

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



Combined Specialty Day Meeting
Saturday, February 8, 2003

New Orleans Hilton Riverside Hotel
Grand Ballroom B
New Orleans, Louisiana

Scientific Program

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Future Combined Specialty Day Meetings

San Francisco, CA	March 13, 2004
Washington, DC	February 26, 2005
New Orleans, LA	March 11, 2006
San Diego, CA	February 17, 2007

<p>Abstract Application forms for the 2003 Knee Society Interim Meeting and the 2004 Combined Specialty Day Meeting are available for download on the Knee Society Website (http://www.kneesociety.org). Deadline for receipt of Abstracts is April 1, 2003.</p>
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**The Knee Society/AAHKS
Combined Specialty Day Meeting
Saturday, February 8, 2003**

8:00 AM	Welcome Robert E Booth, Jr., MD, Knee Society President Michael A Kelly, MD, Knee Society Education Committee Co-Chair Robert L Barrack, MD, Knee Society Education Committee Co-Chair Douglas A Dennis, MD, AAHKS President David Ayers, MD, AAHKS Educational Committee Chair
8:05-8:55 AM	SYMPOSIUM I: THE DIFFICULT PRIMARY KNEE Moderator: Chitranjan Ranawat, MD
8:05-8:15 AM	Severe Valgus or Varus Gerard Engh, MD*
8:15-8:25 AM	Recurvatum John Meding, MD*
8:25-8:35 AM	Flexion Contracture John Callaghan, MD*
8:35-8:45 AM	Extra-articular Deformity Russell Windsor, MD*
8:45-8:55 AM	Stiffness, Ankylosis Michael Kelly, MD*
8:55-9:10 AM	Discussion
9:10-10:00AM	SYMPOSIUM II: THE EXTENSOR MECHANISM IN TKA Moderator: Clifford Colwell, MD
9:10-9:20 AM	Patellar Resurfacing, Indications Douglas Dennis, MD
9:20-9:30 AM	Patellar Options in Revision Cecil Rorabeck, MD
9:30-9:40 AM	Patellar Fractures Michael Keating, MD*
9:40-9:50 AM	Extensor Mechanism Disruption Robert Barrack, MD*
9:50-10:00 AM	Post Patellectomy TKA Paul Lotke, MD*
10:00-10:10 AM	Discussion
10:10-10:30 AM	BREAK

(*) indicates something of value received from a commercial company or institution

10:30-11:30 AM	SYMPOSIUM III: VIDEO VIGNETTES: TECHNIQUES FOR THE INFECTED KNEE Moderator: Thomas Thornhill, MD
10:30-10:35 AM	Articulating Spacer Aaron Hofmann, MD
10:35-10:40AM	Spacer Block Arlen Hanssen, MD
10:40-10:45 AM	Molded Acrylic Spacer Thomas Fehring, MD*
10:45-10:50 AM	How to Resurface the Patella James Rand, MD*
10:50-10:55 AM	MCL Repair/Reconstruction Kenneth Krackow, MD
10:55-11:00 AM	Balancing the Revision Knee Leo Whiteside, MD*
11:00-11:05 AM	Determining Component Rotation Giles Scuderi, MD*
11:05-11:20 AM	Discussion
11:20 AM-12:30 PM	LUNCH BREAK (Knee Society Business Meeting - Members only)
12:30-12:45 PM	Presidential Address Robert E. Booth, Jr., MD
12:45 – 1:30 PM	The Knee Society Award Presentations
12:45-12:50 PM	MARK COVENTRY AWARD Introduction: David Lewallen, MD
12:50-12:57 PM	In Vivo Determination of Knee Kinematics: A Multicenter Analysis of Total Knee Arthroplasty Douglas A Dennis, MD*, <i>Denver, CO</i> , Dylan T Anderson, Richard D Komistek, PhD, Brian D Haas, MD
12:57-1:00 PM	Discussion
1:00-1:05 PM	CHITRANJAN RANAWAT AWARD Introduction: Thomas Sculco, MD
1:05-1:12 PM	Predicting Those at Risk for Greater Total Knee Replacement Pain: A Prospective, Observational Study Victoria A Brander, MD, <i>Chicago, IL</i> , S David Stulberg, MD, Angie Adams, BA
1:12-1:15 PM	Discussion
1:15-1:20 PM	JOHN INSALL AWARD Introduction: W. Norman Scott, MD
1:20-1:27 PM	Primary Total Knee Arthroplasty in Patients with Lymphedema M Wade Shrader, MD, <i>Rochester, MN</i> , Bernard F Morrey, MD
1:27-1:30 PM	Discussion
1:30-1:45 PM	Presentation of 2002 John Insall Fellows Introduction: W. Norman Scott, MD

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SCIENTIFIC PAPER PRESENTATIONS

Moderator: Merrill Ritter, MD*

Paper 1

1:45-1:51 PM

Analysis of Unicompartmental Knee Arthroplasty in a Community-Based Implant Registry

Terence J Gioe, MD, *St. Paul, MN*

1:52-1:55 PM

Discussion

Paper 2

1:56-2:02 PM

Extra-Articular Sources of Severe Component Wear in Cemented and Cementless TKA

Philip C. Noble, PhD, *Houston, TX*, Michael A. Conditt, PhD, Matthew T. Thompson, MS,

Jason A. Stein, MD, Stephan Kreuzer, MD, Brian S. Parsley, MD, Clifford W. Colwell, MD

2:03-2:06 PM

Discussion

Paper 3

2:07-2:13 PM

Limited Success in Acute Staphylococcus Infection After TKA Treated with Debridement and Retention of Components

Jess H Lonner, MD*, *Philadelphia, PA*, Paul A Lotke, MD, Robert E Booth Jr, MD

2:14-2:17 PM

Discussion

Paper 4

2:18-2:24 PM

Reoperations After 3200 Revision Total Knee Replacements:

Prevalence, Etiology and Lessons Learned

Rafael J. Sierra, MD, *Rochester, MN*, William P. Cooney, MD; Mark W. Pagnano, MD,

Robert T. Trousdale, MD, and James A. Rand, MD

2:25-2:28 PM

Discussion

Paper 5

2:29-2:35 PM

Surface Damage on Open Box PS Modular Polyethylene Tibial Inserts

Thomas P Schmalzried, MD*, *Los Angeles, CA*, Mauricio Silva, MD, C A Kabbash, MD, PhD,

J V Tiberi III, SH Park, PhD, O M Mahoney, MD, D T Reilly, MD

2:36-2:39 PM

Discussion

Paper 6

2:40-2:46 PM

Total Knee Arthroplasty for Neuropathic (Charcot) Joints

Javad Parvizi, MD, *Rochester, MN*. Jeffrey Marrs, MD, Bernard F Morrey, MD

2:47-2:50 PM

Discussion

2:50-3:09 PM

BREAK

3:10-4:55 PM

SYMPOSIUM IV: NEW TECHNIQUES AND CONCEPTS IN KNEE ARTHROPLASTY: THEORY VS. REALITY; POINT-COUNTERPOINT

Moderator: Richard Laskin, MD

3:16-3:28 PM

The Introduction of New Implants/Techniques

Peer Review Should be the Standard: A. Seth Greenwald, DPhil (Oxon)

The Public Deserves to Know Sooner: David Hungerford, MD

3:28-3:33 PM

Discussion

3:33-3:45 PM

Minimal Incision TKA

The Future of Knee Arthroplasty: Alfred Tria, MD*

Potential Concerns; Deleterious Effects: Robert Booth, MD*

3:45-3:50 PM

Discussion

3:50-4:02 PM

Image-Guided Surgery

Will Substantially Improve Results: S. David Stulberg, MD*

Technology over Reason: Lawrence Dorr, MD

4:02-4:07 PM

Discussion

(* indicates something of value received from a commercial company or institution)

4:07-4:19 PM	Optimizing Flexion after TKA <i>Significant Advances in TKA Design:</i> Harry Rubash, MD* <i>Design not Critical Factor may be Counterproductive:</i> Chitranjan Ranawat, MD*
4:19-4:24 PM	Discussion
4:24-4:36 PM	The Uni-Spacer <i>Technique and Early Results:</i> Richard H Hallock, MD* <i>Insufficient Data to Support Widespread Use:</i> Richard Scott, MD
4:36-4:41 PM	Discussion
4:41-5:00 PM	Discussion
5:00 PM	Adjourn

(*) indicates something of value received from a commercial company or institution

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



Scientific Presentation Abstracts

Symposium I: The Difficult Primary Knee

Severe Valgus or Varus

Gerard Engh, MD, *Alexandria, VA*

To perform a successful total knee arthroplasty in a patient with severe angular deformity, the surgeon must restore both kinematic balance and alignment to the knee. Load transfer through a correctly aligned and balanced knee optimizes knee motion and function. It also provides the best environment to minimize polyethylene wear.

