THE KNEE SOCIETY

2012 Specialty Day Meeting of
The Knee Society

In association with the
American Association of Hip and Knee Surgeons
(AAHKS)

Final Scientific Program

Saturday, February 11, 2012
The Moscone Convention Center, West, Room 3022
San Francisco, California
Welcome to the 2012 Specialty Day Scientific Meeting of The Knee Society and AAHKS

General Information

The Mission of The Knee Society is:

- To advance knowledge of the knee joint in health and disease.
- To provide an appropriate educational setting that will maintain the highest level of professional standards in order to promote continuous advancement in professional knowledge and improved treatment of disorders of the knee.
- To create an optimum environment to enhance education, research and treatment of arthritis of the knee joint.
- To promote and maintain professional standards to provide the best care to patients with arthritic disorders of the knee joint.

Meeting Objectives:

The Knee Society Specialty Day Meeting is designed to provide practicing orthopaedic surgeons with current information regarding disorders of the knee, surgical and non-surgical treatments for the knee, and emerging technology. Scientific papers and symposia will present information on total knee arthroplasty to enhance the care of patients with painful, arthritic knee joints.

CME Accreditation:

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

The AAOS designates this educational activity for a maximum of 7.5 AMA PRA Category 1 Credits™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Important

Please complete and return your evaluation form to The Knee Society registration table at the conclusion of the program, or complete the evaluation online, at https://www.surveymonkey.com/s/VSP7F5B

Please silence all your electronic devices while inside the session room.

Thank you for your cooperation!
## Acknowledgments

### Past Presidents of The Knee Society
- **1983**: Chitranjan S. Ranawat, MD
- **1984**: Chitranjan S. Ranawat, MD
- **1985**: Richard S. Bryan, MD (deceased)
- **1986**: John N. Insall, MD (deceased)
- **1987**: Charles O. Townley, MD (deceased)
- **1988**: David G. Murray, MD
- **1989**: Frederick C. Ewald, MD
- **1990**: Lawrence D. Dorr, MD
- **1991**: Herbert Kaufer, MD
- **1992**: Paul A. Lotke, MD
- **1993**: Leonard Marmor, MD
- **1994**: David G. Murray, MD
- **1995**: Richard D. Scott, MD
- **1996**: Victor M. Goldberg, MD
- **1997**: W. Norman Scott, MD
- **1998**: James A. Rand, MD
- **1999**: Kenneth A. Krackow, MD
- **2000**: Thomas S. Thornhill, MD
- **2001**: Clifford W. Colwell, Jr., MD
- **2002**: Robert E. Booth, Jr., MD
- **2003**: Cecil H. Rorabeck, MD
- **2004**: Merrill A. Ritter, MD
- **2005**: Russell E. Windsor, MD
- **2006**: Gerard A. Engh, MD
- **2007**: Michael A. Kelly, MD
- **2008**: Douglas A. Dennis, MD
- **2009**: William L. Healy, MD
- **2010**: Arlen D. Hanssen, MD

### Past Presidents of AAHKS
- **1991**: J. Phillip Nelson, MD
- **1992-1993**: Chitranjan S. Ranawat, MD
- **1994**: Richard C. Johnston, MD, MS
- **1995**: Lawrence D. Dorr, MD
- **1996**: Hugh S. Tullos, MD (deceased)
- **1997**: Merrill A. Ritter, MD
- **1998**: Richard H. Rothman, MD, PhD
- **1999**: James A. Rand, MD
- **2000**: Richard B. Welch, MD
- **2001**: John J. Callaghan, MD
- **2002**: Douglas A. Dennis, MD
- **2003**: Clifford W. Colwell, Jr., MD
- **2004**: Richard F. Santore, MD
- **2005**: Joseph C. McCarthy, MD
- **2006**: William J. Hozack, MD
- **2007**: Daniel J. Berry, MD
- **2008**: David G. Lewallen, MD
- **2009**: William J. Robb, III, MD
- **2010**: Mary I. O’Connor, MD

### The Knee Society Executive Board 2011-2012
- **Robert B. Bourne, MD, FRCSC** - President
- **Giles R. Scuderi, MD** - 1st Vice President
- **Steven J. MacDonald, MD** - 2nd Vice President
- **Thomas K. Fehring, MD** - 3rd Vice President
- **Robert L. Barrack, MD** - Treasurer
- **Robert T. Trousdale, MD** - Secretary
- **Arden L. Hanneen, MD** - Immediate Past President
- **William L. Healy, MD** - Past President
- **Jess H. Lonner, MD** - Membership Committee Chair
- **Craig J. Della Valle, MD** - Membership Committee Chair-Elect
- **Michael D. Ries, MD** - Education Committee Chair
- **Adolph V. Lombardi, Jr., MD** - Ed. Cmte. Chair-Elect
- **Juan J. Rodrigo, MD** - Research Committee Chair
- **E. Michael Keating, MD** - Member-At-Large
- **Mark W. Pagnano, MD** - Member-At-Large

### The Knee Society Education Committee 2011-2012
- **Michael D. Ries, MD** - Chair
- **Adolph V. Lombardi, Jr., MD** - Chair-Elect
- **William J. Maloney, III, MD**
- **William L. Griffin, MD**
- **Timothy M. Wright, PhD** - Ex-officio
- **Mark W. Pagnano, MD** - Past Chair

### AAHKS Board of Directors 2011-2012
- **Carlos J. Lavernia, MD** - President
- **Thomas P. Vail, MD** - 1st Vice President
- **Thomas K. Fehring, MD** - 2nd Vice President
- **Brian S. Parsley, MD** - 3rd Vice President
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- **Mary I. O’Connor, MD** - Immediate Past President
- **William J. Robb, III, MD** - Past President
- **Members-At-Large:**
  - C. Anderson Engh, MD
  - Douglas E. Padgett, MD
  - Michael L. Parks, MD
  - William B. Macaulay, MD

### The 2012 Program Co-Chairs
- **The Knee Society:**
  - **Michael D. Ries, MD** (San Francisco, CA)
- **AAHKS:**
  - **Andrew A. Freiberg, MD** (Boston, MA)
Announcements

Future AAOS Annual Meetings and Specialty Days

March 11-15, 2014 – New Orleans, Louisiana

Abstracts for the 2012 Members (Closed) Meeting of The Knee Society and the 2013 Specialty Day Meeting Awards can be submitted on The Knee Society website (www.kneesociety.org) starting in March of 2012.

Abstracts are due by June 1, 2012

Abstracts for the 2012 AAHKS Annual Meeting (papers and posters) can be submitted on the AAHKS website (www.aahks.org).

Abstracts are due by June 1, 2012
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
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</thead>
<tbody>
<tr>
<td>8:00-8:05 am</td>
<td>OPENING REMARKS</td>
<td>Robert B. Bourne, MD, FRCSC (London, ON, Canada) President, The Knee Society</td>
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<tr>
<td>8:05-8:45 am</td>
<td>SYMPOSIUM I: TKR IN THE YOUNGER PATIENT - HAPPENING BUT IS IT REASONABLE?</td>
<td>Moderator: Carlos J. Lavermia, MD (Miami, FL)</td>
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<tr>
<td>8:05-8:11 am</td>
<td>TKR in the Younger Patient –Happening But is it Reasonable?</td>
<td>Kevin J. Bozic, MD, MBA (San Francisco, CA)</td>
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<tr>
<td>8:11-8:17 am</td>
<td>Historic Outcomes of TKR in Patients with greater than 30 yrs of Life Expectancy</td>
<td>Richard D. Scott, MD (Boston, MA)</td>
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<td>8:17-8:23 am</td>
<td>TKR Failure Modes in the Younger Patient</td>
<td>Timothy M. Wright, PhD (New York, NY)</td>
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<td>8:23-8:29 am</td>
<td>What I do differently in the Younger Patient</td>
<td>Craig J. Della Valle, MD (Chicago, IL)</td>
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<td>8:29-8:35 am</td>
<td>Does the Bearing Couple Matter?</td>
<td>Michael D. Ries, MD (San Francisco, CA)</td>
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<tr>
<td>8:35-8:55 am</td>
<td>Discussion</td>
<td>Kevin J. Bozic, MD, MBA, Richard D. Scott, MD, Timothy M. Wright, PhD, Craig J. Della Valle, MD, and Michael D. Ries, MD</td>
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<tr>
<td>8:55-9:45 am</td>
<td>SYMPOSIUM II: CONTROVERSIES IN TKR - WHAT DOES LONG-TERM FOLLOW-UP TELL US?</td>
<td>Moderator: Michael D. Ries, MD (San Francisco, CA)</td>
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The Hip Society: Room 3018

