplasty [Fig.1]. This graft serves quadruple purposes – (1) it fills the medial calcar void, (2) it prevents settling of the prosthesis in varus and retroversion (3) it gives cue to limb length equalization and (4) it restores abductor tension due to restoration of limb length [Fig 2].

Methods: Between 2005 and 2010, we treated 37 patients with intertrochanteric fractures using this technique. The selection criteria were - osteoporosis as judged on preoperative x-rays using Singh's index, unstable fractures according to Evans, and medical co-morbidities that required early full weight-bearing mobilization. All patients were operated within 24 hours after the injury. We analyzed the restoration of limb length (measured from the ipsilateral anterior superior iliac spine to medial malleoli bilaterally) and studied the fate of bone graft (using postoperative radiographs at 6 months). We also analyzed postoperative complications and compared surgical duration, requirement of blood transfusions, and hospital length of stay with values in the literature. Statistical significance was defined as $p \leq 0.05$.

Results: In one case, the graft sank during prosthesis insertion leading to limb shortening of 1.5cm, while in 36 patients the limb lengths were equalized within 5 ± 1.2 mm. 18 patients reported for follow-up - in 2 patients the graft was absorbed, while in 16 patients the bone graft got consolidated. Three patients had implant failures in the form of breakage of implant stem at junction of upper 1/3 with lower 2/3. One patient had a painful nonunion of the greater trochanter, while one patient had a superficial bed sore. One patient died the night of surgery. Our surgical duration was significantly shorter than a study which used cementless calcar-replacement hemiarthroplasty for the management of similar fractures (45 ± 12 minutes vs. 96 ± 26 minutes; $p < 0.0001$). Our mean perioperative blood loss (150 ± 100 ml vs. 511 ± 103 ml; $p < 0.0001$) and incidence of blood transfusions (7 out of 37 patients vs. 27 out of 29 patients; $p < 0.0001$) were significantly lower than those reported in the literature. The hospital length of stay in was significantly lower than the value in the literature (5 ± 2 days vs. 13 ± 2.6 days; $p < 0.0001$).

Conclusion: Using our technique, we have shown that the limb length can be restored in all the cases within 5 ± 1.2 mm, and that the graft gets incorporated, providing adequate support to the prosthesis.

Figures

[Figure 1](#) [Figure 2](#)

Proposed Aggressive Cleaning and Sterilization Procedure for Orthopaedic Surgical Instruments

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Introduction

Sterilization of orthopaedic instruments tends to be more aggressive at European hospitals when compared to hospitals in the United States. This is due to the potential of prion associated infectious diseases such as Creutzfeldt-Jakob and spongiform encephalopathy (mad cow disease). The stability of prions make them difficult to destroy by standard steam autoclaving methods.¹

The purpose of this study was to propose an aggressive cleaning and sterilization method based on previous research that would be more effective in Europe. This method was tested on an existing orthopaedic instrument to determine if the parameters used would be tolerated by surgical instruments.

Materials

Offset Adapters (Stryker Orthopaedics, NJ, n=9), size 8mm.

Ultrasonic Cleaner (VWR, PA) with MetriClean2 (pH>11) (Metrex, CA) for 10 minutes at 98°C.

Autoclave (Steris, OH.), pre-vacuum at 137°C for 18 minutes.

Method

The offset adapters were assembled onto a Triathlon Tibial Baseplate (Stryker, NJ), size 8, during testing. A worst-case loading condition was enforced by orienting the offset adapters to produce increased moment forces (Figure 1, A). A wrench was then used to disengage it from the tibial baseplate. Component failure was defined as disassembly not occurring.

The components were tested for 240 cycles to simulate 10 years of use with a safety factor of 2. The simulated cleaning and autoclave treatment was batched for efficiency and to vary exposure to conditions. In addition, pin protrusion length (Fig. 1, B) was measured before and after 240 cycles were completed.

