More Surgical Options for Active Young Patients

Treatment of hip disease is rapidly evolving to meet the needs of active young patients (15-60 years old) who may require more than 1 hip replacement or revision in a lifetime. Initial treatment usually is surgery to correct anatomic abnormalities that result in femoroacetabular impingement of the hip. More advanced cases of joint degeneration—typically seen in active and athletic patients with arthritis after the fourth decade—may benefit from a newer variant of metal-on-metal total joint replacement called hip resurfacing, which was approved by the US Food and Drug Administration (FDA) in May 2006. Patients older than 60 years may be good candidates for contemporary total hip replacement.

Femoroacetabular Impingement

Femoroacetabular impingement is increasingly recognized as a common, yet frequently undiagnosed cause of hip degeneration. Aggressive surveillance is now recommended for the anatomic abnormalities that give rise to impingement, with the hope that early intervention can save patients’ hips. The typical patient may or may not have arthritis and presents with activity-related groin pain, which may be intermittent at first and then becomes constant (Tables 1 and 2).

If severe arthritis has not developed, Mayo Clinic orthopedic surgeons attempt to restore normal anatomy of the hip in a procedure popularized in 1996 by Professor Reinhold Ganz of the University of Bern. Two Mayo Clinic orthopedic surgeons spent 6 months with Dr. Ganz, evaluating and learning this technique. It involves surgically removing the femoral head and replacing it with a metal implant, which is then capped with a resurfacing implant. The acetabular component is press-fit into the pelvis.

Points to Remember

- Treatment of hip disease is evolving rapidly to meet the needs of active patients.
- Femoroacetabular impingement is increasingly recognized as a common—yet frequently misdiagnosed—cause of hip degeneration in patients who may or may not have arthritis. Surgical remodeling may restore normal hip anatomy.
- In severely arthritic patients, a new form of hip resurfacing using metal-on-metal implants may be indicated. This implant has both potential benefits and drawbacks, and hip resurfacing should be undertaken in carefully selected patients by trained, experienced orthopedic surgery teams.

Clinical suspicion of hip impingement should be raised by the following presentation:

- An active young person
- Reports of activity-related groin pain
- Evidence of decreased internal rotation of the hip at 90° of flexion, which may be painful, especially with extreme flexion and internal rotation (anterior impingement sign)

Although impingement may be difficult to detect radiographically, on x-ray examination the clinician should look for retroversion of the socket and prominence of the ischial spine within the pelvic cavity and lack of spherical symmetry of the head.

Table 1. Hip Impingement Examination: What to Look For

<table>
<thead>
<tr>
<th>Examination</th>
<th>What to Look For</th>
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<td>Hip Impingement</td>
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Figure 1. In hip resurfacing, the femoral head is milled and capped with a metal-on-metal implant and the acetabular component is press-fit into the pelvis.
cal dislocation of the hip joint anteriorly through a trochanteric slide osteotomy to provide access to the femoral head and acetabular rim. While preserving blood supply to the femoral head, surgeons trim the rim and sculpt irregularities off the outer femoral head to restore normal hip anatomy and function and to repair tears in the acetabular labrum. When only the femoral head-neck junction is affected, a femoroacetabular osteoplasty through an anterior Heuter or Smith-Peterson approach provides the patient with a faster recovery than does the trochanteric slide approach.

**Hip Resurfacing**

Advances in bearing surfaces have provided a new approach to hip resurfacing. In this type of joint replacement surgery for patients with severe arthritic degeneration, the femoral head is milled to accept a cap that is cemented into place. The acetabular component is press-fit without screws into the acetabulum (Figures 1-3).

Hip resurfacing has both benefits and drawbacks (Table 3). In general, the overarching advantage of hip resurfacing is that the procedure conserves a portion of the neck of the femur. This makes future hip revision surgery easier because more native bone remains.

Hip resurfacing is available in the United States at a limited number of advanced, comprehensive orthopedic surgery centers. Mayo Clinic’s orthopedic surgery teams have received special training to perform both hip impingement repair and hip resurfacing. In carefully selected patients (Table 2), these experienced orthopedic surgery teams report early excellent outcomes with both procedures.

**Conclusions**

With careful patient selection, Mayo Clinic orthopedic surgery teams are attempting to minimize the disadvantages of hip resurfacing. The result: they achieve reliable pain relief, restore function, and preserve femoral bone stock.

**For More Information**

To refer a patient or make an appointment, please call 507-538-4101.

