

The Knee Society
and the
American Association of Hip and Knee Surgeons



Combined Specialty Day Meeting
Saturday, March 8, 2008

San Francisco Marriott Hotel
Yerba Buena Salons 7-8
San Francisco, CA

Scientific Program

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Las Vegas, NV February 28, 2009
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Abstracts for the 2008 Knee Society Interim (Closed) Meeting and the 2009 Specialty Day (Open) Meeting Award consideration can be submitted on the Knee Society Website (www.kneesociety.org)

Abstracts for the 2008 AAHKS Annual Meeting (papers and posters) can be submitted on the AAHKS website (www.aahks.org).

The deadline for receipt of Abstracts is April 15, 2008

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ACCREDITATION

This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the American Academy of Orthopaedic Surgeons and The Knee Society. The American Academy of Orthopaedic Surgeons is accredited by the ACCME to sponsor continuing medical education for physicians.

CREDIT HOURS

The American Academy of Orthopaedic Surgeons designates this educational activity for a maximum of 8 *AMA PRA Category 1 Credits*[™]. Physicians should only claim credit commensurate with the extent of their participation in the activity.

OBJECTIVES

The Knee Society/AAHKS Specialty Day program is designed to provide practicing orthopaedic surgeons with current information regarding surgical techniques, emerging technology and symposia discussions on managing total knee arthroplasty, and to enhance the care of patients with arthritis and degenerative diseases of the knee joint.

Please complete and return your Evaluation Form to the Knee Society Registration table at the conclusion of the Meeting. Thank you!



Please turn off cell phone ringers while inside the Scientific Session rooms. Thank you.

**The Knee Society/AAHKS
Combined Specialty Day Meeting
Saturday, March 8, 2008
San Francisco, CA**

- 8:00-8:05 AM **OPENING COMMENTS**
Michael A. Kelly, MD, Knee Society President
Giles R. Scuderi, MD, Knee Society Education Committee Chair
- 8:05-8:52 AM **SYMPOSIUM I: TKA: DO WE NEED TO CHANGE THE MATERIALS
OR DESIGN?**
Moderator: Harry E. Rubash, MD (Boston, MA)
- 8:05-8:13 AM Was There a Problem with Prior Materials: A Retrieval Analysis
Gerald A. Engh, MD (Alexandria, VA)
- 8:13-8:21 AM Comparison of Highly Cross-Linked Polyethylene with Standard Polyethylene in
Total knee Arthroplasty with Minimum 5-Year Follow-Up
Aaron A. Hofmann, MD (Salt Lake City, UT)
- 8:21-8:29 AM The Role of Alternate Bearing Surfaces in TKA
Stuart B. Goodman, MD (Stanford, CA)
- 8:29-8:37 AM Can we Improve the Performance Characteristics with Newer Designs?
Peter S. Walker, PhD (New York, NY)
- 8:37-8:52 AM **DISCUSSION**
- 8:52-9:39 AM **SYMPOSIUM II: PE PROPHYLAXIS: IS THERE STILL A
CONTROVERSY?**
Moderator: Richard Iorio, MD (Burlington, MA)
- 8:52-9:00 AM AAOS Guidelines
John J. Callaghan, MD (Iowa City, IA)
- 9:00-9:08 AM What You Can Tell Your Internist About Why Aspirin is Enough
Paul A. Lotke, MD (Philadelphia, PA)
- 9:08-9:16 AM Rationale for Use of Low-Molecular-Weight Heparin
Clifford W. Colwell, Jr., MD (La Jolla, CA)
- 9:16-9:24 AM The Rationale for Low Intensity Warfarin - A Therapeutic Compromise
Vincent D. Pellegrini, Jr., MD (Baltimore, MD)
- 9:24-9:39 AM **DISCUSSION**
- 9:39-10:00 AM **PRESIDENTIAL GUEST SPEAKER**
Robert E. Booth, Jr., MD (Philadelphia, PA)
- 10:00-10:20 AM **BREAK**

- 10:20-11:20 AM **SYMPOSIUM III: FUNCTIONAL OUTCOMES**
Moderator: W. Norman Scott, MD (New York, NY)
- 10:20-10:28 AM The Measuring Tools we Use for Functional Outcomes
Robert B. Bourne, MD (London, Ontario)
- 10:28-10:36 AM Outcome of Revision Compared to Primary Total Knee Arthroplasty
Michael D. Ries, MD (San Francisco, CA)
- 10:36-10:44 AM The Impact of Gender and Age on Knee Pain Following Total Knee Arthroplasty
David G. Lewallen, MD (Rochester, MN)
- 10:44-10:52 AM Outcome of TKA in the Young Active Patient
Leo A. Whiteside, MD (St. Louis, MO)
- 10:52-11:00 AM In Vivo Kinematics of High Flexion Implants
Richard D. Komistek, PhD (Knoxville, TN)
- 11:00-11:08 AM Outcomes of Mobile Bearing TKA
Douglas A. Dennis, MD (Denver, CO)
- 11:08-11:20 AM **DISCUSSION**
- 11:20 AM-12:00 PM ***The Knee Society Awards Presentations***
Moderator: Giles R. Scuderi, MD (New York, NY)
- 11:20-11:23 AM ***Mark Coventry Award***
Introduction: Mark W. Pagnano, MD (Rochester, MN)
- 11:23-11:28 AM ***Mark Coventry Award Paper***
In Vivo Knee Forces During Recreation and Exercise After Knee Arthroplasty
Clifford W. Colwell, Jr., MD (La Jolla, CA)
- 11:28-11:33 AM **DISCUSSION**
- 11:33-11:36 AM ***Chitranjan Ranawat Award***
Introduction: Lawrence D. Dorr, MD (Inglewood, CA)
- 11:36-11:41 AM ***Chitranjan Ranawat Award Paper***
Functional Outcome after Total Knee Replacement Varies with Patient Attributes
David C. Ayers, MD (Worcester, MA)
- 11:41-11:46 AM **DISCUSSION**
- 11:46-11:49 AM ***John Insall Award***
Introduction: Giles R. Scuderi, MD (New York, NY)
- 11:49-11:54 AM ***John Insall Award Paper***
Gender Specific Total Knee Replacement Outcomes: An Analysis using
Prospectively Collected Clinical Patient Data
Steven J. MacDonald, MD (London, Ontario)

11:54 AM -12:00 PM **DISCUSSION**

12:00-12:15 PM **PRESIDENTIAL ADDRESS**
Michael A. Kelly, MD (Hackensack, NJ)

12:15-1:05 PM **LUNCH BREAK**
(Knee Society Business Meeting – Members Only)

1:05-1:12 PM **JOHN INSALL TRAVELING FELLOWSHIP REPORT**
Introduction: W. Norman Scott, MD (New York, NY)

1:12-2:07 PM **SYMPOSIUM IV: COMPUTER NAVIGATION MEETS MIS TKA**
Moderator: Thomas P. Vail, MD (San Francisco, CA)

1:12-1:20 PM Minimally Invasive Total Knee Arthroplasty Performed With and Without
Computer-Assisted Navigation
Michael A. Mont, MD (Baltimore, MD)

1:20-1:28 PM Computer Navigation is a Useful Tool for Primary TKA
James B. Benjamin, MD (Tucson, AZ)

1:28-1:36 PM COMPUTER ASSISTED TKR: Uses to Help Manage Major Deformity
Kenneth A. Krackow, MD (Buffalo, NY)

1:36-1:44 PM Correlation of Intra-Operative Navigation with Post-Op Radiographs
S. David Stulberg, MD (Chicago, IL)

1:44-1:52 PM Navigation in TKR: In Opposition
Chitranjan S. Ranawat, MD (New York, NY)

1:52-2:07 PM **DISCUSSION**

2:07-2:20 PM **BREAK**

2:20-3:05 PM **SYMPOSIUM V: PARTIAL KNEE REPLACEMENT**
Moderator: Richard D. Scott, MD (Boston, MA)

2:20-2:28 PM Long Term Results with a Medial Unicondylar Replacement
David W. Murray, MD, FRCS (Oxford, UK)

2:28-2:36 PM Long Term Results with a Lateral Unicondylar Replacement
Jean-Noël Argenson, MD (Marseille, France)

2:36-2:44 PM There is a Place for Patellofemoral Replacement
Jess H. Lonner, MD (Philadelphia, PA)

2:44-2:52 PM Is there a Place for Bicompartamental Replacement?
Alfred J. Tria, Jr., MD (Somerset, NJ)