Results

During mechanical testing it was found that all test samples were able to disengage from the tibial baseplate. This indicated that the highly aggressive cleaning and autoclaving procedure did not compromise the integrity of the instrument. The pin protrusion length varied between 1.29-1.38mm before testing and 1.33-1.38mm after testing with the 95% confidence interval at

p=0.55. This minimal change in length did not affect the functionality and therefore all offset adapters were functional after testing.

Discussion

Although rare, prions pose a dangerous risk when using reusable surgical instruments. Research has been done to develop cleaning and sterilization protocols but to-date there is no generalized hospital procedure that includes these aggressive parameters and do not damage the surgical instruments. Literature shows that autoclaving on a pre-vacuum setting with a temperature of 134°C for ≥ 18 minutes results in a prion decrease of 5 logs.² In this study we increased this temperature and kept the recommended time the same, assuming this would provide similar elimination of prions.

This protocol was tested on offset adapters to determine its influence on the functionality of this instrument. The offset adapters demonstrated that they were able to endure this aggressive testing for simulated 10 year duration without compromising mechanical or structural integrity.

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Figures

[Figure 1](#) [Figure 2](#)

Poster: 108

An in-Vitro Evaluation of the Initial Stability of Cementless Pressfit Hip Stems Using Injectable HA Bone Substitute

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Introduction

Stability of a cementless press-fit total hip arthroplasty is essential for long-term success of the implant. Areas of non-contact between the bone and implant (gaps) may reduce initial stability of the construct. We proposed the use of an injectable hydroxyapatite (HA) bone substitute to eliminate the gaps created at the bone/implant surface. Micromotion was measure for a cementless hip stem implanted into a composite femur both with and without an injectable HA

bone substitute.

Material and Method

Titanium alloy Meridian ST Femoral Components (Stryker Orthopaedics, NJ) with an ingrowth surface and 1/8" holes drilled into the medial, anterior and posterior aspects.

Synthetic composite femurs (Pacific Research Labs, WA) with gaps created in 32% of femoral canal [1].

Typical surgical recommendations were followed for creating the femoral bone canal. The test group (n=3) had an injectable HA bone substitute pressed into the gaps (Figure 1, A). The control group (n=3) was tested without HA filler. Femur was shortened distally and oriented at 0° flexion and 0° varus/valgus. Metal probes were placed in the 1/8" holes and LVDTs were mounted to the bone via a custom frame (Figure 1, B). Vertical LVDTs collected superior/inferior displacement. Horizontal LVDTs collected medial/lateral displacement from the anterior and posterior probes and anterior/posterior displacement from the medial probe.

Mechanical loading included an axial compressive load (0-1000 N at 200 N/s) followed by ten torsional cycles (8 N-m external torque to 6 N-m internal torque at 0.5 Hz). Calculations were used to find the interfacial micromotion which occurring at the bone/implant interface [2].

Results

Data collected from anterior and medial horizontal probes showed axial compression produced greater micromotion in control group than test group (Figure 2). During torsional loading, test group had reduced motion for anterior, medial and posterior probes. For both groups there was an increase in micromotion at medial probe when compared to anterior and posterior probes for both axial and torsional loading. This indicated the implant tended to tilt in medially during testing.

Translational motion was calculated from vertical probes and summed for axial and torsional loading. The control group had larger total micromotion than the test group. The translational component of micromotion was greater than the rotational component.

Discussion

The purpose of this study was to determine whether the use of an injectable HA bone substitute would reduce initial micromotion of a cementless press-fit hip implant. The addition of the bone substitute in the gaps significantly reduced both translational and rotational micromotion. This stabilizing feature along with the inductive properties of the HA can make it a valuable asset in orthopaedic implantation. The test was conducted for basic research and it does not recommend the use of this product as described. The bone substitute is meant as a bone gap filler and not for mechanical stability. Further research is necessary to determine the usefulness of the bone substitute as a grouting agent.

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Figures

[Figure 1](#) [Figure 2](#) [Figure 3](#)

Poster: 109

Severe Persistent Synovitis After Cobalt Chromium Total Knee Arthroplasty Requiring Revision Surgery Report of Five Patients

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Implant related hypersensitivity is a well-established cause of failure after total hip arthroplasty, but a rare complication after total knee replacement. It remains a relatively unpredictable and poorly understood cause of failure of an implant.