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>8:00-8:05 am</td>
<td>WELCOME</td>
<td>Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH) President, The Hip Society</td>
</tr>
<tr>
<td>8:05-8:45 am</td>
<td>SYMPOSIUM I: HIP PRESERVATION: CASE BASED DISCUSSION, AUDIENCE QUESTIONS</td>
<td>Moderator: Robert T. Trousdale, MD (Rochester, MN) PANEL</td>
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<tr>
<td>8:05-8:11 am</td>
<td>POLYETHYLENE: THEN &amp; NOW</td>
<td>A. Seth Greenwald, D.Phil.(Oxon) (Cleveland Heights, OH)</td>
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<tr>
<td>8:11-8:17 am</td>
<td>Ceramic-on-Ceramic</td>
<td>Carsten Perka, MD (Berlin, Germany)</td>
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<tr>
<td>8:17-8:23 am</td>
<td>Metal-on-Metal</td>
<td>John Skinner, MBBS, FRCS (Eng), FRCS (Orth) (Stanmore, United Kingdom)</td>
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<tr>
<td>8:23-8:29 am</td>
<td>Discussion: Cases and Audience Participation</td>
<td>A. Seth Greenwald, D.Phil.(Oxon), Carsten Perka MD, John Skinner, MBBS, FRCS (Eng), FRCS (Orth), Laurent Sigismond SEDEL, MD, PhD (Paris Cedex, France), Orhun K. Muratoglu, PhD (Boston, MA), and Michael A. Mont, MD (Baltimore, MD)</td>
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<tr>
<td>8:35-9:10 am</td>
<td>SYMPOSIUM III: DIAGNOSING THE FAILED METAL-ON-METAL HIP ARTHROPLASTY: CASE BASED DISCUSSION, AUDIENCE PARTICIPATION</td>
<td>Moderator: Thomas K. Fehring, MD (Charlotte, NC) Panel: Robert L. Barrack, MD (Saint Louis, MO), Keith R. Berend, MD (New Albany, OH), Joshua J. Jacobs, MD (Chicago, IL), Steven J. MacDonald, MD, FRCSC (London, ON, Canada), Aaron G. Rosenberg, MD, FACS (Deerfield, IL), Thomas P. Schmalzried, MD (Los Angeles, CA), John Skinner, MBBS, FRCS (Eng), FRCS (Orth) (Stanmore, United Kingdom)</td>
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10:15-10:20 am | PRESENTATION OF LIFETIME ACHIEVEMENT AWARD                          | Douglas A. Dennis, MD (Denver, CO) Recipient: Thomas H. Mallory, MD (Loudonville, OH)       |
<p>| 10:20-10:35 am | Coffee break                                                        |                                                                                             |</p>
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<th>Time</th>
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| 8:55-9:07 am | DEBATE: CEMENTED VERSUS CEMENTLESS TKRs?  
Cemented: Thomas S. Thornhill, MD (Boston, MA)  
Presented by Robert B. Bourne, MD, FRSCC (London, ON, Canada)  
Cementless: Leo A. Whiteside, MD (Saint Louis, MO) | 18-23 |
| 9:07-9:12 am | Discussion | |
| 9:12-9:24 am | DEBATE: PCL SACRIFICING VERSUS RETAINING TKRs?  
Sacrificing: Steven B. Haas, MD (New York, NY)  
Retaining: Gerard A. Engh, MD (Arlington, VA) | 24-25 |
| 9:24-9:29 am | Discussion | |
| 9:29-9:41 am | DEBATE: RESURFACING VERSUS NOT RESURFACING THE PATELLA?  
Resurfacing: Fred D. Cushner, MD (New York, NY)  
Non resurfacing: Mr. David W. Murray, FRCS (Oxford, United Kingdom) | 26-27 |
| 9:41-9:46 am | Discussion | |
| 9:46-10:06 am | PRESIDENTIAL GUEST SPEAKER  
Introduction: Robert B. Bourne, MD, FRSCC (London, ON, Canada)  
Surgeon Choice and the Impact on TKA Outcome  
Speaker: Stephen Graves, MD (Adelaide South Australia, Australia) | 28 |
| 10:06-10:25 am | BREAK | |
| 10:25-11:05 am | SYMPOSIUM III:  
WHAT DO NATIONAL TKR REGISTRIES TELL US?  
Moderator: Robert B. Bourne, MD, FRSCC (London, ON, Canada) | 29 |
| 10:25-10:31 am | Patient Satisfaction  
Michael J. Dunbar, MD, FRCS, PhD (Halifax, NS, Canada) | 30 |
| 10:31-10:37 am | Effect of Type of Arthritis and Patient Factors on Outcome  
G. Otto Robertson, MD, PhD (Lund, Sweden) | 31 |
| 10:37-10:43 am | Role of Surgeon Experience on Outcomes of TKR  
Nizar N. Mahomed, MD (Toronto, ON, Canada) | 32 |
| 10:43-10:49 am | Effect of Implant Type on Outcomes  
Stephen Graves, MD (Adelaide South Australia, Australia) | 33 |
| 10:49-11:05 am | Discussion  
Michael J. Dunbar, MD, G. Otto Robertson, MD, PhD, Nizar N. Mahomed, MD, and Stephen Graves, MD | 34 |
| 10:35-11:05 am | THE HIP SOCIETY AWARDS  
Moderator: Richard E. White, MD (Albuquerque, NM) | 19 |
| 10:41-10:45 am | DISCUSSION | |
| 10:45-10:51 am | The John Charnley Award  
Clinical Multi-centric Studies of the Wear Performance of Highly Cross-linked Re-melted Polyethylene in THR  
Charles R. Bragdon, PhD (Boston, MA) | 20 |
| 10:51-10:55 am | DISCUSSION | |
| 10:55-11:01 am | The Frank Stinchfield Award  
Decreasing Patient Activity with Aging: Implications for Cross-Linked Polyethylene Wear  
Andrew K. Battenberg, BS (Los Angeles, CA) | 21 |
| 11:01-11:05 am | DISCUSSION | |
| 11:05 am-12:00 pm | SYMPOSIUM IV:  
ARTHROPLASTY REGISTRIES IN THE INFORMATION AGE: PROMETHEUS UNBOUND  
Moderator: David G. Lewallen, MD (Rochester, MN) | 22 |
| 11:05-11:11 am | Institutional Registries: The Mayo Clinic Joint Registry Example  
Rafael J. Sierra, MD (Rochester, MN) | 23 |
| 11:11-11:17 am | State Based Registries: The Virginia Experience  
William A. Jiranek, MD (Richmond, VA) | 24 |
| 11:17-11:23 am | Quality Improvement with Registry Data  
Thomas C. Barber, MD (Oakland, CA) | 25-26 |
| 11:23-11:29 am | National Registries and ISAR (International Society of Arthroplasty Registries)  
Henrik Malchau, MD, PhD (Boston, MA) | 27 |
| 11:29-11:35 am | Multinational Collaboratives: NARA (Nordic Arthroplasty Registry Association)  
Goran Garellick, MD, PhD (Got tøbø, Sweden) | 28 |
| 11:35-11:41 am | International Collaborative of Orthopaedic Registries (ICOR)  
Stephen Graves, MD (Adelaide South Australia, Australia) | 29 |
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<tr>
<th>Time</th>
<th>THE KNEE</th>
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<th>THE HIP</th>
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<tr>
<td>11:05-</td>
<td>SYMPOSIUM IV:</td>
<td>11:41-</td>
<td>Current Status of the AJRR (American Joint Replacement Registry) and Future US Based Collaboration Options</td>
<td>29-30</td>
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<tr>
<td>11:55 am</td>
<td>SEPSIS PREVENTION IN 2012: WHAT IS IMPORTANT</td>
<td>11:47 am</td>
<td>Kevin J. Bozic, MD, MBA (San Francisco, CA)</td>
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<td>Moderator: Kevin L. Garvin, MD (Omaha, NE)</td>
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<td>11:47 am</td>
<td>DISCUSSION</td>
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<td>11:11 am</td>
<td>Javad Parvizi, MD, FRCS (Philadelphia, PA)</td>
<td>12:10-</td>
<td>Richard F. Santore, MD (San Diego, CA)</td>
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<td>11:17 am</td>
<td>Does the use of Laminar Flow and Full Body Exhaust Suits decrease Revision for Infection in Total Knee Replacement?</td>
<td>12:00-</td>
<td>2010 North American/British Travelling Fellows</td>
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<td>11:17 am</td>
<td>Gary J. Hooper, MD (Christchurch, New Zealand)</td>
<td>12:15 pm</td>
<td>Hany Bedair, MD (Newton, MA)</td>
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<td>11:23 am</td>
<td>Body Exhaust Suits?</td>
<td>11:05-</td>
<td>SYMPOSIUM V:</td>
<td>1:00-1:40 pm</td>
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<tr>
<td>11:23 am</td>
<td>E. Michael Keating, MD (Mooresville, IN)</td>
<td>11:47 am</td>
<td>CHALLENGING TOTAL HIP ARTHROPLASTY CASES: GETTING AN EXPERT OPINION</td>
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<td>11:23 am</td>
<td>Antibiotic Cement</td>
<td>11:47 am</td>
<td>Moderator: Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)</td>
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<td>11:29 am</td>
<td>Ove N. Furnes, MD (Bergen, Norway)</td>
<td>11:47 am</td>
<td>Panel: Michael E. Berend, MD (Mooresville, IN)</td>
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<td>11:29 am</td>
<td>Sepsis Prevention in 2012: What is Important?</td>
<td>11:47 am</td>
<td>Robert B. Bourne, MD, FRCSC (London, ON, Canada)</td>
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<td>11:35 am</td>
<td>Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)</td>
<td>11:47 am</td>
<td>John C. Callaghan, MD (Iowa City, IA)</td>
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<td>11:35 am</td>
<td>Discussion</td>
<td>11:47 am</td>
<td>Douglas A. Dennis, MD (Denver, CO)</td>
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<td>11:35 am</td>
<td>Javad Parvizi, MD, FRCS, Gary J. Hooper, MD, E. Michael Keating, MD, Ove Furnes, MD, and Adolph V. Lombardi, Jr., MD, FACS</td>
<td>11:47 am</td>
<td>Kevin L. Garvin, MD (Omaha, NE)</td>
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<td>11:35 am</td>
<td>LUNCH (The Knee Society Business Meeting – Members Only – Rm 3014)</td>
<td>11:47 am</td>
<td>William L. Healy, MD (Burlington, MA)</td>
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<td>11:35 am</td>
<td>SYMPOSIUM V:</td>
<td>1:00-1:40 pm</td>
<td>Mark W. Pagnano, MD (Rochester, MN)</td>
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<td>11:40-2:30 pm</td>
<td>DIFFICULT TKR PATIENTS: CHALLENGING THE EXPERTS</td>
<td>1:40-1:46 pm</td>
<td>SYMPOSIUM VI:</td>
<td></td>
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<tr>
<td>Moderator: Robert T. Trousdale, MD (Rochester, MN)</td>
<td>1:40-1:46 pm</td>
<td>ACETABULAR COMPONENT POSITIONING: THE ACHILLES HEEL OF TOTAL HIP ARTHROPLASTY</td>
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<td>Experts: Johan Bellemans, MD, PhD (Pellenberg, Belgium)</td>
<td>1:40-1:46 pm</td>
<td>Moderator: Miguel E. Cabanela, MD (Rochester, MN)</td>
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<td>Lawrence D. Dorr, MD (Los Angeles, CA)</td>
<td>1:40-1:46 pm</td>
<td>Mr. David W. Murray, MD, FRCS (Oxford, United Kingdom)</td>
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<td>Mark P. Figgie, MD (New York, NY)</td>
<td>1:40-1:46 pm</td>
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<td>William J. Maloney, III, MD (Redwood City, CA)</td>
<td>1:40-1:46 pm</td>
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<td>Aaron G. Rosenberg, MD, FACS (Chicago, IL)</td>
<td>1:40-1:46 pm</td>
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<td>Thomas P. Sculco, MD (New York, NY)</td>
<td>1:40-1:46 pm</td>
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<td>1:40-1:46 pm</td>
<td>OPTIONS AND RESULTS FOR TREATING THE SEPTIC TKR</td>
<td>1:46-1:52 pm</td>
<td>Anatomic Landmarks</td>
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<tr>
<td>Moderator: Arlen D. Hanssen, MD (Rochester, MN)</td>
<td>1:46-1:52 pm</td>
<td>James A. D’Antonio, MD (Sewickley, PA)</td>
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<td>1:40-1:46 pm</td>
<td>Efficacy of Perioperative Irrigation and Debridement for the Treatment of Periprosthetic Infection</td>
<td>1:52-1:58 pm</td>
<td>Cup Positioning in Total Hip Arthroplasty Improves with Clinical Feedback</td>
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<td>Thomas K. Fehring, MD (Charlotte, NC)</td>
<td>1:52-1:58 pm</td>
<td>Harry E. Rubash, MD (Boston, MA)</td>
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<td>Stephen B. Murphy, MD (Boston, MA)</td>
<td>1:58-2:04 pm</td>
<td>Stephen B. Murphy, MD (Boston, MA)</td>
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<td>Time</td>
<td>THE KNEE (Room 3022)</td>
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<tr>
<td>1:46-1:52 pm</td>
<td>Static Antibiotic-impregnated Cement Spacers for the Management of Total Knee Arthroplasty Infections&lt;br&gt;Giles R. Scuderi, MD (New York, NY)</td>
<td>43-44</td>
<td>Lessons Learned from Navigation&lt;br&gt;S. David Stulberg, MD (Chicago, IL)</td>
<td>39</td>
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<tr>
<td>1:52-1:58 pm</td>
<td>Articulated PMMA Spacers&lt;br&gt;Roger H. Emerson, MD (Plano, TX)</td>
<td>45-46</td>
<td>The Robot and I have Solved the Problem&lt;br&gt;Lawrence D. Dorr, MD (Los Angeles, CA)</td>
<td>40</td>
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<tr>
<td>1:58-2:04 pm</td>
<td>Infected Total Knee Replacement – PROSTALAC&lt;br&gt;Bassam A. Masri, MD, FRCSC (Vancouver, BC, Canada)</td>
<td>47</td>
<td>DISCUSSION: CASES AND AUDIENCE PARTICIPATION&lt;br&gt;Professor David W. Murray, MA, MD, FRCS, James A. D’Antonio, MD, Henry E. Rubash, MD, Stephen B. Murphy, MD, S. David Stulberg, MD, and Lawrence D. Dorr, MD</td>
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<td>2:04-2:10 pm</td>
<td>Repeat Two Stage Revisions in Infected TKA&lt;br&gt;Steven J. MacDonald, MD, FRCSC (London, ON, Canada)</td>
<td>48-49</td>
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<td>2:10-2:30 pm</td>
<td>Discussion&lt;br&gt;Thomas K. Fehring, MD, Giles R. Scuderi, MD, Roger H. Emerson, MD, Bassam A. Masri, MD, FRCSC, and Steven J. MacDonald, MD, FRCSC</td>
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<td>2:30-3:00 pm</td>
<td>THE KNEE SOCIETY AWARDS&lt;br&gt;Moderator: Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)</td>
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<td>2:30-2:31 pm</td>
<td>The John Insall Award&lt;br&gt;Introduction: Steven B. Haas, MD (New York, NY)</td>
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<td>2:31-2:37 pm</td>
<td>A Randomized Controlled Trial of Minimally Invasive TKR: Comprehensive Gait and Strength Testing Outcomes&lt;br&gt;Mark W. Pagnano, MD (Rochester, MN)</td>
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<td>2:37-2:40 pm</td>
<td>Discussion</td>
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<td>2:40-2:41 pm</td>
<td>The Mark Coventry Award&lt;br&gt;Introduction: Robert T. Trousdale, MD (Rochester, MN)</td>
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<td>2:41-2:47 pm</td>
<td>A Retrieval Analysis of High Flexion Versus Posterior Stabilized Tibial Inserts&lt;br&gt;Douglas D. R. Naudie, MD, FRCSC (London, Ontario, Canada)</td>
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<td>2:47-2:50 pm</td>
<td>Discussion</td>
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<td>2:50-2:51 pm</td>
<td>The Chitranjan Ranawat Award&lt;br&gt;Introduction: Gerard A. Engh, MD (Arlington, VA)</td>
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<td>2:51-2:57 pm</td>
<td>Efficacy of Postoperative Intraarticular Analgesia Following Total Knee Arthroplasty: A Randomized, Double-Blinded, Placebo-Controlled, Prospective Study&lt;br&gt;Nitin Goyal, MD (Arlington, VA)</td>
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<td>2:57-3:00 pm</td>
<td>Discussion</td>
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<td>3:03-3:09 pm</td>
<td>Management of Early Dislocation after THA&lt;br&gt;Michael D. Ries, MD (San Francisco, CA)</td>
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<td>3:09-3:15 pm</td>
<td>Management of Early DVT/PE&lt;br&gt;Vincent D. Pellegrini, Jr., MD (Baltimore, MD)</td>
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<td>3:15-3:30 pm</td>
<td>DISCUSSION: CASES AND AUDIENCE PARTICIPATION&lt;br&gt;Jay R. Lieberman, MD, Daniel J. Berry, MD, Craig J. Della Valle, MD, Michael D. Ries, MD, and Vincent D. Pellegrini, Jr., MD</td>
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<td>3:30-3:40 pm</td>
<td>HIGHLIGHTS OF HIP PAPERS PRESENTED AT THE 2011 ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS&lt;br&gt;Moderator: Carlos J. Lavernia, MD (Coral Gables, FL)</td>
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<td>3:40-3:44 pm</td>
<td>SYMPOSIUM VIII: REVISION TOTAL HIP ARTHROPLASTY: VIDEO VIGNETTES&lt;br&gt;Moderator: Bassam A. Masri, MD, FRCSC (Vancouver, BC, Canada)</td>
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<td>3:45-3:50 pm</td>
<td>The Wagner Transfemoral Approach&lt;br&gt;J. David Blaha, MD (Ann Arbor, MI)</td>
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<td>3:00-3:05 pm</td>
<td>The Knee Society Lifetime Achievement Award</td>
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<td>3:00-3:05 pm</td>
<td>Introduction: Robert B. Bourne, MD, FRCSC (London, ON, Canada)</td>
<td>Room 3022</td>
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<td>3:00-3:05 pm</td>
<td>Recipient: Accepting the award for John N. Insall, MD (deceased) is W. Norman Scott, MD (New York, NY)</td>
<td>Room 3022</td>
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<td>3:05-3:25 pm</td>
<td>BREAK</td>
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<td>3:25-3:40 pm</td>
<td>HIGHLIGHTS OF KNEE PAPERS PRESENTED AT THE AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS ANNUAL MEETING</td>
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<td>3:40-3:52 pm</td>
<td>SYMPOSIUM VII: WHAT WILL WE BE DOING IN 2022?</td>
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<td>3:52-3:57 pm</td>
<td>Discussion</td>
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<td>Knee Page</td>
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<td>3:57-4:09 pm</td>
<td>DEBATE: CROSS LINKED UHMWPE Pro: Harry E. Rubash, MD (Boston, MA) Con: Thomas P. Sculco, MD (New York, NY)</td>
<td>Room 3022</td>
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<td>4:09-4:14 pm</td>
<td>Discussion</td>
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<td>4:14-4:26 pm</td>
<td>DEBATE: COMPUTER ASSISTED SURGERY Pro: David J. Mayman, MD (New York, NY) Con: Robert L. Barrack, MD (Saint Louis, MO)</td>
<td>Room 3022</td>
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<td>4:26-4:31 pm</td>
<td>Discussion</td>
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<td>4:31-5:15 pm</td>
<td>SYMPOSIUM VIII: HOW DO I DO A REVISION TKR IN 2012: VIDEO, PANEL DISCUSSION, AUDIENCE QUESTIONS</td>
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<td>5:15 pm</td>
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<td>3:50-3:55 pm</td>
<td>Modular Tapered Titanium Stems</td>
<td>Room 3018</td>
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<td>3:50-3:55 pm</td>
<td>Donald G. Garbuz, MD, MHSc, FRCSC (Vancouver, BC, Canada)</td>
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<td>3:55-4:00 pm</td>
<td>Fully Coated Cylindrical Stem Surgical Technique - Extensively Porous-Coated Femoral Components</td>
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<td>3:55-4:00 pm</td>
<td>C. Anderson Engh, Jr., MD (Alexandria, VA)</td>
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<td>4:00-4:05 pm</td>
<td>Femoral Stem Impaction Grafting: What role does it play?</td>
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<td>4:00-4:05 pm</td>
<td>Douglas E. Padgett, MD (New York, NY)</td>
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<td>4:05-4:10 pm</td>
<td>Bone Grafting Osteolytic Defects</td>
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<td>4:05-4:10 pm</td>
<td>William J. Hozack, MD (Philadelphia, PA)</td>
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<td>4:10-4:15 pm</td>
<td>Jumbo Acetabular Revisions</td>
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<td>4:10-4:15 pm</td>
<td>Paul F. Lachiewicz, MD (Chapel Hill, NC)</td>
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<td>4:15-4:20 pm</td>
<td>Ultraporous Cups with Augments Allen E. Gross, MD, FRCSC, O.Ont. (Toronto, ON, Canada)</td>
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<td>4:15-4:20 pm</td>
<td>Symposium IX: My Worst Case: Let the Competition Begin</td>
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<td>4:20-4:40 pm</td>
<td>DISCUSSION: CASES AND AUDIENCE PARTICIPATION Wayne G. Paprosky, MD, J. David Blaha, MD, Donald G. Garbuz, MD, MHSc, FRCSC, C. Anderson Engh, Jr., MD, Douglas E. Padgett, MD, William J. Hozack, MD, Paul F. Lachiewicz, MD, and Allen E. Gross, MD</td>
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<td>4:40-4:44 pm</td>
<td>Panel: William N Capello, MD (Indianapolis, IN)</td>
<td>Room 3018</td>
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<td>4:44-4:48 pm</td>
<td>Kenneth A. Krackow, MD (Buffalo, NY)</td>
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<td>4:48-4:52 pm</td>
<td>Chitranjan S. Ranawat, MD (New York, NY)</td>
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<td>4:52-4:56 pm</td>
<td>Richard H. Rothman, MD (Philadelphia, PA)</td>
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<td>4:56-5:04 pm</td>
<td>Leo A. Whiteside, (Saint Louis, MO)</td>
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<td>5:00-5:04 pm</td>
<td>Clive P. Duncan, MD (Vancouver, BC, Canada)</td>
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<td>5:04-5:14 pm</td>
<td>DISCUSSION: AUDIENCE VOTING William N. Capello, MD, Kenneth A. Krackow, MD, Chitranjan S. Ranawat, MD, Richard H. Rothman, MD, Leo A. Whiteside, MD, and Clive P. Duncan, MD</td>
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<td>5:14-5:15 pm</td>
<td>PRESENTATION OF “MY WORST CASE” AWARD</td>
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Financial disclosures for The Knee Society program are on pages 66 – 69
The 2012 Knee Society Lifetime Achievement Award

John N. Insall, MD
(1930-2000)

Dr. John Insall was one of the co-designers of the Total Condylar total knee, published on all aspects of TKA, and served as a mentor to many of the current members of The Knee Society.

