



**Daniel J. Berry, MD**  
Chair, Mayo Clinic  
Department of  
Orthopedic Surgery

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## Arthroscopic Elbow Contracture Release Restores Terminal Extension in Elite Athletes

Most people who lose terminal elbow extension carry on with daily activities fairly well without interventions such as surgical contracture release. However, in some high-level athletes, a functional elbow arc of motion considered adequate for most adults (30-130 degrees of extension to flexion) is insufficient for full intensity and performance in their sport. "High-level athletes need full, pain-free extension to perform certain sports such as gymnastics and weightlifting. Even minor loss of extension, if it is associated with pain at the endpoint, will limit an athlete's intensity of training and/or performance," explains Mayo Clinic orthopedic surgeon Shawn O'Driscoll, MD, PhD, from Mayo Clinic Sports Medicine Center.

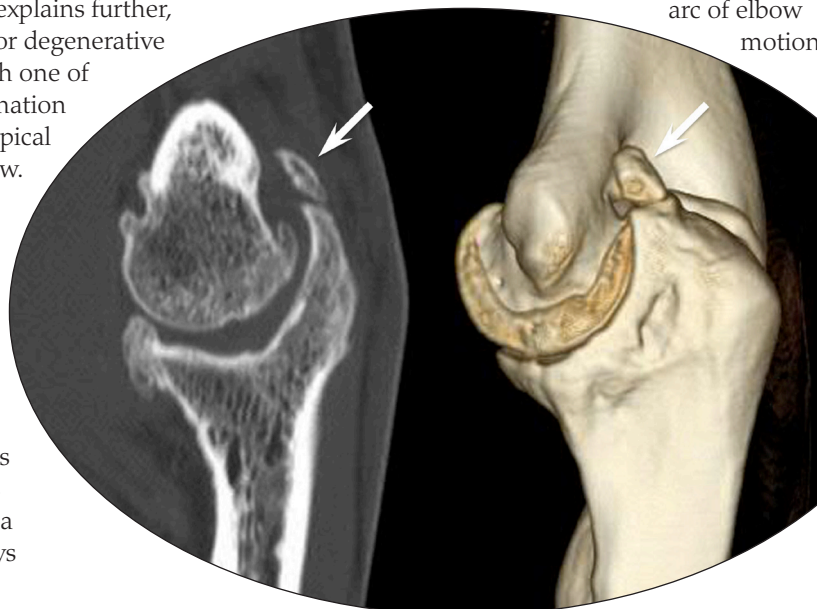
Swimmers, goalkeepers in soccer and boxers are also among those who are especially vulnerable to overuse injuries of the elbow that can lead to loss of elbow extension, often with pain. Dr. O'Driscoll explains further, "The overuse causes minor degenerative changes in the elbow, with one of the earliest being the formation of small osteophytes in typical locations around the elbow. Posterior osteophytes impinge in extension, and as they grow they limit terminal extension. These osteophytes have a propensity to stress fracture from repeated impingement. When they do, they may progress to a painful nonunion. It's become what I refer to as a 'telephone diagnosis,'" says Dr. O'Driscoll. (Fig. 1).

From 1997 to 2007 Mayo Clinic orthopedic surgeons investigated the possibility that the traditional functional arc of motion as defined by Morrey et al (JBJS 1981 63-A:872-877) may be insufficient for some elite athletes. Adds Dr. O'Driscoll's Mayo collaborator James S. Fitzsimmons: "We hypothesized that arthroscopic contracture release is effective in restoring terminal elbow extension in high-level athletes whose loss of terminal extension impairs their intensities and/or levels of performance in sport."

### Optimizing the Arc of Motion

The Mayo team studied the results of arthroscopic capsulectomy or osteocapsular arthroplasty on 24 elite athletes, including 5 at the Olympic or professional level whose primary complaint was lack of terminal elbow extension, with or without pain. Each already possessed an

arc of elbow motion



**Figure 1.** Left to right, radiographic and computed tomography (CT) scans of elbow osteophytes.

considered functional—but not optimal. The study was also designed to help predict return to unimpaired sports performance. Results appear in the American Journal of Sports

Medicine 2010 38:2009, and showed surgery improved all elbows (n=26 in

24 patients), both by subjective and objective measures. All gained extension, with average loss of extension improving from 27 degrees to 6 degrees. Twenty-two of 24 patients returned to the same level of training intensity and sports performance as practiced before the onset of problems. At final follow-up review, 13 of 24 patients considered the elbow normal, or almost normal. (Fig. 2).