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**Table 2. Typical Characteristics of Candidates for Hip Resurfacing**

- Are <60 years old
- Are candidates for arthroplasty because of end-stage disease
- Are able to tolerate a metal-on-metal implant
- Have good femoral neck bone stock
- Are male
- Have enough femoral head to support an implant
- Have no major leg length or offset problems
- Have no major acetabular problems that might undermine fixation without screws

**Table 3. Drawbacks and Benefits of Hip Resurfacing**

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<tr>
<th>Potential Advantages of Hip Resurfacing</th>
<th>Disadvantages of Hip Resurfacing</th>
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<tbody>
<tr>
<td>More normal proximal femoral loading</td>
<td>Metal-on-metal not suitable for pregnant women or those of childbearing age; kidney patients; hypersensitive patients</td>
</tr>
<tr>
<td>Minimal femoral bone resection</td>
<td>Possibility of femoral neck fractures</td>
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<tr>
<td>Easier revision</td>
<td>Possibility of femoral head necrosis could lead to implant failure</td>
</tr>
<tr>
<td>Low risk of dislocation (may also be obtained with large metal-on-metal total hip arthroplasty)</td>
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Figure 2. Intraoperative fluoroscopic imaging helps placement of the pin and implant stem for correct angular positioning and anterior-posterior localization to avoid notching the femoral neck and anterior impingement.

Figure 3. Postoperative radiographic after total hip resurfacing.
A rich heritage of collegial communication informed by academic scholarship has shaped Mayo Clinic medicine for more than a century and remains a core value of our institution. As an extension of this institutional value we offer below selected recent Mayo Clinic orthopedics published scholarship. Our goal is to help you to continue to provide your patients with the best care possible and to facilitate working relationships with you, our physician colleagues.

**SHOULDER**


**ELBOW**


**HAND**


**SPINE**

**C1 anatomy and dimensions relative to lateral mass screw placement.** *Spine* 2007 Apr 15;32(8):844-8. DM Christensen, RK Eastlack, JJ Lynch, MJ Yaszemski, BL Currier.


**HIP**

**Patients preferred a mini-posterior THA to a contralateral two-incision THA.** *Clinical Orthopaedics & Related Research* 2006 Dec;453:156-9. MW Pagnano, RT Trousdale, RM Meneghini, AD Hanssen.


**KNEE**

**The Chitranjan Ranawat Award: Long-term survivorship and failure modes of 1000 cemented condylar total knee arthroplasties.** *Clinical Orthopaedics & Related Research* 2006 Nov;452:28-34. MB Vessely, AI Whaley, WS Harmsen, CD Schleck, DJ Berry.


**FOOT & ANKLE**


**The compartments of the foot: a 3-tesla magnetic resonance imaging study with clinical correlates for needle pressure testing.** *Foot & Ankle International* 2007 May;28(5):584-94. JS Reach, Jr, KK Amrami, JP Felmlee, DW Stanley, JM Alcorn, NS Turner.

**ONCOLOGY**

**Mechanical effects of partial sacrectomy: when is reconstruction necessary?** *Clinical Orthopaedics & Related Research* 2006 Sep;450:82-8. RR Hugate, ID Dickey, R Phimolsamit, MJ Yaszemski, FH Sim.

**Preliminary results of tantalum acetabular components for THA after pelvic radiation.** *Clinical Orthopaedics & Related Research* 2006 Dec;453:195-8. PS Rose, M Halasy, RT Trousdale, AD Hanssen, FH Sim, DJ Berry, DG Lewallen.
Mayo Clinic Orthopedic Scholarship, continued

**Infection**

JM Leone, AD Hanssen.

Recent intraarticular steroid injection may increase infection rates in primary THA. *Clinical Orthopaedics & Related Research* 2006 Oct;451:50-4. AL McIntosh, AD Hanssen, DE Wenger, DR Osmon.

**Pediatrics**


**Trauma**


**Sports**

Mechanical properties of patellar tendon allografts subjected to chemical sterilization. *Arthroscopy* 2007 Apr;23(4):400-4. DB Jones, PM Huddleston, ME Zobitz, MJ Stuart.


**Biomechanics**


**Miscellaneous**


Mark Your Calendars: Mayo Clinic Continuing Medical Education

17th Annual Mayo Clinic Symposium on Sports Medicine
November 9-10, 2007, Mayo Civic Center, Rochester, Minnesota

Health care professionals with an interest in sports medicine or sports-related conditions and injuries should attend this case-oriented symposium. Presentations, lectures, a live physical examination demonstration, and live broadcast anatomy and arthroscopy demonstrations will showcase an integrated approach to the injured athlete.