2:52-3:05 PM **DISCUSSION**

- 3:05-4:00 PM **SYMPOSIUM VI: REVISION TKA TAKES A PLAN**
Moderator: Thomas K. Fehring, MD (Charlotte, NC)
- 3:05-3:13 PM Exposure Options for the Difficult Revision
Henry D. Clarke, MD (Scottsdale, AZ)
- 3:13-3:21 PM Fixation in Revision TKA
Daniel J. Berry, MD (Rochester, MN)
- 3:21-3:29 PM Managing Major Bone Deficiency in Revision TKR
Arlen D. Hanssen, MD (Rochester, MN)
- 3:29-3:37 PM How much Constraint is needed in Revision TKA
Russell E. Windsor, MD (New York, NY)
- 3:37-3:45 PM Management of the Deficient Patella in Revision TKA
Victor M. Goldberg, MD (Cleveland, OH)
- 3:45-4:00 PM **DISCUSSION**
- 4:00-5:00 PM **SYMPOSIUM VII: COMPLICATIONS DO HAPPEN:
HOW TO AVOID THEM AND WHAT TO DO**
Moderator: Ray C. Wasielewski, MD (Columbus, OH)
- 4:00-4:08 PM Wound Problems in Total Knee Arthroplasty
Kelly G. Vince, MD (Hermosa Beach, CA)
- 4:08-4:16 PM Management of Extensor Mechanism Rupture
Aaron G. Rosenberg, MD, FACS (Chicago, IL)
- 4:16-4:24 PM Patella Mal-alignment: Why it Happens and What to Do
John B. Meding, MD (Mooreville, IN)
- 4:24-4:32 PM Diagnosis of TKA infection: Current State of the Art
Robert L. Barrack, MD (St. Louis, MO)
- 4:32-4:40 PM Management of Periprosthetic Fractures
Robert T. Trousdale, MD (Rochester, MN)
- 4:40-4:48 PM The Management of the Stiff TKA
William J. Maloney, III, MD (Stanford, CA)
- 4:48-5:00 PM **DISCUSSION**
- 5:00 PM **ADJOURN**

Scientific Presentation Abstracts

SYMPOSIUM I

TKA: DO WE NEED TO CHANGE THE MATERIALS OR DESIGN?

Was There a Problem with Prior Materials: A Retrieval Analysis

Gerald A. Engh, MD (Alexandria, VA)

Longevity of total knee implants is affected by both clinical and material factors including mechanical stresses which may exceed the fatigue strength of the polyethylene. Studies have shown that UHMWPE has varying properties depending on how it was sterilized, how much it has oxidized on the shelf or in the patient, and the extent of crosslinking. Clinical outcomes of knees sterilized without gamma irradiation in air have shown no revisions for implant-related factors (polyethylene wear, osteolysis, or aseptic loosening). (1) Likewise when examining our own retrievals using the wear rating system of Hood (2), we have observed a difference in the extent and severity of wear of those inserts sterilized by gamma irradiation in air as opposed to other methods of sterilization. Those components were also more likely to have been revised for polyethylene wear or osteolysis. Changes in sterilization techniques to reduce oxidation seem to be improving the material.

References:

- 1) Bourne RB, Laskin RS, Guerin JS. Ten-year Results of the First 100 Genesis II Total Knee Replacement Procedures. *Orthopedics*. 2007 Aug; 30 (8 Suppl): 83-5.
- 2) Hood RW, Wright TM, Burstein AH. Retrieval Analysis of Total Knee Prostheses: A Method and Its Application to 48 Total Condylar Prostheses. *J Biomed Mater Res*. 1983 Sept; 17(5): 829-42.

SYMPOSIUM I

TKA: DO WE NEED TO CHANGE THE MATERIALS OR DESIGN?

Comparison of Highly Cross-Linked Polyethylene with Standard Polyethylene in Total knee Arthroplasty with Minimum 5-Year Follow-Up

Aaron A. Hofmann, MD (Salt Lake City, UT)

Introduction: The purpose of this study is to compare the radiographic and clinical outcomes of patients receiving a total knee arthroplasty using a highly cross-linked or standard polyethylene liner with a minimum follow-up of five years.

Materials and Methods: Highly cross-linked polyethylene became available for use in February of 2001 and was used consecutively at our institution since that date. We retrospectively reviewed the first 100 patients receiving this implant and compared them to 100 patients immediately preceding this date, who received a standard polyethylene insert sterilized with gamma radiation in an oxygenless environment. All patients underwent routine physical exams and radiographs from which a knee score was calculated.

Findings: Of the 200 patients, 24 patients had died, 35 were lost to follow-up, leaving 83 patients in the standard group and 82 patients in the highly cross-linked group with a minimum follow-up of 82 months and 69 months, respectively. Nine patients in the standard group were revised: two for infection, three for aseptic loosening and two for instability, and one for vascular complication. One patient in the cross-linked group was revised for instability. Twenty patients in the standard group had radiographs with radiolucencies. Two radiolucencies were seen in the highly cross-linked group without evidence of loosening or polyethylene wear.

Conclusion: In this study, highly cross-linked polyethylene showed similar clinical findings to standard polyethylene, however, there were fewer revisions and fewer osteolytic lesions seen on radiographs. Highly cross-linked polyethylene showed good durability at this intermediate interval and should continue to perform well long-term.

References:

1. Berry DJ: Recognizing and identifying osteolysis around total knee arthroplasty. *Instr Course Lect* 53: 261-264, 2004
2. Bloebaum RD, Nelson K, Dorr LD, Hofmann AA, Lyman DJ. Investigation of early surface delamination observed in retrieved heat-pressed tibial inserts. *Clin Orthop Relat Res*. 269:120-7, 1991
3. Fisher J, McEwen HM, Tipper JL, et al: Wear, debris, and biologic activity of cross-linked polyethylene in the knee: Benefits and potential concerns. *Clin Orthop Relat Res* 428:114-119, 2004.
4. Hofmann AA, Evanich JD, Ferguson RP, Camargo MP. Ten- to 14-year clinical followup of the cementless Natural Knee system. *Clin Orthop Relat Res* 388: 85-94, 2001.
5. Hofmann AA, Heithoff SM, Camargo M. Cementless total knee arthroplasty in patients 50 years or younger. *Clin Orthop Relat Res* 404: 102-107, 2002.
6. Jacobs JJ, Roebuck KA, Archibeck M, Hallab NJ, Glant TT: Osteolysis: Basic science. *Clin Orthop Relat Res* 393: 71-77, 2001.
7. Muratoglu OK, Bragdon CR, Jasty M, O'Connor DO, Von Knoch RS, Harris WH: Knee-simulator testing of conventional and cross-linked polyethylene tibial inserts. *J Arthroplasty* 19: 887-897, 2004.
8. Muratoglu OK, Mark A, Vittetoe DA, Harris WH, Rubash HE: Polyethylene damage in total knees and use of highly crosslinked polyethylene. *J Bone Joint Surg Am* 85(suppl 1): S7-S13, 2003.
9. Muratoglu OK, Rubash HE, Burroughs BR, Harris WH, et al: Simulated normal gait wear testing of a highly cross-linked polyethylene tibial insert. *J Arthroplasty* 22(3): 435-444, 2007
10. Naudie DDR, Ammeen DJ, Engh GA, Rorabeck CH: Wear and Osteolysis around Total Knee Arthroplasty. *JAAOS* 15: 53-64, 2007.
11. Naudie DDR, Rorabeck CH: Sources of osteolysis around total knee arthroplasty: Wear of the bearing surface. *Instr Course Lect* 53: 251-259, 2004.
12. Willie BM, Bloebaum RD, Ashrafi S, Dearden C, Steffensen T, Hofmann AA. Oxidative degradation in highly cross-linked and conventional polyethylene after 2 years of real-time shelf aging. *Biomaterials* 27(10):2275-84, 2006

SYMPOSIUM I

TKA: DO WE NEED TO CHANGE THE MATERIALS OR DESIGN?

The Role of Alternate Bearing Surfaces in TKA

Stuart B. Goodman, MD (Stanford, CA)

Total knee replacement is a highly successful procedure for decreasing pain and improving function in the elderly population. However, in younger more active individuals, wear of the bearing surfaces can cause recurrent synovitis, periprosthetic osteolysis, abnormal kinematics and poor function. Thus, there is renewed interest in alternate bearing surfaces in TKA, including improving the femoral component composition, adding surface treatments and enhancing polyethylene. This discussion will highlight these new innovations and present early data on outcome.

SYMPOSIUM I

TKA: DO WE NEED TO CHANGE THE MATERIALS OR DESIGN?

Can we Improve the Performance Characteristics with Newer Designs?

Peter S. Walker, PhD (New York, NY)

It has been demonstrated using fluoroscopy and other methods that the kinematics of the knee are not restored to normal after TKR; the axial rotation in flexion is less than normal and paradoxical anterior femoral sliding frequently occurs (1,2,3). These factors may be responsible for limitations in function (4,5). Kinematic parameters which are likely to relate to function are the neutral path of motion, the laxity about the neutral path, and the AP and rotary stability (6). In previous studies using dynamic test machines, we demonstrated that surface guided TKR's reproduced the neutral path of motion, while standard condylar and PS designs did not (7). The studies are extended to include the laxity and stability factors at a full range of flexion. The special TKR's were designed to reproduce a normal neutral path and ranged from a condylar to central cam-ramp designs, up to a cam-post design. It was shown that the proposed designs were able to reproduce close to a normal neutral path as well as anatomic laxity and stability characteristics.