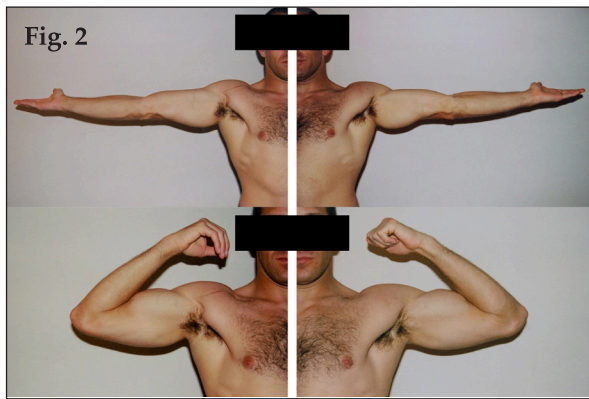


Fig. 2

**Figure 2.** Postoperative clinical photographs of the right and left elbows of a rugby player who underwent arthroscopic osteocapsular arthroplasties for painful limitation of extension. Both elbows had preoperative flexion from 25 - 130 degrees. Results show motion had improved in both elbows to 5 - 140 degrees of flexion after surgery. He had no pain or functional impairment, nor any awareness of limitation in extension after surgery. He stated that each elbow felt normal, as though it had never had any impairment or surgery.

## Mayo Department of Orthopedic Surgery Adds Specialists in Sports Medicine and Shoulder, Pediatrics, Foot and Ankle



Aaron J. Krych, MD



A. Noelle Larson, MD



Daniel B. Ryssman, MD

Three new faculty members joined Mayo Clinic Department of Orthopedic Surgery in August. They are:

**Aaron J. Krych, MD.** After receiving his MD from the Mayo Medical School, Dr. Aaron Krych completed an internship and a residency in orthopedic surgery at the Mayo Clinic in Rochester, MN. Dr. Krych then trained as a fellow with the Sports Medicine and Shoulder Service at the Hospital for Special Surgery (HSS) in New York. At HSS Dr. Krych received the 2011 Philip D. Wilson, MD, Award for Excellence in Orthopaedic Surgery Research for his study, “Cartilage integration with porous nondegradable hydrogels after enzymatic treatment of osteochondral defects in a rabbit model.” Dr. Krych also specialized in care of athletes during his fellowship training. He served as a fellow physician for the New York Giants football team, 2010-2011, as well as fellow physician for the men’s and women’s soccer and basketball teams of Saint John’s University, 2010-2011, in Collegeville, MN, his alma mater. Dr. Krych’s clinical areas of interest include cartilage restoration and transplantation, meniscus transplantation, hip arthroscopy, arthroscopic rotator cuff repair, and anterior cruciate ligament injuries. He joined the Mayo Clinic Department of Orthopedic Surgery as an Assistant Professor.

**A. Noelle Larson, MD.** Dr. Noelle Larson received her bachelor’s degree in physics from Stanford University before attending the University of Washington School of Medicine, where she was

awarded her MD in 2004. She completed both her internship and a residency in orthopedic surgery at the Mayo Clinic in Rochester, MN, followed by fellowship training in pediatric orthopedics and scoliosis at the Texas Scottish Rite Hospital for Children in Dallas, TX. Dr. Larson has received many awards, including Mayo’s Joseph M. Janes Award and the T. Boone Pickens Award for Excellence in Spine Research, which she received in 2010. She has authored 19 peer-reviewed publications, and has a specific interest in long-term outcomes studies, clinical trials, and decision analysis modeling to improve the efficacy of patient care, particularly for conditions of the hip and spine. Her clinical interests include scoliosis, hip disorders, and growth plate injuries. She joined the Mayo Clinic Department of Orthopedic Surgery as an Assistant Professor.

