



14TH ANNUAL MEETING

FINAL PROGRAM



Total Joint Replacement: A Patient's Perspective

GAYLORD TEXAN RESORT & CONVENTION CENTER
DALLAS, TEXAS

NOVEMBER 5-7, 2004

Fourteenth Annual Meeting
November 5-7, 2004
Gaylord Texan Resort, Dallas, Texas

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About AAHKS

Background:

Established in 1991, the American Association of Hip and Knee Surgeons (AAHKS) is committed to its mission of providing educational opportunities to its members. For the past several years, Annual Fall meetings have addressed an increasingly broad array of scientific topics, such as implant design, results, surgical techniques and complications of primary and revision TJA, as well as the latest information available on socioeconomic issues affecting the specialty.

Mission Statement:

The mission of the AAHKS is to provide current educational, research and communication opportunities for the membership and their patients to allow continued quality management of arthritic disorders of the hip and knee.

Vision Statement:

The AAHKS will serve as a forum for physician interaction on patient care and socioeconomic issues related to arthritis of the Hip and Knee.

On the cover: Images from the AAHKS Total Joint Replacement Documentary (from l to r): Clifford Colwell, MD, with bilateral total knee recipient Mae Katon; hip replacement patient Linda Brown; and Eugene Zongrone with his physical therapist at Hospital for Special Surgery. The film has aired in major cities on Public Television, and is available as an Internet webcast through Fall, 2005. Documentary information can be found at www.aahks.org



American Association of Hip and Knee Surgeons
Fourteenth Annual Fall Meeting
November 5-7, 2004
Gaylord Texan Resort, Dallas, Texas

Goals and Objectives

The American Association of Hip and Knee Surgeons Fourteenth Annual Meeting is designed to provide orthopaedic surgeons with state-of-the-art information regarding the latest techniques and controversies in joint replacement surgery, as well as timely socioeconomic and legal issues of interest to our membership.

The Scientific Sessions will include the most current research in joint arthroplasty. Clinical papers will focus on:

- Bearing Surfaces in THA: Is New Better?
- Primary TKA: A Focus on the Younger Patient
- Primary THA: Incisions and Navigation
- Primary THA: Implant Designs and Outcomes
- TKA: From Revision to Outpatient Surgery
- Revision THA: Instability, Bone Loss and Resource Utilization
- Important Hip Topics: Osteonecrosis, Labral Tears and NSAIDS
- TKA: From Surgical Approaches to Computer Navigation

Symposia Topics include:

- Socioeconomic Issues: Insurers, Medicare and Reimbursement (presentations ranging from not accepting Medicare to successful negotiating with insurers)
- Professional Liability Reform
- Systems, Safety and Surgery: Patient Safety is an Attitude (including “report cards” on surgeons and the use of closed claims data in the battle against medical error)
- A Revolution in the Management of the Surgical Patient: How to be a Better and More Cost-Effective Surgeon (updates on rehabilitation, nerve blocks, advances in pain management)
- Surgical Technique Highlights: How the Experts Do It.

Thirty-six free papers will be presented with an open discussion following each paper. Twenty-four scientific poster presentations will be on display throughout the Annual Meeting.

The program is designed for orthopaedic surgeons and meets the seven essential criteria of the Accreditation Council of Continuing Medical Education. As a result, the meeting receives the highest quality education and category I CME credit for participation.

AAHKS 14th Annual Meeting Scientific Program

(Times and Topics subject to change.)

Friday, November 5, 2004

Noon-9:00 pm	Registration	Grapevine Ballroom Foyer
Noon-9:00 pm	Speaker Ready Room	Ft. Worth Room 1
2:00-5:00 pm	Exhibit/Poster setup	Grapevine Ballroom Exhibit Area
3:00-5:00 pm	Improved Patient Care Through Malpractice Protection: Advanced Lawsuit Protection Strategies <i>Guest Speaker: Robert Dowd, LLM, JD</i>	Austin Room 4-6
3:00-6:00 pm	Board of Directors Meeting	Ft. Worth Room 3-4
5:30-8:30 pm	Posters/Exhibits Open	Grapevine Ballroom Exhibit Area
6:00-8:30 pm	Welcome Reception (All attendees invited)	Grapevine Ballroom Exhibit Area
6:00-7:30 pm	Knee Problem Case Session <i>MODERATOR: Arlen D. Hanssen, MD</i> <i>Panel: Douglas A. Dennis, MD, Gerard A. Engh, MD,</i> <i>David A. Fisher, MD and Merrill A. Ritter, MD</i>	Ft. Worth Room 5-7
6:00-7:30 pm	Hip Problem Case Session <i>MODERATOR: Lawrence D. Dorr, MD</i> <i>Panel: C. Anderson Engh, Jr., MD, Daniel J. Berry, MD,</i> <i>Wayne G. Paprosky, MD and Roger H. Emerson, MD</i>	Grapevine Ballroom C
8:30-10:30 pm	Private Board/Past Presidents Dinner	Old Hickory Restaurant

Saturday, November 6, 2004

6:00 am-6:00 pm	Registration	Grapevine Ballroom Foyer
6:00 am-6:00 pm	Speaker Ready Room	Ft. Worth Room 1
6:00-7:00 am	Breakfast Buffet	Grapevine Ballroom Exhibit Area
6:00 am-3:45 pm	Posters/Exhibits Open	Grapevine Ballroom Exhibit Area
6:45-7:25 am	Business Meeting (Active Members only)	Grapevine Ballroom C
7:30-7:45 am	President's Welcome <i>Richard F. Santore, MD, San Diego, CA</i>	Grapevine Ballroom C

SESSION ONE Bearing Surfaces in THA: Is New Better?

7:45-8:29 am *MODERATORS: Thomas P. Schmalzried, MD and Clifford W. Colwell, Jr., MD*

7:45 am **Early Wear of a Crosslinked Polyethylene Liner Versus a Conventional
Polyethylene Liner: A Case-Controlled Study**
Paper #1
Robert J. Krushell, MD, Springfield, MA*

7:50AM **Discussion**

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- 7:56 am **Impingement of Highly Crosslinked Polyethylene Acetabular Cups in a Hip Simulator**
Paper #2
Douglas E. Padgett, MD, New York, NY*
- 8:01 am **Discussion**
- 8:07 am **Cracking and Impingement in UHMWPE Acetabular Liners**
Paper #3
Philip C. Noble, PhD, Houston, TX*
- 8:12 am **Discussion**
- 8:18 am **The Relationship Between Activity and Ions in Patients with Metal-Metal Bearing Hip Prostheses**
Paper #4
Thomas P. Schmalzried, MD, Los Angeles, CA*
- 8:23 am **Discussion**

SESSION TWO

- 8:29 – 9:13 am Primary TKA: A Focus on the Younger Patient**
MODERATORS: *Arlen D. Hanssen, MD and Brian S. Parsley, MD*
- 8:29 am **Unicompartmental Knee Replacement: A Minimum Twenty-One Year Follow-Up End Result Study**
Paper #5
Michael R. O'Rourke, MD, Iowa City, IA*
- 8:34 am **Discussion**
- 8:40 am **Osteolysis at 5-10 Years after Primary TKA: Impact of the Patient, Backside Interface and Polyethylene Sterilization Method**
Paper #6
Matthew B. Collier, MD, Alexandria, VA*
- 8:45 am **Discussion**
- 8:51 am **Total Knee Arthroplasty in Young Patients**
Paper #7
Gavan Duffy, MD, Jacksonville, FL*
- 8:56 am **Discussion**
- 9:02 am **Mobile Bearing TKA: Do the Polyethylene Bearings Rotate?**
Paper #8
Douglas A. Dennis, MD, Denver, CO*
- 9:07 am **Discussion**
- 9:13 am **JAMES A. RAND AWARD WINNER**
PRESENTATION OF AWARD: *Douglas A. Dennis, MD and John J. Callaghan, MD*
Experience with an All-Polyethylene TKR in Younger, Active Patients Follow-Up from 2-11 Years
Amar S. Ranawat, MD, New York, NY*
- 9:19 am **Discussion**

SYMPOSIUM I

- 9:25-10:20 am SOCIO-ECONOMIC ISSUES: INSURERS, MEDICARE & REIMBURSEMENT**
MODERATOR: *Richard F. Santore, MD*
- 9:25–9:32 am **How We Got Here from There: CPT Bundling**
William J. Robb, Jr., MD, Glenview, IL
- 9:32–9:39 am **The Insurers Need Us: The Power of the Group in Negotiation**
Michael P. Connair, MD, North Haven, CT
- 9:39-9:46 am **The Federation of Physicians & Dentists: The Utah Experience**
E. Marc Mariani, MD, Salt Lake City, UT
- 9:46-9:53 am **One Surgeon's Experience in Opting Out of Medicare**
J. Carl Peus, MD, Santa Barbara, CA
- 9:53-10:00 am **Dropping all Insurance: What Can You Do?**
Richard F. Santore, MD, San Diego, CA

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10:00-10:05 am	Health Policy: AAHKS Takes the Lead <i>Lane Koenig, PhD, AAHKS Consultant</i> <i>The Lewin Group, Alexandria, VA</i>	
10:05 am	Discussion	
10:20-10:45 am	BREAK	Grapevine Ballroom Exhibit Area
10:45-11:50 am	KEYNOTE SPEAKERS <i>MODERATOR: Richard F. Santore, MD</i>	Grapevine Ballroom C
10:45-11:00 am	“What a New Hip has Meant to Me” <i>Billy Casper, Masters Golf Champion</i>	
11:00-11:15 am	“Can there be Health Coverage for all without Price Controls?” <i>John Nelson, MD, President of the AMA</i>	
11:15-11:30 am	“Is There an Orthopaedic Surgeon in the House?” <i>Congressman-Elect Tom Price, MD</i> <i>Roswell, GA</i>	
11:30-11:50 am	Discussion	
11:50 am-12:25 pm	Professional Liability Reform <i>MODERATOR: William J. Robb, Jr., MD</i>	
11:50 am–12:02 pm	“Liability Reform: Can We Prevail at the Federal Level?” <i>John Nelson, MD, President of the AMA</i>	
12:02–12:10 pm	AAOS and AAHKS PAC Activities and Progress Update <i>David Lovett, JD, Director, AAOS Washington, DC office</i> <i>Robert Bucholz, MD, AAOS President</i>	
12:10-12:25 pm	Discussion	
12:25-1:10 pm	LUNCH	Grapevine Ballroom Exhibit Area
1:10-1:12 pm	Research Committee Update <i>Steven M. Teeny, MD, Tacoma, WA, Research Committee Chair</i>	
1:12-1:18 pm	Blood Conservation Survey Results <i>Fred D. Cushner*, MD, New York, NY</i>	
1:18-1:24 pm	Surgical Treatment of Displaced Femoral Neck Fractures: Survey Results <i>Richard Iorio, MD, Burlington, MA</i>	
1:24-1:30 pm	Poster Highlights <i>Mary I. O'Connor, MD, Jacksonville, FL, Education Committee Chair</i>	
SESSION THREE	Primary THA: Incisions and Navigation	
1:30-2:25 pm	<i>MODERATORS: Lawrence D. Dorr, MD* and John J. Callaghan, MD*</i>	
1:30 pm <i>Paper #9</i>	Early Results of 1,000 Consecutive Posterior Single-Incision MIS THA <i>Todd V. Swanson, MD, Las Vegas, NV</i>	
1:35 pm	Discussion	
1:41 pm <i>Paper #10</i>	Mini-Posterior vs. Standard Posterior Primary THR <i>Steven T. Woolson, MD, Palo Alto, CA</i>	
1:46 pm	Discussion	

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- 1:52 pm **Clinical Results in Eighty-nine Primary Total Hip Replacements Performed with the Two-Incision Minimally Invasive Approach**
Paper #11 *B. Sonny Bal, MD,* Columbia, MO*
- 1:57 pm **Discussion**
- 2:03 pm **Total Hip Arthroplasty through a Minimal Posterior Approach Using Computer Assisted Hip Navigation**
Paper #12 *Richard L. Wixson, MD,* Chicago, IL*
- 2:08 pm **Discussion**
- 2:14 pm **Comparison of Conventional vs. Computer Assisted Acetabular Component Insertion**
Paper #13 *James B. Stiehl, MD, Milwaukee, WI*
- 2:19 pm **Discussion**

SYMPOSIUM II SYSTEMS, SAFETY AND SURGERY: PATIENT SAFETY IS AN ATTITUDE

- 2:25-3:20 pm **MODERATOR: Edward J. Nebel, MD, Port Huron, MI**
- 2:25-2:30 pm **Introduction**
Edward J. Nebel, MD, Legal Advisory Committee Chair, AAHKS
- 2:30-2:40 pm **AAOS Patient Safety: Tools for Implementation**
David A. Wong, MD, Denver, CO
- 2:40-2:50 pm **Monitoring of Surgeons: Someone is Watching**
Michael Leonard, MD, Evergreen, CO
- 2:50-3:00 pm **Closed Claims Data: Tools in the Battle Against Medical Error**
Larry Brenner, JD, Chapel Hill, NC
- 3:00-3:20 pm **Discussion**
- 3:20-3:45 pm **BREAK** Grapevine Ballroom Exhibit Area

SESSION FOUR Primary THA: Implant Designs and Outcomes

- 3:45-4:29 pm **MODERATORS: J. Wesley Mesko, MD* and Joseph C. McCarthy, MD**
- 3:45 pm **Minimum Ten-Year Follow-up of Cemented Femoral Components with Identical Surface Geometry but Different Surface Finishes**
Paper #14 *Daniel Firestone, BS*, Iowa City, IA*
- 3:50 pm **Discussion**
- 3:56 pm **Ten Year Follow-Up of Hydroxyapatite-Coated Femoral Stem**
Paper #15 *Gregory Y. Lee, MD, San Diego, CA*
- 4:01 pm **Discussion**
- 4:07 pm **The Effect of THA Cup Design on Polyethylene Wear Rate**
Paper #16 *William Hamilton, MD*, Alexandria, VA*
- 4:12 pm **Discussion**
- 4:18 pm **Primary Cementless Harris-Galante I Acetabular Component in Patients Fifty Years Old or Younger**
Paper #17 *Daniel J. Berry, MD*, Rochester, MN*
- 4:23 pm **Discussion**

SESSION FIVE: TKA: From Revisions to Outpatient Surgery

- 4:29 – 5:13 pm **MODERATORS: Carlos J. Lavernia, MD and Thomas K. Fehring, MD**

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4:29 pm <i>Paper #18</i>	The Use of Porous Components in Revision TKA: A 5-Year Follow-up Study <i>S. David Stulberg, MD,* Chicago, IL</i>	
4:34 pm	Discussion	
4:40 pm <i>Paper #19</i>	The Safety and Feasibility of Outpatient TKA <i>Richard A. Berger, MD, Chicago, IL</i>	
4:45 pm	Discussion	
4:51 pm <i>Paper #20</i>	Does Shortened Hospital Length of Stay Affect Clinical Outcomes in Primary Total Knee Arthroplasty? <i>Steven M. Teeny, MD, Tacoma, WA</i>	
4:56 pm	Discussion	
5:02 pm <i>Paper #21</i>	Obesity and Peri-Operative Mortality in TKA and THA Patients <i>Robert S. Namba, MD*, Santa Ana, CA</i>	
5:07 pm	Discussion	
SYMPOSIUM III A REVOLUTION IN THE MANAGEMENT OF THE SURGICAL PATIENT: HOW TO BE A BETTER AND MORE COST-EFFECTIVE SURGEON		
5:13-6:07 pm	MODERATOR: Thomas P. Vail, MD	
5:13-5:23 pm	Patient Education: The Value of Preoperative Efforts <i>Richard D. Coutts, MD, San Diego, CA</i>	
5:23-5:29 pm	Peripheral Nerve Blocks: Pros and Cons from the Surgeon's Perspective <i>Thomas P. Vail, MD*, Durham, NC</i>	
5:29-5:35 pm	Pain Management: Cox-2 Drugs, Analgesics and Anti-Emetics <i>Lawrence D. Dorr, MD, Inglewood, CA</i>	
5:35-5:41 pm	Accelerated Rehabilitation: Hip <i>William J. Hozack, MD, Philadelphia, PA</i>	
5:41-5:47 pm	Accelerated Rehabilitation: Knee <i>Douglas A. Dennis, MD, Denver, CO</i>	
5:47-6:07 pm	Discussion	
6:07 pm	ADJOURN	
6:30-7:45 pm	POSTER RECEPTION (All are welcome)	Grapevine Ballroom Poster Area

Sunday, November 7, 2004

5:30-10:00 am	Registration	Grapevine Ballroom Foyer
6:00-10:30 am	Speaker Ready Room	Ft. Worth Room 1
5:45-7:00 am	Continental Breakfast	Grapevine Ballroom Foyer
7:00-9:00 am	Poster Teardown	Grapevine Ballroom Poster Area
6:45-7:00 am	Research Update (ORS/OREF/NIH) <i>Richard D. Coutts, MD and David C. Ayers, MD</i>	

SESSION SIX: Revision THA: Instability, Bone Loss and Resource Utilization
MODERATORS: Daniel J. Berry, MD* and Wayne G. Paprosky, MD