We present a report of five patients who presented with persistent hypertrophic synovitis (Figure 1 and 2) after total knee replacement using a cobalt chrome component. Extensive preoperative and intraoperative attempts ruled out infection as a cause of symptoms. The knees had good ligamentous balance and were well aligned and fixed.

The clinical condition improved after revision to a zirconium femoral and titanium metal backed tibial components. Intraoperative histopathology revealed thickened synovium with a predominantly monocellular (lymphocytic or histiocytic) response(Fig. 3).

Where infection and instability have been excluded as a cause of persistent pain and swelling, consideration should be given to allergy as a cause of failure in primary knee replacement surgery.

Figures

Poster: 110

The “Sulcus Sign” as a New Clinical Marker of Flexion Instability in Total Knee Replacements

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Introduction: Symptomatic flexion instability has been well documented in cruciate-retaining (CR) as well as posterior stabilized (PS) Total Knee Arthroplasty (TKA). Diagnosis requires a high element of suspicion and is mostly clinical. The purpose of this report is to describe a new clinical sign and the results of revision surgery in this condition .

Materials and Methods: From 2007 through 2010, the senior author evaluated ten patients (10 knees) with symptomatic flexion instability after PS TKA. There were 6 men and 4 women with mean age of 59 years. All knees were evaluated by a distraction maneuver (similar to the sulcus test of the shoulder) as part of physical exam. Knee Society Scores (KSS) were used to document pain and function. Seven of ten knees have undergone revision surgery at this time. In 2 knees, all components were revised. Five knees received isolated tibial insert exchange. Average time from primary TKA to revision was 14 months.

Results: Preoperatively, all knees demonstrated at least 5mm translation with the anterior drawer test and 3 knees (30%) had reducible condylar lift-off at 90 degrees flexion. All knees had a positive “sulcus sign” with the patient sitting, leg by the side of the exam table and knee 90 degrees flexed and distracted. Postoperatively, all knees demonstrated < 5 mm anterior tibial translation absence of condylar lift-off and negative sulcus sign. This corroborated with improvement in mean KSS (59 to 90 and 60 to 84).

Discussion: Careful history taking and clinical examination can correctly identify flexion instability in well fixed and aligned TKA’s. A positive sulcus sign exclusively and reliably occurs in this patient cohort suggesting its usefulness in clinical practice. Revision surgery was successful in alleviating signs and symptoms of flexion instability in this cohort.

Poster: 111

Pre Assembled Ceramic Acetabular Liner. Prospective Study About 100 Patients at 2 Years Follow-Up.

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In prevention of hip dislocation femoral head diameter increased. Ceramic liner and metal-back acetabular cup thicknesses were reduced, to allow 36 mm ball diameter in a 50 mm metal-back external diameter. Thus, new risk of ceramic liner breakage appears [1]. When Metal-back undergoes deformation during impaction [2], ceramic liner might be mal seated. Contacts reduce to some stress riser points instead of large surface could lead to ceramic breakage [3]. The intra operative procedure to get and check a perfect insertion could be time consuming. Impingement between metal stem neck and ceramic liner edge is a cause of metal wear and ceramic chipping breakage [1]. We propose (1) a ceramic liner pre assembled in the metal-back to avoid false ceramic on metal strain spread and (2) metal rim to prevent stem on ceramic liner impingement with a conical range of motion up to 134°.

Out of 2500 implantations, we did a prospective survey of 100 pre assembled ceramic liners. We review the patients at 2 years follow-up. Functional results were excellent in 92 patients, good in 6 patients, fair in 2 patients. Five patients complained about groin pain after strong activities, related to ilio psoas muscle conflict. Two patients reported a transient squeaking. We found neither ceramic liner breakage nor hip dislocation. No patient underwent revision arthroplasty.

Our results are encouraging. This implant design is secure with a quick and simple implantation technique. Results should be confirmed by further follow-up in a larger population.