References:

1. Komistek RD, Dennis DA, Mahfouz M. 2003. In vivo fluoroscopic analysis of the normal human knee. *Clin Orthop* 410: 69-81
2. Banks SA, Harman MJK, Bellemans J, Hodge WA. 2003. Making sense of knee arthroplasty kinematics: News you can use. *J Bone Joint Surg Am* 85: 64-72.
3. Dennis DA, Komistek RD, Mahfouz MR, Walker SA, Tucker A. 2004. A multicenter analysis of axial femorotibial rotation after total knee arthroplasty. *Clin Orthop* 428: 180-189.
4. Blaha JD. 2004. The rationale for a total knee implant that confers anteroposterior stability throughout rang of motion. *J Arthroplasty* 19(4) Suppl 1: 22-64
5. Ries M, Victor J, Bellemans J, Otto J, McKinnon B, Parikh A, Sprague J, Salehi A. 2006. Effect of guided knee motion and high flexion TKA on kinematics, implant stresses, and wear. A Scientific Exhibit at the 2006 AAOS Meeting, Chicago, Illinois.
6. Haider H, Walker PS, 2005. Measuring of constraint of total knee replacement. *J Biomech* 38: 341-348.
7. Walker PS, Yildirim G, Sussman-Fort J, Boyer J (2007). Design features of total knees for achieving normal knee motion characteristics. *Trans Orthopaedic Research Society*, Chicago IL, 19-22 March.

SYMPOSIUM II

PE PROPHYLAXIS: IS THERE STILL A CONTROVERSY?

AAOS Guidelines

John J. Callaghan, MD (Iowa City, IA)

This AAOS clinical guideline has been created to improve patient care by outlining the appropriate information gathering and decision making processes involved in managing the prevention of symptomatic pulmonary embolism (PE) in patients undergoing total knee arthroplasty. This guideline has been created as an educational tool to guide orthopaedic surgeons and other clinicians who provide peri-operative care through a series of treatment decisions in an effort to improve the quality and efficiency of care.

This guideline should not be construed as including all proper methods of care or excluding methods of care reasonably directed to obtaining favorable results. The ultimate judgment regarding any specific procedure or treatment must be made in light of each patient's unique presentation and the needs and resources particular to the locality or institution.

The following recommendations for chemoprophylaxis of patients undergoing total knee arthroplasty are based on a systematic review of the literature and are evidence-based:

Recommendation 1

Patients at standard risk of both PE and major bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including—in alphabetical order: Aspirin, low molecular-weight heparin (LMWH), synthetic pentasaccharides, and warfarin. (Level III, Grade B [choice of prophylactic agent], Grade C [dosage and timing])

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature defining a clearly superior regime.

Recommendation 2

Patients at elevated (above standard) risk of PE and at standard risk of major bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including—in alphabetical order: LMWH, synthetic pentasaccharides, and warfarin. (Level III, Grade B [choice of prophylactic agent], Grade C [dosage and timing])

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature on risk stratification of patient populations.

Recommendation 3

Patients at standard risk of PE and at elevated (above standard) risk of major bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including—in alphabetical order: Aspirin, warfarin, or none. (Level III, Grade C)

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature on risk stratification of patient populations.

Recommendation 4

Patients at elevated (above standard) risk of both PE and major bleeding should be considered for one of the chemoprophylactic agents evaluated in this guideline, including—in alphabetical order: Aspirin, warfarin, or none. (Level III, Grade C)

Note: The grade of recommendation was reduced from B to C for dosage and timing because of the lack of consistent evidence in the literature on risk stratification of patient populations. No studies currently include patients at elevated risk of major bleeding and/or PE in study groups.

There are 10 other recommendations based on the results of the objective AAOS Consensus Process in which the AAOS work group members participated. You can go to www.aaos.org for these recommendations. Hopefully some prospective studies using these guidelines will be performed to evaluate their efficacy concerning this controversial topic.

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SYMPOSIUM II

PE PROPHYLAXIS: IS THERE STILL A CONTROVERSY?

What You Can Tell Your Internist About Why Aspirin is Enough

Paul A. Lotke, MD (Philadelphia, PA)

The AAOS has recently published guidelines for the prevention of Pulmonary Embolism after total joint surgery*. The new guidelines recognize that aspirin is a viable alternative and is an acceptable chemoprophylactic agent. However, aspirin is perceived not to be as effective as other agents, which have higher risks for bleeding. This is a guideline as to what to tell your internist.

1. Times have changed. Early mobilization, less surgical intervention, better anesthesia and better pain control have reduced the risks of fatal PE to 0.1%. This prevalence is the same for all chemoprophylactic agents.
2. Risks vs. benefits. We must balance the risks vs. benefits of any agent. The risk of major bleeding with the heparins or Xa inhibitors is 2 to 5%, which is four to ten times greater than with aspirin.
3. Outcomes. The A-1 recommendations from the ACCP (Chest) are drug comparison studies which compare one drug to another. Their only outcome parameter is DVT (95% distal) and not PE (since the prevalence is too low). Orthopedists consider other outcomes after THA and TKA, which are not analyzed in these studies, i.e., wound problems from increased bleeding, infection, range of motion, LOS, pain, rehab potential etc. Therefore, these studies are not A-1 for orthopaedic outcomes.
4. Flaws in the drug studies: Most A-1 studies use selective populations. They exclude patients with prior PE, prior GI bleeds, the elderly, the frail, the non-compliant. However, we operate on these patients and they may have increased risk from bleeding.
5. High risk patients: Patients with prior PE or other defined coagulopathies are considered at increased risk for PE and should be considered for a VC filter or use higher risk for bleeding drugs (multi-modal approach). Most standard risk patients do not need to be exposed to the risks from increased bleeding.

Reference:

* AAOS Clinical Guideline on prevention of symptomatic pulmonary embolism (PE) in patients undergoing total hip or knee arthroplasty: www.aaos.org/news/bulletin/jul07/clinical3.asp

SYMPOSIUM II

PE PROPHYLAXIS: IS THERE STILL A CONTROVERSY?

Rationale for Use of Low-Molecular-Weight Heparin

Clifford W. Colwell, Jr., MD (La Jolla, CA)

Low-molecular-weight heparins (LMWH) have been studied extensively in total knee arthroplasty (TKA) and provide highly effective and safe venous thromboembolic disease (VTED) prophylaxis. LMWH received high rating in ACCP recommendations for DVT prophylaxis after elective TKA.³ Prevalence of VTED with LMWH prophylaxis was 33% in TKA data pooled from six randomized studies, with a proximal DVT rate of 7.1%.³

One meta-analysis of 1800 patients reported symptomatic PE of 0.2% and major bleeding of 2.4% with LMWH.² LMWH, given by subcutaneous injection, can be started before or after surgery. Also available is a synthetic pentasaccharide, fondaparinux, which received high rating in ACCP recommendations. A study with over 1,000 patients had an overall VTED rate of 12.5% with a proximal DVT rate of 2.4% and 1 non-fatal PE. No major bleeding was reported, but overall bleeding was 2.1%.¹

As with all interventions, benefit has to be considered against risk in use of anticoagulants.

References:

1. Bauer KA, Eriksson BI, Lassen MR, Turpie AG: Fondaparinux compared with enoxaparin for the prevention of venous thromboembolism after elective major knee surgery. *N Engl J Med* 345(18):1305-1310, 2001.
2. Brookenthal KR, Freedman KB, Lotke PA, et al: A meta-analysis of thromboembolic prophylaxis in total knee arthroplasty. *J Arthroplasty* 16(3):293-300, 2001.
3. Geerts WH, Pineo GF, Heit JA, et al: Prevention of venous thromboembolism: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. *Chest* 126(3 Suppl):338S-400S, 2004.

SYMPOSIUM II

PE PROPHYLAXIS: IS THERE STILL A CONTROVERSY?

The Rationale for Low Intensity Warfarin - A Therapeutic Compromise **Vincent D. Pellegrini, Jr., MD (Baltimore, MD)**

Low-intensity warfarin (target INR 2.0) combines safety, in avoidance of bleeding complications, with efficacy in *secondary* prevention of VTED related readmission after total knee arthroplasty. As such, it represents a “therapeutic compromise”; less dramatic primary prevention of venographic thrombosis is accepted in exchange for a lower bleeding rate than is seen with newer agents that more completely eliminate venographic thrombosis.