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- 7:00 am
Paper #22 **Long-Term Outcome of 755 Consecutive Constrained Acetabular Components in Total Hip Arthroplasty: Examining the Successes and Failures**
Adolph V. Lombardi, Jr., MD, FACS, Columbus, OH*
- 7:05 am **Discussion**
- 7:11 am
Paper #23 **High Failure Rate of a Constrained Acetabular Liner in Revision THA**
Craig Della Valle, MD, Chicago, IL*
- 7:16 am **Discussion**
- 7:22 am
Paper #24 **Does Femoral Bone Loss Predispose to Failure in Revision THR with a Tapered Titanium Modular Stem**
Jose A. Rodriguez, MD, New York, NY*
- 7:27 am **Discussion**
- 7:33 am
Paper #25 **Fatigue Fracture of a Modular Revision Femoral Component: A Report of 40 Cases**
Jeffery L. Pierson, MD, Indianapolis, IN*
- 7:38 am **Discussion**
- 7:44 am
Paper #26 **Hospital Resource Utilization in Primary and Revision THA**
Kevin J. Bozic, MD, San Francisco, CA
- 7:49 am **Discussion**

SESSION SEVEN

- 7:55-8:39 am **Important Hip Topics: Osteonecrosis, Labral Tears and NSAIDS**
MODERATORS: David C. Ayers, MD and Douglas A. Dennis, MD
- 7:55 am
Paper #27 **Association of Acetabular Labral Tears with Structural Abnormalities**
Robert T. Trousdale, MD, Rochester, MN
- 8:00 am **Discussion**
- 8:06 am
Paper #28 **Failure of Hemi-Resurfacing for AVN in Young Patients**
Matthew W. Squire, MD, Charlotte, NC*
- 8:11 am **Discussion**
- 8:17 am
Paper #29 **Surface Arthroplasty for Osteonecrosis of the Hip**
Paul E. Beaulé, MD, Los Angeles, CA*
- 8:22 am **Discussion**
- 8:28 am
Paper #30 **Celecoxib Does Not Affect Osteointegration of Cementless Total Hip Stems**
David R. Lionberger, MD, Houston, TX*
- 8:33 am **Discussion**

SESSION EIGHT

- 8:39-9:34 am **TKA: From Surgical Approaches to Computer Navigation**
MODERATORS: William J. Hozack, MD and James B. Stiehl, MD
- 8:39 am
Paper #31 **A Prospective Clinical and Electromyographic Comparison of Vastus Splitting and Median Parapatellar Approaches to Total Knee Arthroplasty**
Matthew Kelly, MD, Waynesville, MO
- 8:44 am **Discussion**
- 8:50 am
Paper #32 **Mini-Incision TKR can Increase Risk of Component Malalignment**
David F. Dalury, MD, Baltimore, MD*
- 8:55 am **Discussion**

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9:01 am <i>Paper #33</i>	Computer Assisted Navigation in TKR: Improved Coronal Alignment <i>Richard L. Wixson, MD*, Chicago, IL</i>
9:06 am	Discussion
9:12 am <i>Paper #34</i>	Computer Navigation versus Standard Instrumentation for TKA: A Single Surgeon's Experience <i>Michael P. Bolognesi, MD, Durham, NC</i>
9:17 am	Discussion
9:23 am <i>Paper #35</i>	Computer Assisted Navigation in TKA: Comparison with Conventional Methods <i>Kevin C. Anderson, MD*, Detroit, MI</i>
9:28 am	Discussion

SYMPOSIUM IV SURGICAL TECHNIQUE HIGHLIGHTS: HOW THE EXPERTS DO IT

9:34-10:35 am	MODERATOR: Mary I. O'Connor, MD,* Jacksonville, FL
9:34-9:41 am	Primary THA in CDH <i>C. Anderson Engh, Jr., MD,* Alexandria, VA</i>
9:41-9:48 am	Extended Trochanteric Osteotomy <i>Wayne G. Paprosky, MD,* Winfield, IL</i>
9:48-9:55 am	Extensile Exposure for Complex Revision THA <i>William C. Head, MD, Frisco, TX</i>
9:55-10:02 am	Periprosthetic Fracture: Double Plate Fixation <i>David G. Lewallen, Rochester, MN</i>
10:02-10:09 am	Opening Wedge UTO <i>Mark W. Pagnano, MD, Rochester, MN</i>
10:09-10:16 am	Varus Producing Supracondylar Distal Femoral Osteotomy <i>Kenneth A. Krackow, MD, Buffalo, NY</i>
10:16-10:23 am	Computer Assisted TKA <i>S. David Stulberg, MD,* Chicago, IL</i>
10:23-10:35 am	Discussion
10:35 am	ADJOURN

Please return your completed Evaluation Form to the Registration Desk at the end of the Meeting. Thank you for your participation!

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Early Wear of a Crosslinked Polyethylene Liner versus a Conventional Polyethylene Liner: A Case-Controlled Study

Robert J. Krushell, MD, Richard J. Fingerth, MD

Introduction : The purpose of this study was to compare two-dimensional femoral head penetration rates of the crosslinked polyethylene liner versus the conventional polyethylene liner as an assessment of polyethylene wear in primary total hip replacements with a minimum 2.5 years follow-up.

Methods: This case-controlled study consists of 40 crosslinked polyethylene liner primary total hips (19 male, 21 female), mean age 68.73 years (45-83), mean body mass index (BMI) 27.85 (20.1–36.2) matched by gender, age, and BMI with 40 conventional polyethylene liner primary total hips (19 male, 21 female), mean age 69.53 years (43-88), mean BMI 28.15 (19.5 – 36.1). Both liners were manufactured by the same company, had a ten degree insert orientation, and were packaged in a nitrogen/vacuum atmosphere. Identical acetabular components and a 28 mm cobalt chrome femoral head were utilized in all cases. Femoral head penetration was calculated using digitized initial and recent radiographs. Mean length of follow-up was 47.73 months (31-56) and 49.53 months (36-72) for the crosslinked and conventional liner hips respectively.

Results: The mean femoral head penetration rate for the crosslinked polyethylene liner group was 0.05 mm/year (0.01-0.09), standard deviation 0.02. The mean femoral head penetration rate for the conventional liner group was 0.12 mm/year (0.02-0.29), standard deviation 0.06. This represents a 58.33 percent reduction in femoral head penetration ($p < 0.001$).

Discussion & Conclusion: At a minimum of 31 months (mean 47.73 months) follow-up, the crosslinked liner demonstrated a 58.33 percent reduction in femoral head penetration versus the conventional liner. These early results are encouraging.

Impingement of Highly Crosslinked Polyethylene Acetabular Cups in a Hip Simulator

K.G. Holley, B.D. Furman, O.M. Babalola, **Douglas E. Padgett, MD**, J.D. Lipman, T.M. Wright

- Purpose:** While highly crosslinked polyethylene acetabular cups have shown low wear rates during in vitro joint simulator studies, the effect of prosthetic impingement of the femoral component against the rim of the acetabular polyethylene rim is unknown. We hypothesized that because of the detrimental alterations in the mechanical properties that accompany increasing crosslinking, impingement would cause accelerated polyethylene wear and cracking compared to that found with conventional polyethylene.
- Methods:** Three groups of cups with different levels of crosslinking were created by exposing them to three different doses of gamma irradiation: 2.8, 10, and 20 Mrad. Four cups from each group were mounted at 50 degrees of inclination in a 12 station hip simulator so that impingement occurred during every wear cycle and subsequently tested for five million cycles (Mc) under a Paul-type loading curve with a maximum load of 2000 N. Cups were weighed against load-soaked controls every half million cycles to determine wear rate, and damage at the area of impingement as well as the articular surface was documented using digital photography. Density profiles were also performed on all test cups and one soaked control. Wear particle morphology was examined on debris recovered from the bovine serum used as a lubricant during the test.
- Results:** The wear rates were different among the groups, with the 10 Mrad cups having the lowest rate (15.2 +/- 5.1 mg/Mc), followed by the 2.8 Mrad (40.1 +/- 4.2 mg/Mc) and 20 Mrad (67.9 +/- 24.2 mg/Mc) groups. This difference was significant between the 10 and 20 Mrad groups. Wear damage was most severe in the 20 Mrad group which showed pitting, delamination, and cracking at the impingement sites by 0.5 Mc and became more severe as the test progressed. No difference in maximum or bulk density was noted among groups.
- Discussion:** Prosthetic impingement in total hip arthroplasty is a common occurrence and the use of highly crosslinked polyethylene may predispose for accelerated wear and damage.

Cracking and Impingement in UHMWPE Acetabular Liners

MV Birman, **Phillip C Noble, PhD**, Michael A Conditt, MD, JD Johnston, JW Alexander, S Li, KB Mathis

Introduction: The use of cross-linked polyethylenes to enhance the wear performance of acetabular liners comes with potential risks due to reduced polymer strength and fracture toughness. The purpose of this study was to determine the prevalence of crack formation in conventional UHMWPE cups and its association with rim impingement, oxidation and time in situ.

Methods: One hundred twenty acetabular cups of 18 metal-backed designs were retrieved during revision total hip arthroplasty. The duration of implantation averaged 80 months (range: 2-204 months). Each component was examined by stereomicroscopy using incident and transmitted light. The presence, severity and location of cracks, areas of impingement, and oxidation were recorded. Severity was assessed subjectively using a four-point grading system. All observations were correlated with the duration of implantation.

Results: In 40% (48/120) of the retrieved specimens, multiple sub-surface cracks of several millimeters in length were revealed by transillumination. Typically, these cracks appeared in the rim of the insert and were aligned in a radial direction. In five specimens, full thickness cracks led to fragmentation of the liner prior to revision. Thirty-eight liners (32%) had regions of moderate to severe impingement damage to the rim; cracks were initiated at the site of impingement in all but one liner ($p < 0.0001$). In 31% of liners with cracking, impingement was not observed; 90% (43/48) also demonstrated moderate to severe oxidation ($p < 0.0001$). Cracks were present in 22% of liners implanted for less than 7 years, compared to 59% of liners with more than 7 years in situ.

Discussion: Cracks commonly occur in conventional UHMWPE liners, often after neck impingement and almost always in association with oxidation of the polymer. Cross-linked polyethylene liners with reduced strength and fracture toughness should be used with caution. With these materials, increased risk of liner fracture is expected unless neck/liner impingement can be prevented.

The Relationship Between Activity and Ions in Patients with Metal-Metal Bearing Hip Prostheses

C Heisel, M Silva, AK Skipor, Joshua J Jacobs, MD, Thomas P Schmalzried, MD

- Purpose:** Metal-metal bearings are frequently implanted in young, active patients. The relationship between patient activity and Co and Cr ion levels has not been scientifically investigated.
- Methods:** Seven patient subjects with well-functioning metal-metal bearing hip prostheses and one control subject (no implants), all with normal renal function, were monitored during a two-week long activity protocol. Lower extremity activity was continuously assessed by a computerized, two-dimensional accelerometer. During the first week, subjects were requested to limit physical activity. Subjects then completed an hour-long treadmill test followed by a week where they were encouraged to be as physically active as possible. Serum Co and Cr ion levels and urine Cr levels were assessed at 10 different time points during these two weeks.
- Results:** Regardless of activity, the serum ion levels for a given patient were essentially constant and there was no correlation between patient activity and serum or urine ion levels. A mean increase in activity of 28% during the high-intensity activity week resulted in a mean decrease of 2.6% in serum Co and a mean increase of 2.0% in serum Cr. During the treadmill test, a mean activity increase of 1,621% resulted in a mean increase of 3.0% in serum Co and a mean increase of 0.8% in serum Cr. This effectively constitutes no change in serum ion levels for these changes in activity because the differences are within the variability for the measurement accuracy of these tests.
- Discussion:** In patients with normal renal function and a well-functioning metal-metal bearing, ion levels are not affected by patient activity. Periodic measurements of serum ion levels can be used to monitor the tribologic performance of prosthesis with a metal-metal bearing without adjusting for patient activity.

The FDA has not cleared the drug or device for the described purpose (Conserve Plus)

Unicompartmental Knee Replacement: A Minimum Twenty-One Year Follow-Up End Result Study

John J Callaghan, MD, Michael R O'Rourke, MD, JJ Gardner, DD Goetz, DA Vittetoe, Richard C Johnston, MD

- Purpose:** The purpose of this study is to report the results of a consecutive series of Marmor cemented unicompartmental knee replacements performed between 1975 and 1982 and followed for a minimum of 21 years.
- Methods:** 136 unicompartmental knee replacements (122 medial and 14 lateral) were inserted in 103 patients between 1975 and 1982. Patients were evaluated clinically using a Hospital for Special Surgery knee rating and Knee Society clinical and functional knee scores. In addition, patients were evaluated for the need of revision. Radiographs were evaluated for femoral and tibial loosening as well as disease progression in the opposite compartment and in the patellofemoral joint.
- Results:** At minimum 21-year follow-up 14 patients with 19 knee replacements were living, 87 patients with 115 knees were deceased, and only 2 patients with 2 knees were lost to follow-up. The average age at surgery was 70.9 years. The average preoperative and final follow-up Hospital for Special Surgery knee score was 58 and 74 points, respectively. The average Knee Society final follow-up clinical and functional score averaged 72 and 53 points, respectfully. Nineteen knees were revised during the 21-year follow up, 9 knees for progression of disease, 8 for loosening, and 2 for pain, at an average 10.6 years (range, 1 to 22 years). Of the 19 knees in living patients, 7 knees were revised, 2 knee for tibial loosening, 4 knees for disease progression, and one for pain.
- Discussion:** Unicompartmental knee replacement in this relatively older age group of patients (average age 70.9 years) performed well at minimum 21-year follow-up. Although the authors are encouraged by these results, this study does not address the results of unicompartmental knee replacement in the younger patients as only 10% of the patients were under age 65 at the age of surgery.

Osteolysis at 5 to 10 Years After Primary Total Knee Arthroplasty: Impact of the Patient, Backside Interface, and Polyethylene Sterilization Method

Matthew B. Collier, MD, Charles A. Engh Jr. MD, Joseph P. McAuley, MD, Gerard A. Engh, MD

Introduction: Osteolysis is an increasingly prevalent complication of total knee arthroplasty (TKA). We assessed the incidence of osteolysis in a design that featured running changes in the tibial baseplate proximal surface finish and polyethylene insert sterilization method.

Methods: 365 posterior cruciate-retaining Anatomic Modular Knee TKA were performed for osteoarthritis (1987-1998) and had 5+ years of follow-up. Anteroposterior and lateral radiographs made within a 5- to 10-year postoperative interval were graded for presence of osteolysis. Four generational permutations of the ultra-high molecular weight polyethylene (UHMWPE) insert and baseplate proximal surface were studied:

1. gamma-irradiated-in-air UHMWPE on grit-blasted titanium
2. gamma-irradiated-in-air UHMWPE on polished cobalt-chromium
3. gamma-irradiated-in-nitrogen UHMWPE on polished cobalt-chromium
4. gas plasma-sterilized UHMWPE on polished cobalt-chromium

Results: The incidence of definite (2-observer agreement) osteolysis was 24% (57/242) for Generation 1 and a combined 2% (2/98) for Generations 3 & 4. Male gender, varus (versus valgus) osteoarthritis, machining inserts from ram-extruded 415 resin bars (versus from compression-molded 412/415 sheets), and insert shelf aging significantly increased the risk of definite osteolysis in Generation 1 ($p < 0.05$, multivariate logistic regression).

Discussion: Closely staggered shifts to a polished baseplate proximal surface of identical geometry (1992) and away from gamma-irradiated-in-air polyethylene (1993) have dramatically reduced the incidence of osteolysis in this design.

Conclusion: An increasing number of contemporary fixed-bearing TKA systems feature a tibial baseplate with a polished proximal surface. We have witnessed a reduction in periprosthetic osteolysis when this variety of baseplate was paired with polyethylene sterilized by contemporary methods. Comparative studies are needed in fixed-bearing designs that feature both a polished baseplate and a nonmodular tibial component, and the role of polyethylene processing/sterilization factors should remain a focal point of these investigations.

Total Knee Arthroplasty in Young Patients

Gavan Duffy, MD, Amy Crowder, MD, Robert Trousdale, MD

Introduction: We report the long-term survival of a successful knee arthroplasty design in a young patient population.

Methods: 72 cemented total knee arthroplasties in 53 patients who were 55 years of age or younger were followed for 18 years (range 15-23).

Results: There were 9 revisions. Seven of the 9 revisions had severe polyethylene wear and osteolysis. Five of these had fracture of the tibial component, the remaining two had loose tibial and femoral components.

Conclusion: Cemented TKA in the young patient is reliable and durable at an average 18 years of follow-up with an estimated survivorship of 96.7% at 15 years and 92.2% at 20 years.

Mobile Bearing TKA: Do the Polyethylene Bearings Rotate?

Douglas A. Dennis, MD, Richard D. Komistek, Ph.D., B.D. Haas, M.D., M.R. Mahfouz, Ph.D., J. Outten, B.S.

- Purpose:** The objective was to assess and compare polyethylene bearing mobility patterns and magnitudes in various TKA types of mobile bearing TKA.
- Methods:** In vivo kinematics were determined for 38 subjects implanted with either a PCL-retaining (PCR) mobile bearing TKA which allows both rotation and anteroposterior (AP) translation (n=20), a posterior stabilized rotating platform (PS) TKA (n=9) or a PCL-sacrificing rotating platform TKA (n=9) using video fluoroscopy. Using a 3D model-fitting technique, kinematics were determined during a weight-bearing deep knee bend. The femoral and tibial components and mobile bearing polyethylene insert (implanted with four tantalum beads) were overlaid onto the fluoroscopic images to determine bearing mobility. AP bearing translation was determined for subjects implanted with a PCR mobile bearing TKA. Subjects implanted with PCR and PCS TKA were evaluated at a single interval. Those with a PS TKA were evaluated at two postoperative intervals, (12 months apart) to assess changes in bearing mobility over time.
- Results:** All subjects experienced polyethylene bearing rotation relative to the tibial tray and minimal rotation relative to the femoral component. The average maximum amount of bearing rotation was 10.3° (3.0° to 20.8°), 8.9° (5.3° to 14.1°), and 8.5° (3.3° to 12.9°) for subjects implanted with a PCR, PS, and PCS mobile bearing TKA, respectively. For subjects implanted with a PS mobile bearing TKA, bearing mobility increased to 9.8° (4.8° to 14.1°) one year later post-operatively. All subjects having a PCR mobile bearing TKA experienced AP bearing translation, averaging 5.6 mm (1.0 mm to 12.5 mm).
- Discussion:** These results demonstrate that the polyethylene bearing is rotating and translating relative to the tibial tray in all subjects. Minimal motion occurred between the femoral component and the polyethylene insert. Magnitude and direction of bearing motion varied among subjects. Paradoxical anterior translation of the bearing during deep flexion was observed in the PCR TKA group. The presence of bearing mobility should result in lower contact stresses reducing the potential for polyethylene wear.