Varus deformity is commonly managed by stripping the contracted deep and superficial medial collateral ligaments from their tibial attachment. An alternative is to section the medial collateral ligaments in their mid-substance while preserving the posterior oblique and posterior capsular structures for knee stability. A third option is to reposition the collateral ligaments with an epicondylar osteotomy. Additionally, the epicondylar osteotomy enhances exposure of the stiff knee and provides access to a contracted posterior capsule. Often a tight posterior cruciate ligament (PCL) contributes to varus deformity. The PCL can be balanced either at its femoral or tibial attachment, or by osteotomy of its insertion to the tibial plateau.

The management of valgus knee deformity is challenging as the asymmetric bone cuts necessary to correct the deformity aggravate the underlying ligament imbalance. Balanced bone cuts from the distal and posterior medial condyle preserve stability on the medial side. Releases on the lateral side usually include the lateral collateral, arcuate, and the iliotibial band. A laminar spreader can be used to tense and identify the tightest structure. To avoid knee instability in flexion, the popliteus tendon is preserved.

Symposium I: The Difficult Primary Knee

Recurvatum

John B. Meding, MD, *Mooreville, IN*

Genu recurvatum deformities are unusual prior to total knee arthroplasty. It may be associated with a severe osseous deformity, including genu valgum, capsular or ligamentous laxity, and, rarely, neuromuscular disease. In the presence of the latter, a plantar flexion contracture of the ankle may also be present. Specific attention should be given, pre-operatively, to evaluation of the quadriceps, hamstrings, and gastrocnemius complex.

Fifty-seven total knee arthroplasties were performed in fifty-three patients all having at least a five-degree hyperextension deformity pre-operatively. The average recurvatum measured eleven-degrees (range, five to twenty-degrees). A posterior cruciate-retaining prosthesis was used in all cases. Intra-operatively, the hyperextension deformity was corrected in all but one knee (98%). The tibiofemoral joint line was raised an average of only 0.6 mm with no measurable change seen in thirty-eight (66%) knees. At the most recent follow-up (average 4.5 years), Knee Society knee and pain scores improved from a pre-operative average of forty-one and thirteen, respectively, to a post-operative average of eighty-one and forty-three, respectively. Furthermore, only two knees (3.5%) had a hyperextension deformity (ten-degrees each). Both knees had five to ten mm of residual instability after implantation. Fifty-two (91%) knees achieved neutral extension.

In the absence of neuromuscular disease, hyperextension deformities tend not to recur after total knee arthroplasty. Care should be taken to avoid even mild degrees of residual instability in the coronal plane at surgery because this is associated with increased extension in the post-operative period. The etiology of the hyperextension deformity must be thoroughly elucidated before surgery.

Symposium I: The Difficult Primary Knee

Flexion Contracture

John J. Callaghan, MD, *Des Moines, IA*

Flexion contracture is inherent to the pathophysiology of osteoarthritis and inflammatory arthritis of the knee. Posterior osteophytes, posterior adhesive capsulitis, and contractures of the capsule, cruciate ligaments and hamstrings may be present. For minor deformities of less than 15 degrees, removal of osteophytes and release of the posterior capsule may be sufficient. For contractures of 15 to 30 degrees, additional femoral resection and posterior cruciate ligament resection may be necessary. For contracture of greater than 30 degrees, additional femoral resection and use of a more constraining device, even a rotating hinge, may be necessary. Controversy exists as to whether a knee flexion contracture of ten degrees or less at the time of component insertion will stretch out after surgery. This author tries to obtain full extension at the time of surgery. However avoidance of hyperextension is paramount especially with the use of PS designs to avoid cam-post impingement.

Postoperative knee flexion contractures can be treated by physical therapy including heel cord stretching, hamstring stretching and night splinting. More severe contractures can be treated by special extension braces or even cast bracing. If the patient continues to work on eliminating the contracture improvement for up to a year can occur. We recommend bracing rather than manipulation to avoid femoral fractures.

Symposium I: The Difficult Primary Knee

Extra-articular Deformity

Russell Windsor, MD, *New York, NY*

Symposium I: The Difficult Primary Knee

Stiffness, Ankylosis

Michael A. Kelly, MD, *New York, NY*

Surgical exposure of the stiff or ankylosed knee when performing a primary TKA may be quite challenging. Maintaining the integrity of the extensor mechanism is critical to the success of total knee arthroplasty. Careful pre-operative planning and surgical technique will help avoid associated complications in the knees.

Preoperative planning should include careful evaluation of the skin around the knee. Occasionally a plastic surgery consult will be necessary. Recent clinical success with soft tissue expanders in preventing skin problems has added this as a surgical option in these difficult knees.

Surgical exposure of the stiff knee utilizes a standard medial parapatellar arthrotomy. Surgical release of the fat pad contractures, possible early lateral retinacular release and proximal tibial subperiosteal exposure maintaining external rotation of the tibia are useful. It is imperative to protect the integrity of the patellar tendon insertion.

Insall described the use of the quadriceps snip in the exposure of more difficult knees. This involves extension of the standard medial parapatellar arthrotomy proximally to the apex of the rectus Femoris tendon and the obliquely lateral into the fibers of the Vastus Lateralis. The arthrotomy and proximal extension are closed in routine fashion requiring no change in postoperative rehabilitation. On rare occasions this will not be satisfactory. Surgical options include a modified V - Y quadriceps turndown. While this allows excellent exposure, a persistent extensor lag is often noted in these patients. Alternatively, a tibial tubercle osteotomy may be performed. My preference is to utilize the technique described by Whiteside using wire fixation. A subperiosteal reel may be necessary in exposing the ankylosed knee. The distal femur is skeletonized by subperiosteal dissection allowing the distal femur to buttonhole anteriorly. A more constrained prosthesis may be necessary in these cases.

Symposium II: The Extensor Mechanism in TKA

Patellar Resurfacing, Indications

Douglas Dennis, MD, *Denver, CO*, Ginger E. Holt, MD

Controversy still exists as to the ideal treatment of the patella in primary total knee arthroplasty performed for osteoarthritis. Opponents of resurfacing contend that the more physiologic, native patella has better clinical results, and when compared to resurfaced patellae, fewer complications. Proponents of patellar resurfacing argue that patients with resurfaced patellae have less pain, better function over time, and that improved surgical technique and component design have led to a decrease in complication rates. More recent prospective, randomized studies show reoperation rates to convert unresurfaced to resurfaced patellae exceeding those for complications following patellar resurfacing. Additionally, the incidence of residual patellofemoral pain following secondary resurfacing is substantially higher than when patellofemoral resurfacing is done primarily. When resurfacing the patella, strict surgical principles are paramount to avoid complications. These include duplication of original patellofemoral thickness, maintenance of intraosseous patellar blood supply, central patellar tracking, and proper positioning of the femoral and patellar components. When not resurfacing the patella, proper patient selection and prosthetic design are critical for successful results. Favorable patient selection criteria include those with noninflammatory arthropathy, good remaining articular cartilage, and central patellar tracking. Optimum prosthetic design features for an unresurfaced patella include an anatomic, asymmetric trochlear groove which is broad, extended (distally and posteriorly) and deeper as compared with first generation designs.