In 1321 patients, 801 completed screening contrast venography; 343 (42.3%) had deep venous thrombosis. Patients discharged on warfarin had a 0.21% readmission rate compared with 1.05% for patients with negative venograms discharged without further anticoagulation. One patient suffered a fatal pulmonary embolism after negative venography and no outpatient prophylaxis. There were no clinically significant bleeding complications.

Surveillance venography was a poor predictor of ultimate thromboembolism risk and need for extended anticoagulation therapy. Routine secondary prophylaxis with extended low-intensity (INR 2.0) warfarin therapy reduces venous thromboembolism-related readmission with negligible bleeding risk.

Reference:

Pellegrini, V.D., Jr., Donaldson, C.T., Farber, D.C., Lehman, E.B., Evarts, C.M.: The Mark Coventry Award. Prevention of Readmission for Venous Thromboembolic Disease after Total Knee Arthroplasty. Clin Orthop Rel Res 2006 Dec; 452:21-27.

SYMPOSIUM III

FUNCTIONAL OUTCOMES

The Measuring Tools we Use for Functional Outcomes

Robert B. Bourne, MD (London, Ontario)

Health-related quality of life outcomes have been developed such that investigators might quantify pre-operative to post-operative improvements in total knee replacement patient health status and has been of value to patients, surgeons and health care providers. Validated outcomes tools are recommended due to their responsiveness, reliability and repeatability. In the field of total knee replacement, validated outcomes tools include those that are disease-specific (i.e. WOMAC, Oxford 12), patient-specific (i.e. MACTAR), global health (i.e. SF-36, SF-12, EuroQual), functional capacity (i.e. 6-minute walk, 30 second stair climb, KOOS, pedometer studies and gait analyses) and cost-to-utility (cost-to-QALY).

For the most part, patient-generated data are preferred to that which is physician-based. An important addition to TKR outcomes has been the addition of patient satisfaction data.

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SYMPOSIUM III

FUNCTIONAL OUTCOMES

Outcome of Revision Compared to Primary Total Knee Arthroplasty

Stephanie Y. Pun, MD, **Michael D. Ries, MD** (San Francisco, CA)

Eighty revision TKA's were separated into five groups based on their pre operative diagnosis (arthrofibrosis, unexplained pain, infection, instability, wear and loosening). Each revision TKA was individually matched by age and gender to two primary TKA's. Post operative function scores were significantly lower for all revision groups compared to primary TKA ($P < 0.05$) while the pain score for instability approached that for primary TKA ($P > 0.05$). Postoperative pain and function scores were significantly higher ($P < 0.05$) for instability and wear or loosening than for arthrofibrosis or unexplained pain.

Our findings indicate that revision for mechanical causes of failure such as instability and wear or loosening are associated with favorable results while revision for more of a biologic or exogenous pathology such as arthrofibrosis or unexplained pain is associated with poor results.

Stephanie Y. Pun, MD
Michael Ries, MD

none
c- Smith and Nephew

SYMPOSIUM III

FUNCTIONAL OUTCOMES

The Impact of Gender and Age on Knee Pain Following Total Knee Arthroplasty

Jasvinder A. Singh, MBBS, MPH, Sherine Gabriel, MD,

David G. Lewallen, MD (Rochester, MN)

Introduction: The impact of gender and age on pain and outcomes following TKA is controversial and existing studies are contradictory (1-6) The purpose of this study was to investigate the impact of gender and age on the prevalence of moderate or severe knee pain 2-5 years after primary and revision TKA.

Methods: Using an Institutional Total Joint Registry, we identified a cohort of patients who underwent primary or revision TKA from 1996-2004 and returned for follow-up or responded to the follow-up questionnaire. We compared the prevalence of moderate or severe knee pain between male vs. female and by age using univariate and multivariable logistic regression models, controlling for pre-operative knee pain severity. A $p < 0.05$ was considered significant.

Results: Both primary and revision TKA cohorts had a mean age of 68-69 years with similar proportions of men and women at the 2- and 5-year follow-ups. Significantly more women had moderate-severe pain 2 years post-primary TKA: 9% vs. 6.6%, (odds ratio [OR]: 1.45; 95% confidence interval [CI], 1.01, 2.08; $p = 0.04$) at 2-years in multivariable-model adjusted for age and pre-operative pain severity. Age > 60 -70 years (compared to age ≤ 60) was associated with lower OR of 0.49 (95% CI, 0.31, 0.77; $p = 0.02$) for moderate-severe pain 2 years post-primary TKA, after adjusting for gender and pre-operative pain severity.

A much higher proportion of patients with revision TKA had moderate-severe pain 2- and 5-years: 22% men, 29% women; and 18% men, 29% women, respectively. Age > 80 years predicted lower odds (multivariable-adjusted OR, 0.27; 95% CI 0.08, 0.89; $p = 0.03$) at 2 years; presence of moderate-severe pre-operative pain was significantly with moderate-severe pain at 2-years (multivariable-adjusted OR, 2.57; 95% CI, 1.36, 4.84, $p = 0.004$) and at 5 years (multivariable-adjusted OR, 5.75; 95% CI, 2.04, 16.18; $p < 0.001$).

Conclusions: Female gender, younger age and worse pre-operative pain predict worse Intermediate term pain outcomes in patients with primary and revision TKA. Further study is needed to investigate the reasons for these associations and to determine whether modifiable associated factors (amenable to intervention) such as surgical technique, implant choice or design, medical and psychological comorbidity, obesity etc. can explain any part of these observed gender and age related differences in outcomes.

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David G. Lewallen, MD

Jasvinder A. Singh, MBBS, MPH

Sherine Gabriel, MD

a,b,c,e-Zimmer; a-DePuy, Stryker

none

none

SYMPOSIUM III

FUNCTIONAL OUTCOMES

Outcome of TKA in the Young Active Patient

Leo A. Whiteside, MD (St. Louis, MO)

Given concerns about long term implant loosening in young, heavy patients, we asked whether these patients would fare as well as older, lightweight patients with bone-ingrowth fixation. Cementless total knee arthroplasty was performed consecutively in 1328 patients (1556 knees) using a total knee system designed for porous-ingrowth fixation. A consecutive series of 122 patients (167 knees) whose age was younger than 55 years and whose weight was greater than 90 kg was compared with a gender-matched consecutive series of 122 patients (167 knees) who were 65 years of age or older and who weighed less than 80 kg. The minimum follow-up was 5 years (mean 7.3 years; range 5 to 10 years).

The mean Knee Society scores and pain scores were similar at each interval for both groups. Function scores were better for the young, heavy patients at each interval. None of the knees in either group loosened. One patient in the young, heavy group underwent polyethylene component revision for wear.

These results indicate young, heavy patients fare as well as older, lightweight patients when this implant is used with the osteointegration technique.

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SYMPOSIUM III

FUNCTIONAL OUTCOMES

In Vivo Kinematics of High Flexion Implants

Richard D. Komistek, PhD (Knoxville, TN), Sumesh Zingde, MS, Mohamed R. Mahfouz, PhD, Douglas A. Dennis, MD, Giles R. Scuderi, MD, Jean-Noël Argenson, MD,
Harold E. Cates, MD

The objective was to determine in vivo kinematics for 137 subjects implanted by seven surgeons with five different high flexion TKA designs. All subjects performed a maximum weight-bearing deep knee bend maneuver under fluoroscopic surveillance and all TKA were judged clinically successful (HSS scores > 90).

The highest and lowest amount of average flexion for a group was 125.4° and 95.1°, respectively and the results were highly variable between groups evaluated. Posterior femoral rollback and axial rotation also varied between each of the groups and kinematic results for the TKA evaluated were statistically less in magnitude compared to the normal knee. On average, the kinematic values were similar between fixed and mobile bearing high flexion TKA, but certain groups did achieve statistically better kinematics.

The fact that one TKA design exhibited both high and lower levels of flexion indicates factors other than implant design (surgical technique, patient factors, etc) play important roles in determination of maximum flexion following TKA.

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Richard D. Komistek, PhD	a,e-Zimmer; a-DePuy
Sumesh Zingde, MS	none
Mohamed R. Mahfouz, PhD	a,c,e-Zimmer; a-DePuy
Douglas A. Dennis, MD	a,c,e-DePuy; a-Zimmer
Giles R. Scuderi, MD	c,d,e-Zimmer
Jean-Noël Argenson, MD	a,c,e-Zimmer
Harold E. Cates, MD	a,b,e-Zimmer

SYMPOSIUM III

FUNCTIONAL OUTCOMES

Outcomes of Mobile Bearing TKA

Douglas A. Dennis, MD (Denver, CO), Joshua Carothers, MD, and Raymond Kim, MD

Background: Mobile-bearing total knee arthroplasty (TKA) were introduced with several reported theoretical advantages. The dual articulation is intended to reduce polyethylene wear, fixation stresses, and ultimately, the rate of revision TKA. Available clinical evaluations were reviewed to evaluate these claims and compare outcomes between different types of mobile-bearing TKA designs.