The FDA has not cleared the drug or device for the described purpose (LCS AP Glide TKA)

Experience with an All-Polyethylene TKR in Younger, Active Patients with Follow-Up from Two to Eleven Years

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Jose A. Rodriguez, MD, Chitranjan S. Ranawat, MD

- Purpose:** There are few modern reports which document the results of all-polyethylene tibial components in younger, active patients. The potential benefits of this design are the elimination of backside wear and lower implant cost than modular, metal-backed components.
- Materials & Methods:** From January 1992 to the present, 54 TKRs were implanted in 38 patients less than 60 years of age at the time of index surgery using a cemented all-poly tibial component with a PS design. Indications included all patients with osteoarthritis or post-traumatic arthritis without significant tibial bone loss. All patients were followed with clinical and radiographic criteria as defined by the Knee Society. Patient Assessment Questionnaires were used to quantify patient activity levels.
- Results:** At an average follow-up of 5 years, the majority of knees are functioning well (95% with a combined KSS > 170, range 162-200). There have been two failures in the study group requiring re-operation, one for deep infection and one for post-traumatic loosening of the tibial component. Two patients (3 knees) are deceased. Three patients (five knees) had less than two-years follow-up. KSS and KSFS improved from an average of 43 to 95 and from 53 to 98, respectively. With the exception of the one post-traumatic failure, there was no radiographic evidence of component loosening, progressive radiolucent lines, osteolysis or severe mal-alignment. Walking distance was self-described as unlimited in 16 patients, 5-10 blocks in 8 patients, less than 5 blocks in 2 patients and not recorded in 6 patients.
- Discussion & Conclusion:** Since the mid 1980s, modular, metal-backed tibial trays have dominated the TKR market based on finite-element analysis studies which demonstrated superior force distribution compared to conventional all-poly components. As a result, backside wear has become an emerging problem and refocused design efforts on unitized components. Our clinical experience indicates an all-polyethylene tibial component fixed with cement can provide excellent performance and survivorship even in younger, active patients at intermediate follow-up.

The Federation of Physicians & Dentists: The Utah Experience

E. Marc Mariani, MD

Discussion: Why have nearly 90% of Utah's Orthopaedic Surgeons chosen to join a union?

In 2001, the medical climate in the state of Utah prompted many practitioners to join "The Federation of Physicians and Dentists."

This presentation will review how the Federation works, why we joined, and what has been the effect to our State Orthopaedic Society collectively and to our members individually over the past three years. It will detail the positive changes we have seen in our remuneration schedules, negotiating abilities and interactions with our colleagues through the use of the Federation.

One Surgeon's Experience in Opting Out of Medicare

J. Carl Peus, MD

After ever falling Medicare Reimbursement, this Hip and Knee Arthroplasty Surgeon decided to resign from the Medicare system at the end of 2000. Since then, I have been in the true private practice of hip and knee surgery.

I will discuss the reasons for my decision, the mechanics, or "How To" opt out of the Medicare bureaucracy. The impact on my practice, my time, my income and psyche as well as the response from my patients and referring physicians will be reviewed.

Current Strategies for Blood Conservation in Total Knee Arthroplasty

Fred D Cushner, MD, GC Lee, MD, TC Hawes, MD, W. Norman Scott, MD

Purpose: Blood transfusion rates following knee replacement continue to be significant. The purpose of this study is to evaluate current blood management strategies in patients undergoing total knee arthroplasty.

Methods: We surveyed 433 active members from the American Association of Hip and Knee Surgeons (AAHKS) about their blood management strategies (i.e. autologous donation, tourniquet use, cell savers, and pharmacologic therapy) in patients preparing for knee replacement surgery. The average time in practice of each surgeon was 18 years and their mean number of procedures performed was between 100 and 150 knee arthroplasties per year.

Results: Of those surveyed, only 21% participated in a blood conservation program. Sixty percent of surgeons routinely utilized autologous donation programs prior to surgery. The amount of banked blood prior to unilateral and bilateral TKR averaged 1.3 units (range 1-4) and 2.0 units (range 1-4) respectively. Only 53% of surgeons reported using human recombinant erythropoetin to minimize postoperative transfusions. The main reason against its widespread use was a combination of cost, time, and insurance issues. Few (11%) have tried antifibrinolytics to reduce surgical blood loss. Overall, the mean reported transfusion rate was between 5-10% following unilateral TKR and between 10-20% following bilateral TKR. Twenty-nine percent had never looked at their transfusion rates, and 11 percent had treated a patient with a transfusion transmitted infectious disease.

Conclusions: Blood conservation programs continue to be foreign to a large number of experienced arthroplasty surgeons. Increasing their awareness of novel methods of blood management may help reduce allogeneic blood requirements in patients undergoing total knee arthroplasty.

Surgical Treatment of Displaced Femoral Neck Fractures

Richard Iorio, MD, William Macaulay, MD, William L. Healy, MD, Steven M. Teeny, MD

- Purpose:** A survey was distributed to the AAHKS membership to evaluate surgical treatment preferences for displaced femoral neck fractures (DFNFX).
- Methods:** 385 of 718 (54%) AAHKS members responded to the 16 question survey which was distributed as an adjunct to the DFACTO project. This multi-center, randomized study (funded by AAHKS and OREF) is designed to prospectively evaluate the efficacy of hemiarthroplasty vs. THA for the treatment of DFNFX.
- Results:** Hemiarthroplasty (85%) was the most preferred treatment option for DFNFX (RIF, 2%, THA 13%). Pre-fracture hip pain or osteoarthritis, poor bone quality and fracture comminution were the main reasons why arthroplasty was chosen over RIF. Ambulatory status and instability risk were the main factors in choosing between uni (48%) and bipolar (52%) hemiarthroplasty. THA is used by 88% of responders. Instability risk and ambulatory status were influential factors against performing THA.
- Conclusion:** Arthroplasty is the preferred method of surgical intervention for the treatment of DFNFX for AAHKS members.

Early Results of 1,000 Consecutive, Posterior, Single-Incision MIS THA's

Todd V. Swanson, MD

Introduction: Minimally invasive surgical (MIS) techniques have become the standard of care in many areas of surgery including some orthopaedic subspecialties. The purpose of this study is to determine the early risks and benefits of MIS THA in a large cohort of patients.

Methods: Between May 1997 and April 2002, 1,085 consecutive patients undergoing posterior MIS THA using cementless components were followed prospectively. Incision length approximated the Body Mass Index (BMI) / 3 in centimeters. One thousand patients were followed a minimum 24-months to analyze peri-operative and post-operative results, complications, and radiographic findings.

Results: Mean follow-up was 37 months (24-70). Mean operative time was 53.2 minutes (23-185). Mean intra-operative blood loss was 307 ml (100-2000). Four hundred one patients received a blood transfusion (40.1%). Mean incision length was 9.6cm (7.0-15.0). Peri-operative complications included 4 deep infections (0.4%), 6 superficial infections (0.6%), 10 patients with minor superficial skin necrosis requiring debridement (1.0%), 31 dislocations (3.1%), 8 nerve palsies (0.8%), and 12 thromboembolic events (1.2%). Mean cup abduction was 40 degrees (29-58) with 30 cups (3.0%) abducted <30 or >50 degrees. Mean cup anteversion was 14 degrees (-4-40) with 10 cups (1.0%) anteverted <0 or >30 degrees. Five stems (0.5%) were placed in >5 degrees of varus or valgus. Leg length discrepancy was <7mm in 912 patients (91.2%). Mean hospital stay was 3.8 days (1-23), and mean time to resumption of normal daily activities was 4.6 weeks (1-14). Six cups failed to osseointegrate (0.6%) while no stems were loose.

Discussion: Posterior MIS THA is a safe and effective procedure with acceptable complication rates and component positioning.

Mini Posterior vs. Standard Posterior Primary Total Hip Replacement

Steven T. Woolson, MD, CS Mow, JF Syquia, JV Lannin, DJ Schurman

- Purpose:** Primary total hip replacement done through a mini posterior approach (an incision that is 10 centimeters or less) has been advocated as a minimally invasive technique that reduces soft tissue trauma. Proponents have claimed that mini incision technique reduces blood loss, transfusion requirements, postoperative pain and the length of the hospital stay compared to standard technique using a longer incision. However, there are no well-designed comparison studies that support these claims of better results. The purpose of this retrospective study was to compare the short-term results of a mini incision to standard incision technique for primary total hip replacement.
- Methods:** A consecutive series of 129 patients who underwent 135 primary total hip replacements (50 mini and 85 standard procedures) by three surgeons at one hospital were studied. Each surgeon selected patients to have mini procedures and performed a standard posterior approach in the remaining patients. In-hospital data was collected retrospectively and an analysis of the initial postoperative radiographs was done. Because of the selection process the mini incision group had both a lower average body mass index and average ASA score, indicating that they were significantly thinner and healthier ($p=0.008$ and $p=0.006$, respectively) than the standard incision group.
- Results:** There were no significant differences between the groups in surgical time, intraoperative blood loss, in-hospital transfusions, or length of hospital stay. There was a higher risk of wound and major complications following mini incision surgery. Acetabular and femoral component malposition was also more common in mini incision patients.
- Discussion:** Despite the fact that mini incision patients were thinner and healthier than standard incision patients, there was no evidence that mini incision technique was less invasive or resulted in a quicker recovery. This experience with mini incision total hip replacement technique fails to confirm optimistic promises of other uncontrolled cohort studies and suggests that further study of this technique is necessary before it can be recommended for general use.

Clinical Results in Eighty-nine Primary Total Hip Replacements Performed with the Two-Incision Minimally Invasive Approach

B. Sonny Bal, MD, Matthew Barrett, MD, Doug Haltom, M.D., Thomas Aleto, MD

Background: Minimally invasive surgical techniques to replace diseased hip joints can result in less blood loss, pain, and a shorter hospital stay compared to the traditional approaches to such surgery, with larger incisions. However, the safety, efficacy, indications, and other variables associated with minimally invasive techniques are still a matter of debate and speculation. We reviewed the acute complications in a consecutive series of 89 primary hip replacements performed with separate incisions to insert the femoral and acetabular components.

Methods: The surgical technique described by Mears and Berger using intraoperative fluoroscopy was used to implant an uncemented hemispherical socket and an uncemented femoral component in each case. Identical rehabilitation protocols were used in all cases. No particular attempt was made to discharge any patient early from the hospital. Data were reviewed at six months following the procedure

Results: Nine patients (10%) required repeat surgery; two to treat a femoral fracture that was identified postoperatively; one to treat an acute dislocation; two to perform superficial debridement for wound drainage, and four for early subsidence and loosening of the femoral implant. 22 hips (25%) suffered an injury to the lateral femoral cutaneous nerve. In each case, symptoms were resolving at the time of follow up. One patient had a neuropraxia of the femoral nerve that resolved in the postoperative period. As a comparison, in 96 primary total hip arthroplasties done with a mini-incision direct lateral approach, the overall complication rate was 6%, and the reoperation rate was 3% at the same followup .

Conclusions: The two-incision hip replacement is a technically demanding procedure. Despite the fact that the procedures were performed by a surgeon specializing in joint replacement surgery, the incidence of complications and repeat surgery was high in our consecutive series of 87 patients.

Total Hip Arthroplasty Through a Minimal Posterior Approach Using Computer Assisted Hip Navigation

Richard L Wixson, MD, MA MacDonald

- Purpose:** With decreased exposure in a minimal posterior hip incision, navigation with computer assistance (CAS) provides an alternative method to accurately place the components. This study compares the results of a series of navigated total hips to a retrospective cohort done with conventional instruments through this approach by the same surgeon.
- Methods:** The surgical incision split the gluteus maximus but did not extend distally into the fascia. The goal of cup placement was 40-45° of abduction and 17-23° of flexion. Post-operative radiographs were digitized and analyzed. In the study group, 82 hips were done with CAS and compared to 50 that had been done with conventional methods through the same incision.
- Results:** There were no hip dislocations in either group. The navigated values registered at surgery were abduction 42° s.d. 2° and flexion 21° s.d. 3°. The radiographic measurements were: CAS group (abduction 43° s.d. 5° and flexion 21° s.d. 5°) - Manual group (abduction 46° s.d. 6° and flexion 22° s.d. 6°). On the x-rays there were significantly less cases inside the desired range of Abduction and Flexion in the manual group (6 percent vs. 30 percent, $p=.001$) with significant differences in the variances of abduction and flexion ($p=.011$ and $.028$). There was a greater correlation between the navigated values from surgery and the radiographic values for abduction than flexion.
- Discussion & Conclusion:** The use of a computer assisted surgery navigation system with a minimal posterior incision for a total hip replacement results in significantly more reproducible acetabular component placement.

Comparison of Conventional versus Computer Assisted Acetabular Component Insertion

James B Stiehl, MD, RGA Haaker, A Ottersbach, F Rubenthaler, M Stockheim, K Tiedjen

- Purpose:** Optimal acetabular component orientation in total hip arthroplasty is a complex three dimensional problem with failure leading to increased wear and instability. This study compared the efficacy of computer aided surgery to place acetabular component orientation in the “safe zone” as defined by Lewinnek with 15° +/- 10° anteversion or 40° +/- 10° abduction as compared to convention techniques using extramedullary guides, anatomical landmarks, or body positioning.
- Methods:** 73 patients who had undergone THA with freehand cup insertion were compared with 98 patients using a CT based computer navigation technique. A postoperative CT scan determined cup position with a validated computer algorithm where the frontal plane of the pelvis connected the anterior superior iliac spines and the pubic tubercles.
- Results:** Following CAS, average cup position was 43° (95% CI: 0.97) abduction, 22.2° (95% CI: 1.72) anteversion. For freehand, average cup position was 45.7° (95% CI: 9.1°) abduction, and 28.5° (95% CI: 10.2°) anteversion. In the CAS group, 25.3% exceeded 25° anteversion and 6.3% had greater than 50° abduction. In the free-hand group, 63% had greater than 25° anteversion, 28% had greater than 50° abduction, and 8% had less than 30° abduction. F ratio was 5.56 for abduction and 3.67 for anteversion (p<.001)
- Discussion:** This study demonstrated substantial statistical improvement in accuracy of cup placement using CAS compared to freehand methods. The final predicted CAS position nearly matched the CT calculated position in every case.

Edward J. Nebel, MD

Public scrutiny of the practice of medicine has intensified recently; the issue of patient safety is increasingly becoming a top priority for all involved in the healthcare industry. The National Patient Safety Foundation defines patient safety as the prevention of healthcare error and the elimination or mitigation of patient injury caused by healthcare errors.

There have been landmark dates addressing patient safety. In 1996, a multi-disciplined group held a conference on “Examination of Errors in Healthcare” at the Annenberg Center for Health Science and initiated the formation of the National Patient Safety Foundation by the AMA and its business coalition.

In 1999, the Institute of Medicine report, “To Err Is Human”, told us that 98,000 Americans die each year from preventable mistakes in hospitals primarily due to system failures. This finding prompted the demand for a systematic approach in reporting errors, but the development has been stymied by the fear of legal discovery and incrimination.

In July 2004, the National Patient Safety Bill, which was modelled after the Aviation Safety Reporting System, was passed by Congress and established a confidential and voluntary reporting system. This Bill should eliminate the shame and blame mentality and give the healthcare industry the tools to improve safety in a very complex system as it did in the aviation industry.

Ultimately, physician leadership with a sincere patient advocacy attitude will be the essential ingredient in making healthcare safer.

AAOS Patient Safety: Tools for Implementation

David A. Wong, MD, MSc, FRCS(C)

Chairman, AAOS Patient Safety Committee

Co-Chair, NASS Patient Safety Task Force

This presentation will outline the history of the AAOS “Sign Your Site” (SYS) program and how it relates to the recently introduced JCAHO Universal Protocol. The Universal Protocol has three elements (patient identification, site marking and “time out”). Analysis of the wrong site surgeries identified in the JCAHO Sentinel Events Program led to the inclusion of all three elements in the Universal Protocol (not just site marking).

Approximately 12% of wrong site surgeries were found to actually be “wrong person” surgeries and 10% were “wrong procedure”. Analysis of risk for anatomic area of the body will be reviewed. Surgery involving the knee was found to have the highest incidence of wrong site surgery of all procedures. The hip was the sixth most frequent anatomic area.

Questions about implementation of the Universal protocol will be discussed, such as who should sign the site, what type of a mark is used, the timing of site marking in relation to the surgical procedure and whether the patient may have sedation pre-operatively for anxiety. A checklist covering the points required in the “time out” will be presented. The acronym for this checklist is “PREPARE”. A brief overview of the patient safety activities of the AAOS will be discussed.