Symposium II: The Extensor Mechanism in TKA

Patellar Options in Revision

C.H. Rorabeck, MD, FRCSC, *London, ON, Canada*, R. Barrack, MD, G. Engh, MD

The patellofemoral articulation is frequently the last issue addressed in revision total knee arthroplasty. The patellar component is often revised, however, a well-fixed component may be left in place. A study was undertaken to objectively determine the results of revision TKA in cases where the patellar component is retained compared to those in which the patellar component is revised.

All cases of revision TKA performed over a two-year period were reviewed. Complete clinical and radiographic follow up was obtained in 111 of 123 knees (90%) averaging 36 months (range 24-36). Cases with prior patellectomy or patellar excision were excluded as were those with prior infection, leaving a study group 73 knees of which 34 knees had well-fixed components retained, while 39 had the patellar component revised. The femoral and tibial component were replaced with the same type of stemmed component. Patients completed a Knee Society Clinical Score (KSCS), SF36, and satisfaction questionnaire pre-operatively and at annual intervals post-operatively. Patients also completed a patellofemoral questionnaire regarding their degree of difficulty with stairs, squatting and kneeling, and getting in and out of a car. Indications for retaining a patellar component included solid fixation, normal or near normal tracking and no or minimal wear. Knees with a retained component were compared to those with a revised patellar component.

Preoperatively the two groups were virtually identical in KSCS as well as clinical and functional subscore. Post-operative KSCS were also indistinguishable between patients with a retained and revised patellar component (131 vs. 134, p=.6). There was also no difference in the clinical or functional subscores of the KSCS between the two groups or the post-operative range of motion. The incidence and severity of anterior knee pain was not significantly different between patients with patellar resurfacing versus patellar retention. The incidence and severity of difficulty with stairs, chairs, getting in and out of a car and squatting and kneeling also demonstrated no significant difference between the two groups. There was also no difference in the level of patient satisfaction with pain relief, return to daily activities, or the overall results of surgery between the two groups.

The method of patellar treatment during revision TKA is often not reported and the impact of the method of patellar treatment on the clinical result has not been well documented. Retaining a well fixed patellar component is an option that is a common practice. The results of this study indicate that the clinical outcome of retaining a well-fixed component is equivalent to revising a patellar component in terms of KSCS, ROM, patellofemoral symptoms and function, and patient satisfaction.

Symposium II: The Extensor Mechanism in TKA

Patellar Fractures

E. Michael Keating, MD, *Mooreville, IN*

We retrospectively reviewed 4,583 primary AGC total knee replacements performed at our institution between 1983 and 1996. We identified 177 fractures in 135 patients for a fracture incidence of 3.8%. Twenty-two fractures were vertical and had a stable implant and intact extension mechanism (Type 1). Twenty-one fractures had disruption of the extensor mechanism of less than one centimeter (Type 2A). Seventeen fractures had disruption of the extensor mechanism of one centimeter or more (Type 2B). One hundred fourteen fractures had a loose component and an intact extension mechanism (Type 3). Patients treated non-operatively generally had a good result with no extensor lag and adequate pain and function scores. Those treated operatively had a high complication rate. Four of nine patients treated with excision of an extruded patella button developed a deep infection. Both patients treated with ORIF developed a nonunion. Surgery on patients with patella fractures has a high complication rate and should be avoided if possible.

Symposium II: The Extensor Mechanism in TKA

Extensor Mechanism Disruption

Robert L. Barrack, MD, *New Orleans, LA*

Disruption of the extensor mechanism during or after total knee arthroplasty is among the most feared complications associated with this otherwise highly successful procedure. It is also the complication that has historically been associated with a high percentage of poor results. The appropriate treatment depends on the level at which the extensor mechanism is disrupted, the chronicity of the injury, and the general health and viability of the tissue. Quadriceps tendon disruption is the least common. Acute primary repair may be possible, but since these injuries most often occur in abnormal tissue, it is advisable to reinforce the repair and/or augment the repair with an Achilles tendon allograft. Patellar fractures are the most common site of extensor mechanism disruption and the primary determinant of treatment is whether there is a substantial functional deficit. If there is an extension lag of less than 15 degrees, non-operative treatment is generally indicated.

Patellar tendon rupture is the most difficult disruption to successfully treat consistently. Chronic tendon ruptures are the most difficult to treat and invariably require allograft substitution. If the quadriceps and patella have retracted extensively, Achilles tendon allograft with a calcaneal bone block is the best option. A quadriceps tendon-patella-patellar-tendon-tibial tubercle allograft is an option that retains the lever arm of the patella and is useful when the patient's patella is absent or insufficient. The results of these types of grafts have been variable. A number of technical and rehabilitation factors are important in consistently obtaining a successful result.

Symposium II: The Extensor Mechanism in TKA

Total Knee Arthroplasty After Patellectomy

Paul A. Lotke, MD, *Philadelphia, PA*, Charles L. Nelson, MD, Jane Kim

The patella is an important structure for the knee. It facilitates the increase of extensor mechanism forces and focuses the quadriceps muscle activity onto the tibia. In some cases, the patella may be absent prior to primary TKA or deficient in revision TKA. The purpose of this paper is to discuss the results of TKA without a patella and describe techniques to compensate for the loss.

There are few reports in the literature evaluating the results of TKA after patellectomy^{1,2,3}. These studies show diminished outcomes although satisfactory results might be attained if posterior cruciate substituting devices were utilized.

In revision total knee arthroplasty, insufficient patellar bone stock is a major concern. The standard approach to the problem is to perform a resection arthroplasty, balancing the remaining shell or fragments to tract centrally in the patellar groove^{4,5}. The results of patellar arthroplasty have shown diminished outcomes with reduced patient satisfaction and a higher incidence of persistent anterior knee pain.

A variety of techniques to substitute for patella loss in primary and revision procedures are evolving. The insertion of bone graft into the substance of the patella tendon during primary TKA⁶ has shown satisfactory results in six cases. In revision cases, morselized bone has been inserted into the patella shell; this remodeled bone graft has yielded positive results in nine cases⁷. Alternatively, a porous metal shell has been fixed to the remaining remnants of bone and a polyethylene button cemented onto the metal. In the eighteen cases reported, the porous metal shells have remained fixed and provided improved patient satisfaction⁸.

In summary, the patellar structure plays a crucial role in producing quality outcomes after TKA. In patients without a patella, the use of a posterior cruciate substituting arthroplasty can offer satisfactory results. In revision knees lacking sufficient patella bone stock, a resection arthroplasty can provide adequate results. However, these results may be improved with either bone graft or porous metal adjuncts.

1. Paletta and Laskin. JBJS, 1995
2. Martin et al. JBJS, 1995
3. Cameron et al. Can J. Surg, 1996
4. Pagnano et al. CORR, 1998
5. Barrack et al. CORR, 1998
6. Buschel. CORR, 1991
7. Hanssen. JBJS, 2001
8. Nelson et al. Orthop Trans, 2003

Symposium III: Video Vignettes: Techniques for the Infected Knee

10-Year Experience in the Treatment of Infected Total Knee Arthroplasty Using an Articulating Spacer

Aaron A. Hofmann, MD, *Salt Lake City, Utah*

Fifty consecutive patients with late infected total knee arthroplasty were treated by debridement and removal of all components and all cement, preserving collateral ligaments. At time of debridement, an articulating spacer was fashioned to allow partial weight bearing and knee range of motion during rehabilitation. This spacer was implanted using antibiotic impregnated bone cement. For this purpose, 4.8g of powdered Tobramycin was mixed with each 40 gram batch of Simplex cement. Cement was applied early to the components but applied late to the femur, tibia, and patella to allow molding to the defects and bone without adherence to bone. Patients received tailored intravenous antibiotic therapy for six weeks, in addition to this antibiotic impregnated cement, for treatment of a variety of gram positive and gram negative organisms. All patients underwent cemented revision total knee arthroplasty using antibiotic impregnated cement with standard cementing techniques employed. Range of motion prior to revision was 6° to 91°. Follow-up averaged 67 months (range, 14-150 months). Average Modified Hospital for Special Surgery knee score after revision was 89 (range, 70-100) with 92% good to excellent results excluding six patients requiring reoperation. Range of motion after reimplantation was 4° to 104°. There have been six failures in the study group; five recurrences due to infection, and one patient with poor post-op range of motion elected to have a fusion. Use of an articulating spacer in the treatment of infected total knee arthroplasty improves the ultimate range of motion and soft tissue health.

