Robotic Full Knee Replacement in Florida

Mayo Clinic in Jacksonville, Florida, is offering full knee replacement using robotic-arm-assisted technology (Figure). Although the procedure has been performed for less than a year, the preliminary results are encouraging.

“Patients who have had a knee replacement with both the robot and traditional surgery feel that it’s been easier to recover from the robotic procedure early on, and to regain the knee’s range of motion,” says Cedric J. Ortiguera, M.D., a consultant in Orthopedic Surgery at Mayo Clinic’s Florida campus. “We’re hopeful that this procedure is an advance that will help patients. But it will take time to prove that the added costs of the robotics will prove to be worthwhile for long-term outcomes for the patients.”

The procedure is similar to robot-assisted partial knee replacement, which has been available for about a decade. The first step is assessment to determine whether the patient is a candidate for full knee replacement. “There are no contraindications for the robot-assisted technology. Anyone who qualifies for a knee replacement can generally have a robotic knee replacement,” Dr. Ortiguera says.

A CT scan of the patient’s knee is then used to generate a 3-D computer model of the bone. “Looking at that model of the patient’s own bone allows us to plan the size and position of the implant before surgery,” Dr. Ortiguera says. “During the actual surgery, we’re able to take some fine-tuning measurements and make final adjustments to the surgery plan.”

When preparing the patient’s bone for the implant, the surgeon guides the robotic arm within the area of the preoperative surgical plan, increasing the accuracy of bone preparation. Working with precise measurements based on the patient’s individual anatomy allows the Mayo Clinic orthopedic surgeon to more accurately balance the ligaments and soft tissue around the knee replacement.

“Achieving that accurate balance is a challenge,” Dr. Ortiguera says. “The robotic device gives us much more information during the surgery to find that balance and to determine how loose or tight the implant might be on a single side.”

Historically, patient satisfaction with the outcome of knee replacement has lagged behind satisfaction with hip replacement. “One of the reasons patients may not be happy with their knee replacements may be the difficulty in balancing the soft tissues that support the implant for that particular patient,” Dr. Ortiguera says.

About 800,000 full knee replacements are performed in the United States each year — a number projected to rise to 3 million by 2030. “People are not just living longer; they’re staying healthier longer. They want to stay active and not accept the limitations of arthritis,” Dr. Ortiguera says. “Patients as well as orthopedic surgeons are looking for improved knee surgery.”
In-Office Arthroscopy for Diagnosing Knee Pathology

Arthroscopy, the gold standard for diagnosis of intra-articular knee pathology, is typically performed in an operating room with the patient given regional or general anesthetics. Mayo Clinic now offers in-office knee arthroscopy that uses only local anesthetics yet provides images of sufficient quality to facilitate diagnosis of complex cases.

“This is an exciting technology that gives the surgeon a highly accurate view — often superior to an MRI — and that allows patients to avoid anesthesia and walk out of the office after the procedure,” says Anikar Chhabra, M.D., a consultant in Orthopedic Surgery at Mayo Clinic in Phoenix, Arizona. “In our experience, this can be a safe and cost-effective adjunct to traditional methods to aid the physician to get an accurate diagnosis.”

The new device, approved by the Food and Drug Administration, is an enhanced version of in-office arthroscopy designs dating back to the 1990s. Those designs were cumbersome, incorporating a tower, fluid irrigation systems and standard optics. The second-generation device forgoes the tower and uses a 14-gauge needle and digital optics (Figure 1).

“The old system just wasn’t practical to use in the outpatient setting. But now the system is a small device hooked up to a tablet,” Dr. Chhabra says. “The quality of the images has improved dramatically” (Figure 2).

Indications for use

In-office arthroscopy is especially useful for patients whose MRIs are inconclusive. “That’s almost always the case for a patient who has had previous meniscal and chondral knee surgery,” Dr. Chhabra says. “The in-office arthroscopy is also useful for grading and judging cartilage with acute or chronic conditions, as MRIs are often inaccurate when it comes to articular cartilage of the knee.”

In addition, in-office arthroscopy can be an option for people who cannot tolerate MRI due to claustrophobia or because they have pacemakers or other metal implants. Dr. Chhabra notes that, once the technique is mastered, in-office knee arthroscopy can be performed in about 15 minutes, and the images reviewed with the patient immediately afterward.