John Insall’s legendary contributions to knee surgery were based on an academic pursuit of excellence in research and patient care. His research endeavors encompassed biomechanics, surgical techniques and vigilant postoperative patient evaluations. Inherent in his life’s work was the importance of educating knee surgeons throughout the world. In recognition of Dr. Insall’s contribution to both the worldwide orthopaedic community and The Knee Society, The John N. Insall Travelling Fellowship is designed to perpetuate his legacy.

The 2012 Knee Society Awards

In October 1993, The Knee Society Board of Directors established an award program to recognize meritorious presentations at the annual Specialty Day meetings. In 1995, the Board designated three awards to be presented annually, in honor of The Knee Society members Mark Coventry (for the best Basic Science Paper), Chitranjan Ranawat (for the best work on a Surgical Technique), and John Insall (for the best work on a Clinical Subject or Outcomes Report). This year’s recipients are:

Mark Coventry Award Paper
A Retrieval Analysis of High Flexion Versus Posterior Stabilized Tibial Inserts
Presenter: Douglas D. R. Naudie, MD, FRCSC
Co-Authors: Nicholas R. Paterson, BScH, Matthew G. Teeter, BScH, Steven J. MacDonald, MD, FRCSC, and Richard W. McCalder, MD, MPhil(Edin), FRCSC

Chitranjan Ranawat Award Paper
Efficacy of Postoperative Intraarticular Analgesia Following Total Knee Arthroplasty: A Randomized, Double-Blinded, Placebo-Controlled, Prospective Study
Presenter: Nitin Goyal, MD
Co-Authors: James McKenzie, BS, Peter F. Sharkey, MD, Javad Parvizi, MD, William J. Hozack, MD, and Matthew S. Austin, MD

John Insall Award Paper
A Randomized Controlled Trial of Minimally Invasive TKR: Comprehensive Gait and Strength Testing Outcomes.
Presenter: Mark W. Pagnano, MD
Co-Authors: Julien Wegrzyn, MD, PhD, Sebastien Parratte, MD, PhD, Krista Coleman-Wood, PhD, PT, and Kenton R. Kaufman, PhD, PE

More than 60 orthopaedic surgeons in 18 different states provided hip and knee joint replacements to more than 85 patients at no cost. All aspects of treatment—preoperative care, surgery, hospitalization, and postoperative care—were covered. The implants were donated by major device manufacturers (Biomet, DePuy, Mako Surgical, Smith & Nephew, Stryker, Total Joint Orthopaedics, Wright Medical Technology, and Zimmer). We thank our volunteers and industry partners!

If you are interested in participating in the 2012 program, that is tentatively planned for December 7, 2012, please email Olga Foley (foley@aaos.org).

AMD3 Foundation, Pittsburgh, PA:
Anthony M. DiGiola, MD; Brian Hamlin, MD; and Anton Plakseychuk, MD

Anderson Orthopaedic Clinic Inova Mount Vernon Hospital, Alexandria, VA:
Gerard A. Engh, MD; Kevin Fricka, MD; Nitin Goyal, MD; and William Hamilton, MD

Colorado Joint Replacement, Denver, CO:
Douglas A. Dennis, MD; Brian D. Haas, MD; Raymond Kim, MD; Todd M. Miner, MD; and John Woodward, MD

Connecticut Joint Replacement Institute at St. Francis Hospital and Medical Center, Hartford, CT:
John Grady-Benson, MD; Courtland G. Lewis, MD; Robert McAllister, MD; Steven Schutzer, MD; and Gordon Zimmerman, MD

The Dorr Arthritis Institute at Good Samaritan Hospital Arthritis Institute, Los Angeles, CA:
Lawrence D. Dorr, MD

Florida Hospital Celebration, Celebration, FL:
David D. Dore, MD; and Matthew Johnston, DO

Franklin Hospital/ North Shore –LJ Health System, Valley Stream, NY:
Giles R. Scuderi, MD

Joint Replacement Surgeons, Mooresville, IN:
Michael E. Berend, MD; Philip M. Faris, MD; E. Michael Keating, MD; Robert A. Malinzak, MD; John B. Meding, MD; Jeffery L. Pierson, MD; and Merrill A. Ritter, MD

Mercy Hospital Orthopaedic Institute, Miami, FL:
Carlos J. Lavernia, MD

Mount Carmel New Albany Surgical Hospital, New Albany, OH:
Keith R. Berend, MD; and Adolph V. Lombardi, Jr., MD, FACS

OrthoCarolina Hip and Knee Center, Charlotte, NC:
Thomas K. Fehring, MD

OrthoIndy / Indiana Orthopaedic Hospital, Indianapolis, IN:
David A. Fisher, MD

Orthopaedic Research Laboratories Cleveland, OH:
A. Seth Greenwald, D.Phil. (Oxon)
Penn Presbyterian Medical Center, Philadelphia, PA:  
Craig L. Israelite, MD; and Charles L. Nelson, MD;  
Rothman Institute/Thomas Jefferson University Hospitals, Philadelphia, PA:  
William J. Hozack, MD; and Javad Parvizi, MD, FACS  
Rush University Medical Center, Chicago, IL:  
Craig J. Della Valle, MD  
Salt Lake Regional Hospital, Salt Lake City, UT:  
Kim Bertin, MD; Aaron A. Hoffman, MD; Trevor Magee, MD; and Jeremy McCandless, MD  
Southside Hospital / North Shore-LIJ Health System, Bay Shore, NY:  
Fred D. Cushner, MD; John A. Saugy, MD; and Ayal Segal, MD  
St. Joseph’s Hospital, Tacoma, WA:  
John H. Bargren, MD  
St. Joseph Medical Center, Towson, MD:  
David F. Dalury, MD  
Saint Michael’s Medical Center, Newark, NJ:  
Richard Bolardo, MD  
St. Vincent Infirmary, Little Rock, AR:  
C. Lowry Barnes, MD; and Gordon Newbern, MD  
The Methodist Hospital for Surgery, Addison, TX:  
Kurt Rathjen, MD  
The Rubin Institute for Advanced Orthopedics, Baltimore, MD:  
Harpal S. Khanuja, MD  
University of Maryland School of Medicine, Baltimore, MD:  
Theodore Manson, MD; Vincent D. Pellegrini, Jr, MD; and Robert Sterling, MD  
University of Nebraska Medical Center, Omaha, NE:  
Kevin L. Garvin, MD; Curtis W. Hartman, MD; and Beau Konigsberg, MD  

The 2011 Knee Society Score ©

If you are a member of The Knee Society, please email knee@aaos.org to request your copy of The 2011 KS Score ©. You will be asked to sign a licensing agreement.

If you are a non-member physician or represent an academic institution or industry, please complete our online questionnaire. (The link can be found on our website at www.kneesociety.org/Outcomes.) Upon completion, you will be advised of further steps.

If you have any questions about The 2011 KS Score ©, please contact The Knee Society by email knee@aaos.org or tel (1) 847.698.1632.
Support The Knee Society through OREF!

Under OREF’s new sharing plan, donors contributing less than $1,000 to the OREF annual campaign may now choose to designate 50% of their gifts to The Knee Society, with 50% directed to OREF. OREF has made this important enhancement to the 2011 OREF annual giving program in an effort to respond to frequent requests for a lower sharing level for donors and to increase the funds raised for The Knee Society, and for all the organizations that participate in the OREF designated giving program. This change invites broader participation by donors to The Knee Society at all gift levels. As in past years, donors contributing $1,000 or more (Order of Merit) will also have the opportunity to designate a portion of their gifts to The Knee Society, with a minimum of $500 directed to OREF. The Knee Society members can make secure online gifts to OREF and The Knee Society at www.oref.org/ks.
TKR in the Younger Patient – Happening But is it Reasonable?

Kevin J. Bozic, MD, MBA
Associate Professor and Vice Chair
University of California, San Francisco
Department of Orthopaedic Surgery and Philip R. Lee Institute for Health Policy Studies

The demographics of patients who undergo total knee replacement (TKR) are changing. Understanding trends in TKR patient demographics can help guide future research on implant designs, clinical decision-making, and health policy decisions related to TKR. The Healthcare Cost and Utilization Project Nationwide Inpatient Sample database was used to analyze demographic data on 6,999,855 total knee replacement procedures performed between 1998 and 2009. Data on the number of TKR performed in hospitals from the Nationwide Inpatient Sample (NIS) show there is an increasing percentage of younger patients undergoing TKR in the United States. The number of patients between 55-64 years of age who received TKRs from 1998-2009 increased, from 20.1% in 1998 to 28.9% in 2009 (Figure 1). Overall TKR procedure volumes have also increased by 246% from 252,241 in 1998 to 619,342 in 2009. Many factors are driving these trends, including an aging US population, an expansion of the indications for TKR to include younger, more active patients (some of which may be driven by advances in implant technology), and supply-driven changes in demand for TKR procedures. As the number of patients with knee OA who desire to maintain an active lifestyle continues to increase, the demand for non-arthroplasty options for managing osteoarthritis (e.g. autologous chondrocyte implantation, synthetic scaffolds) will increase as well.

Figure 1. Changes in TKR patient demographics in the US from 1998 to 2009
With the advent of Total Knee Replacement in the 1970's, the procedure was reserved for the older patient with end-stage knee arthritis. More conservative non-operative and operative measures were employed in younger patients. Non-operative treatments included physical therapy, analgesics and anti-inflammatory medications, intra-articular injections, braces, ambulatory support and limited activity. Patients were often told that “They were too young for Total Knee Replacement”. The average age of a total knee arthroplasty patient in the 1970’s was 68-70.

Operative treatment short of TKR for the younger OA patient consisted of open or arthroscopic joint debridement, osteotomy, metallic hemi-arthroplasty and, rarely, knee fusion. The patient with end-stage rheumatoid arthritis, however, could not benefit from any surgical option short of total knee arthroplasty, so for this diagnosis, age became an unimportant factor in patient selection. In the mid 1970’s, juvenile rheumatoid patients even in their teens underwent total knee replacement to allow some ambulation and independence. Early reports of the successful results of TKR in JRA justified this procedure in the very young. Gradually in the late 1970’s and 1980’s age criteria were lowered in the patient with end-stage osteoarthritis of the knee. In 1997, the classic article by Diduch, Insall, Scott et al. reported the results of TKR in OA patients under the age of 55 years. 114 knees in 88 patients were reviewed and showed 87% survivorship at 18 yrs. Many patients returned to a relatively high level of activity such as skiing, tennis and golf.

Recently, Keeney et al. published a literature review of reports (through 2009) of TKRs in patients less than 55 yrs. They collected 13 studies consisting of 908 knees in 671 patients. The patients included rheumatoids as well as osteoarthritics. Survivorship ranged from 91-99% in the first decade to 85-96% in the second decade.

A study by Julin et al. out of Finland stratified patients into age categories of less than 55 yrs., 56 to 65 yrs. and greater than 65 yrs. Survivorship at 5 years was 92%, 95% and 97% respectively, indicating that the younger patient seems to have a higher failure rate through time. The most common reason for re-operation in the younger patient is for a polyethylene wear debris induced complication. Improvements in the prosthetic articulation through time should lower the re-operation rates in younger more active patients closer to those reported for the elderly less active patient.
Total knee replacement (TKR) is being performed in younger patients, based on the initial success of the procedure in older individuals along with published series of younger patients with excellent clinical and functional outcomes. Patient registry data from large populations, however, show that young age decreases the prognosis of TKR and increases revision rates for non-infectious reasons. Several factors may be responsible for the poorer survival rates, but certainly the greater mechanical demands placed on the implant is an important consideration.

Loads across the knee create considerable burdens to both the bearing surfaces and on implant fixation. Considerable work has been done in quantifying stresses at or near the bearing surfaces, suggesting that abrasion and fatigue wear will be active mechanisms, given the non-conformity of the surfaces and the cyclic nature of the loading. Subjective correlations between these stresses and the wear damage and oxidative degradation observed on retrieved TKR polyethylene components lend credence to the role of high stresses on subsequent wear, though the link is indirect, primarily because of the lack of a validated model for polyethylene mechanical behavior. Such a limitation precludes concrete conclusions, for example, as to which is more important, load magnitude or number of cycles, in determining susceptibility to wear-related failure.

Implant loosening is a common cause for TKR failure. TKR components function as load transfer devices, and therefore some common mechanical principles govern their ability to remain well-fixed. As with concerns for implant wear, the magnitude and nature of the applied loads, together with important design features such as implant shape and material, markedly affect the ability for TKR components to transfer these loads to the surrounding bone. Factors such as the amount of implant deformation are more important in this situation than interface strength. Understanding these principles can lead to an understanding of how greater functional demands might impact failure modes.
What I do differently in the Younger Patient
Craig J. Della Valle, MD
Rush University Medical Center
Chicago, IL

Despite the success of total knee replacement (TKR), orthopaedic surgeons, physicians who refer patients for surgical care and patients alike are all hesitant in proceeding forward with TKR in the “younger patient”. Reasons for this hesitation include concerns over construct durability as well as an overall sense that patient satisfaction may not be as high, particularly in patients who are active.

Unfortunately, there is little data to specifically guide the clinician on what is optimal in this patient population. There are some things, however, that the clinician might consider when faced with a “young” patient who is being evaluated for TKR:

- **Ensure that there are no alternative options.** A well-performed osteotomy can be particularly attractive for a patient interested in a return to running sports. These procedures can also be combined with cartilage or meniscal restoring procedures.

- **Consider unicompartmental knee arthroplasty.** If arthritis is limited to one compartment, these procedures may provide for a more “normal feeling” knee and conserve bone stock for the future if performed well.