The FDA has not cleared the following drug for the use described in this presentation. The following drug is discussed for an off-label use: Nebcin (Tobramycin), Eli Lilly

Symposium III: Video Vignettes: Techniques for the Infected Knee

Static Knee Spacers for the Infected Knee Replacement

Arlen D. Hanssen, MD, *Rochester, MN*

Antibiotic-loaded cement (ABLC) spacers are commonly used for delivery of local antimicrobial agents and maintenance of collateral ligament length during treatment of the infected knee replacement. An initial concern was that the presence of foreign material such as bone cement would compromise the cure rate of infection. Based on the extensive clinical use of ABLC spacers, this concern has not been realized.

The use of ABLC spacers has evolved with loading of higher antibiotic dosages and creation of mobile spacers. Importantly, most ABLC studies have included relatively low dosage regimens of antibiotics whereas much higher dosages of antibiotics are now being used. The primary contraindication to the use of antibiotic-loaded cement spacers is the presence of a microorganism that is resistant to the antibiotics admixed with the bone cement.

Potential disadvantages of cement spacers include bone erosion and extensor mechanism compromise. The methods of spacer formation and limb immobilization seem directly related to the extent of bone loss observed. An additional difficulty associated with ABLC spacers is formation of granulation tissue that can be misinterpreted as infection at reimplantation by frozen histopathology. These phenomena appear to be more prevalent when using mobile spacers as compared with static spacers.

Although mobile spacers have facilitated ease of reimplantation, improvement of final functional outcomes has not been confirmed. Mobile spacers are particularly helpful for the patient who has had simultaneous removal of bilateral infected knee replacements. Severe bone loss is a relative contraindication to the use of mobile spacers, as these knee joints require immobilization during the resection time interval. In contrast, the molded arthrodesis ABLC block is well suited for the knee with severe bone loss.

The FDA has not cleared the following drug/medical device for the use described in this presentation. The following drug/medical device is discussed for an off-label use: Antibiotic-loaded cement

Symposium III: Video Vignettes: Techniques for the Infected Knee

Molded Acrylic Spacer

Thomas K. Fehring, MD, *Charlotte, NC*

Antibiotic-laden spacers are used frequently to treat the infected total knee. Static spacer blocks make exposure and reimplantation difficult secondary to tissue adherence and quadriceps shortening. Unexpected bone loss attributable to migration of spacer blocks also has been reported. To avoid these problems, a temporary articulating molded implant made of antibiotic cement has been used at our center since 1996 to treat infected total knee arthroplasties in a staged fashion.

After implant removal, complete synovectomy, and copious irrigation, intramedullary antibiotic impregnated rods are placed in the tibial and femoral canals. A mold made of antibiotic impregnated cement is then used to fashion a femoral component. A flat tibial component is made to articulate with the molded femoral component. After placement of these molded spacers, the patient is immobilized for approximately ten days. Patients are then instructed to do range of motion exercises three times a day while remaining touchdown weight bearing until reimplantation. These temporary implants impart stability to the joint and act as a depot for antibiotic delivery while allowing range of motion between stages.

In addition to allowing range of motion and prevention of quadriceps scarring, this technique greatly facilitates exposure at the time of reimplantation compared to static techniques. Unexpected bone loss between stages that we encountered frequently when using static spacers is no longer a concern in our revision practice. Our reinfection rate with this technique has remained similar to our results previously reported with static spacers. Molded acrylic spacers that allow range of motion between stages are a simple, effective method to treat the infected total knee.

Symposium III: Video Vignettes: Techniques for the Infected Knee

How to Resurface the Patella at Reimplantation of TKA

J.A. Rand, MD, *Scottsdale, AZ*

Management of the patella at the time of reimplantation of a TKA will be determined by the amount of bone remaining, integrity of the patella, vascularity, the location of the joint line, and soft tissue coverage for wound closure. Other options that should be considered are patelloplasty, bone graft with soft tissue interposition, and patellectomy. A minimum of 10-12 mm of remaining bone must exist to resurface the patella without fracture. Therefore, the ultimate ability to resurface the patella will be dependent upon the preservation of bone at the time of resection arthroplasty. Patellar implant removal is best accomplished with an oscillating saw and a small high-speed burr. At reimplantation, a flat reamer should be used to freshen the patellar bone surface while minimizing additional bone loss. Cancellous allograft is used to fill bone defects. An onlay or inset patella may be used placing fixation pegs away from old bone defects. If the joint line has been restored by an augmented femoral component, the patella should not contact the tibial component through at least 90 degrees of knee flexion. Patellar tracking is assessed, if necessary, a lateral release is performed.

Symposium III: Video Vignettes: Techniques for the Infected Knee

MCL Repair and Reconstruction

Kenneth A. Krackow, MD, *Buffalo, NY*

Most likely MCL laceration during TKR is more common than initially recognized. Almost every one of the seven or eight times it has happened in our operating room, it was not only initially unappreciated, but it was necessary to convince others at the table, sometimes with extra dissection and more direct and extended exposure of the MCL, that this had occurred. This situation seems to derive from the fact that the medial instability is not apparent when the knee is examined in absolute, full extension.

The signs of this event are the sudden ease of delivering the tibia forward together with an apparent external rotation of the tibia while working in flexion. The setting is a tight varus knee, typically with over hanging femoral and tibial osteophytes medially. The laceration can occur with failure of adequate retraction during sawing at the tibial cut or the posterior femur, or with earlier dissection around the tibial osteophyte in particular. If one fails to get an elevator or retractor cleanly under the MCL, just below the osteophyte, and is then superficial to the MCL at this point, as you come up to the osteophyte, you cut the ligament.

Based on personal experience and awareness of others' actions, it is tempting to think of repairing this injury. However, one must recall the setting and realize that adequate reapproximation and sustentation of deformity correction are probably mutually exclusive.

The technique shown in this presentation for managing this occurrence is a semitendinosis transfer tenodesis. The initial exposure may require a bit of extension distally followed by a proximally directed but basically transverse incision over the upper border of the pes anserine tendons. The tendon group is retracted peripherally and distal medially until one can get to the deep surface of the semitendinosis tendon. A tendon stripper is placed around it and the tendon is delivered into the wound still attached distally at the medial tibial metaphysis.

The main issue is the control of the flexion space, because, again, the knee at or toward full extension is usually adequately stabilized by other secondary posterior structures. Therefore we seek to insert the semitendinosis at a point that will be relatively tight in flexion. This typically means a location just above or anterior to the medial epicondyle or the presumed center of curvature of the femoral component.

A 3/16" (4.5mm) hole is made at this point, directed either straight lateral or somewhat proximal-lateral. The end of the tendon is enclosed in what I refer to as a "home-made Chinese finger-trap", (ref. 2nd Chapter of Campbell's Operative Orthopaedics, pub. CV; Mosby, St Louis, USA, 9th ed. By S. Terry Canale, Jan 1998; and Krackow, KA and Cohn B: JBJS Am, Jul 1987, v. 69(#6):922-4). The tails of this tendon passer are directed thru the drill hole and the tendon is easily pulled thru the bone.

At the completion of prosthesis placement, the tendon is either itself stapled in place to adjacent bone, or the tails of the finger-trap tendon passer are secured to the bone by tying to a staple or screw. There is no alteration of after care.

We have not seen radiographic or symptomatic instability in any of the more than seven cases treated this way. Admittedly we do not have a control group to compare against. At this point, though, I am not willing to omit this adjunctive treatment. It is not difficult to perform and only adds approximately 15 minutes to the case, if the technique is known ahead of time.