Minnesota Memorial Regional Pediatric Orthopedic Trauma Symposium
November 16, 2007, Mayo Clinic, Rochester, Minnesota

Join experts from an array of pediatric orthopedic specialties and keynote speaker James R. Kasser, MD, chair, Department of Orthopedic Surgery, Boston Children’s Hospital and John E. Hall Professor of Surgery, Harvard Medical School, for a symposium focusing on the most challenging conditions seen in practice. Emphasis will be on treatment and management of pediatric orthopedic conditions related to trauma, the hip, and the upper and lower extremities.

Mayo Clinic Spine Surgery Symposium

Join Mayo Clinic course directors Bradford L. Currier, MD, and Michael J. Yaszemski, MD, PhD, in a program designed for surgeons and nonoperative clinicians with a special interest in managing spinal disorders. In a highly interactive format, national and international experts will discuss the latest advances in the field, as well as offer skill demonstrations, case presentations, and hands-on workshops.

For more information or to register, go to www.mayo.edu/cme or call 800-323-2688.
In the past, finding the source of debilitating wrist pain associated with high-torque “swing sports” such as golf and baseball has usually been difficult. In some cases, complete separation of the triangular fibrocartilage complex from the ulna or a crosswise rupture of the UT ligament (both causing joint instability) have been found to be the cause of the pain, but many times a definitive cause of pain was never identified, resulting in relatively poor clinical outcomes. However, the recent discovery by a Mayo Clinic orthopedic surgery team of an axial “split tear” of the UT ligament helps explain many cases of wrist pain for which the cause has been unknown or misdiagnosed. (See the Table for comparison of traits of UT ligament injuries.)

The newly defined split tear of the UT ligament is a common source of ulnar-sided wrist pain in which the ligament remains attached to the bone on both ends and is split open lengthwise. The joint is stable, and the MRI is usually interpreted as normal. **Ulnar Fovea Sign**
The Mayo team is the first to devise a simple, quick manual examination to help identify the source of ulnar-sided wrist pain (Figure 1). Called the “ulnar fovea sign,” it elicits exquisite pain in patients who

<table>
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<tr>
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<tr>
<td>Injuries to the ulnotriquetral (UT) ligament are common sources of ulnar-sided wrist pain, usually associated with high-torque swing sport rotation.</td>
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<tr>
<td>Research by the Mayo Clinic orthopedic surgery team identifies a previously undiagnosed form of UT ligament injury—an axial “split tear” of the UT ligament.</td>
</tr>
<tr>
<td>Split tears can be diagnosed with 95% sensitivity by a simple clinical test to elicit tenderness in the ulnar fovea.</td>
</tr>
<tr>
<td>Full, pain-free wrist function can be restored by arthroscopically guided repair of the split tear.</td>
</tr>
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</table>

**Table. Traits of 2 Types of UT Ligament Injuries**

<table>
<thead>
<tr>
<th>Typical UT ligament injury</th>
<th>Split tear of the UT ligament</th>
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<tbody>
<tr>
<td>Complete rupture of ligament-bone union</td>
<td>Ligament remains attached to bone at both ends</td>
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<tr>
<td>Joint instability</td>
<td>Joint stability</td>
</tr>
<tr>
<td>Pain</td>
<td>Pain</td>
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<tr>
<td>Crosswise rupture</td>
<td>Lengthwise rupture</td>
</tr>
<tr>
<td>Easily visible on MRI</td>
<td>Not easily visible on MRI</td>
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Figure 1. A, Deep anatomy of the ulnar fovea sign. The ulnar fovea lies between the ulnar styloid process and the flexor carpi ulnaris tendon (arrow). B, Surface anatomy of the ulnar fovea sign. With the forearm in neutral rotation, the patient’s ulnar styloid process is easily palpated by the examiner’s index finger. IOM, interosseous membrane; L, lunate; LT, lunotriquetral ligament; P, pisiform; PRU, palmar radioulnar joint capsule; R, radius; T, triquetrum; TC, triquetrocapitate ligament; TH, triquetrohamate ligament; U, ulna; UC, ulnocapitate ligament; UL, ulnolunate ligament; UT, ulnotriquetral ligament.

Figure 2. Suturing the lengthwise tear has proved to be a durable repair allowing patients a return to full function of the wrist, with no reports of reinjury.
High-energy knee dislocations often involve multiple ligaments and are limb-threatening injuries with a high risk of popliteal artery injury. Controversy surrounds many aspects of treatment. The experience of Mayo Clinic’s orthopedic surgery team is leading to successful outcomes after multiple ligament reconstruction (Figure 1).

In addition to preferring early percutaneous surgical treatment over nonsurgical treatment, the Mayo Clinic team favors reconstruction over repair (Figure 2). They use a staged surgical protocol to treat patients with high-energy knee dislocations involving multiple ligament reconstruction.