- **Consider cementless fixation.** With improvements in porous metals, these components may provide enhanced durability however there is limited data on these implants as of yet and care should be taken in selecting an implant.

- **Consider a non-modular tibial component.** Several studies suggest “backside wear” as a major contributor to the overall “wear load” and this option has been associated with excellent survivorship in some series although the loss of modularity may have some drawbacks and backside wear issues may be design and polyethylene dependent.

- **Consider alternative bearing surfaces.** Although cross-linked polyethylene has gained some acceptance in TKR, there is little data available to support its use, predominantly related to the difficulties in measuring wear in TKR radiographically. While experience in the hip has been positive, concerns remain over the effects of cross-linking on polyethylene strength.

Unfortunately orthopaedics has a history of applying “new and improved” technologies in younger patients with results that are not always “improved”. Hence prior to considering a change for the younger patient, careful consideration should be given to any change in what is presently working well in your practice. Finally, and potentially most importantly, the younger patient requires additional preoperative education so that their expectations for the procedure are appropriate.
Wear remains a common failure mechanism of TKA, which limits the durability of the prosthetic components. UHMWPE which was sterilized by gamma irradiation in air was discontinued by most manufacturers in the mid 1990’s and replaced with gamma sterilization in an inert environment, or a non irradiation method (ethylene oxide or gas plasma). Retrieved implants which have been sterilized by these methods still demonstrate evidence of wear damage, suggesting that improvement in the bearing couple could further decrease wear in vivo.

Highly crosslinked UHMWPE’s have been used successfully in THA for over ten years, However, crosslinking also reduces the mechanical properties of UHMWPE and a small number of fractures of modular acetabular liners have occurred in vivo.. The non conforming articular surfaces of the knee and interaction of the cam-post mechanism is PS designs can create high stresses on the tibial insert. Methods to reduce the effects of cross linking on the loss of mechanical properties include a reduction in the irradiation dose, and annealing the irradiated material below the melting point, which retains a higher level of crystallinity and strength, but also leaves free radicals which can oxidize in vivo. Secondary processes (Vitamin E or sequential irradiation) have been used to reduce the free radical concentration and potential for oxidation. However clinical retrieval studies which demonstrate the amount of oxidation that occurs with these sub melt annealed and secondary treated crosslinked UHMWPE’s are not yet available.

In vivo roughening of the cobalt chrome counterface can also adversely affect wear,. Use of a hardened abrasive resistant counterface material has been shown to effectively reduce wear in vitro. Clinical retrieval studies also demonstrate less UHMWPE wear damage with a hardened scratch resistant counterface compared to cobalt chrome, although clinical radiographic studies have not demonstrated a clear superiority of one counterface material over another.
Cement fixation of total knee replacements (TKRs) predominates with 85% of TKRs being secured with bone cement, 10% by hybrid fixation (cementless femoral fixation, cemented tibial fixation) and only 5% cementless. (1) There has been little change in these TKR fixation statistics over the past decade. These figures beg the question, “Why do orthopaedic surgeons prefer cement for TKR fixation?” Undoubtedly, surgeon training plays a strong role, but equally important, is the lack of convincing evidence which would prompt an orthopaedic surgeon to abandon the use of cement fixation in favor of the much more expensive cementless alternative. Let us examine the evidence.

Clinical Outcomes:
Long-term, Level I, clinical trials have failed to demonstrate any superiority of cementless TKRs over cemented TKRs. Baker et al performed a randomised clinical trial with fifteen year follow-up, comparing contemporary cemented and cementless TKRs. They found no benefit in using a more expensive cementless TKR, reporting 80.7% fifteen year survivorship for cemented TKRs and 75.3% for cementless TKRs. (2) Park et al performed simultaneous cemented and cementless TKRs in the same patient. They found no difference in clinical outcomes (Knee Society Clinical Ratings, WOMAC and satisfaction) or survivorships at eleven years follow-up. They also questioned the use of more expensive cementless TKRs when cemented TKRs provided the same if not better outcomes. (3)

Fixation:
Cementless femoral fixation appears equal to cemented fixation, but for the tibial component, there seems to be an advantage in using cement. In a randomised clinical trial that used radiostereometric analysis (RSA) as the outcome tool, Nilsson et al found comparable femoral fixation using cemented or cementless fixation. (4) For the tibial component, Nilsson et al found that bone quality affected fixation (poorer if bone density <0.6 gm/cm2) and that some cementless tibial components were associated with increased varus/valgus migration when compared to tibial components secured with cement. (5,6)

Cost:
Cemented TKRs are at least 50% less expensive than their cementless counterparts with no sacrifice in long-term fixation or survivorship. This is important as there are financial pressures on all our healthcare systems and total knee replacement has come under greater scrutiny as a high cost, high volume procedure.

Patellar Resurfacing:
Patellar resurfacing remains an issue for cementless TKRs, as most cementless patellar components require metal-backing, designs associated with unacceptable failure rates. One option is not to resurface the patella, but in most countries patellar resurfacing is favored. The
Australian National Joint Replacement Registry has noted lower revision rates when the patella was resurfaced for both minimally and posterior stabilized prostheses (p<0.001). (7) The highest revision rates were found in posterior cruciate ligament-sacrificing TKRs with a post-and-cam design.

**Conclusion:**
Cemented TKRs remain the gold standard in terms of TKR fixation, providing the most predictable outcomes for all patients in the most cost effective manner.

**BIBLIOGRAPHY:**

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It is clear that with time total knee replacements (TKRs) will be fixed without the use of methylmethacrylate cement. This has been the case with total hip arthroplasty (THR) where virtually all primary total hips and most revisions THRs are performed without the use of cement. The loading characteristics in the knee, however, are dissimilar from those in the hip. To clarify this difference one must look independently at each of the three components of a TKR, namely, the femur, the tibia and the patella.

The published data, from many series with multiple different cruciate retaining and cruciate substituting implants show good success without cementing the femoral component. There are some more recent studies with certain high flex implants that had a high failure rate of femoral loosening both in cemented and uncemented femoral components.

Tibial uncemented fixation has been more problematic. In previous studies with earlier forms of porous coating, there was a higher incidence of tibial loosening in the uncemented versus the cemented tibial components. In many cases, there were other factors other than merely the use of an uncemented implant that contributed to failure. It is clear that one must get excellent initial fixation in order to allow bone to grow into a porous surface. That extra fixation can be with perfect bone cuts, screws, and a variety of lengths and geometry of tibial stems. Screw fixation proved to be a problem as it created an access of back-sided debris from entering the bony surface and causing tibial osteolysis. These earlier reports were with porous coated surfaces that did not have as good an initial interference fit and it became clear that micromotion at the interface prevented ingrowth. On the tibial side, there have been more recent studies that support using trabecular metal which has a very favorable bone ingrowth, good tissue compatibility and a good interference fit. There are several commercially available trabecular metal surfaces that can achieve these goals. The results of uncemented tibial components with these newer surfaces have been favorable in some studies and mixed in others.

Uncemented tibial fixation in TKR requires more precise instrumentation because cement is forgiving. It acts as a grout for bony defects or imprecise cuts that do not allow a complete interference fit. Moreover, on the tibial surface, methylmethacrylate unifies the trabecular bone on the surface of the proximal tibia, which otherwise in a varus knee will be dense and sclerotic on the medial side and osteopenic on the lateral side leading to an inadequate surface to withstand the varus valgus loads that occur in the tibia during normal gait.

Patellar resurfacing with uncemented implants has been problematic. In many centers across the world, surgeons favor not resurfacing the patella and so the problem of uncemented patellar fixation becomes moot. If, however, as most US surgeons do, the patella is resurfaced, there is not yet an adequate interface to ensure patella ingrowth and prevent other mechanical problems. The most common surface has been a metal backed patella with a variety of porous surfaces. The difficulty has not specifically been the ingrowth into the patellar bone, but the thin poly, the
sharp metal poly interface and the accelerated wear and instability that has plagued most, but not all, patellar buttons.

In reported studies comparing cemented versus uncemented total knee replacement, the uncemented knees have a higher failure rate. This, in fact, may be similar to what was seen in the early total hips with inadequate geometry, incomplete proximal porous coating and poor instrumentation causing excessive micromotion. With today's THR designs, many of these problems have been solved.

It is this author’s opinion that with present technology and clinical plus radiographic follow-up, a cemented TKR outperforms its uncemented counterpart. With improvements in tibial and patellar fixation as well as improved surfaces to ensure an excellent interference fit and a favorable surface for ingrowth, most total knees at some point will be performed uncemented.
DEBATE: CEMENTED VERSUS CEMENTLESS TKRs?

Cementless: Leo A. Whiteside, MD
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Critical review of the literature fails to make a convincing case for use of cement in TKA. Many studies demonstrate clinical, mechanical, and biological failure when cement is used for fixation. Work by Ryd et al. [13] has shown that initial migration within the first few months diminished rapidly after the first 6 months with virtually no additional movement for years after. They also suggested that cemented components do not remain rigidly fixed to bone long-term, but loosen enough to move 0.2 to 1 mm at the bone-cement interface with provocative testing. [14] Although bone-ingrowth tibial components migrate slightly more initially than cemented ones do, they stabilize and do not sink progressively. [7,15] Screw fixation adds rigidity, but does not seem to improve results. [17] Rigidity of initial fixation is the most important feature after alignment to ensure pain-free function after arthroplasty, and can be achieved with press-fit techniques in TKA. [2,4,12,18] Several early reports of bone-ingrowth TKA had inferior results because the tibial component had no stem, peg, or screw fixation, leading to implant migration and loosening. [11,12] An effective stem has been shown to greatly improve tibial component fixation. [1,20] The cut upper surface of the prepared tibia has areas that are too weak to withstand the forces that are applied to the surface, and failure in compression is likely unless fixation is augmented. An effective stem also reduces the shear and tensile loads at the bone-prosthesis interface. [17] The effectiveness of compression or compaction of the tibial cancellous bone with an appropriately sized tibial metaphyseal stem has been shown, [8,16] and probably was a major factor in the long-term success of fixation in our series.

Clinical results of TKA with osteointegration techniques for fixation of the femoral and tibial components in our series are comparable with the best series reported with cemented fixation. [5,6,9,10] Many recent studies show significant advantages of osteointegration over cement fixation in TKA. [3,19] Fixation of implants with PMMA pressed into cancellous bone eventually loosens, and fixation of a metal component to bone cement also is tenuous in most cases. Cement is disappearing rapidly from use in total hip, ankle, and shoulder arthroplasty, and soon will be replaced with osteointegration technique in the knee.

Perhaps the most appealing aspect of bone-ingrowth TKA is bone preservation. The ease of revisability because of good bone stock was encouraging in the components that wore, loosened, or became infected in the current series of TKA. These knees are functioning as well as knees with primary TKA. Should these knees develop additional problems, progressive destruction of bone is unlikely to occur, even if repeated revision is necessary.

REFERENCES:
When to preserve or sacrifice the PCL has been an ongoing debate for over 30 years. A more accurate description is PCL substitution (PS), since implants which sacrifice the PCL substitute its function generally with a post and cam mechanism.

PS knees can be used for almost all TKA patients and permit a consistent technique that avoids difficulties with limited motion from an overly tight PCL or subluxation due to a lax PCL.

In vivo fluoroscopic studies suggest that PS knees have more consistent and more normal kinematics. Cruciate retaining (CR) knees tend to have more paradoxical motion and behave like ACL deficient knee.

There are few published randomized clinical trials, but the available studies show similar survivorship at 10 or more years. Studies on patient satisfaction and clinical scores also show similar results.

Comparative studies indicate that PS knees obtain significantly greater range of motion.

PS and CR knees have similar durability and overall clinical results, however we prefer the consistent surgical technique and the greater range of motion seen in the PS designs.
Knee stability can be restored with total knee arthroplasty either with a minimally congruent implant that retains the capsule and ligaments to define kinematic parameters or through interaction between the two components with an implant that substitutes for stabilizing structures. Posterior-stabilized substituting implants were introduced to improve knee flexion and improve survivorship by reducing wear with a more congruent articulation.

However, comprehensive review of the long-term results with this type of implant has failed to identify any benefit. In terms of range of motion, the outcome between retaining and substituting implants is no different. Clinical knee scores and implant survivorship are no different at the 10-year and 15-year intervals. In fact, in the most recent outcome study, the survivorship of posterior-stabilized implants at 15-years was 79%. This was statistically worse than the 90% survivorship of retaining components.1

If no benefit can be demonstrated with cruciate-sacrificing implants, then surgeons should question the use of an implant that sacrifices more bone and introduces unique sources of knee pain and implant wear debris. Unique complications attributed to posterior-stabilized designs include patellofemoral pain and crepitation with patellar clunk syndrome secondary to synovial hyperplasia1, the introduction of additional sources of wear debris from the polyethylene post and backside wear created by transmitting stresses to the modular locking mechanism interface.2

Advocates of posterior-stabilized designs will argue that often the posterior cruciate ligament (PCL) is not normal with the loss of mechanoreceptors and that it is difficult to balance, making the procedure more difficult. Therefore, they conclude that the PCL provides no benefit with knee arthroplasty surgery. Supporters of cruciate-retaining designs will counter that sensory function in the knee should be optimized by retaining all ligamentous structures. Ligament balancing should not be a stumbling block in knee arthroplasty. Surgeons that are comfortable with knee arthroplasty surgery and competent with ligament balancing techniques should choose cruciate-retaining implants. Those that are technically challenged should continue to use stabilizing designs.

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Introduction:
Orthopedic Surgeons like to debate the finer points of surgical technique. While topics such as how to handle the PCL, Ideal DVT Prophylaxis method, and favorite prosthesis may not have a clear debate winner, this is not true for the debate surrounding Patella Resurfacing. This talk will present the clear facts why resurfacing the patella is clearly the correct choice.

1) Bearing Surfaces- Do we really believe that cartilage on metal is a good long term bearing surface. Is this the type of bearing surfaces we want in the current TKA cohort population that is younger and heavier than patients in the past?
2) The cartilage at the patella is not normal. A recent study at our institution showed that even “normal “ patella have significant pathologic changes
3) Anterior Knee pain- This is common following TKA in all patients and significantly increased in the obese patient. How does one distinguish anterior knee pain from pain from an unresurfaced patella
4) Second operations to resurface a patella are often unsuccessful
5) Patella Complication rate from resurfacing is low with several studies showing a 1% incidence
6) All Prosthesis Designs are not created equal. A patella friendly design is needed if patella resurfacing is not performed. Results from one study design does not mean success from another design
7) Meta-Analysis Results show higher revision rates with unresurfaced designs
8) Parvizi et al- Less patient satisfaction with unresurfaced patella
9) Pakos et al- Less reoperation and less anterior knee pain with resurfacing
10) Select Resurfacing- For young patients- Does this make sense? Once again, is cartilage on metal a good choice for patients where prosthesis will be present for 20-30 years
11) Bilateral Knee Studies- More favor the resurfaced knee
12) Swedish Registry Data- 1.4X higher revision rate with no patella resurfacing

So what are we trying to fix?

Patella Complications are rare and most studies, Meta-Analysis Reviews and Registry Data favor Patella Resurfacing
Resurfacing versus not resurfacing the Patella?