Symposium III: Video Vignettes: Techniques for the Infected Knee

Balancing the Revision Knee

Leo Whiteside, MD, *St. Louis, MO*

Positioning of the joint line is achieved by choosing the thickness of the distal portion of the femur. Tensioning of the knee ligaments is achieved by adjusting the thickness of the tibial component. A simple way to handle this ligament balance and joint position problem is to reconstruct the bone stock, saving as much bone as possible in the distal femur and proximal tibia, and then to insert the femoral trial component with the thickest available distal surface. A plastic tibial trial component with enough thickness to stabilize the knee at 90° flexion is inserted, and then the knee is straightened. If the knee extends fully and stops, the femoral component thickness is correct. If full extension cannot be achieved, less distal femoral thickness is required.

If the knee is stable in flexion but unstable in extension or hyperextends, then a thicker tibial component should be used to stabilize the knee in extension, and the knee should be accepted as tight in flexion. This is a rare combination of events because distal femoral bone loss usually is adequately replaced by the distal femoral buildup. The other alternative is to lower the joint line further by using massive block allografting techniques on the distal femur to replace lost bone stock. This creates a tenuous long-term situation and rarely is necessary.

The FDA has not cleared the following drug/medical device for the use described in this presentation. The following drug/medical device is discussed for an off-label use: Profix TKR, cementless technique

Symposium III: Video Vignettes: Techniques for the Infected Knee

Determining Component Rotation

Giles R. Scuderi, MD, *New York, NY*

The importance of axial alignment in total knee arthroplasty has been well recognized. This is achieved by appropriate ligament releases and bone resection, which create equal and symmetrical flexion and extension spaces. While the extension space imparts the intended valgus alignment of the knee, a symmetrical flexion space implies parallelism between the resected tibia and the resected posterior femoral condyles and is influenced by the rotational position of the femoral component.

At least four ways have been proposed to determine the proper rotational alignment of the femoral component during total knee arthroplasty: the transepicondylar axis; the antero-posterior trochlear line; 3 degrees of external rotation based off the posterior condyles; and the amount of external rotation necessary to form a symmetrical flexion space after ligament balance is complete. Discrepancies in the latter three have led to utilization of the transepicondylar axis for setting femoral component rotation.

Use of the transepicondylar axis for femoral component rotation is logical because it approximates the true flexion axis of the knee and is not defined by the articular surface, which may be involved in the arthritic process. When the tibia is resected at right angles to the mechanical axis and the soft tissues are balanced, the transepicondylar axis parallels the resected tibial surface. Along with the axial alignment, femoral component rotation influences knee function. Malrotation of the femoral component may lead to patellofemoral instability, wear or loosening of the femoral component, or patellar fracture. Internal rotation of the femoral component will increase stresses on the tibial component leading to wear or loosening.

The Knee Society Award Presentations

JOHN INSALL AWARD

Primary Total Knee Arthroplasty in Patients with Lymphedema

M Wade Shrader, MD, *Rochester, MN*, Bernard F Morrey, MD

Lymphedema is a relatively common disorder; wound and vascular complications after orthopedic surgery are assumed, but not previously shown, to be higher in this population. We reviewed the outcome and complications of knee arthroplasty in patients with lymphedema, documented by physical exam at their preoperative medical assessment. This was a retrospective analysis of prospectively collected data compiled on all knee arthroplasty patients at our institution. Eighty-three knees were implanted in sixty-three patients. Patients were followed for a minimum of two years, with a mean follow-up of 58 months (range, 24-228). No patients were lost to follow up. We noted significant improvement ($p < 0.0001$) in the Knee Society score from a preoperative mean of 47 (range, 16-75) to a postoperative mean of 87 (range, 53-100). The knee functional score also improved significantly ($p < 0.0001$) from a preoperative mean of 36 (range, 0-80), to a postoperative mean of 59 (range, 0-100). The total complication rate was 31%, with ten superficial wound infections (12%), six deep infections (7%), and three deep venous thromboses (3.6%). We conclude that although knee arthroplasty can be successful in reducing pain and improving function in lymphedema patients, the complication rate is greater than that seen in patients without this diagnosis.

MARK COVENTRY AWARD

In Vivo Determination of Knee Kinematics:

A Multicenter Analysis of Total Knee Arthroplasty

Douglas A. Dennis, MD, *Denver, CO*, Richard D. Komistek, PhD; Mohamed R. Mahfouz, PhD; Brian D. Haas, MD; James B. Stiehl, MD

INTRODUCTION: The objective of the present study was to conduct a comparative analysis of the kinematic data derived for all subjects having a TKA who were analyzed over the past eight years at our laboratory.

METHODS: Femorotibial contact positions for 811 knees, 791 implanted with either fixed bearing or mobile bearing TKA were analyzed. **RESULTS:** During a deep knee bend, subjects having a fixed bearing PS TKA experienced, on average, -3.7 and -1.0 mm of lateral and medial condyle posterior femoral rollback (PFR), respectively from full extension to 90° flexion. Sixty-nine percent of the PS TKA analyzed demonstrated a medial pivot motion. Subjects having a fixed bearing PCR TKA, on average, experienced only -1.6 mm of lateral condyle PFR and an anterior slide of 1.0 mm for the medial condyle. Fifty-three percent of PCR demonstrated a medial pivot motion pattern.

DISCUSSION: Subjects implanted with a PS mobile bearing TKA experienced kinematic patterns similar to fixed bearing PS TKA. Similarly, mobile bearing PCR TKA experienced kinematic patterns more similar to fixed bearing PCR TKA. Subjects having either a fixed or mobile bearing PCR TKA experienced a greater incidence and magnitude of a paradoxical anterior femoral translation of both their medial and lateral condyles. Subjects having a PS TKA, fixed or mobile, appeared to experience a levering effect once the cam and post engaged, forcing the lateral condyle posteriorly as the medial condyle is levered anteriorly. During gait, subjects having a mobile bearing TKA experienced minimal anteroposterior motion.

CHITRANJAN RANAWAT AWARD

Predicting Those at Risk for Greater Total Knee Replacement Pain: A Prospective, Observational Study

Victoria A Brander, MD, *Chicago, IL*, S David Stulberg, MD, Angie Adams, BA

To identify factors predicting unusual pain after total knee arthroplasty (TKA), we used a prospective, observational study design to assess clinical and radiographic variables preoperatively and 1, 3, 6, and 12 months postoperatively. Data sources included the Visual Analog Scale (VAS) and other measures of patient health and component reliability. Pearson's correlation coefficient was determined to evaluate the relationship between predictive factors and postoperative pain. For 116 patients (149 knees; mean age, 66 years; 55.2% women), VAS (SD) values at the preoperative and four postoperative assessments were 52.6 (24.4), 36.8 (21.8), 25.4 (21.3), 20.5 (20.1), and 16.6 (21.0), respectively. Significant pain (VAS >40) was reported by 72.3%, 44.4%, 22.6%, 18.4%, and 13.1%, respectively. No group differences existed for anesthesia, weight, age, or gender. Preoperative depression ($p=.001$) and anxiety ($p=.000$) predicted more pain at 12-month follow-up. Patients with greater preoperative pain used more home and outpatient physical therapy ($p=.025$) and postoperative manipulations, despite similar flexion preoperatively. Many patients have significant pain up to 6 months after TKA despite an absence of clinical or radiographic abnormalities, which may indicate an abnormal experience. Development of office-based preoperative screening tools and interventions for these patients may reduce postoperative costs and improve patient-perceived outcomes.