Methods: A literature search was performed to identify studies reporting outcomes of mobile-bearing TKA. Inclusion requirements for manuscript analysis were a minimum 5 year follow-up duration and those reporting knee scores, motion, loosening rates, and survivorship. Both retrospective and prospective trials were included.

Results: Very low rates of component loosening were identified across all mobile-bearing implant subgroups. Meniscal bearing implants demonstrated higher rates of bearing instability and lower survivorship than rotating platform designs. Implants placed prior to 1995 exhibited higher rates of bearing instability. Prospectively randomized trials comparing fixed and mobile-bearing TKA demonstrated similar results although follow-up duration is limited.

Conclusion: Excellent clinical results with low revision rates have been obtained with use of mobile bearing TKA over two decades. Basic science analyses have demonstrated reduced fixation stresses and polyethylene wear with mobile bearing TKA. Prospectively randomized controlled studies with longer follow-up duration are required to determine if these advantages will demonstrate superior survivorship over fixed-bearing TKA.

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Douglas A. Dennis, MD	a,c,e-DePuy; a-Zimmer
Joshua Carothers, MD	none
Raymond Kim, MD	none

The Knee Society Award Presentations

MARK COVENTRY AWARD for Best Basic Science Paper

In Vivo Knee Forces During Recreation and Exercise After Knee Arthroplasty

Darryl D. D'Lima, MD, PhD, Shantanu Patil, MD; Nikolai Steklov, BS;
Peter C. Chen, PhD; **Clifford W. Colwell, Jr., MD**

Knee forces directly affect arthroplasty component survivorship, wear of articular bearing surfaces, and integrity of the bone–implant interface. It is not known which activities generate forces within a range that is physiologically desirable but not high enough to jeopardize the survivorship of the prosthetic components.

We implanted three patients with an instrumented tibial prosthesis and measured knee forces and moments in vivo during exercise and recreational activities. As expected, stationary bicycling generated low tibial forces while jogging and tennis generated high peak forces. On the other hand, the golf swing generated unexpectedly high forces especially in the leading knee. Exercise on the elliptical trainer generated lower forces than jogging but not lower than treadmill walking.

These results allow for a more scientific approach to recommending activities after total knee arthroplasty and can be used to develop clinically relevant structural and tribologic testing.

Clifford W. Colwell, Jr., MD

Darryl D'Lima, MD, PhD

Shantanu Patil, MD

Nikolai Steklov, BS

Peter C. Chen, PhD

a-National Institutes of Health, Knee Society,
OREF and Donald & Darlene Shiley

a-National Institutes of Health, Knee Society,
OREF and Donald & Darlene Shiley

a-National Institutes of Health, Knee Society,
OREF and Donald & Darlene Shiley

a-National Institutes of Health, Knee Society,
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a-National Institutes of Health, Knee Society,
OREF and Donald & Darlene Shiley

CHITRANJAN RANAWAT AWARD

for Best Work on a Surgical Technique

Functional Outcome after Total Knee Replacement Varies with Patient Attributes **David C. Ayers, MD (Worcester, MA), Patricia Franklin, MD**

TKR is one of the most reliable and beneficial elective operative procedures because of the pain relief and improvement in physical function it provides patients with severe arthritis. While pain relief is consistently achieved in the overwhelming majority of patients after TKR, the amount of improvement in physical function varies (1,2,3). 2645 primary, unilateral TKR patients were studied prospectively. Significant pain relief was reported in >95% of patients after TKR and the improvement in pain score was normally distributed. However, unlike pain relief, the distribution of functional gain was bimodal. The 63% of patients with highest functional gain reported mean PCS improvement of 21 (SD=7), as compared to the second group (37%) of patients with a mean gain of 4.1 (SD=7). Higher odds of less functional gain were associated with each 5 year increase in patient age, BMI>40, lower pre-op MCS, non-OA diagnosis, and poor/fair quadriceps strength. Understanding patient attributes associated with limited gains can guide future strategies to improve post-TKR function.

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David C. Ayers, MD
Patricia Franklin, MD

a-Zimmer Inc.
a-Zimmer Inc.

JOHN INSALL AWARD

for Best Work on a Clinical Subject or Outcomes Report

Gender Specific Total Knee Replacement Outcomes: An Analysis using Prospectively Collected Clinical Patient Data

Steven J. MacDonald, MD (London, ON), Kory D. Charron; Robert B. Bourne, MD; Douglas D. Naudie, MD; Richard W. McCalden; Cecil H. Rorabeck, MD

Gender specific total knee replacement (TKR) design has been a recently debated topic.^{1,2} The purpose of this study was to investigate the survivorship and clinical outcome scores (WOMAC, SF12, KSCRS) of a large primary TKR cohort of 3817 patients with 5279 TKR's (3100-female, 2179-male), specifically assessing any differences between gender. Men had higher raw scores preoperatively. Women demonstrated statistically greater improvement ($p < 0.019$) in all WOMAC domains. There were no gender differences in improvements of the SF12 Physical scores. Men demonstrated statistically greater improvement ($p < 0.0001$) in KSCRS function and total scores, but not the KSCRS knee score. Revision rates were 10.2% for males and 8% for females. The hypothesis of an inferior clinical outcome for women following total knee arthroplasty was not demonstrated as women demonstrated greater implant survivorship, statistically greater improvement in WOMAC scores, equal improvement in SF12 scores and less improvement in only the KSCRS function and total scores.

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Steven J. MacDonald, MD	a-Smith & Nephew; a,e-DePuy
Charron, KD	none
Robert B. Bourne, MD	a,e- Smith & Nephew; a-J & J, Stryker
Douglas D. Naudie, MD	a,b,e- Smith & Nephew; a,b-DePuy;
Robert W. McCalden,	none
Cecil H. Rorabeck, MD	none

SYMPOSIUM IV

COMPUTER NAVIGATION MEETS MIS TKA

Minimally Invasive Total Knee Arthroplasty Performed With and Without Computer-Assisted Navigation

Michael A. Mont, MD (Baltimore, MD)

Recent studies of total knee arthroplasty techniques found that minimally invasive computer-assisted navigation surgery resulted in more accurate component alignment, while minimally invasive surgery without navigation had significantly shorter operative times and fewer complications.

The purpose of the present study was to evaluate the outcomes of two groups of 80 patients who had minimally invasive total knee arthroplasties performed with and without navigation. The mean operative times of the two groups were 112 minutes (range, 63-297 minutes) and 63 minutes (range, 27-94 minutes), respectively ($p < 0.001$). The Knee Society pain and functional scores of the two groups were similar ($p = 0.147$ and $p = 0.171$, respectively). There was no statistical difference in alignment in the coronal plane (femoral flexion, $p = 0.124$; tibial angle, $p = 0.646$) or the sagittal plane (femoral flexion, $p = 0.580$; tibial angle, $p = 0.053$). Complication rates were also similar.

Both of these procedures may be useful treatments and further refinement may reduce complication rates.

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SYMPOSIUM IV

COMPUTER NAVIGATION MEETS MIS TKA

Computer Navigation is a Useful Tool for Primary TKA

James B. Benjamin, MD (Tucson, AZ)

Introduction: Computer assisted surgery holds the potential to improve implant alignment in TKA, especially when combined with surgical approaches using smaller incisions.

Methods: During a 14-month period, 152 consecutive primary cruciate retaining TKA's were performed via a mini-midvastus approach. Seventy-one knees were performed with CAS and 81 with standard instrumentation using intramedullary femoral and extramedullary tibial alignment. Using standardized digital radiographs, pre and post-op femoral-tibial angles, femoral component alignment, and tibial coronal alignment were measured on all patients.

Results: There was no significant difference in the pre-op alignment or demographics between the two groups. The mean post op alignment was 5.4° of valgus in the CAS group vs. 4.3° in the standard instrument group. The standard deviation was statistically smaller in the CAS group (2.1° vs. 3.2°, $p < .001$). Coronal tibial component alignment was 89.1° in the CAS group vs. 88.2° in the standard group, with a statistical reduction in standard deviation in the CAS patients (1.1° vs. 2° $p < .001$). There were no tibial components in the CAS group that fell outside of 3° of ideal coronal alignment in contrast to 15 in the standard instrument group. Mean tourniquet times were 75 minutes in the CAS group versus 65 minutes in the standard group ($p < .001$). There was no difference in incision lengths between the two groups (12.4 cm vs. 12.5 cm). There were no complications related to the use of the array attachment pins.

Discussion: The use of CAS in this consecutive series total knee replacements resulted in a significant reduction in variability in femoral-tibial and tibial alignment. Most significant was the elimination of outliers in tibial coronal alignment in the CAS group. The utility of CAS in determining component rotation and soft tissue balancing has yet to be determined. Although the learning curve for the use of CAS is not long, a thorough knowledge of TKA principles is mandatory, and like any tool or instrument, CAS performance improves with regular use. Long-term follow-up will be required to determine if the improved alignment seen with CAS results in improved clinical outcomes.