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Poster: 112

Conversion of Arthrodesis to Arthroplasty in Hip Joint

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Background: Conversion of arthrodesis to arthroplasty in hip joint remains controversial. Its difficulties include in not only the operative techniques, but also the postoperative slow

recovery of chief complaints such as low back pain, knee pain or contralateral hip pain. However, there were few reports of conversion focusing on the chief complaints. The purpose of this study was to evaluate the results of total hip arthroplasties (THAs) with arthrodesed hips.

Material and Methods: Between February 2004 and July 2009, fifteen arthrodesed hips were converted to THAs in 15 patients with a mean follow-up of 3.2 years (0.4 to 5). There were 10 women and 5 men with a mean age of 62.2 years (46 to 84) at the time of the operation. The mean duration of arthrodesis before conversion was 34.5 years (3 to 78). Initial diagnosis was tuberculosis in 7 hips, developmental dysplasia in 3 hips, ankylosing spondylitis in 2 hips, sepsis in 2 hips and aseptic necrosis in 1 hip. Before surgery, 10 hips (67%) had a surgical fusion and 5 hips (33%) had a spontaneous fusion. The operation was carried out with the patient in the lateral decubitus position using Dall's transgluteal approach, and all patients received cemented THAs. The hips were assessed clinically and radiologically before surgery, at 3 months, 6 months and yearly after THA, retrospectively. No patients were lost to follow-up.

Results: The mean Japanese Orthopaedic Association hip score improved from a mean of 49.1 (24 to 71) to a mean of 74.2 (40 to 89) at the final follow-up. In particular, the result of conversion in a spontaneous fusion was better than in a surgical fusion. Relief of low back pain (10 patients), knee pain (9 patients) or contralateral hip pain (4 patients) was evident in all patients. No radiolucent lines or evident loosening at the most recent follow-up was seen. Post-operative complication included 1 recurrent dislocation requiring revision.

Conclusions: The outcome after conversion of arthrodesis to THA was favorable. However, the indication of conversion should be selected carefully because of preoperative poor function and postoperative long management.

Poster: 113

Total Joint Arthroplasty for QuantiFERON Positive Patients

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Background: Joint tuberculosis (TB) is one of the disorders that we have to keep in our hearts. It is well known that QuantiFERON-TB Gold (QFT-G, Cellestis Limited, Australia) is common method for the diagnosis of TB. However, there is no guideline of the orthopaedic treatment for QFT-G positive cases. Here we report that the successful treatment of five cases who were performed total joint arthroplasty (TJA) in QFT-G positive.

Material and Methods: Between August 2009 and February 2010, five TJAs were performed

in 5 QFT-G positive patients with a mean follow-up of 5.6 months (3 to 9). There were 5 women with a mean age of 80.8 years (77 to 84) at the time of the operation. The breakdown of the patients by disease included spontaneous recurrent hemarthrosis in 1 knee, destructive arthritis in 1 hip and 1 knee, and old TB in 1 hip and 1 knee. Before surgery, they were assessed the activity of TB by PCR of joint fluid, the culture of sputum and chest X-rays. Three total knee arthroplasties and 2 total hip arthroplasties were performed without chemotherapy.

Results: Intraoperative pathological findings in joint were negative of TB. No post-operative complications, such as recurrences of TB were observed. However, intraoperative complication included 1 femoral shaft fracture requiring no revision.

Discussion: Tuberculin skin test which has been used as a tool for the diagnosis of TB has some limitations. Recently, QFT-G proved to be highly sensitive and specific in a pretreatment TB population and among healthy BCG vaccinated young volunteers, and was recommended by CDC in United States. However, there is no guideline of the orthopaedic treatment for QFT-G positive cases. Mori et al. reported that the QFT-G positive rates were 3.1% for those aged 40-49 years, 5.9% for those aged 50-59 years and 9.8% for those aged 60-69 years in Japan. That is to say, QFT-G positive indicates a condition of active of TB, latent TB infection or old TB, therefore, we must distinguish between with and without the activity of TB. In conclusions, it is possible that the conventional operation without chemotherapy is performed in QFT-G positive patients, if it is confirmed no activity of TB by PCR of joint fluid, the culture of sputum and chest X-rays.