Paper #1

Analysis of Unicompartmental Knee Arthroplasty in a Community-Based Implant Registry

Terence J Gioe, MD, *St. Paul, MN*

A registry of implant and explant information, cost data, patient demographics, and reason for revision is maintained by a multi-hospital system. All unicompartmental knee arthroplasties (UKA) performed since 9/91 were followed prospectively to 1/31/02 to assess survival and reason for revision within that time period. 516 UKAs were done; 474 (91.9%) were medial compartment and 42 (8.1%) lateral compartment. UKAs from nine different manufacturers were utilized by 23 surgeons. During this period, 39 of the 516 UKAs were revised. Mean time to first revision was 3.67 years. The major reasons for revision of UKAs were progression of arthritis in the uninvolved compartments (51.3%), aseptic loosening (25.6%), and poly wear (20.5%). Kaplan-Meier survival analysis with revision as the endpoint revealed survival of 92.6% [90.0%, 95.2%] at five years for these UKAs and 88.6% [85.0%, 92.2%] at 10 years, compared to 94.8% [93.5%, 96.0%] at 10 years for primary total knees. Most previously reported UKA survival studies are from single-physician practices or academic institutions, and may not reflect the results obtained in community practice, with different surgeons, varying indications, and numerous designs. This study demonstrates that revision of UKA is most commonly performed for progression of arthritis in the contralateral compartment, and at a higher rate than revision of primary cemented TKA.

Paper #2

Extra-Articular Sources of Severe Component Wear in Cemented and Cementless TKA

Philip C. Noble, PhD, *Houston, TX*, Michael A. Conditt, PhD, Matthew T. Thompson, MS,
Jason A. Stein, MD, Stephan Kreuzer, MD, Brian S. Parsley, MD, Clifford W. Colwell, MD

Polyethylene wear debris in TKA arises from several sources, including the tibiofemoral articulation and the interface between the backside surface of the tibial insert and the metal tibial tray. In this study we examined a seldom recognized source of polyethylene damage resulting in gouging, abrasion and severe localized damage in cemented and cementless total knee replacement. Significant abrasive wear was observed in 32% of the retrievals with cemented femoral components and 9% from non-cemented components. The average area of damage for each individual abrasive scar was $78 \pm 11 \text{mm}^2$. Within the group of worn inserts, abrasive scars were seen with a frequency of 70% on the extreme medial edge, 16% on the extreme lateral edge, 30% on the posterior-medial edge and 19% on the posterior-lateral edge. This confirms that acrylic cement, even in bulk form, often contributes to severe damage of the tibial surface. Improvements to instruments and cementing techniques are needed to prevent this form of articular damage in vivo.

Paper #3

Limited Success in Acute Staphylococcus Infection After TKA Treated with Debridement and Retention of Components

Jess H Lonner, MD, *Philadelphia, PA*, Paul A Lotke, MD, Robert E Booth Jr, MD

Thirty-one total knee arthroplasties with acute gram-positive infections, seen at our institution over a ten-year period, were treated with open debridement and component retention. The index procedure was a primary arthroplasty in twenty-two patients, and revision arthroplasty in nine. The average time from index arthroplasty to debridement was 2 years (range, 16 days-7 years). The average duration of symptoms before debridement was 9 days (range, 1-40 days). Seven infections occurred within 4-6 weeks of surgery; the remainder were late, but acute hematogenous infections. All patients received appropriately directed intravenous antibiotics for six weeks. Eleven (35%) of the thirty-one patients successfully retained their components at most recent follow-up, without ongoing infection (mean, 4 years; range, 2-10 years). Only one (8%) of the thirteen patients infected with *S. aureus* were successfully treated, compared to ten (56%) of eighteen patients with either *S. epidermidis* or a streptococcal species. The difference between these groups is statistically significant ($p = 0.007$). The success rate of debridement with component retention for the treatment of acute infections in knee arthroplasty varies significantly depending on the involved pathogen. The high failure rate of debridement and component retention suggests that immediate component removal should be considered in the presence of acute *S. aureus* infection in total knee arthroplasty.

Paper #4

Reoperations After 3200 Revision Total Knee Replacements: Prevalence, Etiology and Lessons Learned

Rafael J. Sierra, MD, *Rochester, MN*; William P. Cooney, MD; Mark W. Pagnano, MD; Robert T. Trousdale, MD, and James A. Rand, MD

The purpose of this study was to evaluate the prevalence, etiology, and evolution over time of reoperations done after revision total knee replacement. From 1970-2000, 3251 total knee revisions were done at our institution. After excluding knees done with non-condylar designs, previously infected joints and knees with previous revisions done elsewhere, 1893 knee revisions were done at our institution. Two hundred eighty-seven knees (15.1%) subsequently have been re-operated on one or more times. The average time from revision total knee arthroplasty to the first reoperation was 3.1 years (range one day to 20 years). The total number of reoperations was 392 with 221 knees were reoperated on once, 49 knees on twice, seven knees three times, five knees four times, and five knees five or more times.

The most common reoperations included 91 revision of components for aseptic loosening, 99 debridement for infections with resection of one or more components occurring in 47 knees. From the 1970s to the 1990s, the prevalence of reoperations has remained unchanged at 15%. Removal of all components for aseptic reasons and resection arthroplasties after revision total knee arthroplasty decreased from 7.5% to 2.4% and 3.1 to 1.6%, respectively. The prevalence of reoperation in this large series of first time revision total knee arthroplasty done for aseptic reasons was surprisingly high. Despite substantial improvements over the past three decades in component design, surgical technique and in the prevention of infection, patients who have a revision total knee arthroplasty are at substantial risk of developing one or more subsequent problems that result in a reoperation.

Paper #5

Surface Damage on Open Box PS Modular Polyethylene Tibial Inserts

Thomas P. Schmalzried, MD, *Los Angeles, CA*, Mauricio Silva, MD, C. A. Kabbash, MD, PhD, J. V. Tiberi III, S.H. Park, PhD, O. M. Mahoney, MD, D. T. Reilly, MD

Introduction: Wear and other damage on tibial polyethylene inserts of posterior-stabilized (PS) TKRs have been implicated in loosening and osteolysis. What types of damage occur on the post of a design with an open femoral box and how may this influence clinical performance?

Methods: Radiographic and optical light microscopic analyses were performed on 20 cases with modular polyethylene PS TKR components (Scorpio, Osteonics, Allendale, NJ) implanted for a mean of 20.2 months (2 days to 42 months).

Results: Ten knees were revised for aseptic loosening of the tibial component. The average post-operative anatomic axis of these cases was 0.5° (-3° to 4° valgus). The post-operative anatomic axis for the non-loose cases averaged 5° (1° to 9° valgus) ($p=0.003$). Damage to the anterior aspect of the tibial post, as would be caused by impingement of the femoral component with hyperextension, was present on 11/20 components. The average tibial slope of the group with hyperextension marks (HEM) was 7.9° and the average tibial slope of inserts without HEM was 4.6° ($p=0.05$). Combining femoral flexion and tibial slope, the group with HEM had an average of 10.6° and the group without HEM had an average of 6.4° ($p=0.06$). HEM were present in 5/11 loose implants and 6/9 non-loose components ($p=0.4$). *Coarse* abrasions of the side walls of the post were present in 16 cases. The damage score on the lateral side was 2.2 times higher than that from the medial side ($p=0.03$). The damage score for abrasion on the post of loose components was 32% higher than that of non-loose components. The post demonstrated five times more abrasion than the tibiofemoral surface ($p=0.0002$). Considering the whole insert, abrasion accounted for only 6.5% of the total damage score. Damage to the backside accounted for only 0.8% of the total damage score. Small amounts of cement (2-3mm) overriding the notch region were present on 5 of 8 retrieved femoral components. No evidence of rotational motion between the polyethylene component and the metallic tibial tray was observed.

Discussion and Conclusion: With this open box design, damage to anterior aspect of the PS post from femoral component impingement occurred in 11 of 20 cases and was related to the sagittal component positioning. Impingement is less likely with less tibial slope and no femoral flexion. Unique coarse abrasions occurred in 16 of 20 cases and were associated with cement extrusion into the open box and varus malalignment. These observations provide guidance for optimizing both the surgical technique and the design of PS total knee components.