“This technology is an observational tool that can confirm diagnosis. If we know that a person has a knee problem that requires repair, we would do the arthroscopic procedure in the operating room,” Dr. Chhabra says. “But in-office arthroscopy is an exciting option for people who have had an MRI that isn’t conclusive.”

He cites the example of a 43-year-old patient who came to Mayo Clinic with right knee pain eight years after a motor vehicle accident. She had undergone multiple MRIs and been evaluated by several other physicians at other centers. Her diagnosis was inconclusive, and her treatment relied on corticosteroid injections and anti-inflammatory medications to try to control her pain.

In-office arthroscopy of the patient’s knee revealed lateral pathology including a 10-mm-by-10-mm grade IV chondral defect in the lateral femoral condyle and fraying of the anterior horn of the lateral meniscus. Further examination showed a 15-mm-by-15-mm grade IV chondral lesion of the medial condyle and grade III/IV fissuring degeneration of the lateral facet of the patella.

“It’s possible that if direct visualization...
Wide-Awake Hand Surgery

Many hand surgery procedures — such as carpal tunnel release, trigger finger release, flexor or extensor tendon repair, trapeziectomy, and removal of masses — can now be performed under local anesthesia alone, sometimes in the office, without the need for sedation or general anesthesia. This technique is called WALANT, which stands for “wide-awake local anesthesia, no tourniquet.”

The key is lidocaine with epinephrine, typically 0.5 to 1 percent lidocaine 1:100,000 or 1:200,000 with epinephrine. For many years, surgeons were taught that epinephrine used in local anesthesia solutions (such as lidocaine) was unsafe. However, this is a myth and has been disproved by multiple well-done studies. Epinephrine is used to control bleeding in its action as a vasoconstrictor, but it also makes the local anesthesia work for a longer period and allows the surgeon to use more local anesthesia.

For many decades, dentists have safely used lidocaine with epinephrine to safely control bleeding during procedures. The ability to safely control bleeding and to have longer acting local anesthesia now allows hand surgeons to safely perform many procedures with minimal bleeding, without the use of sedation or general anesthesia, and without use of a potentially painful tourniquet. In addition, because of these factors, this technique can be used safely in patients with medical complications or in those who take blood thinner medications, which might otherwise preclude surgery.

The advantages of these techniques are many. Without receiving sedation or general anesthesia medications, patients experience quicker recoveries and return to normal activities, avoiding some of the potential side effects and complications such as nausea. In addition, the cost to the medical system and to the patient is much less, and environmentally, the amount of waste generated is much less. Patients no longer require use of potentially painful tourniquets to control bleeding, and they no longer require IVs.

Julie E. Adams, M.D., has used this technique in the operating room at Mayo Clinic’s campus in Rochester, Minnesota, and has also expanded use of this technique in her practice at Mayo Clinic Health System in Austin, Minnesota.

Dr. Adams says: “We set up a procedure area in my clinic and patients come in and sit in a reclining chair for their procedures. I typically mark and then inject them and let them relax while the lidocaine with epinephrine takes effect. While the block sets up and the arm is prepped and draped, I see a few other patients in the clinic. I then do the procedure — some patients enjoy watching, while others listen to music or watch television. It’s a great way to get patients engaged in their own care. After surgery, most patients say they wish they hadn’t waited so long to undergo the procedure, and ask ‘Why would anyone go under sedation for this procedure?’”

Peter C. Amadio, M.D., an orthopedic surgeon at Mayo Clinic’s campus in Rochester, Minnesota, is an enthusiastic proponent of this technique. Dr. Amadio states:

“Many patients have thanked me after an operation, but it was only after I started doing wide-awake surgery that patients began telling me they enjoyed the operation and learned something from it.”

Dr. Amadio adds: “Postoperative pain and swelling are less, and I’ve noticed that using this technique plus multimodal non-narcotic pain management protocols results in a decreased need for any postoperative narcotic analgesics.”