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SYMPOSIUM IV

COMPUTER NAVIGATION MEETS MIS TKA

COMPUTER ASSISTED TKR: Uses to help manage Major Deformity

Kenneth A. Krackow, MD (Buffalo, NY)

Computer navigation at TKR offers essential information from the start to the finish of any procedure. The point of maximal passive extension is one very simple and important example. Knowing whether and how much flexion contracture or recurvatum is present at the start, plus knowing at the end of the case that things are correct, without navigation are very crude estimates at best.

Varus and valgus deformity management involves adjusting the soft tissue sleeves so that they are balanced. Balancing means releasing the tight side until the respective bones are properly aligned during a tension maneuver that holds the collateral and cruciate ligaments out to length. Axial alignment viewed on a long standing film does not necessarily or typically show this “sleeve alignment”. The x-ray is likely to overstate the deformity, almost never understate it. Passive apparent correctability may not be very helpful. What is apparently corrected certainly may not be fully corrected, and the corrected, forced position does not imply balance at all. In fact, it is likely to be the “least” balanced position.

The proper information about these positions and what represents proper balance can all be obtained with navigation. For the first time we can assess accurately the soft-tissue “sleeve asymmetry” and plan the release process more intelligently and efficiently. Knowing that one has a less severe deformity allows selection of the proper technique and discarding the notion of needing a higher order of varus-valgus constraint. Determining, for example, that the 12 degree apparent deformity is indeed rigid may lead to a more aggressive release technique or even rare consideration of ligament tightening that requires different handling right from the start. This too is information that is only accurately and reliably available with navigation.

This presentation also illustrates a new technique of varus management using over-resection of the medial and posterior-medial aspects of the tibial surface that has proven invaluable for many quite severe cases.

a,b,c,d,e- Stryker; c-Smith and Nephew

SYMPOSIUM IV

COMPUTER NAVIGATION MEETS MIS TKA

Lack of Correlation between Radiographic and Navigation Measurement of TKA Limb Alignment

Mark A. Yaffe BS, Samuel S. Koo MD, **S. David Stulberg, MD** (Chicago, IL)

Introduction: This purpose of this study is to evaluate the relationship of radiographic and navigation alignment measurements, examine the differences between desired and clinically accepted alignment, and evaluate sources of error in radiographic alignment assessment.

Methods: Fifty-eight computer-assisted total knee arthroplasties were performed and limb alignment measurements were recorded both pre- and post-operatively with standard radiographs and with an intra-operative navigation system.

Results: Intra-operative navigation produced consistent alignment results that were within 1° of the desired alignment. The difference between radiograph and navigation measurements could vary by as much as 12° and was dependent upon the degree of limb deformity.

Conclusion: Post-operative radiographic measurements have inherent limitations. Navigation is a highly effective tool for producing consistent alignment results and can be useful in relating alignment outcomes to clinical and functional outcomes

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SYMPOSIUM IV

COMPUTER NAVIGATION MEETS MIS TKA

Navigation in TKR: In Opposition

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2008 and beyond will most likely see a refinement in the use of computer-assisted navigation in TKR. The expanding role of navigation is promising. No one can argue with its accuracy and reproducibility. The question is: does it matter? Recent reports have suggested improved 14-year survivorship with outlier knees compared to well-aligned knees. Other reports have suggested the cost ineffectiveness of these expensive devices.

At present, navigation is of limited use. It is being utilized by an exclusive group of surgeons who are either researchers, or who are marketing themselves to obtain a competitive advantage over other surgeons.

Improved navigation technology has a good chance, in the next several years, to become the standard for TKR. To accomplish this it must become cost-effective, user-friendly and beneficial.

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SYMPOSIUM V

PARTIAL KNEE REPLACEMENT

Long Term Results with a Medial Unicondylar Replacement (UKR)

David W. Murray, MD, FRCS (Oxford, UK), Andrew J Price, FRCS, Ulf Svard, Christopher AF Dodd, FRCS

To obtain good long term results with UKR it is essential to use well defined indications, reliable techniques and an implant that does not wear out. We use the mobile bearing Oxford UKR. The primary indication is medial osteoarthritis with functionally intact ligaments. 1 in 3 knee replacements are appropriate for the Oxford.

There are 6 published long term series of Oxford UKR. In all but one the 10 year survival was above 90%. In Svard et al's series of 683 Oxfords the 20 year survival was 92%. Although the commonest cause of failure was arthritis in the retained lateral compartment, this occurred in only 1% of patients. At 10 years 92% of the knees had good or excellent HSS scores.

These results indicate that with appropriate implants, indications and techniques UKR is a definitive knee replacement and that the retained compartments do not inevitably fail in the long term.

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SYMPOSIUM V

PARTIAL KNEE REPLACEMENT

Long Term Results with a Lateral Unicondylar Replacement

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Introduction: Limited long term follow-up data are available for unicompartmental knee arthroplasty (UKA) performed for lateral femorotibial osteoarthritis. The aim of this study was to report the average 10 year- follow-up of a consecutive series of lateral UKA performed in the same institution.

Methods: Between 1984 and 2004, 40 isolated lateral UKA were performed and followed in the institution while 703 isolated medial UKA were performed and followed during the same period. All patients were evaluated pre and post-operatively using the Knee Society Score. The radiological indication was based on full loss of cartilage limited to the lateral femorotibial compartment evaluated on stress X-rays and full weight bearing views of the limbs evaluating the mechanical axis. All components were cemented.

Results: The average follow-up was 10.8 years (range, 4 to 20 years). All patients had marked preoperative pain preoperatively and the average preoperative mechanical axis (hip – knee –ankle) was 6° of valgus. The average Knee Society Score improved from 55 to 95 and from 58 to 92 for function. The average postoperative mechanical axis was 2° of valgus. Four knees were revised, one for tibial migration and three for progression of osteoarthritis. Implant survival at 20 years was 80% (0.62 – 0.99).

Discussion/Conclusion: Lateral UKA represents in our experience 5% of all UKA implantations. However the long term results of lateral UKA presented in this study compares at least equally with those reported for medial UKA.

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SYMPOSIUM V

PARTIAL KNEE REPLACEMENT

There is a Place for Patellofemoral Replacement

Jess H. Lonner, MD (Philadelphia, PA)

Isolated patellofemoral arthritis can occur in as many as 9% of patients over the age of forty, and is particularly common in women, who often have subtle patellofemoral maltracking or malalignment. Patellofemoral arthroplasty has a legitimate role in the treatment of this condition.

Early implants had a high incidence of patellar maltracking, catching and subluxation, due to design features of the trochlear components, inadequate soft tissue balancing, and component malposition. Improved contemporary designs, as well as refinement in surgical indications, improved surgical techniques and instrumentation, have and will continue to reduce the incidence of patellar maltracking and enhance the outcomes, leaving late tibiofemoral degeneration as the primary cause of “failure” of patellofemoral arthroplasties.

Several long-term studies have shown a rate of tibiofemoral degeneration of approximately 20% at 15 years. Combining patellofemoral arthroplasty with biological resurfacing of full-thickness defects of the femoral condyles may expand the indications for the procedure and protect the tibiofemoral cartilage from degeneration.

Finally, the results of TKA do not seem to be compromised by the presence of a prior patellofemoral arthroplasty.

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a,c,e-Zimmer

SYMPOSIUM V

PARTIAL KNEE REPLACEMENT

Is there a Place for Bicompartamental Replacement?

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Bicompartamental knee replacement has some history. The original approaches used two separate implants at the same operation.^{1,2} The results were acceptable but with the increasing success of total knee arthroplasty, partial replacements lost favor.

In the 1990s, Repicci introduced a limited incision for unicondylar replacement (UKA) and encouraged new interest.^{3,4} The Deuce Knee (Smith and Nephew, Memphis, Tenn., USA) combines the medial and patellofemoral articulations into a single femoral implant with a medial tibial tray and a polyethylene patella.⁵

Forty patients underwent the replacement. The average age was 70. The average pre-op flexion was 122 degrees and the post operative flexion was the same at 6 weeks after surgery. There were no significant medical complications. One patient required a lateral retinacular release. The Knee Society score improved from 49 to 84 and the Function Score improved from 57 to 81.

The bicompartamental arthroplasty has early results similar to UKA and protects the patellofemoral joint while preserving all of the ligaments of the knee.

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SYMPOSIUM VI

REVISION TKA TAKES A PLAN

Exposure Options for the Difficult Revision

Henry D. Clarke, MD (Scottsdale, AZ)

Problems gaining adequate exposure may occur in primary total knee arthroplasty (TKA) but are more frequently encountered in the revision setting. Poor exposure can result in component mal-positioning and other serious complications including patellar fracture and tendon rupture. In difficult cases, the surgeon must be prepared to use additional maneuvers to facilitate exposure.