Minimum Ten-Year Follow-Up of Cemented Femoral Components with Identical Surface Geometry but Different Surface Finishes

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Douglas R. Pedersen, Ph.D.; Devon D. Goetz, M.D.; Patrick M. Sullivan, M.D.,
David A. Vittetoe, M.D.; Richard C. Johnston, M.D.

The purpose of this study was to evaluate the contribution of surface finish to the durability of the cemented femoral construct by comparing the results of THRs performed by a single surgeon using a femoral component with three different surface finishes (5, 30, and 80 microinch Ra) but with identical geometry at 10-year follow-up.

The three consecutive non-selected groups of patients consisted of 304 hips in the 30 microinch Ra group, 120 hips in the 80 microinch Ra group, and 149 hips in the 5 microinch Ra group.

At minimum 10-year follow-up no hips were lost to follow-up in any of the three groups. The prevalence of revision for aseptic femoral loosening was 2% in the 30 microinch Ra group, 10.8% in the 80 microinch Ra group, and 0% in the 5 microinch Ra group. Radiographic femoral loosening, including revision, occurred in 3.6% in the 30 microinch Ra group, 13% in the 80 microinch Ra group and 0% in the 5 microinch group. The radiographic results were significantly different for all three groups. The revision rates were significantly different ($p < .05$) for the 30 microinch versus 80 microinch groups and the 5 microinch versus 80-microinch groups but not for the 30 microinch versus 5-microinch groups. Femoral osteolysis distal to the trochanters occurred in 7.6% of 30 microinch components, 10% of 80 microinch femoral components and 5.4% of 5 microinch components. These differences were not significant. Interestingly the highest femoral stem debonding rate was in the 80-microinch components (14.2%) as compared to the 30 microinch (3.6%) and 5 microinch (0%) components.

Ten-Year Follow-Up of a Hydroxyapatite-Coated Femoral Stem

Gregory Y Lee, MD, A Srivastava, Darryl D. D'Lima, MD, P Pulido, Clifford W Colwell, MD

- Purpose:** The Omnifit-HA femoral component has shown excellent results in early and mid-term industry sponsored multi-center clinical trials. To validate these results, an independent cohort of patients was followed prospectively for an average of ten years.
- Methods:** The senior author performed 103 consecutive uncemented primary total hip arthroplasties in 89 patients from July 1991 to December 1996. The components implanted were the Omnifit-HA femoral stem and the Omnifit PSL porous coated acetabular shell. The cohort, with a mean age at the time of the index procedure of 52 ± 9 years, was comprised of 45 females and 58 males. The mean follow up was 10.3 years (range 7.3 –12.7 years). Two independent observers who were not part of the surgical team performed clinical and radiographic evaluations.
- Results:** The mean preoperative Harris Hip Score was 56 ± 13 , which increased to a mean of 92 ± 9 at final follow up. The overall survivorship of the Omnifit-HA stem was 100% with revision or aseptic loosening as endpoints. The survivorship of the Omnifit PSL cup was 88% with 4 acetabular revisions for aseptic loosening and 6 polyethylene exchanges for osteolysis or late instability. The mean linear polyethylene wear rate was 0.24 ± 0.12 mm per year and volumetric wear rate was 105 ± 72 mm³ per year. Polyethylene wear did not correlate significantly with gender, age, weight or cup abduction angle. Acetabular lysis was seen in 10 hips. Femoral lysis was noted in 4 hips (all proximal, in zones 1 and 7).
- Discussion:** The Omnifit-HA femoral component continues to show excellent clinical results as indicated by the multi-center trials. This is the first study to report 10-year follow up by an independent surgeon. Despite the younger mean age, relatively high polyethylene wear, and 10% rate of lysis in the acetabulum, the femoral stem had a 100% survivorship. This supports the theory that proximal circumferential bone ingrowth affords protection against the migration of wear debris along the femoral stem.

The Effect of Total Hip Arthroplasty Cup Design on Polyethylene Wear Rate

Robert H. Hopper, Jr., PhD, John M. Iskander, MD, Anthony M. Young, MS,
William G. Hamilton, MD, C. Anderson Engh, Jr., MD

Introduction: Implant design is thought to play a fundamental role in the wear process. In the context of five different cup designs, this study sought to identify those factors that influenced polyethylene wear rates. The objective was to identify those generic and design-specific features that contributed to wear.

Methods: We identified 954 porous-coated cups (850 patients) that had minimum 5-year radiographic follow-up and at least 3 annual x-rays. The mean follow-up was 9.8 ± 3.5 years (range 5.0 to 19.1 years). This group included 49 AML TriSpike (DePuy), 223 Arthropor (Joint Medical Products), 142 ACS Triloc+ (DePuy), 53 Harris-Galante (Zimmer) and 487 Duraloc cups (DePuy). Serial head penetration measurements were made with computer-assisted techniques and used to calculate a wear rate for each hip. Using a multiple linear regression analysis, the effects of implant-specific design features and other factors were examined.

Results: When accounting for patient factors and generic implant characteristics, cup design did not play a prominent role in the wear process ($p > 0.25$). Implant factors associated with an increased wear rate included terminal sterilization with a non-crosslinking chemical surface treatment, a lateralized liner, a cobalt-chrome femoral head and a longer shelf life for gamma-irradiated-in-air Hylamer liners. Patient factors associated with increased wear rates included decreased age at surgery and male gender. Increased patient weight and a pre-operative diagnosis of developmental dysplasia were associated with decreased wear rates.

Conclusions: Although polyethylene wear is commonly characterized for specific implant designs, this study demonstrated that there are several common factors that influence polyethylene wear rates. After accounting for these factors, the wear rates among five different porous-coated hemispheric cups from three different manufacturers were not significantly different.

Primary Cementless Harris-Galante I Acetabular Component In Patients Fifty Years Old or Less

Daniel J. Berry, MD, Gavan P. Duffy, MD, Ingrid M. Negron, MD

- Purpose:** A young patient cohort of HG I acetabular components after a minimum of 15 years follow up were evaluated.
- Methods:** 73 patients (84 hips) underwent total hip arthroplasty using the Harris-Galante I cementless acetabular component younger than 50 years.
- Results:** There were 27 revisions of the acetabular component. The estimated 15-year survivorship free of revision for any reason of the acetabular metal shell was 80.9%.
- Conclusions:** HG I acetabular component provided excellent fixation in patient 50 years old. However, polyethylene wear and osteolysis remain major problems resulting in a high reoperation rate in these young patients.

The Use of Porous Components in Revision TKA: A 5-Year Follow-Up Study

S. David Stulberg, MD

- Purpose:** Segmental defects, in TKA revisions, require treatment that provides rigid, initial and long-lasting structural replacement of the defect. Solid metal augments, however, are attached to bone with cement, and the bone is often of poor quality. In addition, solid metal augments do not lead to the restoration of bone stock. Porous implants made of tantalum have been applied in a number of clinical conditions in which the restoration or preservation of bone stock is desired. The purpose of this study was to evaluate the safety and efficacy of porous augments attached to revision TKA femoral and tibial components during revision TKA surgery.
- Methods:** Between 1998-2002, 43 revision TKA procedures were performed using porous, tantalum, augments. In older patients (>60 years), cement was placed the distal femoral and proximal tibial augments. Cement was not placed on the bone or augments in patients less than 60, nor placed on the posterior femoral augments of any patients. KS clinical and x-ray scores were obtained on all patients prior to surgery and at most recent follow-up. In addition, fluoroscopic inter-face x-rays were obtained to determine the quality of attachment of the porous implants.
- Results:** Average KS pre-op score was 54 (33- 62) and average post-op score was 87 (79-100). Four knees have undergone further surgery: 2 for revision of a patellar implant and 2 for infection. No knees have been revised for loosening. At final follow-up, all implants appear to be well fixed. Interface x-rays suggest bone attachment of the uncemented posterior augments. At the time of the 2 patellar implant revision, the distal and femoral augments were observed to have been attached to bone. There have been no mechanical failures of the porous augments.
- Conclusions:** Porous augments allow biologic fixation of revision TKR components placed in the presence of segmental bone loss. This fixation may be particularly useful for younger patients requiring revision and for patients with bone stock which is inappropriate for cement fixation.

The Safety and Feasibility of Outpatient Total Knee Arthroplasty

Richard A Berger, MD, Aaron G Rosenberg, MD, Joshua J Jacobs, MD, C Della Valle, MD,
Wayne P. Paprosky, MD, S Sporer, MD

- Purpose:** As surgical techniques and patient management improve, more procedures are being performed in the outpatient setting. To assess the feasibility and safety of outpatient total knee arthroplasty (TKA), a comprehensive perioperative management protocol was developed and implemented.
- Methods:** Fifty consecutive patients were selected and enrolled in this prospective study. The average patient age was 66 years (53-79 years). Preoperatively, the patients attended a teaching class and physical therapy training. Intraoperatively, regional anesthesia combined with a minimally invasive TKA technique, which does not cut or split the Quadriceps muscle or tendon, were used. Postoperatively, patients receive physical therapy and oral analgesia.
- Results:** No intraoperative complications occurred. Forty-seven of the 50 patients (94%) chose to go home the day of surgery. Three patients stayed over night; nausea, pain, and patient desire. All patients were discharged to home. There were two cases of small skin abrasions with delayed wound healing. There were no infections. There have been no major post-discharged complications, no reoperations, and no readmissions. All patients were followed for 3 months with none lost to followup.
- Discussion:** Outpatient total knee arthroplasty can be done safely in selective patients. Currently, over 20% of all patients undergoing TKA are enrolled in this outpatient protocol; 94% of patients enrolled are discharged the day of surgery. In these selected patients, outpatient TKA is safe; readmission and complications after discharge have not been a problem. This comprehensive approach to total knee arthroplasty in the future may make it possible for total knee replacement to be done as an outpatient in specialized surgicenters.

Does Shortened Hospital Length of Stay Affect Clinical Outcomes in Primary Total Knee Arthroplasty?

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- Purpose:** Rehabilitation outcomes were compared following primary total knee arthroplasty (TKA) between patients who participated in a comprehensive hospital joint replacement program implemented to decrease length of stay with patients who did not.
- Methods:** Once inclusion criteria were met, purposive sampling method was used to select subjects for retrospective medical records review. The first 55 patients to participate in a joint replacement program were compared with the last 55 patients prior to the program implementation. All TKA's were performed by a single surgeon at the same hospital. A 2-way independent t-test was used to analyze demographics and identify confounding variables between groups. Range of motion and Knee Society scores pre-op, 3, 6, and 12 month post-operative intervals were then compared.
- Results:** Prior to surgery, there were no significant differences between groups; therefore outcome data was analyzed by t-test. Although program implementation reduced hospital length of stay by a mean of 1.3 days, which resulted in a slightly lower range of motion at discharge, no significant differences were found between the Knee Society functional or rating scores pre-operatively ($p=0.520$, $p=.357$), and post-operatively at 3 months ($p=.270$, $p=.272$), 6 months ($p=.816$, $p=.190$), and 12 months ($p=.566$, $p=.219$). Both groups showed significant improvements between all Knee Society scores pre-operatively and at all intervals measured post-operatively.
- Discussion:** The initial clinical outcomes following primary unilateral TKA as measured by Knee Society Scores and range of motion were not compromised by participation in a hospital program implemented to reduce length of stay.

Obesity and Peri-Operative Morbidity in THA and TKA Patients

Robert S. Namba, MD, D Fithian, L Paxton, ML Stone

- Purpose:** A prospective study evaluated the impact of Body Mass Index (BMI) on perioperative morbidity in THA and TKA patients.
- Methods:** 1,071 patients undergoing THAs and 1,813 TKA patients in 2001 and 2002 at 18 different hospital facilities were classified into highly obese (BMI>35) and non-obese (BMI< 35) groups. Preoperative conditions were recorded and complication rates were tracked up to 1 year post-operatively. Data was analyzed using chi-square statistics, t-tests, and multivariate logistic regression.
- Results:** The mean BMI for the obese THA group (N=126) was 39 (range, 35-55) and 27 (range, 15-34) for the non-obese THA group (N=945). The mean BMI was 41 (range, 35-61) for the obese TKA patients (N=337) and 28 (range, 16-34) for the non-obese TKA (n=1,476). The obese THA and TKA groups were significantly younger (THA mean=61,TKA mean=64) than non-obese groups (THA mean=67;TKA mean=69) (p<.001). The obese TKA group consisted of more females (75%) than the non-obese TKA group (57%) (p<.001). The obese THA and non-obese THA groups had similar gender distributions. Preoperative morbidity in the obese groups included higher rates of diabetes (THA=15% vs 8%, TKA=21% vs 12%) and hypertension (THA=53% vs 36%;TKA=54% vs 44%) (p<.001). The obese groups had higher post-operative infection rates (TKA=1.3%, THA=1.3%) than the non-obese groups (TKA=.2%, p=.01; THA=.3%, p=.12). The odds ratio was 6.7 times higher risk for infection in obese TKA patients and 4.2 time higher for obese THA patients.
- Conclusions:** Obese patients undergoing TKA and THA have higher rates of diabetes and hypertension. Obese THA and TKA patients have significantly higher postoperative infection rates. The high incidence of obesity in TKA patients indicates a clear association of obesity and knee arthritis, a relationship not seen with hip arthritis.

SYMPOSIUM III:

A REVOLUTION IN THE MANAGEMENT OF THE SURGICAL PATIENT: HOW TO BE A BETTER AND MORE COST-EFFECTIVE SURGEON

Thomas P. Vail, MD

Surgeons have a strong influence on patient choice in anesthetic type. Newly developed catheters for continuous medication delivery, specialized infusion pumps, and expertise in the field of Anaesthesiology have made regional anaesthesia more attractive to patients and surgeons. Regional anaesthesia for major lower extremity reconstruction includes the use of single shot and continuous epidural injection, single shot and continuous spinal injection, continuous lumbar plexus blockade, and continuous peripheral blockade of the femoral and sciatic nerves.

These developments have led to the application of regional anaesthetic technique in conjunction with major lower extremity reconstructive procedures such as multi-ligament knee reconstruction, tibial osteotomy, unicompartmental replacement, ankle fusion, and ankle replacement, as well as hip and knee replacement. Surgeons without experience in the use of regional anesthesia are hesitant to adopt the technique because of perceived inefficiency and prolonged room turnover, while also indicating great satisfaction with the pain relief provided by continuous peripheral nerve blockade. Recent evidence indicates a high degree of reliability, safety, effectiveness, and patient satisfaction with regional anaesthesia. In addition, continuous peripheral nerve blockade can be used effectively in an outpatient environment when a comprehensive system is developed.

Widespread adoption of regional technique will require continued demonstration of safety, the possibility of early mobilization with weight-bearing, the early return of proprioceptive function, and system efficiency.

SYMPOSIUM III:

A REVOLUTION IN THE MANAGEMENT OF THE SURGICAL PATIENT: HOW TO BE A BETTER AND MORE COST-EFFECTIVE SURGEON

Pain Management: Cox-2 Drugs, Analgesics and Anti-Emetics

Lawrence D. Dorr, MD

The new process of THR has enabled patients to be discharged home in 48 hours and has eliminated the necessity for postoperative rehab. The foundation of this program has been a change in the anesthesia and postoperative pain management.

The success of this anesthesia/pain program has been the elimination of intravenous and epidural narcotics. An epidural is used with 50% Ropivacaine and 50% Lidocaine that enables the patient to have motor function in the recovery room. Patients with oral medication only can be ambulatory within 4 hours after surgery.

Through the use of Reglan, Prevacid and Anzemet, nausea and vomiting are absent which allows the patient to be more energetic and want to go home. A multimodal pain program is used to prevent peripheral and central sensitization of the pain pathways. This program concentrates on local nociceptors in the joint; Cox-2 inhibition in the dorsal neurons, and prevention of central cerebral sensitization.

SYMPOSIUM III:

A REVOLUTION IN THE MANAGEMENT OF THE SURGICAL PATIENT: HOW TO BE A BETTER AND MORE COST-EFFECTIVE SURGEON

Accelerated Rehabilitation: Hip

William Hozack, MD

Perhaps the major benefit of MIS surgery is its emphasis on a more accelerated rehabilitation program. Such a program, designed to facilitate and speed up the recovery process after THA, is multifaceted. The patient must be properly selected to be both physical and mentally able to cooperate with the demands of rapid rehabilitation. Preoperative education and physical therapy create a positive attitude in the patient which greatly facilitates recovery. Of particular importance, the patient must not be dependent upon narcotics preoperatively.

While surgeons tend to emphasize the value of MIS surgical techniques, it is more important that the prosthesis chosen allows the patient to weight bear as tolerated immediately after the operation. Also, any restrictions on activity (such as standard hip precautions) will inhibit a rapid recovery.

The patient also requires additional support from physical therapists, nurses, family, and the pain management team. Physical therapists must be available on the day of surgery and twice daily thereafter. Nurses must be comfortable with the program, encourage the patient to mobilize quickly, and reassure the patient about the safety of the “no hip precaution” system. Family members must make themselves available to the patient, perhaps even taking time off work to help out.

Pain management in the first few days around the surgery greatly facilitates early mobilization. Accelerated rehabilitation for the patient requires an extensive support structure, not just a minimally invasive surgical procedure.

SYMPOSIUM III:

A REVOLUTION IN THE MANAGEMENT OF THE SURGICAL PATIENT: HOW TO BE A BETTER AND MORE COST-EFFECTIVE SURGEON

Accelerated Rehabilitation: Knee

Douglas A. Dennis, MD

Many factors affect the speed of rehabilitation following total knee arthroplasty (TKA). These include preoperative education, preoperative exercise program, the type and quality of anesthesia, the adequacy of perioperative analgesia, the aggressiveness of the physiotherapy program, and the motivation of both the patient and physician.