**Daniel B. Ryssman, MD.** Dr. Daniel Ryssman earned his MD degree from the University of Utah School of Medicine in 2005. He completed his internship and orthopedic residency training at the Mayo Clinic in Rochester, MN in 2010. He then pursued an orthopedic foot and ankle reconstruction fellowship in Baltimore at Mercy Medical Center for one year. Following his fellowship training, Dr. Ryssman joined the Mayo Clinic Department of Orthopedic Surgery as an Assistant Professor. His scope of surgical practice covers a wide range of issues related to the foot and ankle, including sports-related injuries, arthritis, simple or complex foot reconstruction, ankle replacement, trauma, and resident education.

## Standardizing Surgical Technique

Arthroscopic capsular release and osteocapsular arthroplasty are complex procedures. For safety and effectiveness, they are best performed by experienced teams. While developing and refining his approach, Dr. O'Driscoll devised a standardized, 4-step sequence that he believes is fundamental to excellent outcomes.

He recommends beginning posteriorly; proceeding to the medial and then the lateral gutters; then doing the work anteriorly, including the anterior capsulectomy. In each compartment 4 sequential steps are to be performed:

- Get in and establish a view
- Create a space in which to work
- Bone removal
- Capsulectomy



Shawn W. O'Driscoll, MD, PhD

"Through standardization, both safety and efficacy have become highly reproducible," Dr. O'Driscoll says. "The medical community has learned that invasive procedures, from cardiac catheterizations to total joint arthroplasties, have the best results and lowest complication rates when performed using standardized methodologies."



James S. Fitzsimmons, BSc

## Indications and Contraindications

Indications that a patient is a candidate for arthroscopic contracture release or osteocapsular arthroplasty to restore pain-free terminal extension include:

- The patient is an athlete—disciplined, committed and established in a long-term and high level of sports performance
- The patient perceives lack of terminal elbow extension, with or without pain, that impairs intensity of training or performance
- The contracture has been present for 6 months or more

Contraindications include:

- Minor loss of extension that does not cause pain or impairment of training intensity or performance in the patient's sport

For high-level athletes, these complex elbow surgeries when performed by experienced practitioners can help the recovery of peak performance.

## At a Glance

### Arthroscopic Release of Elbow Contracture Study

In the Mayo study, the underlying diagnosis for elbow contracture was hypertrophic osteoarthritis in 19 elbows, posttraumatic elbow contracture in 6; and arthritis and contracture secondary to osteochondritis dissecans in 1.

The study involved:

- 24 high-level athletes for a total of 26 elbows
- Patients with an average age at surgery of 38 years
- 22 males and 2 females
- 20 patients whose dominant arm was affected
- Median time from onset of contracture to arthroscopic release of 2 years
- 5 professional or Olympic athletes; 2 semiprofessional athletes; 17 amateur athletes

To assess patient satisfaction, 2 scales were used.

### Subjective Patient Outcome Return To Sports

#### S.P.O.R.T.S. Score

Category	Relative value	Definition (as pertaining to condition treated)
Unlimited Effort Unlimited Performance No Pain	10	Perform same sport at same level of effort and performance as before onset of impairment, and with no pain.
Unlimited Effort Unlimited Performance Some Pain	9	Perform same sport at same level of effort and performance as before onset of impairment, but with pain.
Unlimited Effort Limited Performance	6	Perform same sport at same level of effort but reduced performance level compared to before onset of impairment.
Limited Effort Limited Performance	3	Perform same sport, but at reduced levels of effort and performance compared to before onset of impairment.
Disabled	0	Unable to return to same sport.

### Simple Outcome Determination

#### S.O.D.

Category	Relative value	Definition (as pertaining to condition treated)
Normal	10	As if never diseased, injured or operated*.
Almost normal	9	Not normal, but symptoms are of no concern to patient.
Greatly improved	6	Quality of life greatly improved, but minor pain and/or impairment present.
Improved	3	Quality of life improved, but major pain and/or impairment present.
Not improved	0	Quality of life no better or minimally improved; treatment not worthwhile.
Worse	-3	Quality of life worse than before treatment.
Profoundly worse	-6	Quality of life profoundly worse due to complication of treatment.

\*Except for surgical scars.