Staged Surgical Protocol

The goal of treatment for high-energy knee dislocation is restoration of axial alignment, knee stability, and joint function. Recognizing the benefits of a staged surgical protocol in tibial plateau fracture management, the Mayo Clinic team uses a staged protocol also for high-energy dislocations of the
knee. These surgeons are seeing the excellent results after multiligament knee reconstruction that were first observed in tibial plateau fracture staging, where complication rates decreased from more than 50% to less than 10%.

Stage 1
The first surgical stage involves examination under anesthesia with application of a joint spanning external fixator or a hinged knee brace locked in full extension to align the limb and to extend soft tissues to resting length (Figure 3). Imaging is performed under anesthesia with fluoroscopy for bilateral comparison. Subsequently, further imaging is obtained with MRI, and prophylaxis with low-molecular-weight heparin is initiated to prevent deep vein thrombosis. Swelling is allowed to subside with the tissues in correct anatomic alignment until inflammation is minimal and the limb is amenable to surgery.

Stage 2
Between 2 and 3 weeks after injury, definitive ligament reconstructions begin. The time between the 2 stages allows adequate opportunity for soft tissue recovery, but the interval is short enough to avoid development of extensive fibrosis. Definitive treatment decisions are based on evaluation of the soft tissue envelope and ligamentous involvement.

In a study led by an orthopedic surgeon now at Mayo Clinic, reconstruction of 37 high-energy knee dislocations with the staged protocol approach was durable and functional after at least 22 months of follow-up. Of the 37 patients, 7 required revisions for failed posterolateral corner and/or posteromedial corner repairs.

Acute Reconstruction Preferred
Recent data support ligament reconstruction over repair. In a study of 11 acute repairs conducted by an orthopedic surgeon now at Mayo Clinic, 64% failed and required reconstruction—and the reconstructions did not require further revision. The study involved a review of the records of knee patients treated by a single surgeon using the same protocol for acute repair of posteromedial corner and posterolateral corner structures, followed by delayed anterior cruciate ligament–posterior cruciate ligament reconstructions. Of the 11 acute repairs done in 8 patients between May and December 2004, most—7, or 64%—failed and required reconstruction: 5 of the 8 posterolateral corner repairs and 2 of

Figure 1. A. Lateral view of knee showing joint dislocation. B. Anteroposterior view of 4-ligament reconstruction showing the internal hardware to stabilize and restore function to the anterior cruciate ligament, the posterior cruciate ligament, the medial collateral ligament, and the posterolateral corner.

Figure 2. Percutaneous treatment is preferred. Intraoperative photograph of ACL and PCL reconstructions using minimally invasive percutaneous surgical treatment.
the 3 posteromedial corner repairs.

Because no patients have required further revision reconstructions, the Mayo Clinic team has concluded that abandoning repair techniques is warranted in most cases of multiple ligament injuries to the knee and favors reconstruction instead.

**New Mayo Task Force**

To continue to help resolve the controversies surrounding the treatment of high-energy knee dislocations, Mayo Clinic orthopedic surgery team members have initiated a multicenter Knee Dislocation Task Force. Experts in the field of knee dislocations from across the United States and Canada will work together to develop clinical trials and pool data to help resolve the controversies surrounding multiligament knee reconstructions.

**For More Information**

To learn more about Mayo Clinic’s approach to multiple ligament reconstructions of high-energy knee dislocations or to refer patients for evaluation, please call 507-538-4101.

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**Mayo Clinic W. Hall Wendel, Jr. Musculoskeletal Center to Open December 2007**

The new Mayo Clinic W. Hall Wendel, Jr. Musculoskeletal Center will be among the world’s most advanced musculoskeletal facilities, bringing together diagnostic, treatment, and rehabilitation services in a center designed to yield high efficiencies for both patients and clinicians. In addition to the orthopedic subspecialty practices, expertise and services will include musculoskeletal radiology, rheumatology, endocrinology, physical medicine and rehabilitation, spine center, outpatient surgery center, and state-of-the-art patient education services. The facility will have a 2-story lobby atrium on the 14th and 15th floors of the interconnected Gonda and Mayo Buildings in Rochester, Minnesota.

“By bringing together specialties engaged in treatment related to musculoskeletal problems, the center will allow patients to be seen by a variety of physicians in a central location,” says Daniel J. Berry, MD, chair of the Department of Orthopedic Surgery at Mayo Clinic. “It will also enable the physicians to easily consult with one another—a hallmark of Mayo Clinic care.”