Poster: 114

A Run of Femoral Artery in the Case of Congenital High Hip Dislocation

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[Introduction]

In adult hip, femoral artery or profunda artery usually runs apart from the acetabular anterior roof. There were few cases of injured profunda artery at the time of total hip arthroplasty (THA). However, we had injured profunda artery during the operation of original acetabulum in the case of congenital high hip dislocation. Retrospectively examined, the femoral artery of affected side had run more closely from acetabular anterior roof than that of unaffected side. And the affected side femoral artery forked to the profunda artery at the level of original acetabulum, more proximally than usual.

Therefore we analyzed anatomical evaluation on a run of femoral artery. We asked (1) whether affected side femoral artery would run more closely from acetabular anterior roof than unaffected side, (2) whether iliopsoas muscle cannot be seen between femoral artery and

acetabular anterior roof and (3) whether affected side femoral artery would fork more proximally to profunda artery than unaffected side artery, in the case of congenital high hip dislocation.

[Patients and Methods]

We retrospectively reviewed 18 patients / 23 hips of congenital high hip dislocation, one male / 17 female, mean 65.1 ± 8.8 years old (54-83), eight Crowe Type III hips / 15 Type IV hips. There were no Crowe Type I and II hips. In the unilateral patients, unaffected side hip was defined as normal hip. Radio graphical examination was performed using CT scan image. We classified a run of femoral artery as far group if the distance between femoral artery and acetabular anterior roof was more than 1cm and as near group if the distance was less than 1cm. We examined the location of the fork of femoral artery to profunda.

[Results]

Near groups were 17 hips in the 23 hips of congenital high hip dislocation (73.9%) and 4 hips in the 12 normal hips (33.3%). Near groups could be seen significantly frequent in the cases of congenital high hip dislocation than in the normal hips. The distance between femoral artery and acetabular anterior roof was significantly shorter in the case of congenital high hip dislocation. Twenty iliopsoas muscles could not be seen in the 23 cases of congenital high hip dislocation and all iliopsoas muscles could be seen in the 12 normal hips between femoral artery and acetabular anterior roof. Nine femoral arteries forked to the profunda artery at the level of original acetabulum in the 23 cases of congenital high hip dislocation (39.1%). Three femoral arteries forked at the level of original acetabulum in the 12 normal hips (25.0%).

[Summary]

We evaluated anatomical analysis of femoral artery in the case of congenital high hip dislocation using CT scan. The femoral artery of affected side had run closely from acetabular anterior roof in the case of congenital high hip dislocation. We should pay attention to the run of artery surrounding hip.

Poster: 115

Evaluation of New Developmental Navigation System for Total Knee Arthroplasty

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(Purpose)

The navigation system was reported to improve the accuracy of bone resection for total knee

arthroplasty (TKA). In the other hand, one of its clinical problems was invasion such as larger skin incision and duration of operation. New navigation system was developed to cut the bone minimally invasively for TKA. The purpose of this study was to evaluate the new navigation system to cut the bone using reference points in the limited area.

(Material and Methods)

The accuracy of new developmental navigation system (CT-based) was compared with image-free BrainLAB navigation system. This new system was only required the reference points from unilateral small limited area of femoral condyle and proximal tibia to obtain the optical images. Three-dimensional geometrical bone model was generated from the previously obtained CT images of cadaveric knee with 3D image analysis software (Mimics, Materialise) and then constructed with 3D-CAD software (Imageware1.0, EDS). Bone cutting was achieved by using this navigation system (group D) and BrainLAB navigation system (group B) at the same time. The cut surface was measured using 3D surface scanner (Mitsutoyo, JPAPAN). The accuracy was evaluated by comparing the data from 3D surface scanner to these from the two navigation systems. In clinical situation, we underwent 5 TKA using the two navigation system simultaneously. Bone resection was performed in based on group B directions. We evaluated the deviation of cutting surface angle and placement in these group D using the group B method.