Preoperative education should include information on anesthesia options, the operative procedure, perioperative exercise program, the importance of rapid mobilization and hospital discharge to avoid medical complications, assistive devices, and a timeline of activity goals that the patient needs to accomplish. The method of anesthesia must avoid prolonged postoperative somnolence or nausea. Adequate postoperative analgesia is critical to allow the patient to mobilize with acceptable levels of pain while avoiding over sedation or motor blockade. The physiotherapy program must begin immediately with the goal of ambulating the patient the same day as the operative procedure.

Lastly, both the surgeon and all healthcare team members involved in the patient's care must continually provide motivation and appropriate encouragement to facilitate a rapid return to normal health.

Long-Term Outcome of 755 Consecutive Constrained Acetabular Components in Total Hip Arthroplasty: Examining the Successes and Failures

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Joanne B. Adams, BFA, Jackie H. Russell, RN, Kari L. Groseth, BS

- Purpose:** Constrained components can treat or prevent instability following total hip arthroplasty (THA). We examine the long-term results of constrained acetabular components, reviewing 755 consecutive constrained THA in 720 patients from 1986 to 1993.
- Methods:** Procedures were 62 primary, 59 conversion, 565 revision, 60 reimplantation and 9 total femur. Eighty-three patients (88 THA) were lost prior to 10-year follow-up, leaving 639 patients (667 THA) available for study including 356 deceased patients (374 THA).
- Results:** Re-operations were performed in 281 THA (57.9% survivorship). Dislocation occurred in 117 hips (17.5%), in 37 of 128 (28.9%) constrained for recurrent dislocation, and 46 of 163 (28.2%) with history of dislocation. Fifty-one acetabular, 28 stem, and 16 combined revisions were performed for aseptic loosening. Other reoperations were for infection (40), periprosthetic fracture (19), stem breakage (2), cup malposition (1), dissociated insert (1), dissociated femoral head (1), and impingement of 1 broken and 4 dissociated constraining rings.
- Discussion:** Constrained acetabular components should be used cautiously as there is a high long-term failure rate of 42.1% in this series. Dislocation was common despite constraint with previous history as a significant risk. The construct was successful in preventing recurrent dislocation in 71.1%.

High Failure Rate of a Constrained Acetabular Liner in Revision Total Hip Arthroplasty

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Richard A. Berger, MD, Aaron G. Rosenberg, MD, Wayne G. Paprosky, MD

Introduction: Constrained acetabular liners have been advocated as one solution to both treat and prevent instability at the time of revision total hip arthroplasty (THA). The goal of this study was to determine the performance of a constrained acetabular liner in revision THA.

Methods: Fifty-nine consecutive revision THAs in 56 patients where a constrained acetabular liner was used (DePuy, Warsaw, IN) were reviewed. Forty-six constrained liners were placed for recurrent instability (mean 4 dislocations, range 1 to 18) and 13 were placed for inadequate stability at the time of revision total hip arthroplasty. The mean age of the cohort was 63 years and 37 of the hips were in female patients (62.7 percent). Thirty-eight of the 59 hips had a constrained liner placed without revision of the components. At the most recent evaluation, 4 patients had died (4 hips) and 4 patients were lost to follow-up (4 hips) leaving 51 hips in 48 patients who were evaluated both clinically and radiographically at a minimum of 2 years.

Results: Nine of the 51 hips (17.6 percent) sustained a dislocation after placement of the constrained liner at a mean of 19 months postoperatively (range 2 weeks to 59 months). Eight of these 9 dislocations occurred in patients who had undergone revision to a constrained liner for recurrent instability without revision of the femoral or acetabular component.

Discussion: The constrained liner studied in this report performed poorly with a failure rate of 17.6 percent and thus we no longer use this device.

Does Femoral Bone Loss Predispose to Failure in Revision THR with a Tapered Titanium Modular Stem

Jose A. Rodriguez, MD, R Fada, S Murphy, Vijay J. Rasquinha, MD,
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Femoral bone deficiency has been shown to adversely affect the results of revision THR with extensively coated stems. Tapered titanium modular stems allow distal fixation of the fluted, conical portion of the stem in the remaining bone, and may be a more versatile approach to fixation in the setting of bone loss.

102 consecutive hips with proximal bone loss underwent revision femoral reconstruction between 1998 and 2002 at 3 centers using the Link-MP modular stem. 43 hips had Mallory Type 3c femoral deficiency, and 42 hips were exposed using a transfemoral osteotomy. 5 patients died before the 2-year minimum follow-up. 97 hips were followed for an average 39 months (range 24-63). Fixation was achieved distally, and the proximal segment was chosen to optimize center of rotation. Clinical and radiographic results were assessed with regard to Mallory classification of bone deficiency.

Clinically, mean Harris Hip Score improved from 36 to 84 (range 54-99). Radiographically, 94 hips were considered stable, with no circumferential lucencies at the distal fixation surface. Lucencies around the proximal segment were common. 2 hips with type 3c deficiency migrated and failed. They were each successfully revised to a larger implant. 5 other hips had migration of 1-2 mm. One stem in a 320 lb man fractured, and was revised to a larger implant. 10 hips dislocated, with 6 being revised by altering the modular proximal segment. There were 3 periprosthetic fractures successfully treated with ORIF.

Distal fixation is well maintained with this distally fluted tapered titanium stem in the face of severe bone loss. Even in Type 3c deficiency, only 2 of 43 hips (5%) failed, and were successfully revised to a larger implant.

Fatigue Fracture of a Modular Revision Femoral Component: A Report of Forty Cases

Jeffery L. Pierson, MD, RD Crowninshield, DR Earles

Background: Diaphyseal fixation with either extensive porous coating or a corundumized titanium ongrowth surface provides excellent results in revision total hip arthroplasty (THA). Modular prostheses offer some advantages over monoblock prostheses, particularly in the ability to independently fit the proximal and distal prostheses to the bone. The purpose of this paper is to report on a series of fatigue fractures associated with a mid-stem modular femoral component.

Methods: All cases in which a fracture of a mid-stem modular femoral component (Zimmer Modular Revision, ZMR) were reported to the manufacturer were evaluated. When available, patient height, weight, time from implantation to failure, stem diameter, offset, radiographs and specimen analysis were evaluated.

Results: Forty fractured stems were identified. During this time period, approximately 13,600 modular stems of this type were implanted, resulting in a known fracture prevalence of 0.29 per cent. The average time from implantation to fracture was twenty-one months (range, five to thirty-seven months). All cases except one fractured through the distal aspect of the stem-taper junction. Fractured stems were generally associated with a large stem diameter (> 18 millimeters), corundumized tapered distal stem, extended neck offset, and an apparent lack of bone support (on radiographs) of the proximal stem.

Conclusions: Fatigue fractures have been previously reported with both monoblock and modular femoral components. Although uncommon, these have been associated with distally fixed stems and deficient proximal bone. The current study illustrates the importance of obtaining proximal femoral support with the use of modular revision femoral prostheses.

Hospital Resource Utilization in Primary and Revision Total Hip Arthroplasty

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Daniel J. Berry, MD, Harry E. Rubash, MD

- Purpose:** Despite previous studies that have reported higher hospital resource utilization for revision than for primary THA, current Medicare hospital reimbursement does not distinguish between the two procedures. As a result, hospitals that perform high volumes of revision THAs have sustained substantial financial losses related to these procedures. This study was undertaken to compare actual hospital resource utilization between primary and revision THA and to identify clinical and demographic factors that are predictive of higher resource utilization.
- Methods:** Clinical, demographic, and economic data were evaluated for 491 consecutive unilateral primary or revision THA at a single institution between January, 2000 and December, 2002. The distributions of various demographic, clinical, and utilization characteristics were compared and multi-variable linear regression techniques were used to determine independent patient characteristics that were predictive of higher costs for both primary and revision THA procedures.
- Results:** Mean total hospital costs were 29% higher, mean operative time was 41% longer, EBL was 160% higher, complication rates were 42% higher, and average length of stay was 16% longer for revision than for primary THA. When controlling for all other independent variables, more severe co-morbid medical disease was predictive of higher resource use for both primary and revision THA. Additionally, pre-operative femoral and acetabular bone loss and a diagnosis of peri-prosthetic fracture were predictive of higher resource utilization associated with revision THA.
- Discussion:** Hospital resource utilization is significantly higher for revision than for primary THA procedures. However, this information is not reflected in current Medicare hospital reimbursement, which is the same for all lower extremity arthroplasty procedures. If these trends continue, access to care for patients with failed total hip replacements could be jeopardized.

Association of Acetabular Labral Tears with Structural Abnormalities of the Hip

KR Kendall, DE Wenger, **Robert T. Trousdale, MD**, MR Miner

- Purpose:** Acetabular labral tears have become increasingly recognized as a cause of hip pain. These tears have been reported to occur after trauma and in association with various structural hip abnormalities. We are not aware of any data that documents the prevalence of labral tears in the absence of osseous abnormalities. The purpose of this study is to evaluate the percentage of patients with acetabular labral tears that have a structural hip abnormality detectable by hip radiographs.
- Methods:** CT and MR arthrograms were reviewed from 1996 through 2002 to identify patients with labral tears. Hip radiographs of these patients were then reviewed. Abnormal findings were defined as: 1) Tönnis (horizontal toit externe) angle $\geq 15^\circ$, 2) center-edge angle of Wiberg $< 15^\circ$, 3) retroversion of the acetabulum, 4) femoral neck-shaft angle of $< 120^\circ$ or $> 140^\circ$, 5) incongruency between the femoral head and acetabulum, 6) head-neck offset of less than 7.2 mm on a cross-table lateral view of the hip (lateral views of the hip were available on 27 of the 31 patients).
- Results:** 27 of 31 patients (87%) had at least 1 abnormal finding and 35% had more than 1 abnormality. 10 had a retroverted acetabulum (version could not be determined on 3 patients), 16 had coxa valga, 2 had an abnormal Tönnis angle, and 2 had incongruent hips (1 of these patients had a history of Legg-Calve-Perthes disease). 11 of 27 patients had an abnormal femoral head-neck offset. None of the patients had an abnormal Wiberg (center-edge) angle or coxa vara. 4 of 31 patients (13%) had no abnormal findings. Additionally, 14 patients had osteophytes about the hip joint. 13 of these had a structural abnormality of the hip while 1 did not.
- Conclusions:** This is the first study we are aware of to document that the majority of patients with labral tears have a structural hip abnormality detectable with radiographs. These abnormalities are often relatively subtle and therefore, may go unrecognized. Familiarity with these structural abnormalities is critical for early detection, accurate diagnosis, and may significantly impact optimal treatment planning and prognosis.

Failure of Hemi-Resurfacing for AVN in Young Patients

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- Purpose:** The appropriate treatment for the young patient with post-collapse avascular necrosis of the femoral head continues to be controversial. Hemi-resurfacing arthroplasty has emerged as a potential strategy to delay arthroplasty in these patients. The following study was performed to evaluate the clinical outcomes of patients undergoing hemi-resurfacing for avascular necrosis of the femoral head.
- Methods:** All patients who underwent hemi-resurfacing of the femoral head for post-collapse AVN were identified from a joint registry. Survivorship of the hemi-resurfacing arthroplasties using conversion to THA as an end point was calculated. Functional status of the remaining patients was also evaluated using the modified Harris Hip Score. Patient satisfaction was determined for all patients who underwent this procedure.
- Results:** 36 patients underwent hemi-resurfacing for post-collapse AVN. The average age of this group of patients was 36 (18-51). At an average follow-up of 30 months, (range 4-87 months) 12 patients (33%) had been converted to THA. The average time from hemi-resurfacing to THA was 25 months (range 6-87 months). Using conversion to THA as the end point, the Kaplan-Meier Analysis predicted only a 54% survival at 5 years. The average Harris Hip Pain Score for the surviving patients was 28 (range 0-44).
- Discussion:** Hemi-resurfacing for AVN is an unpredictable procedure. In contrast to previous reports in the literature, hemi-resurfacing in this series had a high prevalence of revision and a low level of patient satisfaction at early follow-up. This procedure is no longer offered as a treatment option for post-collapse AVN at our institution.

Surface Arthroplasty for Osteonecrosis of the Hip

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Frederic Dorey, PhD

Introduction: To determine if differences in outcome exist between HSR and MMSA at 5 years of follow-up in a group of patients with Ficat Stage III and IV osteonecrosis.

Methods: 84 hips with osteonecrosis were treated with a resurfacing implant: 56 with a metal-metal SA, mean age 40.4 and 28, mean age 37.2 with a hemiresurfacing. Male/female ratio was 73%/27% for HSR and 87%/13% for MMSA.

Results: Average follow-up was 4.9 years. UCLA hip scores were significantly better for MMSA versus HSA for function and activity, as well as Harris Hip scores and physical component of the SF-12 scores. In the MMSA group, 2 hips were revised to THR for femoral loosening, and 5 hips had adverse radiological changes. In the HSA group, four hips were revised (1 sepsis and 3 for pain).

Discussion: Although the functional clinical outcome of MMSA is superior to HSR, patients are at greater risk of femoral loosening. Use of a larger femoral component in MMSA may decrease the risk of femoral loosening.

Conclusion: Treatment of osteonecrosis of the hip in the young adult still remains a challenge. The continued use of conservative prosthetic solutions should help minimize the morbidity of revision hip surgery.

The FDA has not cleared the drug or device for the described purpose (Conserve Plus)

Celecoxib Does Not Affect Osteointegration of Cementless Total Hip Stems

David L. Lionberger, MD, Phillip C. Noble, PhD

Purpose: Cyclooxygenase (COX)-2 specific inhibitors are increasingly being used for the treatment of pain following surgery. However, it is not clear whether they provide a safer alternative to nonspecific nonsteroidal anti-inflammatory drugs when the surgery involves bone incorporation. To date, there have been no prospective human studies investigating the effects of COX-2 specific inhibitors on bone ingrowth on a long-term basis. The aim of this study was to investigate whether celecoxib affected prosthetic osteointegration in patients undergoing cementless total hip replacement.

Methods: This was a prospective, placebo-controlled, double-blind study. Of the 49 patients in the study, 24 were randomized to celecoxib (200 mg/day) and 25 to placebo. Treatment duration was 6 weeks. Periprosthetic bone mineral density (PBMD) determinations and X-rays were obtained at the index operation, 3 months, and 6 months. Bone markers, N-telopeptide (NTx) and bone specific alkaline phosphatase (BALP), were obtained postoperatively, and at 6 weeks and 12 weeks.

Results: No radiographic prosthetic subsidence occurred. There were no significant differences from baseline in PBMD between the celecoxib and placebo groups at 3 months (1.78 g/cm³ vs 1.83 g/cm³, respectively; P = 0.52) and 6 months (1.81 g/cm³ vs 1.87 g/cm³, respectively; P = 0.56). Furthermore, there were no significant differences in PBMD in any Gruen zone between the celecoxib and placebo groups. There were no significant differences in baseline BALP values between the 2 groups (celecoxib 15.5 mg/L vs placebo 14.9 mg/L; P = 0.88). At 6 weeks and 12 weeks, average BALP values increased to 19.3mg/L and 18.6 mg/L, respectively. Urinary NTx concentrations followed a skewed distribution. Normalized NTx concentrations were statistically significantly greater in the celecoxib group than the placebo group at 6 weeks (65%; P = 0.004) but not at 12 weeks (18%; P = 0.23).

Discussion: Celecoxib, given in an appropriate therapeutic dose and duration, does not appear to have any deleterious effects on osteointegration when assessed by bone markers, PBMD, or traditional radiographs.

A Prospective Clinical and Electromyographic Comparison of Vastus Splitting and Median Parapatellar Approaches to Total Knee Arthroplasty

Matthew Kelly, MD, M.A. Parentis, William M. Parrish, MD, Vincent D. Pellegrini, Jr., MD

A prospective randomized clinical trial was conducted comparing the vastus splitting and median parapatellar approaches for primary total knee arthroplasty (TKA). Informed consent and IRB approval were obtained; 42 consecutive patients (51 knees) were enrolled. Functional evaluation, operative data, and preoperative and postoperative electromyography (EMG) were assessed.

Early postoperative results at 5.8 months showed no differences in range of motion, strength, knee scores, tourniquet time, proprioception, kinesthesia, or frequency of patellar resurfacing. There were significantly more lateral releases and greater blood loss in the median parapatellar group. Nine of twenty-one (43%) knees in the vastus splitting group had abnormal post-operative EMG of the vastus medialis; all 25 in the median parapatellar group were normal.

Long-term follow-up in 31 of 42 patients (39/51 knees) at mean 5.27 years (range 4.32-5.97 years) reaffirmed comparable functional evaluation and knee scores in the two groups. Electromyograms were repeated in those nine patients with prior abnormal studies; seven had returned to normal and each had the muscle split developed by blunt digital dissection. One patient had chronic changes indicative of reinnervation and one demonstrated evidence of ongoing denervation. No significant functional differences existed in these nine patients.

The vastus splitting approach for primary TKA offers a reasonable alternative to the median parapatellar approach and significantly reduces the need for lateral release. Early EMG abnormalities represent reversible neurapraxic injury that can be avoided by blunt muscle dissection. Knowledge of the functional innervation of the extensor mechanism will be important in less invasive approaches to knee arthroplasty.