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# The Role of Ankle Arthroplasty in Treating End-Stage Ankle Arthritis



Norman S. Turner III, MD



Richard J. Claridge, MD



Joseph L. Whalen, MD, PhD

Management of patients with symptomatic ankle arthritis is challenging, particularly as regards the clinical decision to treat by arthrodesis or arthroplasty. Use of total ankle arthroplasty for debilitating end-stage ankle arthritis is expanding as implant design and technique have steadily improved over the past 20 years. Interest in arthroplasty has also been renewed by concerns that arthrodesis, the traditional treatment modality, may contribute to progression of arthritis in adjacent joints due to transmission of increased stress.

However, long-term effectiveness data on modern ankle arthroplasty are not yet available for several reasons. One is the lack of uniform outcome measures to apply to clinical results. Another is the variation in mobile-bearing and fixed-bearing prostheses. Generalizations are therefore difficult to make. But recent prospective controlled trials, meta-analyses and experience suggest that when the latest prostheses, instrumentation and techniques are employed, total ankle arthroplasty can offer equivalent pain relief—and perhaps even better function due to increased range of motion—than ankle arthrodesis.

## Patient Selection, Education

Patient selection and education, along with physician expertise and experience from a high-volume foot and ankle practice, remain cornerstones of consistent success with arthroplasty in terms of functional outcomes and revision-free implant survival. “The importance of carefully considering and fitting the selection criteria for ankle replacement

to each patient individually cannot be overstated,” explains Mayo

Clinic orthopedic surgeon Norman S. Turner III, MD. “It is

the key to achieving the best possible outcomes with total ankle arthroplasty.”

He adds that

patients tend to equate ankle replacement with hip and knee replacements—with little appreciation for

the fact that ankles have unique physiological and mechanical attributes that complicate arthroplasty.

As a result, one of the first tasks of the consulting foot and ankle surgeon often is to explain the unique character of the ankle joint to patients. Notes orthopedic foot and ankle specialist Richard J. Claridge, MD: “A range of treatment options exist, and we at Mayo Clinic consider them all for our ankle patients—but there are patients who come in asking for arthroplasty right away, assuming it will solve all their problems. While we understand their desires, it’s very important to choose the treatment that best suits their needs.”

Adds their colleague, Joseph L. Whalen, MD, PhD. “Ankle replacement is not for everyone. We select patients in whom it is most likely to succeed, which certainly influences our outcomes as consistently among the best. Educating a patient about total ankle replacement including the risks, benefits and current outcomes is important.” (Fig. 1).

## The Treatment Continuum

The most common causes of ankle arthritis are trauma and abnormal mechanics that produce pain, inflammation, impaired mobility and ankle instability. Non-operative treatment modalities include physical therapy and anti-inflammatory medications, bracing, modifying footwear, immobilization, behavior changes such as switching to low-impact activities or sports, weight loss in the case of obese patients, and joint injections.

When pain remains debilitating, and conservative measures have failed to treat end-stage ankle arthritis, surgical options include: arthroscopic or open debridement of chondral defects, impinging and loose bodies; ankle arthrodesis through a variety of techniques, plate and screw styles and arrangements; arthroplasty. First developed more than 40 years ago, ankle arthroplasty has improved as it has evolved, particularly in terms of refinements in hardware design and fabrication, instrumentation, implant positioning technique and reconstructive benefits to the hindfoot.

## Indications and Contraindications

No standard clinical indications have been formulated. In general, primary indications for total ankle arthroplasty are degenerative, posttraumatic and rheumatoid arthritis.

### Elements of Success

Elements of successful ankle arthroplasty include:

- Adequate amount and quality of soft tissue
- Potential for correct biomechanical alignment
- Lifestyle that supports compatible activities post-surgery, given that the ankle is subjected to high weight-bearing force per unit area
- Multidisciplinary depth to aid wound-healing, rehabilitation, recovery and continuity of care
- Scrupulous surgical technique to minimize chance of deep infection

Experienced specialists tend to consider arthroplasty for patients with:

- Advanced, debilitating ankle arthritis
- Joint surfaces destroyed by trauma, scarring or deformity
- Pain and impairment so severe that daily life tasks are interrupted