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There are conflicting opinions about the merits of patellar resurfacing at total knee replacement: Some surgeons always resurface the patella, some never resurface it and some sometimes resurface it. This is primarily because there is conflicting evidence about the merits of patellar resurfacing, in part because most randomised controlled trials (RCT) have not been adequately powered. To address this, a pragmatic multicentre randomised trial involving 116 surgeons in 34 UK centres was begun in 1999. Within a partial factorial design, 1715 patients were randomly allocated to patellar resurfacing or not. Patients were assessed preoperatively and annually. The primary outcome measure was the Oxford Knee Score (OKS); secondary measures included SF-12, EQ-5D, costs, cost-effectiveness and need for further surgery. Patient reported data has been collected for ten years. Complication and reoperation data is obtained from the patients, hospital records and national statistics. This analysis has been completed for five years. Every year, up to ten years, there has been no significant difference between the resurfaced and non resurfaced groups in OKS or any of the other outcome score. The outcome was not influenced by whether the patella was domed or anatomic. There was no significant difference in the incidence of readmission/further intervention, minor/intermediate reoperation, major reoperation, further patella related surgery, or total healthcare costs.

This RCT of patellar replacement is larger than any previous RCT or meta-analysis of RCTs. The conclusion is that after TKR, functional outcomes, reoperation rates and healthcare costs are not influenced by whether the patella is replaced or not. Therefore surgeons can resurface the patella or not according to their own views. However as resurfacing offers no advantage it seems unnecessary and therefore unjustified.
There are myriad of factors known to impact on the outcome of knee replacement surgery. It can be difficult to understand the relative importance and interrelationship of these factors in a given clinical situation. Clinical trials although important at providing hypothesis driven outcome data do not necessarily provide sufficient information to enable surgeons to make decisions about what is the best approach in a given clinical situation. This is due to the know limitations of clinical trials which include exclusions, inadequate power and limited capacity to compare results within but most importantly between studies. A well controlled clinical trial has poor external validity and as a consequence it is difficult to extrapolate the results to different clinical situations and different prostheses.

Consequently there remains an on ongoing debate about the relative value of cemented v’s cementless, PCL sacrificing v’s retaining, mobile v’s fixed and patella resurfacing v’s no resurfacing. Different clinical trials have reported excellent outcomes for each of these approaches. Relying on clinical trials evidence is potentially confusing and can lead surgeons to adopting a philosophical approach to decision making.

One of the most powerful features of a comprehensive National Registry is that it is able to provide analysis of community based data which simultaneously compares multiple different approaches to joint replacement surgery. It can provide quality information with no lost to follow up on the relative risk of revision and how that varies with prosthesis patient and surgeon factors.

This presentation will provide an overview of the Australian Orthopaedic Association National Joint Replacement Registry knee replacement data. In addition the data will be used to provide insight into the impact that surgeon choice has on the capacity to optimize the outcome of knee replacement with particular focus on surgery in the young patient.
National Arthroplasty Registries have provided significant insight into the survivorship of various implant designs and philosophies, as applied to large population of patients. Survivorship is a definitive outcome metric but has limitations, as it does not capture subjective, patient perceived outcomes, such as satisfaction. Satisfaction has merit as a subjective outcome for National Registries because it is simple to apply with good response rates, but also because it encapsulates a multitude of intangible constructs within one metric.

A comprehensive survey on satisfaction has previously been completed with the Swedish Knee Arthroplasty Register that was followed by a cross sectional study using additional health outcome questionnaires. Similar studies have been completed in jurisdictions in the United Kingdom and Canada. Perhaps the most compelling data from these findings indicates that a remarkably consistent rate of 20% dissatisfaction with TKA was seen in all jurisdictions. Satisfaction was most closely correlated to relief of pain followed by improvement in physical function, when compared to conventional metrics, such as the WOMAC. The chronicity of the onset of the disease process that led to TKA was also related to satisfaction, with rheumatoid patients having the highest level of satisfaction and post-traumatic pathologies having the lowest. The greatest risk for dissatisfaction post TKA was unmet expectations.

National Registries tell us that there is a ceiling to satisfaction post TKA, and that this ceiling is in large part related to unmet expectations. This is compelling giving the decreasing average age for TKA patients. Strategies to address unmet expectations post TKA, including patient counseling and implant design factors, should be adopted in order to break through the glass ceiling of satisfaction.

REFERENCES:


Effect of Type of Arthritis and Patient Factors on Outcome
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PURPOSE:
To describe the population having knee arthroplasty with respect to the diagnoses and patient characteristics, discussing how these factors may affect outcome after surgery.

METHOD:
The paper was prepared using data from the Swedish Knee Arthroplasty Register (SKAR) as well as available information on knee arthroplasty from other national registries.

RESULTS:
In the recent years Sweden has experienced a considerable increase in the use of total knee arthroplasty (TKR), mainly for osteoarthritis (OA). The prevalence of knee arthroplasty in Sweden in 2010 had become greater than 10% meaning that more than one in ten 85 year old women was walking around with at least one knee arthroplasty. At the same time the age distribution has changed towards younger patients having surgery and while the surgery has increased for OA the incidence of TKR for rheumatoid arthritis (RA) has been halved in a decade. The reasons for these changes are unclear but both patient related factors and changes in treatment options undoubtedly play a role.
That the type of disease may affect outcome after knee replacement is well illustrated by the much higher rate of revision for RA patients after unicompartmental arthroplasty (UKR). For TKR, the differences in overall risk for revision for the different types of diagnoses are relatively small. However, the reasons for, and the types of revisions vary. E.g. compared to OA, RA patients are more often being revised for infection. Male gender has in many papers been correlated to higher risk of revision and a slightly higher revision rate for males has been observed by the Australian and New Zealand national joint registers after adjustment for differences in age. However, in Sweden the overall difference between the sexes has been negligible although males are more often revised for infection than females.
In all national registers, young age has been found to affect results negatively and in Sweden this has been more obvious for OA than for RA.

CONCLUSION:
While TKR for RA has reduced in recent years there has been substantial increase in TKR for OA in all age groups but especially so among the younger ones. This is somewhat worrying as the risk of revision I known to be inverse proportional to age. The overall revision rate after TKR does not vary much depending on the preoperative diagnosis or gender. However, the types of revisions vary with some of the more serious ones being more common in RA as well as males.
To facilitate further research in this area there is a need for coordination in the classification of possible diagnoses leading to arthroplasty, the reasons leading to revision as well as the types of revisions performed.

KEYWORDS:
Role of Surgeon Experience On Outcomes of TKR
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Introduction:
Total knee replacement is a very successful surgical procedure that provides significant improvement in health related quality of life outcomes and patient satisfaction. The overall success of TKR surgery is over 90% however, some patients still encounter complications and poor outcomes following surgery. Many factors influence the success following TKR including patient factors, implant factors, hospital factors and surgeon experience.

Objective:
To review the literature on the role of surgeon experience and its impact on the outcomes following TKR.

Methods:
We reviewed the published literature in the English language from 1990 to 2011 using Medline and Embase to identify pertinent publications. Papers that did not evaluate surgeon experience specifically were excluded. Several studies looked at the role of both hospital volume and surgeon volume of TKR and these were included in the review. We identified papers from several countries however the majority were from the US and Canada. In the majority of papers surgeon annual volume of TKR procedures performed was used as an indicator of surgeon experience. Similarly for hospitals annual volume of TKR procedures was used as an indicator of hospital specialization for the procedure.

Results:
We identified 11 studies that met our inclusion criteria of evaluating the effect of surgeon experience on patient outcome. Studies performed in the US have demonstrated reduced mortality (measured at variable time points from in-hospital rate to 30, 90 and 1 year mortality), and peri/postoperative complications (ranging from in-hospital to 8 years post surgery) with higher surgeon volume (defined as from >10 to >35 cases per year) when compared to surgeons with low surgeon volume (defined as <10-15 cases/year). Studies performed in Canada have shown no difference in mortality and complication rate. High hospital volume (defined in studies as ranging from > 85 cases per year to >270 cases per year) has been demonstrated to have a significant effect on outcome, with high volume centers having significantly lower mortality and morbidity rates. Results should be interpreted with caution for hospital and surgeon volume studies, as potentially confounding variables are not controlled.

Conclusions:
The effect of surgeon experience on outcomes following TKR is largely unclear. Other factors may be contributing to the heterogeneity of results in the literature, especially when considering the difference between studies performed in the US and Canada. Further study may help elucidate other potential factors confounding the relationship between surgeon experience/volume on outcome.
Effect of Implant Type on Outcomes
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National joint replacement registries are able to simultaneously compare the outcomes of different types of knee prostheses. Using revision as an end point it is quite straightforward to undertake a statistical comparison to determine if there is a significant difference in the outcome for individual prostheses compared to other prostheses when used in a specific patient population. It is possible to identify those prostheses that have the lowest and highest rates of revision. As well as individual prostheses it is also possible to determine differences in outcome between classes of prostheses, prostheses with different generic features and prostheses within a family.

Most prostheses perform in a similar manner however there are a number of outlier prostheses that are able to be identified as having a higher than anticipated rate of revision when compared to all other prostheses. The Australian Orthopaedic Association National Joint Replacement Registry has developed a three stage process to both identify and determine if these prostheses should be highlighted in the Annual report. After an initial screening analysis to identify potential outliers there is a subsequent more detailed analysis to determine if there are any differences in the reasons for revision and what non device related factors, if any, are impacting on the outcome. The third stage involves an independent review of the registry analysis by a panel of arthroplasty surgeons. It is this panel which decides if a prosthesis should be highlighted as an outlier in the Annual Report. The implications and outcomes of highlighting outlier prostheses will be discussed.
The rationale behind the use of prophylactic antibiotics is to reduce the bioburden in the host and in turn preventing proliferation of bacteria, particularly those in the vicinity of an implant. Studies in 1960s have shown that prophylaxis is effective only if the antibiotic is available in the serum prior to introduction of bacteria. Because of the latter, antibiotic is given prior to surgical site infection (within one hour of surgery- SCIP and AAOS recommendation). Regardless of the dose of antibiotic given, it is impossible to sterilize the host. The type of prophylactic antibiotics given requires knowledge of potential organisms that can gain access to the wound. Skin flora, in particular Staph. aureus and Staph. epidermidis are the two most common skin organisms that are known to result in surgical site infection. Other bacteria, though rare, can also result in SSI. Sir John Charnley is credited to be the first who described the role of prophylactic antibiotics in prevention of SSI following joint arthroplasty. During the early era of joint arthroplasty (1960s), and in an effort to evaluate the importance of clean operating room environment, he avoided administration of prophylactic antibiotic and observed an infection rate of 7%. In 1970s and with administration of prophylactic antibiotics, the incidence of infection dropped considerably to around 0.5%.

The best prophylactic antibiotic for joint arthroplasty is cefazolin or cefuroxime. These bactericidal drugs have an excellent tissue penetration, rapid (within minutes) and good bioavailability, broad spectrum of activity against all skin flora including gram negative bacilli, nonbacteroid anaerobes, and gram positive cocci. The antibiotic needs to be dosed according to patient weight. Patients weighing > 80 Kg should receive 2gr whereas those with lower weight can be given 1 gr. The dose of antibiotic needs to be repeated if surgery lasts more than two hours, or patient loses more than 30% of circulating volume (1500 ml). There are numerous studies showing that extending prophylaxis beyond 24 hours confers no benefit. Thus, current recommendations are to administer prophylactic antibiotic within one hour of surgery and for 24 hours after surgery. In recent years there has been a rise in the number of (methicillin) resistant organisms. In some high volume centers in Chicago and New York the incidence of methicillin resistant Staph. aureus reaching 40%. Thus, the choice of antibiotic should take into account the pattern of bacterial resistance in the community and the hospital. Vancomycin should be administered to patients colonized with MRSA/MRSE, facilities with high prevalence of MRSA/MRSE (>10%), those with proven penicillin allergy (though some centers may prefer to administer clindamycin to these patients), and facilities with MRSA/MRSE outbreak. If used, vancomycin should also be dosed according to weight (10-15 mg/kg) and in order to prevent rapid release of histamine (red man syndrome) infusion of 1 gr of vancomycin should be over one hour. All prophylactic antibiotics should be administered intravenously to ensure predictable bioavailability. Prophylaxis may also be administered by adding antibiotic to methylmethacrylate cement. Though not FDA approved, majority of surgeons use Abx impregnated cement as a prophylaxis during total joint arthroplasty.

References:


Does the use of Laminar Flow and Full Body Exhaust Suits decrease Revision for Infection in Total Knee Replacement?

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We reviewed all patients with a registered Total Knee Replacement (TKR) on the New Zealand Joint Registry and investigated whether the use of laminar flow operating rooms with or without full body exhaust suit reduced the rate of revision for early deep infection.

The 12 year results of the registry for the 48,232 TKRs showed that laminar flow operating rooms were used in 42%. There were 72 TKR revised for infection within six months of the index procedure with a significant increase in those procedures performed in a laminar flow compared to a conventional operating room (p=0.002). Full body exhaust suits were used in 14262 (30%) of cases with a significant increase risk of revision for early infection when a suit was worn (p<0.001). When a suit was worn there was no difference in the infection rate between the conventional and laminar flow rooms (p=0.15) but there was a significant increase in the conventional rooms when a suit was worn compared to no suit (p=0.014) These results were independent of age, disease and operative time and were unchanged when the surgeons and hospitals were analyzed individually.

We concluded that the rate of revision for early deep infection has not been reduced by using laminar flow or full body exhaust suits. These results question the rationale for the increasing use of these modalities in routine joint replacement and the added cost to the health system would seem to be unjustified.
With the advent of total hip replacement in the 1960’s and 1970’s, Sir John Charnley identified an increased infection rate with prosthetic surgery. It was felt that this was primarily from the types of air flow and that there was increased contamination from the people present and their dress. Multiple bacteriologic studies were done on the operation room environment. These multiple studies determined that the contamination came from the people present and that people shed from 1,000 to 10,000 bacteria per minute. This bacterial contamination was not prevented by surgical gowns although switching from cloth to plastic gowns lessened the bacteria shed. Shed was also not prevented or lessened with different surgical caps or masks. It became a major worry once walled laminar flow clean air rooms were developed since surgeons would be placing their unscrubbed heads in the clean air flow. Body exhaust suits were developed in an attempt to solve this problem.

Sir John Charnley and others were able to show a large decrease in infections with these changes. Tidwell et al in a review of over 8,000 arthroplasty operations found a decreased infection rate, from 3.4% to 0.2% with the use of clean air, antibiotics and body exhaust suits.

With advancing technology, operating rooms have better ventilation and air flow, both in laminar and conventional OR’s. In fact, the distinction between the two has become blurred. With the increased ventilation, it has been felt that walls were no longer needed to isolate the patient from the non-sterile surgical team. Helmets have been developed with fans on the helmet to do away with the hose ventilation system. More recent data shows that exhaust suits probably no longer have a significant effect on the bacteriology of the modern operating room.

REFERENCES:


Antibiotics in the bone cement have been used in the treatment of infected prostheses in hips and knees since the early 1970s. From the mid 1990s, antibiotics in the cement in combination with antibiotics systemically has been used routinely as prophylaxis in primary TKA and THA in the Scandinavian countries, and increasingly also in other European countries (1, 2).