A wide spectrum of cases can be done with this technique, including trapeziectomy, Dupuytren’s contracture release, fracture fixation, ligament repair, osteotomies, joint replacements in the fingers, as well as peripheral nerve procedures at the wrist and elbow and tendon and soft tissue procedures in the elbow, forearm, hand and wrist.

Other advantages of doing the procedures in the wide-awake setting include being able to assess and adjust tension for tendon transfers and check integrity of tendon repairs and look for gapping with active motion after flexor tendon repair.
Mayo Clinic goes beyond providing typical Level I trauma care to treat complex cases that involve both joint arthroplasty and traumatic injury (Figures 1 and 2). Mayo Clinic’s orthopaedic surgeons have extensive experience treating the growing number of patients with broken bones around joint replacement arthroplasties (periprosthetic fractures).

“We have significant expertise in the gray area where traumatic musculoskeletal injury overlaps with arthroplasty. Our group includes surgeons with the skill set to treat fractures and perform arthroplasty or revision arthroplasty in a single procedure if needed,” says Brandon J. Yuan, M.D., a consultant in Orthopedic Surgery at Mayo Clinic in Rochester, Minnesota.

As a Level I Trauma Center, Mayo Clinic has a large volume of patients and 24-hour in-house surgical coverage. Four orthopedic surgeons, including Dr. Yuan, have fellowship training in trauma and focus solely on patients with acute musculoskeletal injuries, allowing for rapid surgery for transferred patients. The surgeons’ expertise extends to young patients who have severe accidents or trauma as well as older patients who have a fall or low-energy trauma after joint replacement.

Complex conditions treated by Mayo Clinic trauma orthopedists include:
• Fracture nonunion and malunion
• Pelvis and acetabular fractures
• Correction of limb deformities, both congenital and trauma related
• Leg-lengthening procedures
• Periprosthetic fractures
• Complex periarticular trauma of the upper and lower extremity

Multidisciplinary focus
As a multidisciplinary practice, Mayo Clinic has the resources to manage patients with musculoskeletal injuries who also have multiple medical comorbidities. “We work closely with our colleagues in critical care medicine, anesthesiology, cardiology and internal medicine,” Dr. Yuan says.

For more information

Dr. Adams says: “After incorporating wide-awake hand surgery in my practice, I’ve had patients specifically request this technique. It’s a game-changer in terms of quality of care, improved patient satisfaction, decreased cost, decreased waste and more environmentally conscious care, and transparency.”

Older patients with fractures are routinely referred to the W. Hall Wendel Jr. Musculoskeletal Center for assessment of bone health and future fracture risk, as well as outpatient treatment and rehabilitation. The center brings together specialists in physical medicine and rehabilitation, rheumatologists, endocrinologists and radiologists, as well as pediatric orthopedic specialists for younger patients with bone issues. Similar integrated care is available at Mayo Clinic’s campuses in Phoenix, Arizona, and Jacksonville, Florida.

“This approach is especially beneficial for people with bone health issues or total joint replacements who then have fractures that impact the joint replacement,” Dr. Yuan says. “We have a system for caring for these patients’ medical comorbidities and bone health issues.”

Patients also benefit from the research undertaken by Mayo Clinic orthopedic surgeons. In a study published in 2017 in The Journal of Arthroplasty, Dr. Yuan and colleagues found that the short-term survivorship of a conversion hip arthroplasty after surgical treatment of an intertrochanteric fracture is excellent, regardless of whether the fracture fixation used an intramedullary or extramedullary device.

“As a major center with clinicians who are involved in research, Mayo Clinic has substantial resources devoted to caring for the multiple needs of trauma patients,” Dr. Yuan says. “That care starts with orthopedic traumatologists but continues through all aspects of the patient’s medical care and recovery.”

For more information

Total Elbow Replacement: Matching the Success of Hips and Knees

Mayo Clinic has pioneered an approach to elbow replacement surgery that seems capable of offering young, active patients a stable and durable treatment. A 20-year effort initiated by Mayo Clinic has resulted in the development of a prosthetic elbow and surgical technique that appear to provide an elbow replacement with quality approaching that of hip and knee replacements.

“We are on the verge of being able to offer patients a joint replacement of the elbow that we can expect to remain stable and not wear out prematurely. It’s a game-changer,” says Shawn W. O’Driscoll, M.D., Ph.D., a consultant in Orthopedic Surgery at Mayo Clinic in Rochester, Minnesota.