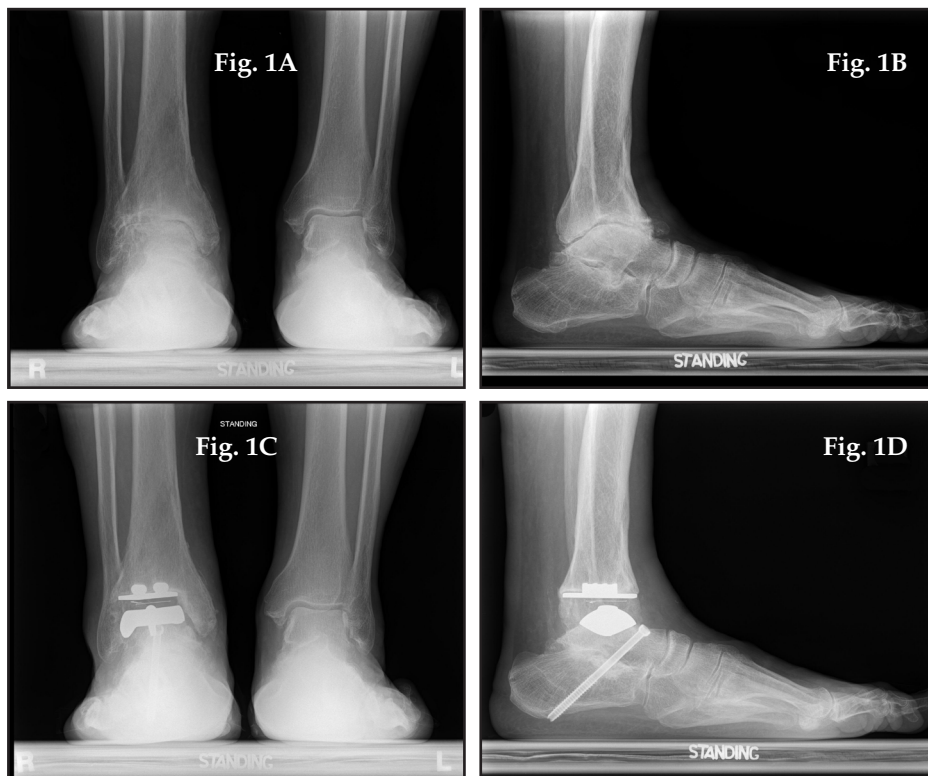
Arthroplasty is contraindicated for patients with recent infections and serious comorbidities such as vascular impairment; severe joint laxity; compromised soft-tissue envelope; a neuropathic joint disease, avascular necrosis of the talus; and severe deformities of the ankle.

### Evaluation and Rehabilitation

Evaluation starts with a thorough medical and orthopedic evaluation of the patient. This includes gait analysis and weight-bearing X-ray, and possibly computed tomographic (CT) scan, magnetic resonance image (MRI) and bone scan. Obtaining a complete understanding of lifestyle factors and medical history is also important because it can impact the implant durability and performance, and patient likelihood to comply with a rehabilitation program.

The postoperative rehabilitation of ankle arthroplasty patients is a period of non-weight bearing and cast immobilization for

several weeks. If the soft tissue structures have been balanced during the surgery and the intraoperative range of motion was satisfactory, physical therapy is usually not required to achieve range of motion. Patients at six weeks following surgery can usually start bearing weight and progress to normal activities over the following month.



**Figure 1.** 1A and 1B preoperative radiographs of the ankle showing osteoarthritis degeneration. 1C and 1D postoperative radiographs showing good alignment of total ankle implants.

## Research Highlight

Improving patient care through scholarship on orthopedic issues has long been a core mission of Mayo Clinic Department of Orthopedic Surgery. From Jan. 1 to Sept. 30, 2011, Mayo specialists published approximately 165 original articles across all orthopedic subspecialties areas. One highlight appears below.

### Total Elbow Arthroplasty

*Journal of the American Academy of Orthopaedic Surgeons* 2011 19:121-125.

Joachin Sanchez-Sotelo, MD;

Bernard F. Morrey, MD

Total elbow arthroplasty (TEA) has become an increasingly popular reconstructive technique over the past 20 years

due to improved implants and surgical technique. Post-operative infection is the most frequent complication, and complication rates have remained high compared with other large-joint replacements.