It has been demonstrated in Scandinavian registry studies that antibiotics systemically combined with antibiotics in the cement decreases the risk of revisions due to infection and aseptic loosening of primary THA (3,4) and in TKA (5). The Australian registry confirms this finding both for TKA and THA (6). However; a recent registry study on primary TKA in the US (Kaiser Permanente) did not find reduction in revisions due to infection with cement containing antibiotics (7). One small randomized study (n=340) found a reduction in infection with antibiotic in cement combined with systemic antibiotic (8). The Swedish study (9) of 1688 patients demonstrated lower infection rate in gentamicin bone cement compared to systemic antibiotic at 2 an 5 years but not at 10 years. On small study (n=401) did not find a difference between systemic prophylaxis or antibiotic in cement (10). However, we have not been able to identify any sufficient powered randomized studies using clean-air measures comparing THAs or TKAs inserted with antibiotic loaded bone cement combined with systemic antibiotic prophylaxis and replacements with antibiotics systemically without antibiotic in the cement.

In the US, the FDA has not approved antibiotics in bone cement for routine use in primary TKA and THA due to concerns about development of bacterial resistance and uncertainty about the cost effectiveness (11). However, a cost-effectiveness analysis based on Norwegian THA data and US data on cost showed that use of antibiotic-impregnated bone cement resulted in an overall cost decrease when revision due to either infection or aseptic loosening is considered to be the primary outcome. (12).

Conclusion
Registry data indicate that a prophylaxis of antibiotics in cement combined with antibiotics systemically prevents revisions due to infection in both primary THA and TKA, compared to systemic antibiotic prophylaxis only. There is a need for sufficient powered randomised studies on both THA and TKA to confirm these results, both in high and low risk patients.

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According to *Webster’s Dictionary*, efficiency is defined as the capacity to produce desired results with a minimal expenditure of energy, money, time, and materials. For a surgeon performing an operative procedure this would mean “skillfulness in avoiding wasted time and effort.” (www.webster-dictionary.org) The essential ingredient to becoming efficient is to promote a culture of efficiency. There are 10 elements: 1) proactive surgeon perspective; 2) effective utilization of preoperative holding area; 3) preoperative planning / templating; 4) development of preference cards; 5) OR set-up protocols; 6) OR team concept; 7) streamlined instrument sets; 8) consistent operative workflow; 9) standardized closure / dressings; and 10) prompt and meticulous room turnover.

This culture of efficiency will assist the surgeon in the prevention of periprosthetic joint infection by minimizing iatrogenic causes. It has been well established that one of the most significant methods of reducing infection is to reduce the bio-burden. Techniques of reducing this bio-burden include: 1) prophylactic antibiotics; 2) laminar airflow; 3) ultraviolet light – in operating room itself or in the HVAC ducts; 4) meticulous sterile technique; 5) antimicrobial skin prep; 6) hand washing by all personnel; 7) decreased traffic flow; 8) only essential OR personnel; 9) personal protection systems; 10) minimizing flash sterilization; and 11) decreased OR time.

The culture of efficiency requires buy-in by all involved in the operative procedure. Every one entering the operating theatre should have proper body coverage – no hair visible, no nose visible. There should be a strict limit to needless activity: minimum opening of doors, no changing of personnel during an operation, and use of intercom/telephone to request equipment. As the surgeon and the team begin to embrace efficiency, surgical times will decrease. Multiple studies have demonstrated that increased surgical time is associated with a higher incidence of infection. This is secondary to time-dependent contamination of the surgical wound and field.

The take home message is to develop and embrace efficiency. Your OR days will flow smoothly. Your operations will proceed with minimal stress. You will spend less time drinking coffee between cases and have more free time at the end of the day. However, most importantly, you will deliver a quality product to your patient.

REFERENCES:

SYMPOSIUM V: DIFFICULT TKR PATIENTS: CHALLENGING THE EXPERTS

12:55-1:40 pm

Moderator: Robert T. Trousdale, MD (Mayo Clinic, Rochester, MN)

Experts:
Johan Bellemans, MD, PhD (University Hospital Leuven, Pellenberg, Belgium)
Lawrence D. Dorr, MD (Dorr Arthritis Institute, Los Angeles, CA)
Mark P. Figgie, MD (Hospital for Special Surgery, New York, NY)
William J. Maloney, III, MD (Stanford University Dept of Ortho Surg, Redwood City, CA)
Aaron G. Rosenberg, MD, FACS (Midwest Orthopaedics at Rush, Chicago, IL)
Thomas P. Sculco, MD (Hospital for Special Surgery, New York, NY)

This 45 minute symposium will be a lively interactive session discussing various issues with primary and revision TKA. Cases presented with highlight indications, preoperative planning, surgical technique, intraoperative and postoperative complications in both the complex primary and revision TKA situation.
Irrigation and debridement is a time-honored procedure for surgical site infection. Unfortunately the results of this procedure for periprosthetic infection must be considered mediocre at best with a reported failure rate of 68% \(^1\). Despite such results, enthusiasm for this procedure persists because the alternative – removal of the implant – is perceived as radical by patient and surgeon alike.

While it is well accepted that irrigation and debridement is not an effective treatment method for chronic infections, its use is frequently advocated if the infection is recognized early or involves a sensitive organism\(^2\). A recent report, however, found that failure occurs 64% of the time even if the irrigation and debridement is performed in the perioperative period – defined as the first three months postoperatively\(^3\). Additionally, sensitive organisms appear to have a similar failure rate compared with other organisms. Patients with a periprosthetic infection involving streptococcal organisms had a 71% failure rate compared with a 67% failure rate for infections including other organisms \(^4\). Finally recent evidence has shown an 84% failure of irrigation and debridement for infections involving resistant organisms, MRSA or MRSE\(^5\).

These high failure rates appear to have an effect on the results of subsequent two-stage reimplantation. The failure rate of two-stage reimplantation following a failed irrigation and debridement is three times the failure rate of two-stage reimplantation reported in the literature\(^6\). The rapid formation of a protective biofilm layer during periprosthetic infection appears to protect bacteria and may be the cause of the high failure rates reported for irrigation and debridement. Caution should be used when recommending this treatment method.

Prospective studies are underway by the Periprosthetic Infection Consortium concerning the efficacy of irrigation and debridement in the management of acute hematogenous infection.
Static Antibiotic-impregnated Cement Spacers for the Management of Total Knee Arthroplasty Infections
Giles R. Scuderi, MD
Insall Scott Kelly Institute for Orthopaedics and Sports Medicine
New York, NY

Infection is a devastating complication following total knee arthroplasty. The treatment for late chronic infection is a two-stage procedure with removal of the implant, insertion of an antibiotic-impregnated cement spacer, IV antibiotics and then re-implantation. Insall first described this course of treatment in 1983 and because of success rates > 90% this has become the standard of care in the United States.

The addition of static antibiotic-impregnated cement spacers has demonstrated better clinical success over two-stage procedures without the insertion of spacers. PMMA serves as a delivery vehicle for local antibiotics. Antibiotics are eluted from the surface and pores of cement, as well as from the micro-cracks within it. The elution of the antibiotic from the cement spacer is dependent upon the antibiotic dose, the combination of antibiotics used and the type of cement.

The clinical efficacy of antibiotic-impregnated cement spacers relies on: the elution characteristics of the selected antibiotics, the strength and fatigue life of the polymethylmethacrylate cement and the mixing technique. The antibiotic used must be thermostable during the exothermic reaction; have the ability to diffuse in water; it should also be broad spectrum and bactericidal at low concentrations and carry a low risk of allergy or delayed hypersensitivity. Finally the antibiotic must be available in powder form.

The benefits of static cement spacers include: distraction and preservation of the joint space for subsequent re-implantation; stabilization of the limb until re-implantation; and the use of large doses of antibiotics within the cement. The introduction of intramedullary femoral and tibial antibiotic-impregnated cement rods also permits elution of the antibiotics within the medullary canals. Complications of static spacers include bone loss, dislocation, continued pain, decreased mobility and occasionally fracture. However, most of these reported complications are the result of improper preparation of the static antibiotic-impregnated cement spacers.

The preferred technique for static antibiotic-impregnated cement spacers is to place the doughy cement between the femur and tibia with distraction of the joint in such a manner as to avoid invagination of the cement into the cancellous bone. Cement dowels can be fabricated and inserted into the femoral and tibial canals. The solid stable construct should extend to the cortical margins of the femur and tibia and an anterior flange should be included between the femur and patella. The “hockey puck” or “hamburger” spacers should be avoided since they are unstable, can easily displace and result in excess bone loss. At the conclusion of the procedure, the knee is immobilized in either a cast or long leg brace. The advantage of immobilization beyond stabilization is that it allows the inflamed soft tissues to heal.

While the re-infection rates and clinical results with static spacers are comparable to those of mobile spacers, there is a marginal advantage to post-op range of motion with mobile spacers. Potential disadvantages of mobile spacers include problems with tibio-femoral instability, patella instability, wound healing, and increased risk of cement fracture.
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Traditional 2-stage revision of infected total knee replacement requires a period of time between explantation and subsequent re-implantation, while receiving intra-venous antibiotics. Disappointment with the results of simple implant resection has lead to the use of spacers of various types that serve to elute additional antibiotics and splint or otherwise aide in soft tissue management.

Static spacers immobilize the knee in extension, which serves to maintain the length of the peri-articular soft tissues, but still limits the length of the quadriceps mechanism, promoting contracture of these tissues. This may make exposure of the knee more difficult at the time of re-implantation, and make it difficult to close the extensor mechanism if a quadriceps snip or quadriceps V-Y plasty is used.

There are two types of articulated PMMA spacers, hand-fashioned(1) and made from pre-fabricated molds.(2) General principles of both types of spacers are to attach the spacers with thick dough-phase cement to prevent boney fixation, distract the leg to tension the soft tissues, and control the post op range of motion with a hinged knee brace.

Concerns with this technique include the extent of drug elution and infection control, bone damage during the period of implantation, breakage or dislocation of the device, and debris generation into the synovium. Range of motion with the spacer has been reported from 20° to 80°, average 58°. (4)

Higher doses of antibiotic improves elution rates.(5) Re-infection after a PMMA spacer varies from 9% to 12% from 1-2 years post revision. (2,3,4) Most series show some late re-infections with new organisms. Particulate debris is generated from the PMMA articulation and extensive lavage and synovectomy should be part of the re-implantation. (6) Bone damage from the spacer can be mitigated by protecting the limb and using diaphyseal support where indicated. (4)

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Two-stage arthroplasty remains the gold-standard for the treatment of the infected knee replacement. While initially described with no spacer after the infected implants are removed, this technique has been modified with the insertion of an antibiotic-loaded spacer to allow tensioning of the soft tissue and to allow local antibiotic release. This main disadvantage of this static spacer technique is that the knee is held in full extension between stages, which makes rehabilitation difficult for the patient.

The Prosthesis of Antibiotic-Loaded Cement (PROSTALAC) was initially designed in 1987 as a hand molded cement on cement articulation to allow some motion between stages. This was subsequently modified in 1991 by the addition of plastic molds to allow more precise intraoperative manufacturing of the spacer. The following year, a metal on polyethylene articulation was added, and one year later, the design was changed to a posterior-stabilized design with a metal on poly articulation and manufactured using rigid molds to simulate a knee replacement, while maintaining a high surface area of antibiotic-loaded cement. At our center, this system has been in use since then. At a minimum five-year follow-up, infection was eradicated in 101 out of 115 infected knees. Of the recurrent infections, only 4 were with the same organism, and the rest were with new organisms. Of the 14 recurrent infections, 12 were salvaged using a repeat two-stage exchange arthroplasty with the PROSTALAC system, for a total infection eradication rate of 98%.

In summary, the addition of metal and polyethylene to the articulation of the PROSTALAC has not adversely affected its ability to eradicate infection, but allows easier knee motion for the patient between stages.
Repeat Two Stage Revisions in Infected TKA
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Management of the infected total knee arthroplasty is clearly a challenging problem. Perhaps even more vexing is what to do with the patient that has already undergone a previous two stage procedure, and now presents with a recurrence of infection. This is not an uncommon clinical scenario, as success rates for the first two stage procedure are currently quoted at around 80-85% in the literature.

There are 4 treatment options for patients presenting with a failed two stage procedure:
1) Chronic antibiotic suppression
2) Repeat two stage revision
3) Knee arthrodesis
4) Above knee amputation

Obviously there is no one treatment option that is best for all patients. It must be individualized based on numerous factors, including patient desires and acceptance.

Critical factors to evaluate when contemplating a repeat two stage procedure include:
1) Infecting organism
-a growing body of literature attests to the difficulty in eradicating resistant organisms
2) Host factors
-comorbidities such as diabetes, immunosuppression, and obesity are all risk factors and predictors of reinfection
3) Local factors
 - skin and soft tissue coverage issues, as well as extensor mechanism compromise, are critical in weighing surgical options
4) Technical factors
-an understanding of the exact history of the previous two stage procedure – Abs utilized in the previous spacer (concentration and sensitivity to organism being treated), length of treatment of intravenous Ab, known infection eradication prior to reimplantation

There are few reported series in the literature discussing repeat two stage revisions. Two recent series\(^1,5\) discuss infection free results, at a minimum of 2 years, of 78% and 94% respectively.

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Two-stage reimplantation for periprosthetic knee infection involving resistant organisms

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Reinfected revised TKA resolves with an aggressive protocol and antibiotic infusion
Clin Orthop. Sep 27, 2011 (Epub ahead of print)
A Randomized Controlled Trial of Minimally Invasive TKR: Comprehensive Gait and Strength Testing Outcomes.

Running title: Functional outcomes of minimally invasive TKR

Julien Wegorzyn, MD, PhD 1,2, Sebastien Parratte, MD, PhD 1,2, Krista Coleman-Wood, PhD, PT 2, Kenton R. Kaufman, PhD, PE 2, and Mark W. Pagnano, MD 1

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Background:
While some clinical reports have suggested that minimally invasive surgical (MIS) techniques improve recovery and reduce pain in the first months after total knee replacement (TKR), no study has directly compared MIS and standard approach TKR using objective functional outcomes assessed by gait analysis and thigh musculature strength.

Questions/purposes:
Our explicit hypothesis was that TKR performed through a minimally invasive subvastus approach would result in improved objective and subjective functional outcomes when compared to a standard medial parapatellar approach two months after surgery.

Patients and Methods:
Forty patients were randomized into two groups according to the surgical approach: minimally invasive subvastus (MIS) or a standard medial parapatellar approach. Patients were evaluated pre-operatively and two months after surgery. Subjective functional outcome and quality of life (QOL) was assessed using routine questionnaires (SF-12; Knee Society Score; KOOS; UCLA activity; patient milestone-diary of activities). Objective functional outcome was determined by measuring the isometric strength of the thigh musculature and by 3D gait analysis during level walking and stair climbing.