Numerous techniques have been previously described including the quadriceps snip, the femoral peel, the V-Y turndown and the tibial tubercle osteotomy.¹⁻⁴ While there are theoretical advantages of each technique, the author favors the use the quadriceps snip and/or tibial tubercle osteotomy. The quadriceps snip represents a good initial choice when the exposure is limited.

However, in cases of severe arthrofibrosis with limited flexion, significant patella baja, or long well fixed stems, use of a tibial tubercle osteotomy as the primary maneuver is appropriate.

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SYMPOSIUM VI

REVISION TKA TAKES A PLAN

Fixation in Revision TKA

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The use of stems, either cemented or uncemented, in total knee arthroplasty is well established. Stems off-load stress over a broad surface of the diaphysis and help protect the metaphyseal interface areas from failure. Stems also can provide extra fixation. Both cemented and uncemented stems have advantages and disadvantages.

Uncemented stems are expeditious, compatible with intramedullary-based revision instrumentation, easy to remove if necessary, and by filling the diaphysis help guarantee axial alignment. Disadvantages include the fact that uncemented stems help off-load stress but in most iterations do not provide true fixation. Uncemented stems also do not fit all canal deformities and potentially can cause end-of-stem pain in some cases. Cemented stems have advantages of adding permanent fixation in fresh metaphyseal and diaphyseal bone. They have a proven ten-year track record and allow the surgeon to adjust for canal geometry abnormalities. Disadvantages include the fact they are difficult to remove, and they do not fill the canal and consequently do not guarantee alignment as well as uncemented stems in most cases.

Favorable results with both uncemented and cemented stems have been reported in several series. There are specific technique issues that can help either cemented or uncemented implants work most satisfactorily, and these will be discussed.

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a,b,c,e-DePuy; a-Zimmer, Stryker

SYMPOSIUM VI

REVISION TKA TAKES A PLAN

Managing Major Bone Deficiency in Revision TKR

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Large (massive) bone deficiencies are often present extremely challenging dilemmas during revision knee replacement. Frequently, the defects encountered are irregular in size and shape. Massive cavitory or uncontained (absent cortical rim) defects are treated primarily with three different treatment approaches which include:

- 1) structural allografts
- 2) impaction bone allografting
- 3) porous metal metaphyseal cones.

Structural allografts provide support for prosthetic components and have been used in this setting longer than the other two reconstructive techniques. Advantages include the ability to construct any shape or size of construct and the potential for biologic integration. Disadvantages include prolonged operative times, nonunion, delayed union, graft resorption, graft infection, and the possibility of disease transmission. Depending upon the size of graft used, complete revascularization of these grafts does not occur. These reconstructive procedures require careful preoperative preparation, ready availability of large structural allografts, and considerable experience in complex knee replacements.

Impaction bone allografting can also be used for constrained and unconstrained bone defects. Uncontained defects usually require the use of wire mesh to contain the cancellous bone graft. The concept of impaction grafting is to allow more rapid and complete revascularization of the morseled bone graft. Femoral reconstructions are more difficult than tibial reconstructions. Radiographs typically show progressive incorporation and remodeling of the bone graft. Advantages include the ability to deal with many irregular shapes and sizes of bone defects. Disadvantages include the time consuming and technically demanding nature of these reconstructions, particularly when extensive mesh is required, and the possibility of disease transmission from the bone graft material.

Porous metal metaphyseal cones have added a new dimension to the treatment options for severe proximal tibial and distal femoral bone defects. These cones are designed for restoration of the proximal tibial and distal femoral metaphyseal regions for Type 2 and 3 defects. Porous metal cones have essentially eliminated the need for extensive bone grafting or structural allograft in revision knee arthroplasty. Advantages include the ability to provide mechanical support for the prosthetic component, provide the potential for long-term biologic fixation, decrease the complexity of the reconstruction, and avoid the issues of disease transmission association with bone graft material. Disadvantages include the short-term clinical experience, and the possibility of difficult extraction if removal is required.

Massive bone loss associated with revision knee replacement provides unique challenges, requiring proficiency in multiple techniques of bone loss treatment. The superiority of any one of these reconstructive techniques as compared with each other has not yet demonstrated.

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SYMPOSIUM VI

REVISION TKA TAKES A PLAN

How much Constraint is needed in Revision TKA

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The technical goals of revision TKA are restoration of mechanical alignment and rebalancing of the collateral ligaments. In most clinical situations, these two goals may be achieved successfully by standard total knee replacement resurfacing designs and revision implants that make use of unlinked constraint. However, many times collateral ligament balance may not be possible, due to interstitial change in the ligaments themselves secondary to prior procedures, injury or damage by failed implants. 95% of the cases can be treated by using a constrained, condylar design with a constrained polyethylene insert. Similar unlinked, rotating platform implants are also available for use.

Vince et al reported on failures of Constrained Condylar designs where internal, unlinked constraint failed due to global loss of soft tissue integrity. Mechanical failures included cold flow with deformation of the polyethylene post, breakage of the post and excessive wear. These cases require the use of linked, hinge designs that presently are bone conserving. Additionally, distal femoral and/or proximal tibial replacements are required in cases of severe bone destruction and total loss of collateral ligament integrity.

Noiles experience has been favorable as has been the experience of Barrack. These cases represent the worst case profile of revision total knee replacement. Nevertheless, the clinical results overall were acceptable. Newer rotating platform replacement designs have shown better wear characterized and longevity. Subsequently, the threshold for using these implants has been lowered. Nevertheless, the surgeon must first attempt to restore mechanical alignment and ligament balance before considering the use of linked constraint.

Surgical judgment must be utilized and every attempt must be made to use an unlinked construct. However, linked, rotating platform designs have been now successfully utilized in cases of complete collateral ligament destruction or absence.

SYMPOSIUM VI

REVISION TKA TAKES A PLAN

Management of the Deficient Patella in Revision TKA

Victor M. Goldberg, MD (Cleveland, OH), **Ryan Garcia, MD**, **Matthew Kraay, MD**

There are a number of options available to manage the patella when revising a failed knee replacement. If the patellar component is well fixed, undamaged, and compatible with the new components it may be retained. If the component is malpositioned, damaged, or loose with adequate remaining patellar bone an onlay cemented implant may be used. With as little as 5 mm of central bone remaining and peripheral support a biconvex patellar component is a satisfactory choice.

Severe patellar bone deficiency is a difficult problem, but the choices for treatment include patellectomy or patellar resection arthroplasty, with or without bone grafting. New technology uses a trabecular metal plate with a polyethylene patellar component that is apposed to remaining patellar bone and may be sutured to soft tissues for difficult revisions with extreme bone loss.

Whatever the selected approach to the patella revision a successful outcome requires proper patellar tracking and satisfactory anatomical relationships.

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SYMPOSIUM VII

COMPLICATIONS DO HAPPEN: HOW TO AVOID THEM AND WHAT TO DO

Wound Problems in Total Knee Arthroplasty

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Wound problems can sometimes be prevented: 1) existing longitudinal incisions (if neither too medial nor too lateral) should be re-used 2) prior transverse incisions (patellectomy and HTO) can be ignored and 3) amongst multiple scars, the most recently healed or the most lateral are preferred. The worst situations can be improved with soft tissue expanders or gastrocnemius flaps prior to arthroplasty. Hematoma and persistent drainage predict infection.[1] Poor nutritional status increases the risk of wound problems and infection[2], tourniquet pressures above 350 mm Hg decrease skin oxygenation[3], 24% oxygen by nasal cannula increase skin oxygenation[4] and surgical drains decrease the percentage of patients with serous wound drainage but increase the need for transfusion[5]. Allogenic transfusions have been associated with infection.[6]

Superficial wound problems should be distinguished from joint sepsis (which mandates different intervention) by aspiration before antibiotic therapy is initiated. Synovial fluid leukocyte concentrations in excess of 2,500 where more than 50% are polymorphonucleocytes are highly suggestive of infection.[7] Expeditious surgical attention to wound problems is generally recommended.[8]

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SYMPOSIUM VII

COMPLICATIONS DO HAPPEN: HOW TO AVOID THEM AND WHAT TO DO

Management of Extensor Mechanism Rupture

Aaron G. Rosenberg, MD, FACS (Chicago, IL)

Disruption of the extensor mechanism in TKA can be difficult to manage and is associated with a substantial rate of failure and associated complications^{1,2,3}. Disruption may occur by tubercle avulsion, patellar or quadriceps tendon rupture, or patella fracture. Whether occurring intra-operatively or post-operatively, bony failure can be treated with fracture fixation and soft tissue lesions with primary repair. This surgery is usually performed in compromised tissues, and repairs must frequently be protected with cerclage wiring and/or augmentation with local tendon (semi-tendinosis, gracilis) which may also be used for chronic tendon rupture.⁴