Mini-Incision TKR Can Increase Risk of Component Malalignment

David F. Dalury, MD

- Purpose:** There has been a recent surge in interest in TKR through smaller incisions. This report compares a matched group of TKR done by a single surgeon through a small incision (8-10 cm) and a group done via the traditional incision length.
- Methods:** 30 patients undergoing TKR via a small incision (8-10 cm) Group A were matched to a group of 30 patients with a traditional incision (Group B) for weight, deformity, age and pre-op range of motion. The two groups were compared for surgical and peri-operative complications, alignment issues, range of motion and Knee Society scores.
- Results:** There were no significant differences between the two groups in terms of complication rates, Knee Society scores and range of motion at 3-month follow-up. Tourniquet times were increased and there were increased incidences of minor wound healing problems in Group A. Group A patients used less total pain medications and slight increased range of motion at their 6 week follow up. Radiographically Group A had 4 patients whose tibia was placed in varus (less than 87 degrees of alignment). In Group B there were none.
- Conclusion:** While it appears that TKR can be performed via a small incision without excess complications, it appears that the smaller incisions, which can compromise the surgeon's vision, can influence component alignment. The higher incidence of tibia varus seen in Group A gives cause for concern.

Computer Assisted Navigation in Total Knee Replacement – Improved Coronal Alignment

S. Kim, Richard Wixson, MD

Introduction: The use of a computer navigation system is intended to optimize implant positioning and alignment over either intramedullary or extramedullary instruments. The goal of this study was to compare a series of prospectively followed total knees done with an imageless computer assisted navigation system to a retrospective cohort of knees done with manual instruments.

Methods: There were 147 patients with a primary TKA done by a single surgeon with 78 patients in the manual group and 69 patients in the navigated group. The mean age was 68 years old (56-86), 34.5% males and 64.2% females, with 95% of the osteoarthritis. There were no differences between the two groups on the basis of age, gender, diagnosis or pre-op deformity. Coronal alignment of the TKA was determined by postoperative evaluation of full-length standing radiographs.

Results: The two groups had similar mean values for radiographic mechanical axis with the computer navigated group 0.4° (+/- 1.50) versus 0.4° (+/- 2.3) for the conventional group ($p = .06$). However there was a larger variation in alignment in the manual group. 58% of the manual group was within two degrees of neutral alignment compared to 78% of the navigated group ($p = .008$).

Discussion: Compared to conventional manual total knee alignment instruments, the navigation system reproducibly resulted in more reliable reproduction of the mechanical axis.

Total Knee Arthroplasty Using an Imageless Computer Navigated Technique Versus Standard Instrumentation: A Single Surgeon's Experience

Michael P Bolognesi, MD, TD Goldberg, A Lahav, Aaron A Hofmann, MD

- Purpose:** Alignment errors in total knee arthroplasty (TKA) greater than three degrees can be associated with poorer outcomes and accelerated failure.
- Methods:** This retrospective study compares alignment between fifty TKAs performed using an imageless computer navigation system and fifty TKAs using standard instrumentation. The same surgeon used a posterior referencing TKA system (Natural Knee™) in all cases. Long-standing radiographs were collected at 6 weeks follow-up and measured for component orientation.
- Results:** When the navigation system was used 98% (49/50) of all femoral components and 100% (50/50) of all tibial components were placed within +/- 3° of the radiographic goal position. There was a decrease in the standard instrumentation group to 90% (45/50) and 92% (46/50) within ± 3°, respectively. There was a significant difference in the standard deviations observed for the navigated cases and the conventional cases when femoral ($p=0.016$) and tibial ($p=0.013$) component position was considered. Average tourniquet time was 68 minutes in the navigated group and 57 minutes in the conventional group.
- Discussion & Conclusion:** This system affords the surgeon the potential to reduce outliers with regard to component position without adding significant operative time. In addition, violation of the intramedullary canal is avoided using this instrumentation. Navigation may lead to improved component survivorship in the long term and a reduction in complications associated with embolic phenomena occurring with intramedullary instruments.

Computer-Assisted Navigation in Total Knee Arthroplasty: Comparison with Conventional Methods

Kevin C Anderson, MD, KC Buehler, DC Markel

The alignment of the lower extremity following total knee arthroplasty has been determined to affect the structural and functional outcome. The purpose of the present study was to investigate the alignment of the limb and implant positioning following total knee arthroplasty with the use of a computer-assisted navigation system compared with conventional methods.

A retrospective review of 61 patients receiving a Scorpio condylar total knee replacement (Stryker Osteonics) using conventional intramedullary guides was compared to 130 patients receiving the same design implant with the use of an image-free computer-assisted navigation system (Stryker Navigation System). Radiographic analysis was conducted on pre- and postoperative full-length alignment radiographs. Measurements included overall alignment of the lower extremity as well as implant component positioning.

Postoperative mechanical alignment was not significantly different between the two groups (178.06 degrees in the control group versus 180.03 degrees in the navigation group). Tourniquet time was significantly increased in the navigation group (75.8 versus 89.8 minutes; 95% confidence interval). The alignment of the various total knee components was significantly different. Tibial slope measured 3.04 degrees in the navigation group and 3.96 degrees in the control group (95% confidence interval). Femoral component coronal alignment was 0.54 degrees of varus in the navigation group versus 0.84 degrees of valgus in the control group (95% confidence interval). Femoral component sagittal alignment was 0.80 degrees of flexion in the navigation group versus 0.41 degrees of extension in the control group (95% confidence interval).

While the overall mechanical alignment of the lower extremity was not significantly different with the use of navigation, the positioning of the tibial and femoral components of the condylar total knee was altered with the use of the navigation system. These subtle differences may have an impact on the longevity of the implants.

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Cemented Rotating Platform Total Knee Replacement: A Minimum Fifteen-Year Follow-Up Study

John J. Callaghan, MD; Michael R. O'Rourke, MD; **Michael F. Iossi, BS**;
Devon D. Goetz, MD; David A. Vittetoe, MD; Richard C. Johnston, MD

Between November 1985 and November 1988 the senior author performed 119 consecutive total knee arthroplasties in 86 patients with an LCS rotating platform tibial and femoral component and a Townley all polyethylene dome patella component. All components were fixed with cement.

At minimum 15-year follow-up 38 patients with 54 knees were living and no patients were lost to follow-up. No knees were revised for loosening or wear (one for infection, one for periprosthetic fracture with retention of the components) during the entire follow-up study. The average HSS knee score for the living patients was 77 points at final follow-up. The average Knee Society clinical and functional scores were 85 points and 57 points respectively at final follow-up. Osteolysis was only noted around 1 tibial component and 1 femoral component. The average scaled WOMAC score was 21 points at final follow-up.

This minimum 15-year follow-up supports the durability of cemented rotating platform mobile bearing knee replacements. No patient had prosthetic loosening and only 2 patients had small areas of periprosthetic osteolysis.

The Natural History of Periacetabular Osteolysis: Observations Made in Autopsy Retrieved Hemipelves with Computed Tomography

Nobuto Kitamura, MD, Douglas D.R. Naudie, MD, FRCSC, Serena B. Leung, MS
Robert H. Hopper Jr., PhD, Charles A. Engh, Sr., MD

- Background:** To better understand the natural history of peri-acetabular bone loss, this study assessed the incidence and three-dimensional volume of osteolytic-like lesions among a series of autopsy-retrieved hemipelves.
- Methods:** Forty-four hemipelves that had undergone primary total hip arthroplasty (THA) with uncemented titanium porous-coated modular acetabular components were imaged with computed tomography (CT). The CT images were analyzed to determine the volume and location of peri-acetabular bone loss. The mean age of the patients at the time of surgery was 69.9 ± 9.4 years. The mean time in situ for the implants was 8.1 ± 3.9 years.
- Results:** A total of 46 osteolytic-like lesions were identified in 28 of the 44 hips (64%). Lesions were observed in 15 of 18 hips with cups featuring a single central hole without screw holes, 3 of 7 hips with cups that had a central hole with cavitory screw holes, and 10 of 19 hips with cups incorporating a central hole and rim screw holes. The mean volume of lesions was 4.4 ± 13.4 cm³. A lesion most commonly occurred in the superior zone behind the cup and least frequently in the posterior zone. Two-thirds of the lesions had one or more apparent communications to the joint space.
- Conclusions:** Peri-acetabular bone loss was commonly observed at early time intervals around modular uncemented acetabular components. While it is possible that some of these lesions represented bone defects that existed prior to THA because we did not have the capability to compare CT scans before or immediately after surgery, the incidence and size of the lesions was not greater with longer times in situ and was not limited to one particular shell design.

Minimum 5- Year Results with the Sigma TKR System

David A. Dalury, MD

- Purpose:** This paper reports on a single surgeon's results with a single TKR implant system at a minimum 5 -year follow-ups.
- Methods:** 212 consecutive patients (285 knees) undergoing TKR from 6/96 to 12/97 were prospectively studied. Pre-operative diagnosis was osteoarthritis in 95% of patients. All patients had a cemented tricompartmental Sigma TKR (Depuy) done via a standard procedure and followed for a minimum 5 years, average of 6.6 yrs. (range 5-7 yrs.). 95% of the patients had a cruciate retaining implant and 5% had a cruciate substituting implant.
- Results:** One patient was lost to follow-up 9 patients died leaving 202 patients with minimum 5-year follow-up. There was one revision in the group, which was not implant related. No implants were radiographically loose or at risk for loosening. Radiolucencies were identified in 7% of medial tibias on the AP film. None of these were greater than 2 mm in size and none were progressive. On the femoral side, radiolucencies were seen in 17% of the posterior femora seen on the lateral x-ray. These radiolucencies were all less than 1-2mm and were non-progressive. KSS scores improved from an average of 48 points pre-op to an average of 94 points at last follow-up.
- Discussion:** This study demonstrates that the Sigma Knee system at intermediate follow up has excellent durability in this group of patients.

The Capsular Noose: A New Technique to Reduce Dislocation after Posterior, Single-Incision MIS THA

Todd V. Swanson, MD, JC Ballard, MD

- Introduction:** A new method of capsular repair advances the posterior capsular flap around the prosthetic neck creating a noose constraint around the head.
- Methods:** 280 consecutive posterior MIS THA's underwent capsular noose reconstruction. 450 consecutive MIS THA's underwent standard posterior repair. 20 patients were studied intra-operatively to determine the amount of torque and degree of internal rotation to dislocation a) without capsular repair, b) with standard repair, and c) with noose repair.
- Results:** After minimum 12 months follow-up, 1 patient dislocated in the capsular noose group (0.4%) while 20 patients dislocated in the standard repair group (4.4%, $p < 0.01$). Dislocation occurred at mean 49.8 degrees with no repair, 53.6 degrees with standard repair, and 66.4 degrees with noose repair ($p < 0.05$). Mean torques to dislocation were 0.68 N-m for no repair, 0.82 N-m for the standard repair, and 1.05 N-m for the noose repair ($p < 0.05$).
- Discussion:** Capsular noose advancement enhances resistance to dislocation after posterior approach THA.

A Five-Year Comparison of the Measurement of Femoral Head Penetration in THR Using RSA and the Martell Method

Charles R. Bragdon, PhD, J.M. Martell, MD, M.E. Greene, BS, D.M. Estok II MD,
J. Thanner MD, H.Malchau MD, J. Kärrholm MD, W.H. Harris MD, DSc

- Purpose:** We tested the hypothesis that the RSA analysis and the Martell analysis would yield comparable wear data from the same group of THR patients.
- Methods:** Forty-five total hip replacement patients had both RSA and standard A/P pelvis and cross-table lateral radiographic films taken at post-operative time periods of 6 wks, 1yr, 2yr and 5yr.
- Results:** There was good agreement among the three readers using the Hip Analysis Suite™ software. Multivariate ANOVA analysis indicated that the measured total penetration increased with time with both methods ($p=0.001$), was higher with the Martell method ($p=0.001$), and was greater with three-dimensional analysis for both methods ($p=0.001$). After the bedding in period, the steady-state two-dimensional penetration rate (wear rate) measured by the RSA ($0.07\pm 0.08\text{mm/yr}$) was significantly lower than that measured by the Martell Method ($0.12\pm 0.12\text{mm/yr}$), ($p=0.03$). However, there was no significant difference in the three-dimensional wear rate during this time interval between the RSA and Martell methods, ($0.12\pm 0.08\text{mm/yr}$ and $0.17\pm 0.09\text{mm/yr}$ respectively), ($p=0.10$).
- Discussion:** This is the first comparative assessment of the relative values of femoral head penetration into conventional polyethylene in THR patients using these two methods on a single cohort of patients.

Single Incision Posterolateral “Minimally Invasive” Total Hip Arthroplasty does not Reduce Blood Loss Compared to Standard Technique

Jeffrey L. Pierson, MD, DR Earles

- Purpose:** “Minimally invasive” (MI) total hip arthroplasty (THA) is intended to reduce soft-tissue trauma, blood loss, rehabilitation time, morbidity and transfusions. The purpose of this study was to compare blood loss and transfusion requirements of a single incision MI THA with standard techniques.
- Methods:** A retrospective comparison of 78 patients in whom a MI THA (incision less than 10 centimeters) was used with 255 patients in whom a standard incision (greater than 10 centimeters) was used.
- Results:** The MI patients had a significantly greater decline in hemoglobin levels ($4.38 + 1.29\text{ g/dl}$) compared to the standard incision group ($3.98 + 1.15\text{ g/dl}$) ($p = 0.01$). There were no significant differences in allogeneic transfusions or complications.
- Discussion:** Single incision posterolateral MIS THA does not result in decreased blood loss, allogeneic transfusions, or complications compared with standard techniques. This suggests that blood loss is determined by bony bleeding more than incision length.

The Reliability of Anatomic Landmarks for Determining Femoral Implant Rotation in TKA Surgery: Implications for CAOS TKA

John Currie, BS, A Varshney, VA Brander, SDavid Stulberg, MD, AD Adams, O Woods, SJ Austin

Purpose: CAS TKA systems are being introduced to increase the accuracy and reliability when performing TKAs with the goal of placing the femoral components parallel to the epicondylar axis. This study was designed to determine the reliability of various anatomic landmarks for aligning the femoral TKA component parallel with the epicondylar axis.

Methods: Pre- and post-surgical CT scans were obtained from 40 patients. The posterior condylar axis, epicondylar axis, and Whitesides' line were measured on all pre-surgical scans. Twenty TKA's were performed using the posterior-condylar axis to establish femoral rotation and twenty TKA's were performed using Whitesides' line.

Results: The mean relationship of the posterior condylar line to the epicondylar line on the pre-surgical CT scans was 4.69° internal rotation. Similarly the mean relationship of Whitesides line to the epicondylar line was 0.07°.

The variation between the posterior condylar axis measured on pre-operative CT scans and measured intra-operatively using surface registration techniques was 2 degrees. Similarly, on the epicondylar axis the variation was 3 degrees.

The mean relationship of the femoral component to the epicondylar line in the twenty TKA's performed using the posterior condylar axis to establish femoral rotation was 1.5 degrees internal rotation. Similarly the mean in the twenty TKA's performed using the patellar groove, the mean relationship was 0.5 degrees internal rotation.

Discussion: There was not a reliable relationship between the posterior condylar line and the epicondylar axis. Whiteside's line approximated the epicondylar axis. The intra-operative determination of the posterior-condylar axis and the epicondylar axis using surface registration techniques was unreliable. Femoral components were placed more reliably relative to the epicondylar axis using the Whitesides' lines

Two-Stage Reimplantation for Periprosthetic Hip Infections Involving Resistant Organisms

C Marculesca, Arlen D. Hanssen, MD, Thomas K. Fehring, MD, **Yogesh Mittal, MD**, D Osmon, J Steckelberg, E Berbari

- Purpose:** Two-stage reimplantation is the most accepted mode of treatment for most patients with periprosthetic hip infections. While reported success rates have not been stratified based on the type of infecting organism, delayed reimplantation, when dealing with MRSA and MRSE, has been discouraged in the literature. The purpose of this study was to review the outcomes of those patients with chronic periprosthetic hip infections treated with two-stage reimplantation.
- Methods:** A multi-center retrospective study was performed to review all total joint arthroplasties infected by MRSA or MRSE between 1987 and 2003. The prevalence of re-infection following two-stage reimplantation was determined. In addition multiple variables were reviewed including pre-revision serology, post-revision histology and bacteriology, use of antibiotic-impregnated PMNA spacers and interim antibiotic therapy.
- Results:** Forty-three out of 244 infected hip joints found to have MRSA or MRSE infections were treated with two-stage reimplantation. Seven patients (16%) became re-infected, 6 by the same organism and 1 by a different organisms. The average follow-up for those patients undergoing reimplantation was 33 months (range 1-83 months). Final histology following reimplantation was positive for acute inflammation in three patients (7%), two of which also had positive cultures. Those patients with positive final histology or cultures were chronically suppressed with oral antibiotics. None of these patients went on to re-infection.
- Discussion:** Previous reports in the literature have discouraged reimplantation in total hip arthroplasties that have been infected by highly resistant organisms. This study demonstrates a success rate of almost 84% in patients treated with standard two-stage techniques. Although slightly less successful than previous studies, two-stage reimplantation remains a viable treatment option for periprosthetic hip infections with resistant organisms.

Gender Differences in Arthroplasty Surgery

Carlos Lavernia, MD, R Diaz, M Dapuzzo

We have previously reported gender differences in the preoperative status of patients undergoing hip and knee arthroplasty. Our objective was to compare 2-year post-surgical outcomes in men and women.

A total of 331 patients undergoing total hip and knee replacement surgery were studied. Each patient was assessed preoperatively and at two years utilizing WOMAC, QWB, and SF36. Analysis of Covariance was used controlling for age; $p < .05$ was considered significant.