However, TEA can be a valuable treatment for a variety of pathological conditions in carefully selected patients. This is especially true when scrupulous surgical technique is practiced, including:

- Avoiding complications in the first place by anticipating them, such as ruling out septic processes through preoperative aspiration
- Observing that TEA is contraindicated in patients receiving disease-remitting agents
- Collaborating with plastic surgeons when there are significant soft-tissue or wound-healing issues

# Twenty-Year Comparative Survival Study of Uncemented Acetabular Components in Primary Hip Arthroplasty



David G. Lewallen, MD



Hilal Maradit Kremers, MD

New implantable devices can never reach clinical use without some level of uncertainty about their effectiveness and overall safety, despite the best possible safeguards and pre-market regulatory requirements. This is particularly true because many will be required to function for decades following implantation. Therefore, post-marketing studies of implantable devices are essential to continually evaluate the performance of such implants in the real-world environment, as it may be years or decades before we can truly assess their effectiveness. “For this reason large databases or registries of patients, such as the Mayo Total Joint Replacement Registry, have an essential role to play in the monitoring of medical implants,” explains Mayo Clinic orthopedic surgeon David G. Lewallen, MD.

In a recent study using data extracted from the Mayo Total Joint Registry, Dr. Lewallen and a Mayo team of orthopedic surgeons compared the long-term performance of 20 different types of uncemented acetabular components in 9,584 total hip procedures performed at the Mayo Clinic between January 1994 and December 2004. Published in the September 2011 issue of the *Journal of Bone and Joint Surgery*, it is

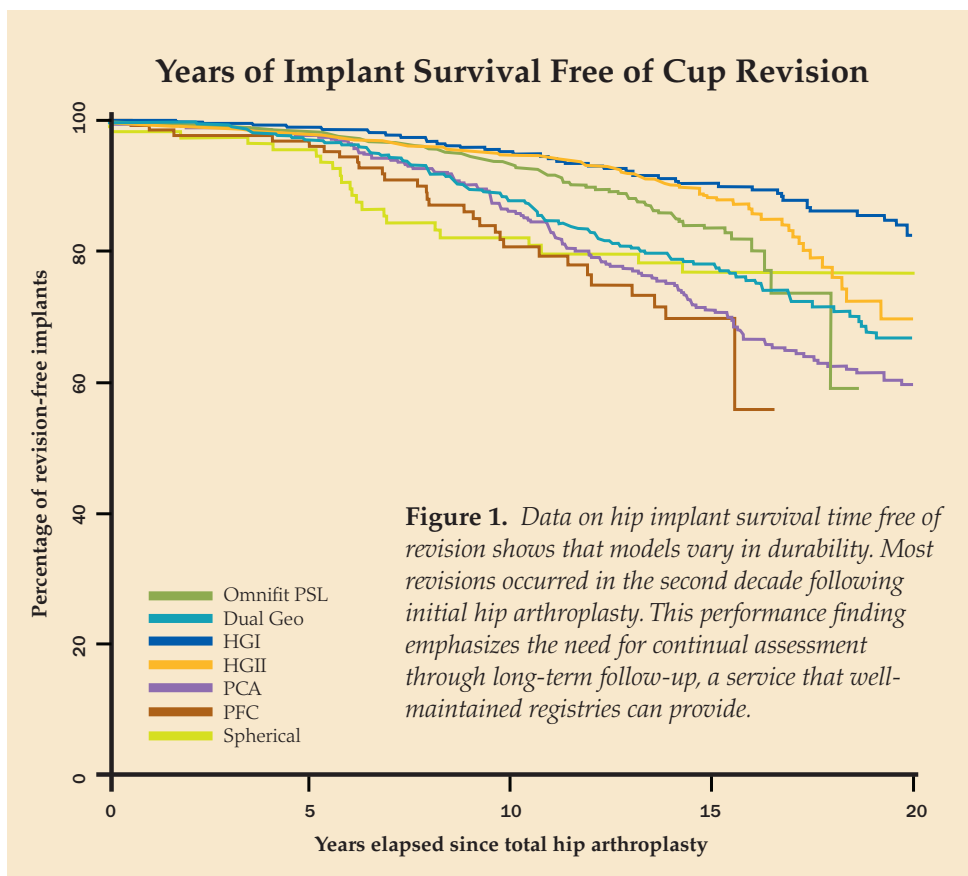
the largest of its kind in the United States of American-made implant components used in hip arthroplasty. Notes Mayo epidemiologist on the study, Hilal Maradit Kremers, MD, MSc: “To find out how patients are really doing and how the devices are performing, you need to watch for changes over long periods of time, not just for a few months or years following surgery. You need to allow enough time for the implants to begin to wear or become unstable.”