Results:
In the two groups, improvements in functional scores and QOL from preoperative to 2 months post-operative were dramatic (p<0.0001 to 0.003) as were the improvements in knee kinematic and kinetic gait parameters during level and stair walking (p<0.0001 to 0.048). Isometric quadriceps strength increased two months after surgery in the two groups (p=0.022 to 0.038) although remaining lower when compared to the sound limb (p=0.007 to 0.002). We could not find any substantial difference, however, between the two groups in regard to: Knee Society; SF-12; KOOS; UCLA activity; or patient milestone-diary of activities questionnaire results. In addition, we could not find any difference in isometric 24 quadriceps strength or 3D gait parameters between the MIS and the standard approach (p = 0.65 to 1.00), except a marginally higher speed of stair ascent two months after surgery in the MIS group (p=0.018).

Conclusions:
In this randomized controlled trial which included contemporary anesthesia, pain management, rapid rehabilitation and patient education protocols, no substantial difference was found between MIS and standard medial parapatellar approach TKR in regard to function at two months after surgery as assessed by comprehensive gait analysis, strength testing, a patient milestone-diary of activities, and multiple questionnaire-based outcome tools.
Level of evidence:
Therapeutic Level I. See instructions to Authors for a complete description of levels of evidence.

Key words:
Total knee replacement, minimally invasive surgery, mini-subvastus approach, quadriceps strength, gait analysis.
A Retrieval Analysis of High Flexion Versus Posterior Stabilized Tibial Inserts

Running title: **Damage in Retrieved HF vs. PS Tibial Inserts**

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Ethical Statement: Ethics approval was obtained from our institution’s ethics review board.

This work was performed at The London Health Sciences Centre, London, Ontario, Canada.

Background:
High flexion (HF) implants have recently been introduced to increase range of motion and patient satisfaction, but have not yet been studied in a retrieval analysis in comparison to standard posterior stabilized (PS) tibial inserts.

Questions/Purposes:
The purpose of the present study was to examine how the design changes between HF and PS tibial inserts would affect their (1) overall damage profile and more specifically the damage on their (2) articular surface, (3) backside and (4) tibial post.

Methods:
We matched 20 retrieved HF inserts to a cohort of 20 PS inserts from the same manufacturer on the basis of duration of implantation, body mass index, and age. Inserts were divided into 16 zones and a microscopic analysis of surface damage was carried out. Several inserts were scanned using micro-CT to further quantify instances of severe post notching.

Results:
Significantly greater backside (p=0.01) and post (p = 0.02) damage were found in the HF group, with no significant difference in the articular surface (p = 0.70) or overall (p = 0.18) damage scores. Notch depths around the post in both groups ranged from 0.6 to 1.9 mm.

Conclusions:
Increased post damage in the HF group suggests a potential susceptibility to post fracture, particularly at higher flexion where contact stresses are higher. The increased backside damage was unexpected as the two groups have the same tibial component, locking mechanism, and sterilization method.
Clinical Relevance:
The introduction of a highly crosslinked HF insert will require close scrutiny as a result of the increased strain and potential for post damage demonstrated in this series.
Efficacy of Postoperative Intraarticular Analgesia Following Total Knee Arthroplasty: A Randomized, Double-Blinded, Placebo-Controlled, Prospective Study

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Background:
Postoperative pain after total knee arthroplasty remains one of the most significant challenges facing patients after surgery. Successful postoperative rehabilitation hinges on excellent pain management, and the adverse effects of current analgesic approaches continue to potentially limit achievement of rehabilitation goals. The balance between adequate analgesia, limitation of the functional impact of regional anesthesia, and minimization of opioid side effects is critical to postoperative outcome. This study was designed to investigate the effectiveness of an intraarticular pump delivering a local anesthetic agent in reducing postoperative pain and opioid consumption.

Methods:
In this prospective, double-blinded, placebo-controlled study patients were randomized to either (1) the experimental group (n=75) – receiving a continuous intraarticular infusion with 300mL of 0.5% bupivacaine at a speed of 5cc/hr through an elastomeric infusion pump, or (2) the control group (n=75) – receiving a continuous intraarticular infusion with 300mL of 0.9% normal saline solution at a speed of 5cc/hr through an elastomeric infusion pump. All patients received standardized regional anesthesia, and a preemptive, multimodal analgesic protocol. Data concerning postoperative pain levels through a visual analog scale (VAS), postoperative opioid consumption, opioid-related side effects, and complications was collected and analyzed.

Results:
In the setting of excellent pain control and low overall opioid consumption in both groups, patients in the experimental group receiving the bupivacaine reported a statistically significant reduction in pain levels in highest (p=.01), lowest (p=.01), and current (p=.03) VAS scores compared with the placebo group on the first postoperative day and highest (p=.04) VAS score on postoperative day two. Additionally, there was an average 33% reduction in opioid consumption on day two (p=0.021) and an average 54% reduction in opioid consumption for patients remaining on postoperative day three (p=0.038) in the experimental group.

Conclusion:
TKA patients benefited significantly from the use of a postoperative intraarticular catheter delivering local anesthetic. Overall pain levels and the need for opioids were reduced. This intraarticular analgesia delivery device provided an effective adjunct for sustained pain relief in the immediate postoperative period without the disadvantages encountered with epidural anesthesia, regional nerve blockade, and patient controlled analgesia (PCA) pumps.

Level of Evidence:
Therapeutic Level 1.
There have been 5 “bad ideas” in total knee arthroplasty over the past 30 years: carbon-reinforced polyethylene, metal-backed patella components, routine use of low molecular weight heparin, gender-specific femoral components, and now, patient-specific instruments. These instruments shift the bone landmark registration and implant positioning of computer navigation from the intra-operative setting to the pre-operative setting. A preoperative MRI or CT scan is mandatory! Default implant sizing and alignment targets are STILL predetermined (templated) by the surgeon and mapped onto the virtual knee. The surgeon must also REVIEW, MODIFY, and ADJUST the preoperative computer plan to incorporate any clinical findings, such as, flexion contracture and ligament imbalance or insufficiency. The finalized preoperative plan is then sent back to the implant vendor for fabrication of patient-specific cutting blocks. The supposed advantages of these instruments include more accurate coronal alignment, fewer outliers, no instrumentation of intramedullary canal, decreased operative time, decreased hospital costs to clean-sterilize instruments, better outcomes and fewer revisions. However, there is no evidence to support any of these marketing claims.

It is crucial to remember that patient-specific instruments will NOT: perform ligament releases to balance the knee; determine proper tibial component rotation; resect the patella for resurfacing; or cement the components. These are the crucial factors which determine the long-term success and rate of revision of total knee arthroplasty. There are many disadvantages of patient-specific instruments, including: cost ($1000 for MRI and $1500 for fabrication), preoperative scheduling of MRI, the learning curve for surgeon to work with implant company engineers, and the uncalculated valuable preoperative time spent by the surgeon planning and reviewing the “blueprints”. One study of OtisMed instruments reported no difference in blood loss, decreased tourniquet time of only 13 minutes, 4.7 % recutting tibia and 9.5% alignment outliers. Another study using the Materailise software suggested a learning curve of 26 knees and 10 minutes decrease in operative time. A Markov model study reported an increased cost of $4600 for 4.6 QALYs for patient-specific instruments and that the rate of revision must be reduced by 50% or more for these instruments to be cost-effective.

The author continues to strongly recommend conventional instruments with preoperative templating of radiographs for femoral and tibial component sizes, as well as measuring the distal femoral and proximal tibial resection amounts. This is simple, requires minimal time, and only a long cassette film is necessary. In a study of 200 consecutive knees using this method, 95% femurs and 99% tibias had proper coronal alignment. In another study using preoperative digital templating in 100 knees, one surgeon supplied the preoperative implant sizes to three different vendors to provide 3 lightweight instrument trays based on sizing. In 97% of cases, the prepared sizes and 3 trays were all that was needed, as opposed to the usual 6-9 instrument trays.

When considering new technology to perform total knee arthroplasty, 3 questions should be asked: Does it provide a better result for the patient? Is it less expensive? Is it easier for the surgeon? For patient-specific instruments, the answer to all 3 questions is NO! The use of conventional instruments with preoperative templating of implant sizes and resection amounts and careful intraoperative ligament balancing is strongly recommended.
REFERENCES:

Technology in most industries has led to improved efficiency and reduced cost. The future of medicine in the US and worldwide will require technology to increase efficiency. Patient specific instrumentation (PSI) is disposable Total Knee Arthropasty cutting blocks designed using the patient’s anatomy. Pre-operative imaging (MRI, CT, full-leg X-ray) are utilized to determine the correct fit of the implant and proper component alignment. Mechanical axis alignment is identified and generally used to position the components, however modifications to this can be made. PSI may improve efficacy and accuracy, and potentially reduce costs as well.

PSI creates efficiency by eliminating many of the steps for preparing both the femur and tibia. One guide, which is easily placed, determines valgus angle, level of resection, rotation size and AP position. Since the femoral canal is not invaded, there is less blood loss and no risk for fat embolization.

The TKA is performed “virtually” on the computer pre-operatively. The pre-op plan is then transferred to the patient with custom cutting blocks that are designed with a “reverse glove fit”. This technique is a form of pre-op computer navigation. Additionally, since the thickness of all bony resections is known, the surgeon is able to identify technical errors that deviate from the pre-op plan.

There is also the potential for cost saving. First, more efficient surgery is faster and less time provides cost savings for both the hospital and the surgeon. Secondly, the numerous knee replacement instruments sets are expensive to make process and sterilize. Eliminating the need for most instruments can reduce costs for both the manufacturer and the hospital. Finally, more accurate surgery may reduce cost by reducing outliers, errors and reoperations. In addition, PSI offers the potential for custom kits of completely disposable instrument packages.

Several studies have documented improved accuracy and reduced instrument processing with these techniques.

The future of medicine requires improved efficiency and accuracy, and reduced costs. PSI technology in may address the needs of the surgeon, hospital and the coming world of joint replacement. Further studies including cost / time analyses are essential to document the efficiency and cost effectiveness of PSI technology.
Wear and damage in total knees are caused by material, surgical (alignment, ligament balance), design (conformity, modularity, polyethylene thickness), and environmental (third-body particles) factors. The bearing surface of choice; ultrahigh molecular weight polyethylene (UHMWPE), was improved by crosslinking and can accommodate these factors.

Material-related (Wear/Lysis): Delamination is a common wear mechanism in knees caused by subsurface fatigue cracks. The UHMWPE alternatives in the knee are (1) un-irradiated (gas sterilized), (2) gamma sterilized (in air and in inert gas) ‘conventional’, (3) irradiated and melted crosslinked virgin (no antioxidant), (4) sequentially irradiated/annealed crosslinked and (5) irradiated, vitamin E stabilized UHMWPE. Un-irradiated UHMWPE has high strength and is oxidation resistant, but is not crosslinked and has high wear. While conventional UHMWPEs also have high fatigue strength, they lose it due to oxidation caused by radiation-induced free radicals [1] and subsequent delamination is predominant. Radiation doses up to 100 kGy are used to decrease wear but also reduce fatigue strength. Oxidative damage is greatly hindered by thermal or antioxidant stabilization of the free radicals. Thus, highly crosslinked irradiated/melted UHMWPE, sequentially irradiated/annealed UHMWPE and irradiated, vitamin E diffused UHMWPE showed from 65 up to 95% wear reduction and no delamination after aging compared to conventional UHMWPE, which delaminated at as low as 50,000 cycles [2-4]. Although in vivo studies have been limited for knees, one retrospective series (200 knees) showed reduction in radiolucency in the highly cross-linked (irradiated and melted) cohort when compared to conventional [5]. Another study with a minimum follow-up of 2 years showed no revisions and no osteolysis for both irradiated/melted and conventional UHMWPEs [6].

Surgery-related (Alignment, ligament balance): Axial or rotational malalignment contributes to implant failure by compromising the ligamentous balance and increasing the stress on the bearing materials. Failure risk can be reduced by design features such as a medial eminence and anterior flare, but the decrease in the fatigue strength of UHMWPE with increasing radiation dose and post-irradiation melting remains a concern. In a simulator study with maligned components in varus, neither irradiated/melted and sequentially irradiated/annealed UHMWPE showed delamination after aging and 5 MC of testing [7]. In a fatigue model simulating stair climbing with a tight posterior-cruciate ligament, irradiated/melted UHMWPE did not delaminate or crack after 0.5 MC [8], but conventional UHMWPE delaminated. A custom flexural fatigue test for the impingement resistance of a posterior-stabilized (PS) post in irradiated, vitamin E diffused UHMWPE, showed that the fatigue strength was comparable to unaged conventional UHMWPE and was significantly higher after aging. During stair climbing in the presence of rotational malalignment highly cross-linked UHMWPE patellas showed better crack resistance than conventional UHMWPE. These studies showed that crosslinked UHMWPEs can decrease damage in adverse situations in vitro by optimizing wear, oxidation and fatigue strength simultaneously [9].

Design-related (Conformity, modularity, polyethylene thickness): Implant designs minimizing anterior-posterior displacement, internal-external rotation, having curved conforming surfaces and rotating platforms may decrease implant wear. Backside wear of the tibial insert with modular designs contributes to overall wear, but in a study quantifying backside wear by measuring the
protrusion of the material through the screw holes on the tibial plate, highly cross-linked UHMWPE showed higher resistance to wear than conventional UHMWPE [10]. Using a rotating platform design, there was also a clear reduction in wear and volume of wear particles using a highly cross-linked UHMWPE [11]. While typical initial polyethylene thickness in tibial inserts is 7-8 mm [12], there can be significant thickness lost due to oxidation and wear using conventional UHMWPE; whereas, limiting wear and oxidation using crosslinked polyethylenes can limit thickness loss and may prevent malignment or collapse due to these changes.

Environment-related (Third body particulate, roughness of counterface): It has been suggested that articulating against roughened counterfaces due to third-body particulate debris can severely increase the wear of cross-linked surface. In a knee simulator study against explanted femoral components with clinically relevant roughness, highly cross-linked UHMWPE preserved its superior wear resistance compared to conventional UHMWPE [13], despite increased wear for both.

While there needs to be longer term follow-up and randomized clinical trials for outcome comparison, current results corroborate the expectations based on in vitro studies that by minimizing wear and limiting oxidation, highly crosslinked UHMWPE promise better functional outcomes.

REFERENCES:
High crosslinked polyethylene has gained widespread acceptance for total hip replacement and it has been estimated that 60-70% of acetabular lines are now highly crosslinked polyethylene. Multiple authors have documented reduction in wear with highly crosslined acetabular liners. However, the kinematics are much different in total knee replacement and polyethylene surface loads can be very high as contact stresses tend to be higher in knee replacement. Because highly crosslinked polyethylene has reduced physical properties failure may result from tibial implant fracture in knee replacement. The spine of the posterior stabilized tibial component is particularly at risk because of potential loading through the cam mechanism.

Additionally, polyethylene wear has been an infrequent cause of failure in modern total knee replacement designs requiring revision total knee replacement. Currently used compression molded polyethylene has excellent wear properties and is durable. Reports of excessive wear or failure of this bearing surface have been uncommon at greater than 10-15 year follow-up. Cost is also a factor and highly crosslinked polyethylene can add cost premiums of 20-30%.