Males consistently scored higher than females on the following patient oriented outcomes at 2 years: QWB $0.588 \pm 0.08SE$ vs. $0.557 \pm 0.07SE$ ($p < .011$), SF-36 Physical Function $65.21 \pm 3.27SE$ vs. $51.95 \pm 2.45 SE$ ($p = .002$), Vitality $66.54 \pm 2.91SE$ vs. $58.04 \pm 2.03SE$ ($p = .018$) and Role Emotional $86.40 \pm 3.81 SE$ vs. $73.75 \pm 3.44SE$ ($p = .025$).

Females undergoing hip and knee arthroplasty have lower scores preoperatively than males in most outcome measures. Despite marked improvement in all measures by both genders at the 2 year follow up these gender differences persist.

Total Hip Arthroplasty: Does Incision Length Matter

M Ciminiello, Javad Parvizi, MD, Richard H Rothman, MD

- Introduction:** In the recent years there has been considerable discussion about minimally invasive total hip arthroplasty. Outcome data is eagerly awaited at present time to evaluate the role of MIS surgery. This study reports the outcome of THA performed through conventional and small incision technique by a single surgeon from a high volume center.
- Methods:** During a 12 month period, patients were assigned to receive THA through a conventional incision measuring greater than 10 cm or to undergo surgery through incision measuring less than 10 cm. The outcome of THA with regard to surgical blood loss, analgesia requirement, ease of rehabilitation, functional recovery, and complications were evaluated.
- Results:** There were 120 patients in this cohort with a mean age of 70.2 years (range, 44.9 to 90.2). The two groups were matched for age, sex, and body mass index. 60 patients received THA through conventional technique and the other 60 patients underwent THA using small incision exposure. There was no detectable difference in outcome between the two groups with regard to blood loss, narcotic requirement, functional recovery, and length of stay. One patient in the MIS group required revision of the femoral component eight months later.
- Discussion:** The recent extensive interest for minimally invasive THA has been attributed to market and patient driven demand for this procedure. The orthopedic community eagerly continues to await data regarding the outcome of THA performed by minimally invasive means. We were not able to detect any difference in outcome parameters for THA performed through small incision compared to the conventional techniques.

The Planovalgus Foot: A Harbinger of Failure in Posterior Cruciate-Retaining Total Knee Arthroplasty

John B. Meding, MD, E. Michael Keating, MD, ME Berend, MD, Merrill A. Ritter, MD, Philip M. Faris, MD

- Purpose:** The purpose of this study was to evaluate the relationship between failed total knee arthroplasties (TKA) and ipsilateral posterior tibial tendon insufficiency PTTI.
- Methods:** A consecutive series of 9,475 primary cemented posterior cruciate retaining TKAs were performed using a nonmodular, metal-backed tibial component. Diagnoses included 87% osteoarthritis. Age averaged 71 years. Infections and extensor mechanism complications were excluded.
- Results:** Forty-seven tibial components were revised, 14 for posterolateral instability. Twelve of these 14 patients also were diagnosed with PTTI at the time of revision TKA. At least eight of the patients had documented PTTI at the time of the index operation. Over 25% (12 of 47) of the tibial components revised were in patients with PTTI.
- Discussion:** PTTI should be treated to prevent any potential deleterious effect on the TKA, especially in the pre-operative valgus knee where the incidence of PTTI is as high as 15%.

Flexibility in Administration of Fondaparinux (Arixtra™) for Prevention of Symptomatic Venous Thromboembolism (VTE) in Orthopedic Surgery

Clifford W. Colwell, MD, L Kwong, AGG Turpie, BL Davidson

- Background:** Patients undergoing total hip replacement (THR) or total knee replacement (TKR) surgery are at high risk for developing venous thromboembolism (VTE). Fondaparinux has proven its efficacy in reducing the incidence of VTE when administered 6-8 hours following major orthopedic surgery. Flexibility in the timing of administration of VTE prophylaxis may enable customization of postoperative patient care regimens, thereby improving clinical outcomes.
- Primary Objective:** To compare the prophylactic effect of fondaparinux, initiated either 6-10 h post surgery or the next morning after surgery, on the incidence of symptomatic VTE and major bleeding over the subsequent 6 weeks in patients undergoing THR or TKR surgery.
- Secondary Objective:** To evaluate the incidence of non-major bleeding and all-cause mortality.
- Design:** Randomized, open-label, multi-center study.
- Setting:** 136 centers in the United States.
- Patients:** 2046 patients undergoing primary TKR or THR surgery.
- Intervention:** 2.5 mg fondaparinux, once-daily, subcutaneously, with the first dose administered either (i) 6 to 10 hours after surgery or (ii) between 7am and 9am the morning after surgery. All subsequent doses were administered daily between 7am and 9am for a total of 7 to 10 days post-surgery.
- Measurements:** The primary efficacy outcome was the incidence of symptomatic VTE events reported up to 6 ± 1 weeks post-surgery. The primary safety outcome was the incidence of major bleeding occurring up to 6 ± 1 weeks post-surgery. An independent, blinded committee adjudicated all outcomes.
- Results:** Fifteen (1.6%) of the 912 patients who received fondaparinux, administered per protocol, between 6 to 10 hours post-surgery, experienced a symptomatic VTE event, compared with sixteen (1.8%) of the 905 patients who received fondaparinux, administered per protocol, the morning after surgery [absolute difference of 0.2%; 95% confidence interval, 0.456 to 1.895, P = 0.842 (NS)]. Major bleeding occurred in twelve (1.2%) of the 994 patients randomized to fondaparinux administered 6 to 10 hours post-surgery, compared with seven (0.7%) of the 1018 patients randomized to fondaparinux administered the morning after surgery [absolute difference of 0.5%; 95% confidence interval, 0.69 to 4.49, P = 0.2368 (NS)]. The incidence of all-cause mortality was 0.4% (4 out of 990 patients) and 0.1% (1 out of 1010) respectively while the incidence of non-major bleeding was 1.4% (14 out of 994) and 1.9% (19 out of 1014) respectively. No deaths occurred secondary to PE or major bleeding.
- Conclusions:** Once daily, subcutaneous fondaparinux initiated the morning after surgery, provides an additional option to orthopedic surgeons who wish to defer the onset of VTE prophylaxis in patients undergoing THR or TKR surgery.

The FDA has not cleared the drug or device for the described purpose (Arixtra- fondaparinux)

A Holistic Perioperative Program Decreases Hospital Length of Stay and Reduces Hospital Readmissions following Total Hip Arthroplasty

Kathleen L. Dodds, BS, RN, Keith R. Berend, MD, **Adolph V. Lombardi, Jr., MD, FACS**, Thomas H. Mallory, MD, FACS

- Introduction:** Total hip arthroplasty (THA) is successful in quality of life years gained. Long-term outcomes are excellent. Short-term recovery has become the new target in patient care. This study examines the effect of a holistic program of perioperative care on hospital length of stay (LOS), discharge disposition, and readmission.
- Methods:** A retrospective study was performed of primary THA performed during the first 6 months of 1997 (Group I: n=168 THA) and the first 6 months of 2003 (Group II: n=128 THA). Groups I and II underwent preoperative education including physical therapy, discharge planning, and nutritional and smoking counseling. Group II received perioperative preemptive analgesia, and aggressive postoperative rehabilitation with a rapid recovery protocol.
- Results:** Demographics were similar. LOS was reduced from 4.0 days (range: 2-9; SD: 1.1) to 2.7 days (range: 1-7; SD: 0.9; $p<0.05$). The 3-month readmission rate was lower in Group II (3.9%) than Group I (8.3%; $p<0.05$). Discharge disposition did not change. In Group I 20% and in Group II 23% discharged to a skilled or rehabilitation setting. In Group I 80% of patients discharged home and 24% received home health. In Group II, 77% of patients discharged home and 15% required home health.
- Discussion:** A more rapid recovery is built upon interest in less invasive and small-incision surgeries for THA. The incision size may not be the most critical aspect. Aggressive, holistic perioperative care appears to safely shorten hospital stay without shifting the burden of health care to the inpatient rehabilitation or home health setting.

Minimum 12-Year Follow-Up of Porous-Ingrowth Revision Acetabular Implants Secured with Peripheral Screw Placement

Steve V. Weeden, MD, Wayne G. Paprosky, MD

- Background:** Cementless acetabular revisions can be performed using peripheral rim screws instead of conventional dome screws. The purpose of this paper was twofold: to assess the success of acetabular revisions performed with cementless, porous-coated acetabular components stabilized by peripheral screws at minimum twelve-year follow-up; and to assess these revisions in relation to the amount of acetabular bone deficiency at the time of the procedures.
- Methods:** From 1987 to 1991, the senior author performed 203 acetabular revisions. Porous-ingrowth acetabular cups with peripheral screw placement were implanted in 142 acetabula (137 patients) with severe acetabular bone deficiencies. The deficiencies in these acetabula did not require an acetabular allograft transplant. All acetabular components allowed for fixation with a minimum of two screws. At an average follow-up of 13.2 years (range, twelve to fifteen), 129 patients (134 hips) were available for review. These patients were reviewed clinically and radiographically.
- Results:** At final follow-up, 127 (94.8%) of 134 hips were stable and clinically successful. Seven hips (5.2%) failed, five of which required revision and two of which were classified as radiographic failures without revision. The failures included five previously infected hips and two hips with aseptic loosening. The hips with aseptic loosening involved Paprosky type III acetabular defects, as did three of the other failures. Therefore, 71% of the failed hips involved a Paprosky type III acetabular defect. Among the successful hips, all but four acetabular components showed evidence of bony ingrowth. These four components showed evidence of early migration less than one year post-operatively before obtaining stable fixation. Two screws were required for most of the revisions (117 hips). All screws were secure initially, and screw loosening became evident only in the cups that migrated. At a minimum twelve-year follow-up, no progressive lucent lines or osteolysis were apparent around the stable cups or screws.
- Conclusion/
Clinical
Implication:** The use of a porous-coated press-fit acetabular prosthesis with peripheral screw fixation provides for long-term survivability in the revision setting among hips with severe defects that do not require structural allograft (Paprosky Type 1 and Type 2 defects). However, Paprosky Type 3 acetabular defects had an aseptic loosening rate of 7.4% and an overall failure rate of 18.5% at 13.2 year-follow-up. Therefore, when using acetabular implants secured with peripheral screws, more severe defects (Type 3A and 3B) should be augmented with structural allograft to improve initial stability, or other reconstruction components should be considered.

Hydroxyapatite Coated Femoral Stems in Revision Hip Surgery

SP Trikha, Sameer Singh, FRCS, O Raynham, J Lewis, P Mitchell, AJ Edge

- Aim:** We describe the clinical and radiological results of 120 consecutive revision hip arthroplasties in 113 patients, using a titanium alloy femoral component fully coated with Hydroxyapatite (HA).
- Method:** The mean age at the time of operation was 71 years (range 35 to 92). The average length of follow up was 8 years with a minimum of 5 years (range 5.0 to 12.6). All patients receiving a JRI Furlong HA coated femoral component were included regardless of their primary aetiology. These included patients on whom previous revision hip joint surgery had taken place. Patients were independently reviewed and scored using the Charnley modification of the Merle d'Aubigne and Postel Score (MDP), Harris Hip Score (HHS) and The Western Ontario and McMaster Universities Osteoarthritis index (WOMAC). Radiographs were assessed by three reviewers (blinded to clinical details) for new bone formation, osteolysis and radiolucent lines in each Gruen Zone.
- Results:** The mean Harris hip score was 85.8 (range 42 to 100) at the latest post-operative review. The mean WOMAC and MDP scores were 34.5 and 14.8 respectively.
- The mean pain visual analogue score (range 0 to 10) was 1.2 overall and 0.5 specifically for mid-thigh pain.
- There were no revisions of any femoral component for aseptic loosening. There were only three stem re-revisions (2 cases of infection, 1 recurrent dislocation).
- Radiological review of all femoral components, including the three mentioned, revealed stable bone ingrowth with no continuous or progressive radiolucent lines in any zone. Using revision or impending revision for aseptic loosening as the end point, at 10 years the cumulative survival for the stem was 100% (95% CI 94 to 100).
- Conclusion:** We present excellent medium term clinical, radiological and survivorship results with the use of a fully HA coated titanium stem in revision hip surgery.

Titanium Surface with Biologic Activity Against Infection

Javad Parvizi, MD, NJ Hickok, E Wickstrom, AR Zieger, JJ Purtill, Peter F. Sharkey, MD, William J. Hozack, MD, C Adams, IM Shapiro, Richard H Rothman, MD

- Introduction:** Despite immense improvements, periprosthetic infection continues to compromise the result of otherwise successful joint arthroplasty. The purpose of this study is to report the result of a novel series of experiments during which covalent bonding of antibiotics to the surface of titanium was achieved.
- Methods:** Titanium particles were reacted with aminopropyltriethoxysilane (APTS) to yield a surface suitable for solid-phase Fmoc coupling of aminoethoxyacetic acid linkers (AEEA), followed by Fmoc coupling of vancomycin. Bonding of vancomycin to the surface was tested by Matrix Assisted Laser Desorption Time of Flight (MALDI-TOF) mass spectrometry. Vancomycin activity was tested using a [¹⁴C]peptidoglycan binding assay and by the ability to inhibit or kill adherent *Staphylococcus aureus*, as measured by a colony formation assay and the Live/Dead BacLight Assay.
- Results:** Covalent bonding of vancomycin via AEEA and silane linkers to the Ti support was confirmed by MALDI-TOF. The presence of active vancomycin bound to the APTS-Ti was further confirmed by the specific binding of its ligand, [¹⁴C]-D-Ala-D-Ala. *S. aureus* cultured on vancomycin-APTS-Ti showed greatly decreased viability by differential membrane/nuclear staining and decreased colony formation. In contrast, *S. aureus* cultured on APTS-Ti stained as viable organisms and exhibited greater colony formation. In summary, it is possible to covalently bond vancomycin to APTS-Ti such that it retains its activity and is present at concentrations that are bactericidal.
- Discussion:** Recent advances in delivery of surgical care has lead to significant reduction in the incidence of periprosthetic fracture from the historical 9-10% to about 1-2%. Their current strategies to treat periprosthetic infection, however, remains imperfect. The inability to prevent infection or to eradicate organisms in all cases of infection, highlight some of these limitations. Furthermore, the surgical treatment of periprosthetic fracture under current circumstances carries immense psychosocial and economic costs. Improved techniques for prevention and treatment of periprosthetic infection is needed. This study has accomplished a novel method of attaching antibiotics to the surface of implants using stable covalent bonds that can be directly modulated.
- Significance:** This technology holds a great promise for manufacturing of implants that can be self-protective against periprosthetic infection or be used for the treatment of periprosthetic infection when they occur.

Periprosthetic Femur Fractures (Vancouver Type B-2) Treated with A Modular, Tapered, Femoral Implant

Arthur L. Malkani, MD, Javad Parvizi, MD, William J. Hozack, MD, A Hedley

Purpose of this study was to evaluate results of femoral component revision with a modular, tapered, fluted femoral implant that can facilitate fixation and reduction of femoral periprosthetic (Vancouver Type B-2) fractures. Sixteen patients with Vancouver Type B-2 fracture patterns were retrospectively reviewed. Average age of patients was 71 years (range 40-92 years). Minimum follow up was two years (range 2-3.9 years). Average postoperative Harris Hip Score was 77 points (range 52-93). Average distal stem diameter was 17 mm (range 15-24). All patients achieved fracture union. There were no cases of loosening, infection, or dislocation. Use of a modular femoral implant facilitates revision surgery of periprosthetic femoral fractures. Numerous stem and proximal body sizes provide optimum and independent distal and proximal fixation, restoring leg length and offset. Use of a modular femoral implant appears to be a good alternative to monolithic implants in treatment of Vancouver Type B-2 periprosthetic fractures.

Total Knee Arthroplasty in Parkinson's Disease: A Protocol for Improved Extension

David Nazarian, MD, P Reynolds, K Majid, Robert Booth, Jr., MD

- Purpose:** This study is a review of a consecutive series of patients with the diagnosis of Parkinson's Disease who underwent primary total knee arthroplasty.
- Methods:** Fifty-six knees were treated in patients with a prior diagnosis of Parkinson's disease who underwent primary knee arthroplasty with a cemented posterior stabilized component and an all polyethylene patellar component. A soft tissue tensor device and extramedullary alignment guide was used, a thorough posterior release performed and Botox injections in the hamstrings postoperatively were given.
- Results:** The average Knee Society Score went from 49 to 86, while the functional score improved from 44 to 80, with an average follow-up of 4.9 years (range 2 to 10). All patients had good or excellent pain relief and improvement in their functional ability. Nine patients had a flexion contracture greater than 5 degrees. The average range of motion was 4 to 110 degrees. Seven patients required manipulation under anesthesia. Four of these were treated with manipulation and casting.
- Discussion & Conclusion:** This study reports on a consecutive series of patients who achieved very good functional results through a predetermined intraoperative protocol and an aggressive post-operative physical therapy regimen including Botox injections. The patients in this report compare favorably with previous studies and suggest that total knee arthroplasty in this difficult population may provide a satisfying outcome.

Poster #21

The Effect of Cable Debris on Acetabular Construct Durability in Cemented Total Hip Arthroplasty at Nineteen to Twenty Year Follow-up

Kevin A. Dahl, MD, John J. Callaghan, MD, Douglas R. Pedersen, PhD, Steve S. Liu, MD, Devon D. Goetz, MD, David A. Vittetoe, MD, Patrick M. Sullivan, MD, Richard C. Johnston, MD

The purpose of this study was to determine the durability of cemented total hip arthroplasty at a minimum follow-up interval of 20 years in cases where braided cable was used to reattach the greater trochanter and to compare the acetabular revision loosening, osteolysis and wear rates of this group versus a control group of hip replacements performed by the same surgeon with identical construct but with wire trochanteric attachment.