## Key Findings

Study results show that long-term survival differs significantly among the different types of uncemented acetabular components following primary hip arthroplasty—and that newer designs are not inherently better than older ones. For example, implants designed in the 1990s do not perform significantly better than one of the earliest models (the Harris-Galante I cup) introduced in the early 1980s.

Notably, most revisions occurred in the second decade following the initial hip arthroplasty. This indicates that implant performance in the real-world setting needs to be continually assessed through long-term follow-up. In many circumstances, follow-up beyond 5 to 7 years is needed to determine real differences between designs in implant survival free of revision due to complications such as aseptic loosening, wear and bone loss due to osteolysis.

Explains Dr. Lewallen: “Among the main take-home messages here that orthopedists need to consider in planning for best outcomes are: 1) Newer, typically more expensive implants may not necessarily be better than older implant designs. 2) Performance differences between implants often only become obvious after 5 to 7 years of follow-up. So, shorter-term studies may be inadequate to capture differences in failure rates across different implants. And, 3) revisions due to excessive polyethylene wear have been a major clinical problem with modular uncemented designs in the past, validating clinical interest in improved bearing materials.”





## The Mayo Registry Model

### A Vital Role for Orthopedic Registries

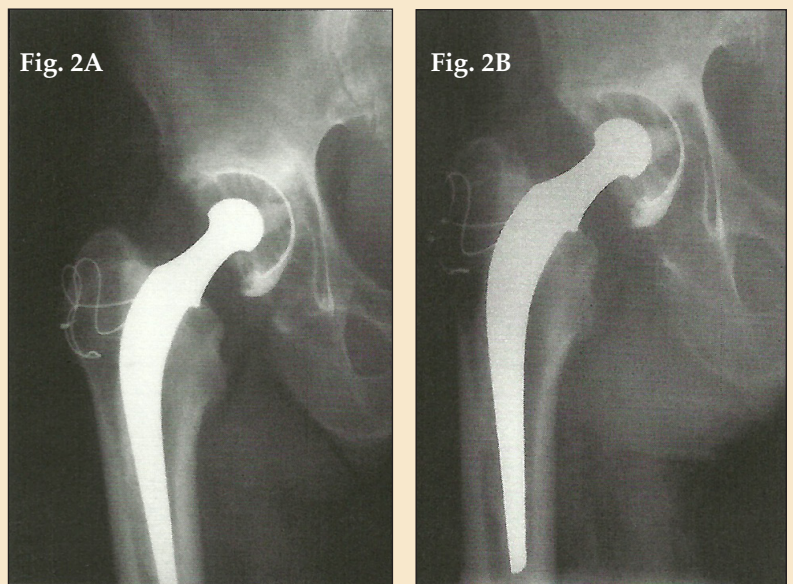
Registries are important for examining the effectiveness of orthopedic implants that have limited pre-market performance information. The Mayo data come at an important time for a large initiative now under way in the U.S. to establish a comprehensive nationwide orthopedic registry to gather data on joint replacement and revision surgeries. The American Joint Replacement Registry (AJRR) is a project initiated by the American Academy of Orthopaedic Surgeons and developed in collaboration with a range of stakeholders including orthopedic surgeon associations and professional societies, orthopedic industry partners, private payers, and even public representatives. The AJRR has just completed a pilot project with data collection establishing methods that are being used to expand operations nationally. As with other national registries around the globe, the goal of the AJRR is to improve patient safety, enhance the quality of care and reduce cost.