(Results)

The deviation in group D / group B data to comparison with 3D scanner measure data was 0.8/1.0 degree on coronal plane, 0.9/3.0 degree on sagittal plane, and 1.1/1.0 mm on bone resection at the cutting surface of distal femur. The deviation of anterior femur was 1.6/2.0 degree on rotation, 1.7/0.5 degree on sagittal plane and 2.4/0.7 mm on bone resection. The deviation of proximal tibia was 0.9/0.3 degree on coronal plane, 0.3/1.5 degree on sagittal plane and 0.8/1.1 mm on bone resection. The accuracy of both group D and group B was sufficient for the appropriate position in previous reviews. In clinical situation, the deviation of group D to group B was 1.1 degree on coronal plane, 1.7 degree on sagittal plane and 0.3 mm on bone resection at the cutting surface of distal femur. The deviation of anterior femur was 1.6 degree on rotation, 1.0 degree on sagittal plane and 1.9 mm on bone resection. The deviation of proximal tibia was 0.2 degree on coronal plane, 0.1 degree on sagittal plane and 1.4 mm on bone resection. The deviation of group D to group B was less than 2 degree and 2 mm.

(Discussion)

Although new developmental navigation system had the variability for the rotation and bone resection amount of anterior femur side, this system achieved that the alignment error was less than 2 degree and the position error was less than 2 mm. Our navigation system had enough accuracy for the bone resection of the knee even in small registration area.

Total Hip Arthroplasty

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Cup orientation of total hip arthroplasty (THA) is critical for dislocation, range of motion, polyethylene wear, pelvic osteolysis, and component migration. But, substantial error under manual technique has been reported specially in revision THA due to a bone loss and poor anatomical landmark. We have used three kinds of navigation systems for cup positioning in primary and revision THA. The purpose of this study is to evaluate the accuracy of navigation in revision THAs.

Patients & Methods: Since 2005, consecutive 24 revision THAs were performed with volumetric post-operative CT scan images to measure three dimensional positionings of cups. We implanted cementless hemispherical cups in 14 hips using fluoro-based navigation (FN) system (Stealth Station Tria), in 5 hips using a CT-based navigation (CTN) system (VectorVision CT Hip 3.1) and in 5 hips using fluoro-CT-based navigation (FCTN) system (VectorVision CT Hip 3.5). For all the patients, volumetric post-operative CT scan was performed to measure 3D cup orientation. Using 3D image-processing software (JMM, Japan) we converted all data to radiographic angles to compare different navigation system.

Results: The difference from target angles of anteversion was 5.6 ± 4.9 degrees. The absolute value of difference from target angles of inclination was 6.5 ± 3.8 degrees. The system accuracy was 4.2 ± 2.9 in inclination and 4.7 ± 4.1 . Accuracy of three navigation system was not significantly different. No postoperative dislocation was observed in this series. No complication related to navigation system was observed, either.

Discussion: Cup malpositioning can easily occur with a conventional alignment guide especially in MIS THA due to complexity of a operation. In revision THAs, high incidence of malpositioning of cups and post operative dislocation were reported. We previously reported that navigation system improved the accuracy of acetabular component orientation in MIS THA comparing to manual technique. Conventional CT-based navigation system in revision THAs had two problems. First, it was difficult to get accurate surface registration because a presence of a bone loss prevented surface registration. Secondly, an artifact of CT images due to previous implants during a preoperative planning. For surgical approach (removal of implants), damages of bone easily occurred before surface registration. Damages of bone changed the landmarks for surface registration. These problems might lead the error of CT-based navigation system.

On the other hand, FN and FCTN system does not need surface registration around acetabulum. This feature is great advantage to revision THA. Therefore, FN and FCTN system have theoretically would be friendlier for revision THA than CTN system. We also reported FCTN system showed superior accuracy than CTN system [2]. In the present study, there were no significant differences between three kinds of navigation systems. But, our volume of patients was too small to draw differences between systems. We need to continue this study to get more cases.

However, in conclusion, an application of navigation system in revision THAs was effective and safe procedure to eliminates postoperative complications such as a malpositioning and post-operative dislocation,

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