Dr. O’Driscoll and colleagues at Mayo Clinic and other centers have been implanting the elbow design since 2001. “With a follow-up of up to 16 years, rates of revision due to wear are truly minimal,” he says. “We will continue to study the procedure’s longevity, but I think we can say we are accomplishing our goal of bringing elbow replacement to the level of hip and knee replacement.”

Out of the Dark Ages

Advances in hip and knee replacement have made those procedures fairly routine. “When performed by surgeons with subspecialist training, total knee and total hip replacements are done at a very high level. By comparison, elbow replacement has been in the Dark Ages,” Dr. O’Driscoll says.

Historically, the procedure has had a high rate of complications, revision and failure. Unlinked elbow replacements have often resulted in dislocations. In linked elbow replacements, the prosthetics’ hinges and plastic cushions have tended to wear out.

“The general sense is that patients do poorly,” Dr. O’Driscoll says. “So except in the direst circumstances, orthopedic surgeons haven’t done elbow replacement, and patients have had no other option. They simply suffer.”

A nonfunctional elbow is significantly disabling. Use of the hand is generally affected, as the elbow is unable to stabilize the hand or move it through space. Patients also experience pain.

Their injuries are often related to motor vehicle accidents, sports, farming or other manual labor. “The typical case is a young, healthy and active patient who has had an isolated injury to the elbow, which greatly limits quality of life,” Dr. O’Driscoll says. “At Mayo Clinic we are also seeing a number of armed-services personnel who were injured by a rocket-propelled grenade or an improvised explosive device.”

Mayo Clinic’s innovations in elbow replacement are part of the institution’s distinguished history of orthopedics research. Mayo Clinic’s shoulder and elbow laboratory is at the forefront of basic research and prosthetics design. “Our new design taps into the profound advances made in the last three decades in understanding the basic anatomy and biome-
The researchers have also sought to solve problems with elbow prosthetics’ stability and durability. “The new design has a much thicker polyethylene lining and a much broader surface area, so the pressures placed on the joint are distributed more evenly,” Dr. O’Driscoll says. “The design was accomplished with computer optimization so that at any particular position throughout the entire range of motion — or during angular deflections when the joint is trying to be torqued out of place — the surface area never diminishes to an area small enough to concentrate pressure and wear out the plastic.”

**Replacing a grenade-shattered elbow**

Dr. O’Driscoll keeps on his desk a United States flag insignia given to him by a grateful patient. The insignia was part of the special forces uniform the patient wore in Afghanistan, where a rocket-propelled grenade shattered his right elbow.

“He lost a great deal of blood and nearly died,” Dr. O’Driscoll says. Military surgeons were able to stabilize the injury, but despite subsequent surgeries, the patient had almost no use of his right hand and experienced severe pain when he came to Mayo Clinic.

Dr. O’Driscoll performed an elbow replacement that also involved reconstructing the patient’s triceps tendon, which was completely missing. “Afterward, for the first time in eight years, he could straighten his elbow,” Dr. O’Driscoll says.

The patient subsequently had a recurrence of pain caused by a loosened stem in the prosthesis. “That happens in about 10 percent of cases,” Dr. O’Driscoll says. “It’s not a very serious problem, but it requires revision surgery. We remove the loose piece, enlarge the opening and put in a new stem. We are careful to explain this possibility to patients before their elbow replacement, and every single patient who has needed the revision surgery has been totally fine with that.”

The special forces veteran was able to resume the physical training that is an important part of his life. “I gave him permission to put a lot of stress on that elbow,” Dr. O’Driscoll says. “He told me that Mayo Clinic had restored his life and made him whole again.”

**Surgical site infection is a challenging complication associated with total joint arthroplasty.**

Although infection is relatively uncommon, the number of infections is rising as total hip arthroplasty and total knee arthroplasty are increasingly performed on an aging population. As a major referral center, Mayo Clinic has significant experience and expertise treating these prosthetic joint infections.

“We have sufficient patient volume that we are able to offer patients a surgeon who focuses on these types of cases. Treating these joint infections accounts for a large part of my practice,” says Kevin I. Perry, M.D., a consultant in Orthopedic Surgery at Mayo Clinic in Rochester, Minnesota.