As chair of the AJRR Board of Directors, Dr. Lewallen views the Mayo data as a useful example of the vital role that registry data can play in improving care. A well-designed, fully staffed long-term nationwide registry could provide information on a larger scale and allow more rapid improvement in orthopedic care in the United States. National data collection on hip and knee implants could enable orthopedic surgeons, device manufacturers and hospitals to analyze outcomes for insight into what determines the success or failure of such devices. It could also help inform decisions on where to deploy research and resources to improve performance. With the AJRR, surgeons, hospitals and device manufacturers would be able to review their own data and compare performance against national benchmarks. “The kinds of comparisons a well-run registry makes possible can help identify opportunities for improvement,” Dr. Lewallen notes. “And that’s the goal we all share—surgeons, patients, device manufacturers, hospitals and insurance companies alike.” The AJRR can also serve as a resource for patients in retrieving information on their own specific surgery and the device that they had implanted during their operation, information that is not always easily obtained by patients at present.

begun in 1969, the Mayo Clinic Total Joint Registry has been continuously staffed by dedicated and trained personnel since its inception. With data today on more than 100,000 total joint arthroplasties, the registry provides an unrivaled level of detail on a wide range of devices, procedures, patient profiles and long-term outcomes. This most recent study and those that have preceded it underscore the importance of institutional commitment in support of such a comprehensive registry effort over time.

“What makes this registry unique and invaluable is the incredible detail and completeness of information and its continuity over time,” Dr. Lewallen says. Registry staff members have consistently recorded not just every patient and procedure, but every screw and hardware element, every part’s catalog number and manufacturing lot number. The completeness of patient follow-up is also critical and has been so far unparalleled. For example, of all the surgeries with the potential for at least 22 years of follow-up, 80% had been followed for at least 20 years.

Explains the epidemiologist involved in the study, Hilal Maradit Kremers, MD, MSc: “Many large orthopedic hospitals keep registries—there are at least 10 to 15 other orthopedic registries in the United States—but none of them has been in operation as long as the Mayo Registry nor have any of these registries the same level of follow-up.”



**Figure 2.** (A) Radiograph of the first total hip arthroplasty approved by the US Food and Drug Administration, performed by Mayo Clinic’s Mark B. Coventry, MD in October 1969. (B) 15-year-follow-up radiograph showing no change in the prosthetic joint.

## Mayo Clinic Orthopedic Update

## Medical Editors:

Daniel J. Berry, MD  
Arlen D. Hanssen, MD  
Michael J. Stuart, MD

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## Resources

[mayoclinic.org/medicalprofs](http://mayoclinic.org/medicalprofs)

Clinical trials

CME

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Scientific videos

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### 7th Mayo Clinic Spine Symposium

March 20-24, 2012

Naples, FL

The 7th Mayo Clinic Spine Symposium will be held in Naples, FL. This annual CME course is targeted to both surgeons and non-operative clinicians involved in the care of patients with spinal disorders and deformities. Sessions will focus on advances in minimally invasive surgical techniques, clinical assessment of operative and non-operative cases, as well as health quality measures for evaluating treatment outcomes. Attendees and faculty will have ample opportunity for interaction over the course of the five-day event.

### Advanced Techniques in Shoulder Arthroscopy, Arthroplasty, and Fractures

April 27-28, 2012

Rochester, MN

A two-day workshop on Advanced Techniques in Shoulder Arthroscopy, Arthroplasty, and Fractures will be held at the Mayo Clinic Surgical Skills Laboratory in Rochester, MN. Didactic lectures delivered by faculty from the Mayo Clinic and other national and international orthopedic centers will be augmented with hands-on laboratory experience using cadaver specimens to provide a comprehensive approach for understanding the most recent advances in shoulder treatment. This CME course will also feature live video demonstrations and panel discussions and will focus on the management of rotator cuff tears, shoulder instability, and treatment options for arthritis.

### Diagnostic and Interventional Musculoskeletal Ultrasound

July 19-21, 2012

Rochester, MN

The Mayo Clinic, in collaboration with the American Institute for Ultrasound in Medicine (AIUM), is offering a three-day CME event in Rochester, MN. This course will provide intensive, hands-on experience scanning live models and performing sonographically guided procedures on unembalmed cadavers. Expert faculty will lead live demonstrations of examination techniques as well as didactic lessons focusing on the review of common musculoskeletal pathologies and ultrasound-guided interventions. The course has been designed for physicians and sonographers at all levels of experience who are involved in treating patients with musculoskeletal diseases.

To view all Mayo Clinic CME offerings visit [www.mayo.edu/cme/](http://www.mayo.edu/cme/)

For information, contact: [cme@mayo.edu](mailto:cme@mayo.edu), or (800) 323-2688.