Paper #6

Total Knee Arthroplasty for Neuropathic (Charcot) Joints

Javad Parvizi, MD, *Rochester, MN*. Jeffrey Marrs, MD, Bernard F Morrey, MD

The clinical and radiographic results of 40 modern design condylar total knee arthroplasty in 29 patients with confirmed diagnosis of Charcot joint were reviewed. Follow-up averaged 7.9 years (range, two to 15 years) for clinical and 6.4 years (range, two to 15) for radiographic surveillance. There was a significant improvement in Knee Society pain and function scores and range of motion following knee arthroplasty. Extensive bone fragmentation and bone defect was present in 38 knees (95%). Metal wedge augments (ten), autologous bone grafting (17), and bone allografts (two) were used to reinforce the bony defects. Ligamentous instability necessitated the use of long stem components in 27 knees, and rotating hinge prosthesis in five knees. There were six reoperations for periprosthetic fracture (two), aseptic loosening (two), instability (one), and deep infection (one). Total knee arthroplasty may be offered to a select group of patients with end-stage neuropathic arthropathy. The basic principles of knee arthroplasty in restoring limb alignment, reinforcing bony defects by bone grafting or augmented prosthesis, careful ligamentous balancing, and appropriate selection of constrained prosthesis is particularly important in these patients. The technical challenges encountered during total knee arthroplasty in patients with neuropathic arthropathy, particularly in those with significant deformities, can require skills, implant systems and methods usually reserved for complex revision arthroplasty.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

The Introduction of New Implants/Techniques

Peer Review Should be the Standard

A. Seth Greenwald, DPhil (Oxon), Cleveland, OH

The public's access to innovative surgical developments, promising direct patient benefit with little evidence to support the claims, presents a challenge to the current process of peer review. The careful documentation of patient outcome assigned by a jury of one's peers has, in the main, proved beneficial although time consuming and often frustrating in its conduct. Its critics would argue that at its extreme the process is moribund and inhibits advancement often driving it to other countries. However, simply letting the marketplace decide what works and what doesn't, although a solution in mercantile commerce, potentially renders the patient the loser. The continually increasing corporate cost of product innovation, the need to differentiate one's clinical practice and one's hospital has led to a dramatic shift towards direct patient/consumer marketing. This process skirts a Rubicon between clinical realities of safety and efficacy and flights of fancy where unmet patient expectations provide little comfort.

The public's right to know is a cornerstone of our democratic process and should not be denied. However, it is the practitioner's ethical and technical responsibility to determine whether or not the actual application of these medical advances is in the best interest of the patient. The peer review process, as we know it, is well suited in this regard. It is not limited to a descriptive journal article vetted by a jury of one's peers, but is inclusive of institutional review, regulatory determination, ultimate reimbursement for such advances and the moral suasion of one's professional body.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

The Introduction of New Implants/Techniques: The Public Deserves to Know Sooner

David Hungerford, MD, *Baltimore, MD*

This debate is about whether the current controls of introduction of ‘new’ into the orthopaedic mainstream, and hence into the public domain, is sufficient or not. My opponent is arguing for a new standard, i.e. peer review publication as a prerequisite for “going public” with innovations in orthopaedics. The current restrictions include the current IDE regulations of the FDA, introduced in 1979 and fully implemented in 1980, the malpractice environment, and the Medical Board of Quality Assurance, or whatever name that organization has in a particular state. These are sufficient impediments to the introduction of truly radical and dangerous ‘new’ practices or implants.

After 23 years of the status quo, why is this a hot issue today. We are in an environment of marketing directly to the public. Drug companies are doing it “Ask your doctor if Viagra is right for you.” Implant companies are doing it. Hospitals are doing it. And now practices and even individual doctors are doing it. Many physicians are opposed to it, but it is the reality of the present. In this environment, “minimally invasive” has become a byword: minimally invasive tkr, tkr, uni-tkr and the Uni-Spacer. The latter is a 510-K approved modification of the MacIntosh prostheses. None of these, though ‘marketed’ to the public has been the subject of a peer-reviewed publication.

There are three problems with the proposed requirement of peer-reviewed publication prior to release of public information. 1. What qualifies as peer-review? 2. Who controls and enforces the regulation? And 3. What are the sanctions? I believe that such a requirement is unnecessary, unwieldy, unfair and unworkable. In addition, the public deserves to know sooner.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Minimal Incision: The Future of Knee Arthroplasty

Alfred Tria, MD, *Somerset, NJ*

Total knee arthroplasty has evolved over the past 30 years to a well defined technical surgery with excellent results out to 20 years of follow-up. The concepts of exposure, ligament balancing, and joint alignment have been clearly established by John Insall and others. In the early 1990's, John Repicci introduced minimally invasive surgery (MIS) for unicondylar knee arthroplasty. This approach suggested that less invasive surgery could accomplish similar results to those of standard unicondylar knee arthroplasty. Early reports in the literature do support these conclusions. It was only logical that the MIS approach would eventually be applied to total knee arthroplasty. It is extremely important to establish a clear definition of the MIS surgery and then to follow the results. The authors have completed 70 MIS total knee arthroplasties over the past nine months with early results that indicate less intra operative blood loss, shorter length of stay, increased range of motion, with similar implant accuracy to standard total knee arthroplasty. These new procedures will require thorough evaluation as with any new clinical endeavor. It is also of paramount importance to remember that the main goal of any new technology is to advance the science of medicine without compromising the ultimate result for the patient. The early findings are encouraging for the future of MIS total knee arthroplasty and the authors hope to improve the technology over the next few years.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Minimal Incision : Potential Concerns; Deleterious Effects

Robert Booth, MD, *Philadelphia, PA*

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Image-Guided Surgery Will Substantially Improve Results

S. David Stulberg, MD, *Chicago, IL*

A number of factors are related to the successful outcome of a Total Knee Replacement. These include: 1. Proper patient selection; 2. correct implant selection and design; 3. surgical technique, and 4. appropriate peri-operative management. Of these, surgical technique is acknowledged to be the most critical. The consequences of performing a TKR inaccurately are: 1. more rapid implant loosening and wear, and 2. suboptimal clinical function. Although mechanical alignment systems have substantially improved the reliability of outcomes of TKR, errors in alignment and soft-tissue balancing continue to occur, even when the procedures are done by experienced surgeons. Computer guided TKR surgical systems have been developed to overcome the inherent deficiencies in mechanical systems.

A number of outcomes can be affected by the use of computer-assisted TKA. These include:

1. increased accuracy and reliability of implant and limb alignment;
2. reduced surgical morbidity;
3. improved clinical function, and
4. prolonged implant survival.

Over 10,000 TKRs have been performed in Europe using computer-assisted TKR systems. Results of this experience show that: 1. TKRs are performed more accurately and reliably when computer-assisted systems are used; 2. minimally invasive TKRs are made feasible and are more accurately performed when computer-assisted systems are used, and 3. the accuracy with which each step of the TKR procedure is performed is greater when computer-assisted systems are used.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Image-Guided Surgery: Technology over Reason

Lawrence D. Dorr, MD, *Los Angeles, CA*

The only reason for use of navigation guides in total knee replacement surgery is to guarantee reproducible positioning and orientation of implants combined with stable soft tissue balance. Furthermore, to be clinically relevant, this technology must provide clinical outcomes that are better and cost effective. Finally, the technology must be simple to use and not require imaging other than that done intraoperatively. Presently, what real clinical problems does this technology solve for the experienced high-volume surgeon? Are the outcomes better for this surgeon? How does the low volume surgeon (who may benefit most) afford the technology? Hospitals will pay for it only when outcomes analysis and cost benefit analysis validate the usefulness and a reduction in complications such as postoperative stiffness, instability, and patellar subluxation. Surgeons will not use this technology until the clinical application proves that it provides a satisfactory solution to intraoperative problems that present guides, combined with surgical judgment, do not easily overcome. Until then, this technology will be a measurement tool used by researchers to evaluate and validate surgical techniques.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Optimizing Flexion after TKA: Significant Advances in TKA Design

Peter Sultan MD, Guon Li, PhD, Ephrat Most, MS, Harry E Rubash MD, *Boston, MA*

Total knee arthroplasty (TKA) is a reliable and widely used surgical procedure capable of providing long-term success rates in excess of 85% at 10-15 year follow-up. In general, the clinical results with most modern TKA designs are highly satisfactory with regard to pain relief and improving walking ability. However, one problem that has not been fully addressed by current designs is the ability to consistently achieve flexion of greater than 120°. Although the human knee is capable of flexion of up to 150°, an analysis of the results of contemporary TKA reveals that on average, patients rarely flex beyond 120°. The factors associated with range of flexion following TKA have proven to be multifactorial and encompass pre-operative, intra-operative, and post-operative factors as well as implant design.