At 15-year follow-up for both groups, the acetabular loosening occurred in 25% of hips in living patients with cable reattachment and 11.3% of living patients with wire reattachments ($p = .006$). Radiographic loosening occurred in 39.1% of cable hips and 22.9% of wire hips in patients living 15 years ($p = .02$). Linear head penetration averaged .143 millimeters per year in the cable group and .094 millimeters per year in the wire group ($p = .037$).

This study should heighten the awareness of the surgeon to potential deleterious effects of third body particulates in the total hip arthroplasty construct.

The Effect of Risedronate on Bone Mineral Density Following Total Hip Arthroplasty

David F. Scott, MD, JN Woltz, MS

The purpose of this two-year prospective study is to evaluate the effect of risedronate on the loss of femoral bone mass after total hip arthroplasty (THA). Following THA, patients taking 5 mg of risedronate daily for 24 months were compared to patients in the control group. Bone mineral density is determined by DEXA analysis on all patients preoperatively, and postoperatively at 3 to 7 days, 6 weeks, 6 months, 1 year, and 2 years.

At one year, females in the treatment group had significantly less bone loss compared to females in the control group ($p=0.001$). Two-year data revealed a trend of less bone loss in both males and females in the treatment group, though only 3 treatment patients have reached this point.

Risedronate significantly reduced bone loss in females after uncemented THA and this short-term data shows a trend of reduced bone loss in males. Thus, risedronate may have a role in long-term therapy after THA, for some patient groups.

The FDA has not cleared the drug or device for the described purpose (Risedronate)

Mobile Bearing TKA Does Not Reduce the Need for Lateral Release

Andrew I. Spitzer, MD, K Suthers, P Grandbois, P Goodmanson, Karen Evensen, MD

Mobile Bearing TKA has been reported to improve patellofemoral tracking. Between December 1998 and October, 2003, 445 primary TKAs were performed via transpatellar arthrotomy, with careful attention to technical details meant to optimize patellar tracking. 312 fixed bearing and 133 rotating platform tibias were implanted using the identical posterior stabilized femoral component design. Lateral release was performed if necessary once the trials or implants were placed. There were 47 (15%) lateral releases performed in the fixed bearing knees, and 14 (11%) in the mobile bearing knees ($p=NS$). Surgical technique may be the most important factor determining the need for lateral release. The self-aligning feature of mobile bearing TKA may further improve patellar tracking. However, the limited rotation of the mobile bearing may be insufficient to prevent lateral release in those patients in whom lateral tracking persists even after all other factors affecting patellar tracking have been surgically optimized.

Comparative Flexion following Rotating Platform vs. Fixed Bearing Total Knee Arthroplasty

Thomas Thornhill, MD, Richard D. Scott, MD, Matthew Evans, MD, E. Parsons, D. Zurakowski, **Jordan Shubert, MD**

- Introduction:** Mobile bearing articulations are being used because they provide increased topside conformity while addressing backside wear in a modular total knee prosthesis. Their high conformity, however, could result in the disadvantage of less post-operative flexion, decreasing the functional result.
- Methods:** We retrospectively reviewed rotating platform (n=113) and fixed bearing (n=100) total knee arthroplasties at minimum 2-year follow-up performed by one of two surgeons. The 2 groups of patients were matched for age, gender, diagnosis and pre-operative range of motion. The only difference between the two groups was the design of the tibial bearing and its tibial tray. In all cases the posterior cruciate ligament was preserved or selectively released.
- Results:** We could demonstrate no significant difference in knee flexion following either fixed bearing or rotating platform cruciate retaining TKA. The mean flexion at minimum 2 years post-operation for the rotating platform group was 117 degrees (range 50-135), and was 114 degrees (range 75-140) for the fixed bearing group. Multivariate analysis revealed that that none of the co-variables measured either individually or in combination produced a statistically significant difference ($p < 0.05$) in post-operative range of flexion between the two groups. These variables included: age, gender, body-mass index, side of surgery, PCL release or retention, and surgeon.
- Discussion:** This study indicates that a highly conforming rotating platform mobile bearing knee prosthesis can provide its potential advantage of decreasing polyethylene wear while not compromising post-operative flexion and ultimate knee function when compared to a matched group of patients treated with a similar fixed bearing design.

Mini-Subvastus Approach for Total Knee Arthroplasty

William Schroer, MD, Paul Diesfeld, PA-C, Mary Reedy, RN

150 TKA utilizing a mini-subvastus surgical technique (MIS) were evaluated prospectively. This surgical technique avoids both cutting the quadriceps and everting the patella. The MIS TKA results were compared to 150 traditional TKA. All 300 procedures were performed by a single surgeon utilizing the same implants.

Range of motion was significantly greater at 3, 6, 12 and 24 weeks for the MIS group. 83% (124 of 150) of the MIS group were able to straight leg raise the day after surgery. No patients in the control group demonstrated this ability. Hospital length of stay decreased to 3.4 days for the MIS patients versus 4.0 for the control patients. Fewer patients required SNF or rehab.

Matched Pair Analysis of Two Techniques
for Femoral Component Rotation in TKA—
“Posterior Condylar Cut Parallel to Tibial Cut” (PCCPTC) vs. Epicondylar Axis

Shrinand V. Vaidya, MD, Chitranjan S. Ranawat, MD, VB Kasodekar, MD

- Purpose:** Proper femoral component rotational alignment in total knee arthroplasty (TKA) is crucial for stability of knee and patello – femoral mechanics. The purpose of this prospective study was to determine whether significant differences in femoral component rotation and functional outcome exist between PCCPTC technique, as advocated by senior author and parallel to “Epicondylar axis” technique of femoral component insertion.
- Methods:** Two randomized cohorts, operated by same surgeon, were identified and matched pair analysis of femoral component rotation was done using PCCPTC technique in first cohort and parallel to transepicondylar axis in the second cohort. The transepicondylar axis and balanced flexion gap were identified intra operatively by author and other independent observer.
- Results:** The knee society functional score in cohort 1 was better and statistically significant than cohort 2, as proved by Mann Whitney U test.
In cohort 1 the femoral component external rotation was 2.69 ± 0.9 degrees and in cohort 2 it was 5.60 ± 1.60 degrees as confirmed on postoperative CT scan.
- Discussion:** The PCCPTC technique may offer superior reliability because of independence of obscured bony landmarks and can restore the rotational alignment of the femoral component within permissible limits with better functional outcome.
- Conclusion:** The transepicondylar axis was less predictable and significantly more externally rotated than PCCPTC technique and also had significant interobserver differences.

Bony Response to a Proximal Modular Femoral Revision Component

Joseph C. McCarthy, MD, JE Lee, MS

- Purpose:** This study examines the outcome of femoral fixation and bone preservation utilizing a modular proximally coated component at mean 12 year follow-up.
- Materials & Methods:** This study retrospectively examined 35 hips having revision hip surgery using a proximally coated, modular femoral component with follow-up of 8 to 14 years (mean 12 years). Preoperative radiographs were reviewed using Paprosky's classification. Postoperative radiographs were reviewed for osteolysis, endosteal hypertrophy, cortical hypertrophy, distal pedestals, breakage, and loosening. Average age at revision was 55.0 years (range 23-81). There were 18 males and 17 females. Twenty-three hip revisions were performed on previously cemented femoral components, and 5 were girdlestone conversions. Twenty-one hips required femoral allografting, 5 of which were proximal femurs requiring cemented sleeves.
- Results:** Twenty-five of the 30 (83%) non-cemented stems were bony ingrown at mean 12 year follow-up. All 25 (100%) had proximal bone preservation and 13 of 25 (52%) had bone hypertrophy in the diaphysis around zones 2 and 3. There were 5 aseptic failures (16%). Preoperatively each of those were Paprosky Class 3B or 4, one patient with osteogenesis imperfecta, 3 had periprosthetic fractures with lysis, and all had 2 prior revisions. There were no failures in Paprosky Class 2 or 3A. The aseptic failures have been rerevised.
- Conclusion:** This modular stem resulted in reliable fixation with preservation of proximal bone stock at this intermediate interval in complex revisions in Paprosky Class 2 and 3A. Class 3B and 4 Paprosky defects needed additional fixation with a fully coated revision stem.

Total Knee Arthroplasty Using the Press-Fit Condylar Design: 14- to 17- Year Follow-Up with a Posterior Cruciate Retaining Design

David J. Rodricks MD, Greg Lee MD, Pamela Pulido, BSN, Clifford W. Colwell MD

- Introduction:** Press-Fit Condylar (PFC) total knee arthroplasty (TKA) design remains relatively unchanged and is a popular system. Intermediate-term (10-year) results are available. Our study represents followup of 14-17 years.
- Methods:** 156 consecutive PFC cruciate retaining TKA were performed in 138 patients. Index procedure mean age was 70.5 years (range 34.7-94.0). 64 of 65 surviving knees had followup at a mean of 15.8 years. Knee Society functional scores and clinical scores were obtained on all contacted patients, with radiographs on all capable patients.
- Results:** Average Knee Society functional scores were 65 ± 29.1 , with clinical scores of 89 ± 12.9 . Overall survivorship of PFC knees was 92.5% with revision for any reason and 96.2% for aseptic loosening. Radiolucent lines were present in 57% of knees with no knees loose by radiographic criteria.
- Discussion & Conclusion:** This study is first to show PFC total knee system long-term results, which were excellent with either revision or aseptic loosening as the endpoint.

Complex Revision Total Knee Arthroplasty with Rotating Hinge Prostheses

Steven S. Goldberg, MD, Edward J. McPherson, MD

- Purpose:** Rotating hinge design total knee prostheses are used by joint surgeons faced with difficult revision knee arthroplasties such as those with massive bone loss, absent collateral ligaments, anteroposterior instability or a combination of these deficits. There is debate whether the high complication rates associated with older hinged implants justifies their current use in complex cases.
- Methods:** We studied the results of 31 revision total knee arthroplasties performed in 30 patients employing modular rotating hinge prostheses and followed for a minimum of two years, with an average follow-up of 42 months. The indications for revision were reimplantation following sepsis (26 cases), multiligament instability (3 cases) and aseptic loosening with significant bone loss (2 cases).
- Results:** Seven of the 31 cases have required revision, 6 for recurrent sepsis and one for aseptic loosening. Of the remaining 24 cases the average Knee Society clinical score and functional score improved from 23.0 and 15.4 respectively to 74.6 and 38.3 at final evaluation. Other major complications included extensor mechanism disruption (5 cases), mechanical problems related to the prostheses (2 cases) periprosthetic fracture (1 case), and transient peroneal nerve palsy (1 case). 43% of patients experienced at least one major complication, and 33% have needed further surgery.
- Conclusion:** The newer rotating hinge knee prostheses reliably restored stability and improved pain and function in these difficult revision cases, however the high rate of complications warrants consideration by the surgeon in each case whether a less constrained implant may be more appropriate.

Small Incision Total Hip Replacement via the Direct Lateral Approach

Thomas L. Bernasek, MD, G Haidukewych, E Rommel

Minimal incision total hip arthroplasty may improve early functional outcomes, however the decreased exposure could adversely affect the precision of component placement. This study compared the radiographic and clinical results of a conventional approach (> 10cm), to those of a minimal incision approach (≤ 10cm). All patients received a direct lateral approach, a Summit stem and Pinnacle cup, and all had either osteoarthritis or avascular necrosis. Radiographic analysis for acetabular and femoral component positioning was performed. Mean cup abduction angle was $53.2^{\circ} \pm 5.5$ (minimal incision) and $52.0^{\circ} \pm 6.0$ (large incision). Mean anteversion angle was $19.4^{\circ} \pm 8.7$ (minimal incision), and $17.6^{\circ} \pm 8.4$ (large incision). Direct lateral minimal incision approach can allow satisfactory hip implant position with operative and clinical parameters similar to large incisions. Clinical outcomes were equivalent in both groups.

At What Steps in the Performance of a TKA do Errors Occur when Manual Instrumentation is Used?

Loukas Koyonos, BS, S David Stulberg, MD, O Woods

- Purpose:** Computer assisted navigation tools make it possible to measure the accuracy with which each step of a total knee replacement is performed using conventional manual instrumentation. The purpose of this study is to determine when during the performance of each step of a TKR errors occur and to quantify the magnitude of these errors.
- Methods:** 25 TKR were performed using a manual, intra-medullary based alignment system. The accuracy of each step of the procedure was measured using an image-free navigation system (OrthoPilot™). The steps measured were: initial positioning of the distal femoral cutting block, anterior-posterior cutting block, and proximal tibial cutting block; effect of pinning on the position of each of the cutting blocks; accuracy of resection using each of the cutting blocks; and accuracy of final positioning of the femoral and tibial implants. Perfect alignment was defined as placement of the femoral and tibial blocks and implants at 90 degrees to the mechanical axis in the frontal plane and parallel to the mechanical axis in the sagittal plane.
- Results:** Initial positioning of the femoral and tibial cutting blocks was most accurate and consistent in the frontal plane (average alignment: 89°, range: 87-91°) and least accurate in the sagittal plane (average alignment: 3°, range -6° to +6°). Manual pinning of the blocks was associated with substantial (ave. 4°) but difficult to visualize change of femoral and tibial cutting blocks from initial positioning. Resection through slots introduced small average errors (1°), but a wide range (5°) of variation. Final femoral implant positioning was associated with a small error (< 1°), but final tibial implant positioning introduced an average error of 2° into hyperextension.
- Conclusions:** Substantial errors occur during the performance of each step of the surgical procedure when performed using manual instruments. An awareness of the potential for the occurrence of these errors can lead to changes in technique (e.g. inserting pins into blocks with power equipment) and improvements in manual instruments (e.g. cutting blocks with slots that limit saw blade deflection).

On-site Registration Hours

Friday, November 5	Noon – 9:00 pm
Saturday, November 6	6:00 am – 6:00 pm
Sunday, November 7	6:00 – 10:00 am

All on-site registrants must provide payment (credit card or check) at time of registration.

CME Credit

This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (AACME) through the joint sponsorship of the American Academy of Orthopaedic Surgeons and the American Association of Hip and Knee Surgeons. The AAOS is accredited by the AACME to sponsor continuing medical education for physicians.

This continuing medical education activity has been submitted for review by the AAOS for up to 13 hours in category 1 credit of the Physician's Recognition Award of the American Medical Association.

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Each participant in the Annual Meeting has been asked to disclose if he or she has received something of value (in excess of \$500) from a commercial company or institution that relates directly or indirectly to the subject of their presentation. The American Association of Hip and Knee Surgeons has identified the options to disclose as follows:

- A. Research or institutional support has been received;
- B. Miscellaneous non-income support (e.g., equipment or services), commercially derived honoraria, or other non-research related funding (e.g., paid travel);
- C. Royalties;
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Thomas P. Schmalzried, MD		Robert J. Krushell, MD	a, e - Stryker Orthopaedics
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Lawrence D. Dorr, MD	a, c - Zimmer	Gavan Duffy, MD	c, e - DePuy Orthopaedics
John J. Callaghan, MD	a, b, c, e - DePuy	Douglas A. Dennis, MD	a, c - DePuy
Edward J. Nebel, MD		Amar S. Ranawat, MD	e – Dr. Chitranjan S. Ranawat is consultant for DePuy Orthopaedics, Inc.
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PAPER PRESENTER	RELATIONSHIP DISCLOSED	POSTER PRESENTER	RELATIONSHIP DISCLOSED
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S. David Stulberg, MD,	e - Zimmer	Todd V. Swanson, MD	
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Robert T. Trousdale, MD	none	Arthur L. Malkani, MD	none
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Paul E. Beaulé, MD	a, e - Wright Medical Technology, Inc.	Steve S. Liu, MD	a, b, c, e - DePuy; c, e - Zimmer
David R. Lionberger, MD	a, e – Pfizer; a – Stryker, a – Proctor Gamble; e - Zimmer	David F. Scott, MD	a - Proctor & Gamble
Matthew Kelly, MD	none	Andrew I. Spitzer, MD	a, b, c, e - DePuy
David F. Dalury, MD	e - DePuy	Jordan Shubert, MD	
Richard L. Wixson, MD	a, e – Stryker Corporation	William Schrorer, MD	
Michael P. Bolognesi, MD	none	Shrinand V. Vaidya, MD	
Kevin C. Anderson, MD	b – Stryker – Howmedica - Osteonics	Joseph C. McCarthy, MD	
C. Anderson Engh, Jr., MD	a – Inova; c, e - DePuy	David J. Rodricks, MD	none
Wayne G. Paprosky, MD	c - Zimmer (Warsaw, IN)	Steven S. Goldberg, MD	none
William C. Head, MD	none	Thomas L. Bernasek, MD	a, c, - DePuy
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Mark W. Pagnano, MD	none		
Kenneth A. Krackow, MD	none		
S. David Stulberg, MD	e – Aesculap		

FUTURE MEETINGS

Combined Specialty Day

Knee Society/Hip Society/AAHKS
February 26, 2005
Washington, DC

Combined Specialty Day

Knee Society/Hip Society/AAHKS
March 11, 2006
New Orleans, LA

Combined Specialty Day

Knee Society/Hip Society/AAHKS
February 17, 2007
San Diego, CA

AAHKS 15th Annual Meeting

November 4 - 6, 2005
Gaylord Texan Resort, Dallas, TX

AAHKS 16th Annual Meeting

November 3 - 5, 2006
Gaylord Texan Resort, Dallas, TX

AAHKS 17th Annual Meeting

November 2 - 4, 2007
Gaylord Texan Resort, Dallas, TX



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