Therefore with outstanding physical properties, acceptable wear rates and reduced cost current compression molded polyethylene are the gold standard in total knee replacement.
Computer navigation for knee replacement surgery has been available for over a decade yet is still not widely used. There is no debate that computerized guides for knee replacement surgery are more accurate than standard mechanical guides, but up until now there have been significant barriers to its use. These barriers include, cost, learning curve, extra incisions and pin sites, and increased surgical time. With the advance of surgical navigation tools there are now devices on the market that are lower cost and disposable. These devices have minimal learning curves and still maintain the improved accuracy of large console navigation systems.

Literature has shown that overall length of knee replacement surgery is largely dependant on the time needed for tibial and femoral preparation.\(^1\) The variability in the amount of time needed to cut the tibia and distal femur are in part due to indecisiveness of the surgeon due to lack of objective data. Numerically accurate values can help decrease this time.

Biomechanical and clinical literature have both shown increased loads and increased rates of failure with knees that are put in with significant malalignment.\(^2,3\) Although some recent clinical studies have not shown higher failure rates at mid term follow-up with mild malalignment\(^4\), this does not mean that inaccuracy in alignment should be accepted.

OrthAlign has created KneeAlign, an FDA approved accelerometer based, disposable navigation system for the proximal tibial and distal femoral cuts that has been shown to achieve cuts within 2 degrees of neutral mechanical axis in greater than 95% of cases with total surgical time for use of less than 5 minutes\(^5,6\).

Every time we go into the operating room to do a knee replacement we have an alignment goal. A fast, easy to use, accurate tool that allows us to obtain this goal more frequently without increasing time or risk to the patient should always be considered.
Introduction:
Computer-assisted TKA surgery has now been used for over ten years to assist in the placement of cutting guides, instruments, and implants in TKA surgery. It has been reported to demonstrate improved radiographic alignment1, primarily in the coronal plane. Recent advances in computer-assisted navigation, 3-dimensional imaging, and patient-specific positioning guides have challenged the potential for greater precision in bone resection, component positioning, and alignment in TKA surgery. Whether CAS-TKA improves the medium to long-term clinical outcome remains to be determined, and is the focus of this review.

Materials and Methods:
A systematic review of the current literature of CAS-TKA was undertaken to determine if any outcomes are improved with CAS-TKA compared to conventional TKA. Using the PUBMED database, with a focus on randomized clinical trials, meta-analyses, and registry data, a review of the evidence for CAS-TKA was performed. In addition to TKA coronal alignment (which is the focus of most reports), other outcomes including clinical outcomes, cost, patient satisfaction, component axial rotation, anteroposterior and medial-lateral stability, complications, and longer-term results of CAS-TKA compared to conventional TKA are reviewed.

Results:
Radiographic coronal plane alignment is improved with CAS-TKA2 when compared to conventional TKA3, with fewer radiographic outliers. Improvements in radiographic coronal and sagittal1,4 alignment measures are reported for patients with mild to moderate deformity of the knee. Improvements in femoral component external rotational alignment are not demonstrated, with no difference comparing CAS-TKA to conventional TKA using CT scan analysis;4 tibial component rotation is usually not reported. There is no difference in coronal or sagittal plane TKA stability.5 No clinical improvement,4-5 including 5-7 year studies,6 or contradictory reports continue to emerge4,7 with one Registry8 demonstrating a higher revision and complication rate at 2-years following CAS-TKA. Increased operative time up to 30 minutes (55% longer) or more3,9-10 and costs2-3 are associated with CAS. Although the duration of surgery is typically increased, the benefit of alignment with increased accuracy in these studies continues to been cited to justify this increased OR time,10 without any clinical evidence, and with unique complications7,11-12 Restoration of joint line has not been improved using CAS13. The costs associated with CAS may be more than with the newer patient specific guides and with an added increase in OR time.9 Reports comparing CAS-TKA to conventional TKA frequently report advantages in alignment; however no improved functional outcomes have been demonstrated.4,10

Conclusion:
The results of CAS-TKA should be interpreted with caution. Reports are published at centers with expertise in CAS-TKA, and do not identify the associated learning-curve. There are no long-term studies demonstrating improved clinical outcomes, despite many short-term reports. Many of the studies may be underpowered despite randomization. Combining CAS-TKA with minimally invasive surgery employs two potentially new and unfamiliar procedures to the surgeon, with new
complications. While there is evidence to support improved coronal plane alignment, other endpoints including achieving correct axial component external rotation, improvement in clinical outcomes, knee stability, increased operating time, unique complications, and the increased costs have not demonstrated advantages of this technology. Despite substantial research, contradictory results and reservations about the cost and efficacy of the technology have contributed to the failure of computer navigation to become the accepted standard in TKA surgery. Longer-term outcome studies demonstrating improved functional outcomes, lower revision rates, and acceptable costs are required before CAS-TKA may be widely adopted.

REFERENCES:


SYMPOSIUM VIII: HOW I DO A REVISION TKA IN 2012: VIDEO, PANEL DISCUSSION, AUDIENCE QUESTIONS

4:31-5:15 pm

Moderator: Daniel J. Berry, MD (Mayo Clinic, Rochester, MN)

Panel: Robert E. Booth, Jr., MD (Pennsylvania Hospital, Philadelphia, PA)
        Craig J. Della Valle, MD (Midwest Orthopaedics at Rush, Chicago, IL)
        Thomas K. Fehring, MD (OrthoCarolina Hip and Knee Center, Charlotte, NC)
        Arlen D. Hanssen, MD (Mayo Clinic, Rochester, MN)
        Steven J. MacDonald, MD, FRCSC (London Health Sciences Centre, London, ON, Canada)
        Giles R. Scuderi, MD (Insall Scott Kelly Institute, New York, NY)

This will be an interactive and practical session focusing on how a panel of expert surgeons—all of whom are Knee Society members—perform a revision total knee arthroplasty. Case examples and video will be used to illustrate how these individuals perform specific technical steps of the operation. The session will also explore key decisions in revision total knee arthroplasty: stems, stem length, bone loss management, constraint. The session will be fast paced and will seek both consensus and individual opinions.
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.

FDA Statement

Some pharmaceuticals and/or medical devices 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 pharmaceuticals and/or medical devices he or she wishes to use in clinical practice.

The Knee Society policy provides that “off label” uses of a device or pharmaceutical may be described in The Knee Society’s CME activities so long as the “off label” status of the device or pharmaceutical is also specifically disclosed (i.e. that the FDA has not approved labeling the device for the described purpose). Any device or pharmaceutical is being used “off label” if the described use is not set forth on the product’s approved label.

To obtain information regarding the clearance status of a device or pharmaceutical refers to the product labeling or call the FDA at 1-800-638-2041 or visit the FDA internet site at http://www.fda.gov/cdrh/510khome.html

FINANCIAL DISCLOSURE

Each participant in The Knee Society Specialty Day Meeting has been asked to disclose if he or she has received something of value from a commercial company, which relates directly or indirectly to the subject of their presentation. The Knee Society has identified the options to disclose as follows:

1. Disclosure Items Answered: (n) = Respondent answered ‘No’ to all items indicating no conflicts.
2. 1= Royalties from a company or supplier; 2= Speakers bureau/paid presentations for a company or supplier; 3A= Paid employee for a company or supplier; 3B= Paid consultant for a company or supplier; 3C= Unpaid consultant for a company or supplier; 4= Stock or stock options in a company or supplier; 5= Research support from a company or supplier as a PI; 6= Other financial or material support from a company or supplier; 7= Royalties, financial or material support from publishers; 8= Medical/Orthopaedic publications editorial/governing board; 9= Board member/committee appointments for a society.

The Knee Society 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 2011 The Knee Society Specialty Day Meeting.

EDUCATION COMMITTEE:

Michael D Ries, MD - Program Chair: 1 (Smith & Nephew); 3B (Smith & Nephew; Stryker); 4 (OrthAlign); 8 (The Knee); 9 (Foundation for the Advancement of Research in Medicine); Submitted on: 05/17/2011. *

Adolph V Lombardi Jr, MD: 1 (Biotronik; Innomed); 2 (Biotronik); 3B (Biotronik); 5 (Biotronik; Stryker; Salient Surgical Technologies; Angiotech); 8 (Clinical Orthopaedics and Related Research; Journal of Arthroplasty; Journal of Bone and Joint Surgery - American; Journal of the American Academy of Orthopaedic Surgeons; Journal of Orthopaedics and Traumatology; Surgical Technology International); 9 (Hip Society; Knee Society; New Albany Surgical Hospital Foundation); Submitted on: 11/02/2011. *

William J Maloney MD: 1 (Wright Medical Technology, Inc.; Zimmer); 3C (ISTO Technologies; Moximed); 4 (Abbott; Gillead; ISTO Technologies; Johnson & Johnson; Merck; Moximed; Pfizer); 5 (DePuy, A Johnson & Johnson Company; Zimmer); 8 (Journal of Orthopaedic Research; Journal of Orthopaedic Science); 9 (AJRR; Western Orthopaedic Association); Submitted on: 08/23/2011. *

Mark W Pagnano, MD – Past Chair: 1 (DePuy, A Johnson & Johnson Company Mako; Stryker); 5 (Zimmer); 7 (Clinical Orthopaedics and Related Research); 8 (Clinical Orthopaedics and Related Research); 9 (Knee Society; AAOS); Submitted on: 10/23/2011. *

Timothy M Wright, PhD - Ex-officio: 1 (Mathys Ltd); 4 (Exactech, Inc); 5 (Synthes; Stryker); 7 (Journal of Orthopaedic Research; Wolters Kluwer Health - Lippincott Williams & Wilkins); 8 (Journal of Orthopaedic Research); 9 (Knee Society); Submitted on: 10/19/2011. *

PRESENTERS, MODERATORS AND CO-AUTHORS:

Matthew Austin, MD (Philadelphia, PA): 1 (Zimmer); 2 (DePuy, A Johnson & Johnson Company); 3B (Zimmer); 5 (DePuy, A Johnson & Johnson Company); 8 (Journal of Arthroplasty); Submitted on: 12/05/2011. *

Robert L Barrack, MD: 1 (Smith & Nephew); 3B (Stryker); 5 (Biotronik; EOS Imaging; Medical Compression Systems; National Institutes of Health (NIAMS & NICHD); Smith & Nephew; Stryker; Wright Medical Technology, Inc.); 7 (Wolters Kluwer Health - Lippincott Williams & Wilkins); 9 (American Association of Hip and Knee Surgeons; American Association of Hip and Knee Surgeons; American Association of Hip and Knee Surgeons; American Association of Hip and Knee Surgeons; American Association of Hip and Knee Surgeons; American Orthopaedic Association; American Orthopaedic Association; Hip Society; Hip Society; Knee Society); Submitted on: 09/16/2011. *

Johan Bellemans, MD: 1 (Smith & Nephew); 2 (Smith & Nephew Mobilife Boehringer Ingelheim; DePuy, A Johnson & Johnson Company; Biomet); 3B (Smith and Nephew Boehringer Ingelheim Mobilife; Biomet; DePuy, A Johnson & Johnson Company); 4 (Pfizer Tigenix Praxim; Stryker; DePuy, A Johnson & Johnson Company); 5 (Zimmer Sanofi Aventis Biomet Deupuy Johnson and Johnson Regentis Synthes Smith and Nephew Boehringer Ingelheim Heraeus TOB Orteq Serica ; Smith & Nephew; DePuy, A Johnson & Johnson Company); 6 (Praxim Brainlab ); 7 (Acco Springer Verlag); 8 (The Knee KSTTA Acta Orthopaedica Belgica); 9 (ES5KA EKA BVGT ); Submitted on: 05/28/2011. *

Daniel J Berry, MD: 1 (DePuy, A Johnson & Johnson Company); 5 (DePuy, A Johnson & Johnson Company); Submitted on: 10/31/2011. *

Robert E Booth, Jr MD: 3B (Zimmer); Submitted on: 04/26/2011. *
Thomas P Sculco, MD: 8 (American Journal of Orthopedics); Submitted on: 10/30/2011. *

Peter F Sharkey, MD (Media, PA): 1 (Knee Creations Stryker Orthopaedics StelKast, Inc.); 2 (Stryker Knee Creations); 3B (Stryker Knee Creations, Arthrex); 4 (Physician Recommended Nutriceuticals, Knee Creations); 5 (Convatec); 7 (none.); 8 (Journal of Arthropalsty American Journal of Orthopaedics Clinical Orthopaedics & Related Research); 9 (American Association of Hip & Knee Surgeons); Submitted on: 12/07/2011. *

Matthew G. Teeter, BSCh: (n)

Thomas S Thornhill, MD: 1 (DePuy, A Johnson & Johnson Company); 3B (DePuy, A Johnson & Johnson Company); 3C (Scientific Advisory Board of Conformis); 4 (Conformis); 7 (Up to Date); Submitted on: 09/15/2011. *

Robert T Trousdale, MD: 1 (DePuy, A Johnson & Johnson Company; Wright Medical Technology, Inc. ortho developement, MAKO); 3B (DePuy, A Johnson & Johnson Company; Wright Medical Technology, Inc., MAKO); Submitted on: 10/20/2011. *

Keith K Wannomae (Boston, MA): (n) Submitted on: 05/27/2011. *

Julien Wegryn, MD, PhD: (n)

Leo A Whiteside, MD: 1 (Smith & Nephew; Stryker); 2 (Smith & Nephew); 3A (Signal Medical Corp); 3B (Signal Medical Corp); 3C (Smith & Nephew); 4 (Signal Medical Corp); 8 (Journal of Arthroplasty; Clinical Orthopaedics and Related Research; Journal of Orthopaedics and Traumatology); Submitted on: 04/08/2011. *

Timothy M Wright, PhD: 1 (Mathys Ltd); 4 (Exactech, Inc); 7 (Journal of Orthopaedic Research; Wolters Kluwer Health - Lippincott Williams & Wilkins); 8 (Journal of Orthopaedic Research); 9 (Knee Society); Submitted on: 10/19/2011. *

STAFF:

Olga Foley (Rosemont, IL): (n) Submitted on: 10/03/2011. *

Elizabeth Frale (Rosemont, IL): (n) Submitted on: 12/22/2011. *
The FDA has not cleared the following pharmaceuticals and/or medical devices for the use described in these Knee Society/AAHKS Open Meeting presentations. The following pharmaceuticals and/or medical devices are being discussed for an off-label use.

8:23-8:29 am "What I do differently in the Younger Patient" presented by Craig J. Della Valle, MD (Chicago, IL). The abstract is on page 16.
**The FDA has not cleared the following: Multiple Manufacturer; product or device: use of antibiotics in bone cement for the use described in this presentation.

8:55-9:07 am "DEBATE: CEMENTED VERSUS CEMENTLESS TKRs? Cementless:" presented by Leo A. Whiteside, MD (Saint Louis, MO). The abstract is on pages 22-23.
**The FDA has not cleared the following: Manufacturer Signal Medical Corp; product or device: Symmetric TKR – Cementless Use for the use described in this presentation.

1:58-2:04 pm "Infected Total Knee Replacement – PROSTALAC" presented by Bassam A. Masri, MD, FRCSC (Vancouver, BC, Canada). The abstract is on page 47.
**The FDA has not cleared the following: Manufacturer DePuy; product or device: PROSTALAC for the use described in this presentation.