The success of any total knee system may in part be linked to its ability to optimally restore normal kinematic function. Currently, at our laboratory, an in-vitro experimental model incorporating robotics is being used to investigate the kinematics of the native knee throughout a complete range of motion as well as the ability of various TKA designs to restore intact, native knee kinematics at flexion angles of up to 150°.

Ultimately, this robotic model in conjunction with clinical studies may provide an understanding of the ligamentous and osseous limitations of contemporary knee designs with regard to achieving higher degrees of knee flexion, leading to the refinement of existing designs or development of newer prostheses that may enhance the both kinematics and the range of flexion that is achievable following TKA.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Optimizing Flexion after TKA: Design not Critical Factor may be Counterproductive

Chitranjan Ranawat, MD, *New York, NY*

Introduction: Medical research, including orthopedics, should be evidence-based. In refining medical or surgical technology, we are obligated to determine scientific information based upon objective data, as opposed to personal opinion or observation. Thus, proponents of the high-flex knee have a long way to go before they can offer conclusive proof; in other words, the jury is still out on this one.

Concept: Designing a high-flex knee is possible, and, indeed, several companies have either designed one or are in the process of doing so. In fact, the high-flex knee with PS design seems to be the current trend.

Possibilities Within Limits: If their preoperative ROM was 110° or more, most TKR patients can achieve 110° to 125° pain-free flexion, provided the soft tissue balance is correct, and the patellar is properly aligned. The “ideal” TKR patient can perform most activities of daily living, such as walking, kneeling, climbing stairs 9-12” high, using an 18” high toilet seat comfortably, getting into and out of cars and taxis, and participating in sports and fitness.

Different Grooves for Different Moves: For Oriental and Islamic patients, whose daily activities may include frequent and prolonged kneeling and bending, a knee design with an ROM of 140° to 150° may meet their needs; whether the TKR patient with a high-flex knee will achieve such motion without instability, dislocation, or abnormally high stress in the polyethylene, remains to be seen.

Research: One preliminary study claimed 140° of motion in half the patients receiving the high-flex knee; however, all the patients in this study had good preoperative ROM. In a comparative study of the high-flex knee against the standard knee, the authors found an ROM of 110° in both groups.

Conclusion: Evidence-based scientific proof is currently lacking for the high flexion knee. A high flex knee design does not guarantee 140° to 150° of pain-free ROM with stability, and may increase the risk of instability, dislocation, increased wear, and patellofemoral complications.

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Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

Unicompartmental Interpositional Arthroplasty: Minimum One Year Follow Up of the UniSpacer[®] Knee System

Richard H Hallock, MD, *Camp Hill, PA*

Seventy-one UniSpacer[™] Knee System implants were inserted from July 24, 2001, to June 26, 2002, for treatment of isolated medial compartment osteoarthritis. The mean age and weight of these patients was 54 years and 209 lbs., respectively. The minimum follow-up for this group of patients is one year. Patients were evaluated utilizing the Knee Society and Lysholm scoring methods.

Knee Society Clinical scores improved from an average preoperative score of 29 to an average one-year post-operative score of 78. Knee Society Functional scores improved from a pre-operative average of 55 to a post-operative average of 72. The Knee Society Functional scores are artificially lowered because of point deductions for failing to achieve 5° to 10° of postoperative valgus alignment, which is not an operative goal of this procedure. Lysholm scores improved from 41 at the pre-operative assessment to 77 at one year.

Complications within this group included anterior dislocation (3) and pulmonary embolism (1). A total of 13 implants (18.3%) were revised. Eight (8) implants (11%) were revised to another UniSpacer and five (5) implants (7%) were revised to a total knee arthroplasty. Further monitoring of these patients is necessary to establish the functional life of the UniSpacer procedure. The short-term data demonstrates significant improvements in pain and function with minimal risk for complications.

Symposium IV: New Techniques and Concepts in Knee Arthroplasty: Theory vs. Reality; Point-Counterpoint

The Uni-Spacer: Insufficient Data to Support Widespread Use

Richard Scott, MD, *Boston, MA*

The concept of a “Uni Spacer” is not new. McKeever and MacIntosh metallic hemi-arthroplasties have been available for over fifty years. Two decades ago, published reports for patients with unicompartmental osteoarthritis revealed good initial results in 85% of patients. This procedure is conservative and easily revised if necessary to any type of arthroplasty in the future.

The uni spacer can be thought of as a “mobile” McKeever or MacIntosh metallic hemi-arthroplasty. Rather than attempting fixation to the tibial plateau via a keel or a roughened undersurface, it is designed to translate freely on the tibial plateau as determined by the conforming articulation of its top side surface with the femoral condyle. This mobility makes it inappropriate for use in the lateral compartment where the femoral rollback could cause prosthetic dislocation and/or soft tissue impingement.

The eventual role of the uni spacer in arthroplasty surgery is uncertain at this time. There are no published reports of its effectiveness. Its indication should be similar to those from McKeever arthroplasty: a patient with unicompartmental osteoarthritis in whom an osteotomy is contraindicated but is considered too young, heavy, or active for a metal-to-plastic arthroplasty. Less than 1% of OA patients should be appropriate candidates. The procedure is technically demanding and sensitive, making its widespread success unlikely.

CME Accreditation Statement

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

The American Academy of Orthopaedic Surgeons designates this educational activity for maximum of 8.0 hours in category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the activity.

Goals and Objectives

The Knee Society/AAHKS 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 of the knee joint. The program is designed to meet the seven essentials of the Accreditation Council for Continuing Medical Education, and as a result, program participants will receive the highest quality education and become eligible for up to eight hours of Category 1 CME credit.

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

- Critique presentations of surgical techniques and demonstrations of treatment options.
- Discuss management of patients who present with musculoskeletal injuries and conditions related to the knee joint.
- Determine indications and complications in TKA and other surgical interventions.
- Update basic knowledge and skills through clinical research findings and biomechanical studies.

Disclaimer

The material presented at this continuing medical education activity has been made available by the Knee Society/AAHKS for educational purposes only. This material is not intended to represent the only, nor necessarily best, methods or procedures appropriate for the medical situations discussed, but rather is intended to present an approach, view, statement of opinion of the faculty, which may be helpful to others who face similar situations.

The Knee Society/AAHKS disclaims any and all liability for injury or other damages resulting to any individuals attending a session, and for all claims which may arise out of the use of the techniques demonstrated therein by such individuals, whether these claims shall be asserted by a physician or any other party.

FDA Statement

Some drugs or medical devices demonstrated at the Specialty Day 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 drug or medical device he or she wishes to use in clinical practice.

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Financial Disclosure

Each participant in the Specialty Day Meeting has been asked to disclose if he or she has received something of value (any item, payment, or service valued in excess of \$500) from a commercial company or institution which relates directly or indirectly to the subject of their presentation.

The options are 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
- d. Stock or stock options; or
- e. Consultant or employee

If a participant has received something of value from a commercial company or institution, an asterisk (*) will appear next to their name in the Program outline. The Knee Society/AAHKS does not view the existence of these interests or commitments as necessarily implying bias or decreasing the value of the author's participation in the Specialty Day Meeting.

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John Callaghan, MD	a,b,e-DePuy
Russell Windsor, MD	a,c-Zimmer
Michael Kelly, MD	c,e-Zimmer
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