Patellar fracture should be treated on the basis of residual extensor mechanism function. Assuming no loss of component fixation, maintenance of active extension is a good sign that conservative therapy will yield better function than ORIF. Loss of extension (or component failure) indicates that surgery will be required. In this setting restoration of extensor continuity is more important than retention of the patellar component.²

Chronic failure is frequently complicated by tissue loss and retraction and several reconstructive options such as medial gastrocnemius flaps with tendon⁵, achilles⁶ and entire extensor mechanism allografts have been described. In this setting attention to fixing the graft in full extension is mandatory to prevent severe extensor lag as the graft will stretch out over time.⁷⁻¹⁰ An extensor mechanism allograft may also be indicated in the treatment of severe heterotopic ossification of the extensor mechanism, severe patella baja or conversion of a previous knee arthrodesis to a total knee.^{8,9,10}

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a,b,c,d,e-Zimmer; e-TissueLink

SYMPOSIUM VII

COMPLICATIONS DO HAPPEN: HOW TO AVOID THEM AND WHAT TO DO

Patella Mal-alignment: Why it Happens and What to Do

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Between 0.5% and 2% of all patients will exhibit some degree of symptomatic patellar instability after TKR with or without patellar resurfacing. A greater part of these cases are a result of surgical error and are, therefore, avoidable. Thus, when encountered at operation, the surgeon should meticulously examine the knee for a mistake or oversight in surgical technique including component malalignment. Intraoperatively, patellar tracking is assessed using the rule of “no thumbs” with the tourniquet released to avoid undo quadriceps tension. In spite of these measures, a lateral retinacular release or a mesh expansion may be needed.

When encountered postoperatively, patellar instability is evaluated initially by a thorough examination of the knee and radiographic work-up including an axial patellar view (standard axial or the Baldini-Sculco modification) and a CT scan.

The most common causes are related to the surgeon and include internal malrotation or medial placement of the femoral component, over sizing the femoral component, internal malrotation or medial placement of the tibial component, lateral placement of the patellar component, failure to restore the original patellar thickness with the patellar button-patellar bone construct, and asymmetric patellar resection

Other etiologies may be related to the implant design (shallow trochlear groove or lateral femoral flange, a fixed axis of rotation, or a rotationally unconstrained knee allowing lateralization of the tibial tubercle). Trauma, valgus alignment, patella alta, collateral instability, soft tissue imbalance (VMO weakness or a tight lateral retinaculum), a failed capsular repair, or a capsular defect are other causes of patellar instability.

Treatment is directed at the cause. Non-operative treatment, including quadriceps rehabilitation, bracing, and activity modifications yield poor results. Implant related problems generally require component revision. True cases of soft tissue imbalance (rare) are treated with proximal realignment (LRR or VMO advancement) or a distal realignment with a tibial tubercle transfer. In spite of attempts at surgical correction, recurrent patellar instability ranges between 0% and 29% of cases.

Of 8,531 cemented PCR TKR implanted between 1983 and 2003, patellar instability was one of the greater risk factors (2.8 times the risk) for loosening ($p=0.0094$); secondary only to obesity (6.3 X) and LRR (3.8 X).

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SYMPOSIUM VII

COMPLICATIONS DO HAPPEN: HOW TO AVOID THEM AND WHAT TO DO

Diagnosis of TKA infection: Current State of the Art

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Although total knee arthroplasty (TKA) is a very effective and successful procedure, the outcome is occasionally compromised by complications including periprosthetic joint infection (PJI). Currently, the diagnosis remains dependant on clinical judgment and reliance on standard clinical tests including serologic tests, analysis of aspirated joint fluid, and interpretation of intraoperative tissue and fluid test results.

Clinical and laboratory data on all revision TKA performed at three academic referral centers was prospectively collected and analyzed. There were 889 revision procedures performed over a 6 year time period, of which 197 were classified as infected. Gram stain had extremely low sensitivity but high positive predictive value in diagnosing infection. ESR and CRP combined had an accuracy of 96% in ruling out infection. The optimal cut-off values for fluid cell count and neutrophil differential is 1100 cells/ μ l and 64% respectively. Administering preoperative antibiotics did not affect the intraoperative culture results of patients with an isolated preoperative organism.

This multi-center prospective study has highlighted some important findings that may impact the ability of orthopedic surgeons in diagnosing periprosthetic joint infection.

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SYMPOSIUM VII

COMPLICATIONS DO HAPPEN: HOW TO AVOID THEM AND WHAT TO DO

Management of Periprosthetic Fractures

Robert T. Trousdale, MD (Rochester, MN), George J. Haidukewych, MD

The use of locked plating techniques for fracture fixation has enjoyed widespread popularity. Anatomically pre-contoured locked plates that allow fixation in various anatomic regions are currently widely available. Additionally, new technologies have become available that utilize subchondral support locking pegs, polyaxial bushings, and locking washers, to improve intraoperative versatility, however, limited data is available on the efficacy of these new implants, especially when used around TKA.

Although the clinical performance of locked plates have generally been good, several unique complications have been noted such as malalignment, fracture distraction, and loss of diaphyseal fixation, especially when percutaneous techniques and unicortical screws were used. Additionally, the expense of locked plate constructs is a concern, as this technology typically costs three times more than similar nonlocked constructs. This presentation will discuss indications, surgical technique, and outcomes of periprosthetic femur fractures treated with locking plates.

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SYMPOSIUM VII

COMPLICATIONS DO HAPPEN: HOW TO AVOID THEM AND WHAT TO DO

The Management of the Stiff TKA

William J. Maloney, III, MD (Stanford, CA)

Range of motion following total knee replacement is an important outcome measurement as it has a significant impact on the ability to perform activities of daily living. The stiff total knee is also often painful and thus patients often require a secondary procedure.

When evaluating a stiff knee, it is helpful to know if the patient was in a high-risk group for limited motion pre-operatively. The most important determinant of post-operative flexion is pre-operative flexion and those patients who have a pre-operative flexion of less than 90 degrees are more at risk for limited motion. Similarly, post-traumatic arthritis, young age and male gender have been associated with decreased post-operative flexion following total knee replacement.

Physical examination should include documentation of range of motion, as well as evaluation of patellar mobility. X Ray evaluation should be used to evaluate joint line position, tibial slope and patellar thickness. In addition, implant rotation should be assessed. This is difficult on plain radiographs and a CT scan can be utilized if necessary.

One then needs to make a diagnosis. Based on an understanding of the patient's pre-operative condition, the limited post-operative motion may simply be an expected outcome. In contrast, there may be arthrofibrosis and a technical problem may exist. In the case of arthrofibrosis, studies have demonstrated that with both cruciate retaining cruciate-substituting total knee designs, manipulation under anesthesia can significantly improve range of motion, specifically knee flexion. Knee manipulation requires adequate anesthesia. If the patient resists manipulation secondary to pain, it increases the risk of tendon rupture and femur fracture.

In the presence of chronic stiffness or in the case of implant malposition, reoperation may be necessary. We retrospectively reviewed 23 patients who had revision total knee replacement for limited knee motion and pain. At a mean of three years after the revision procedure, patients who had soft tissue releases with component retention and tibial insert down-sizing if possible improved their mean arc of motion 26 degrees, their mean clinical score 38 points and the mean functional score 21 points. Patients who at the time of surgery were felt to need component revision had a mean improvement in knee motion of 18 degrees, but very little change in clinical or functional score. In this series, patients who had a limited soft tissue approach fared relatively well and were happy with the procedure. In contrast those who had complete revision were less likely to improve as a whole. It is likely that other psychosocial factors such as chronic pain syndrome, depression and chronic narcotic usage may play a role in outcome of both primary knee replacement as well as revision surgery for limitation of motion and chronic pain.

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Goals and Objectives

The Knee Society/AAHKS 2008 Combined Specialty Day Meeting is designed to provide practicing orthopaedic surgeons with state-of-the-art information about the surgical applications and treatment protocols for the diagnosis and management of total knee replacement, and to enhance the care of patients with arthritis and degenerative diseases. Both free paper presentations and interactive symposia will be utilized.

Upon completion of this activity, participants will be able to:

- Update clinical skills and basic knowledge through research findings and biomechanical studies.
- Discuss the various surgical and non-surgical treatments and management of conditions related to the knee joint.
- Determine indications and complications in total knee arthroplasty.
- Critique presentations of surgical techniques and demonstrations of treatment options.
- Evaluate the efficacy of new treatment options through evidence-based data.

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Some pharmaceuticals and/or medical devices at the Interim Meeting have not been cleared by the U.S. Food and Drug Administration (FDA) or have been cleared by the FDA for specific purposes only. The FDA has stated that it is the responsibility of the physician to determine the FDA status of each pharmaceuticals and/or medical devices he or she wishes to use in clinical practice.

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