Through the use of antibiotic spacers (Figures 1 and 2) fabricated at the time of surgery, Mayo Clinic is able to provide patients with maximal use of their joints during treatment. “The types of spacers allow patients reasonable function during the treatment period. As a result, many patients are able to put weight on the joint and to move around while we clear the infection,” Dr. Perry says.

Treating joint infections is complex, requiring open surgery to remove the patient’s prosthetic, thorough debridement of the infected material and insertion of the antibiotic spacers. Patients then typically have a six-week course of intravenous antibiotics and, after a period of waiting to ascertain that the infection has cleared, a second open procedure to remove the spacers and replace the prosthetic.

“The great strength we have at Mayo Clinic is coordination of care,” Dr. Perry says. “As
orthopedic surgeons, we work very closely with subspecialists in orthopedic infectious diseases. Often the orthopedic surgeon and the orthopedic infectious disease specialist see the patient together. We have a good working relationship to come up with the best plan to treat these patients.”

At Mayo Clinic, most joint infections are cleared completely. “Outcomes depend a lot on the health of the patients — their medical comorbidities, the number of operations they’ve had and the status of the infected limb,” Dr. Perry says. “But in generally healthy patients, we see a better than 90 percent cure rate.”

Underpinning this clinical practice is a research program focused on improving treatment for patients with prosthetic joint infections. In a study published in the November 2017 issue of The Journal of Arthroplasty, Mayo Clinic researchers found that prolonged retention of an antibiotic spacer — which is occasionally chosen in treatment of a hip or knee infection if the patient is considered medically unfit for future surgery — leads to frequent mechanical failure and relatively poor clinical outcomes.

“We’ve learned to control the surgical and postoperative environments to minimize the risk of infection,” Dr. Perry notes. “But because the number of arthroplasty procedures continues to rise, infection will continue to be a burden.”

**For more information**

**Figure 1.** Anteroposterior radiograph shows an articulating antibiotic spacer used for an infected total hip arthroplasty.

**Figure 2.** Lateral radiograph shows an articulating antibiotic spacer used for an infected total hip arthroplasty.
Education Opportunities

For more information or to register for courses, visit https://ce.mayo.edu/orthopedic-surgery/orthosurgery, call 800-323-2688 (toll-free) or email cme@mayo.edu.

Mayo Clinic Comprehensive Shoulder and Elbow Course: Current Concepts and Controversies 2018
This course provides information on the latest treatment options for shoulder and elbow arthroplasty, arthroscopy, fracture and reconstruction. Focusing on new technology and the best current practice in diagnosis and treatment, international experts in shoulder and elbow surgery discuss how to optimize surgical techniques and avoid complications. Participants are encouraged to bring cases for discussion.

2nd Annual Mayo Clinic Sports Medicine for the Primary Care Clinician 2018
This conference allows participants to fill gaps in their residency training and to reinforce their knowledge of diagnosis and treatment for musculoskeletal conditions. Topics include procedural techniques that primary care clinicians can use to treat athletes and active individuals.

1st Annual Mayo Clinic Sports Medicine Summit: Care for the Athlete
April 6-7, 2018, in Phoenix
This course is designed to discuss current topics in sports medicine and features evidence-based, cutting-edge diagnostic and treatment strategies for sports-related and musculoskeletal conditions. Faculty includes leaders in various fields of sports medicine, including orthopedics, physical medicine and rehabilitation, radiology, neurology, and physical therapy. Multiple educational formats include case presentations, interactive question-and-answer sessions, lectures on various sports medicine topics, live ultrasound demonstrations, and small breakout sessions to discuss various topics of sports medicine.

7th Annual Comprehensive Sports Medicine Update and Board Review 2018
June 20-23, 2018, in Minneapolis
This award-winning course is designed to provide a comprehensive review of all subjects contained in the sports medicine board examination. The course faculty includes internationally recognized experts in the field of sports medicine.

Mayo Clinic Opioid Conference: Evidence, Clinical Considerations and Best Practice 2018
This conference aims to highlight the shift in guidelines and public concern regarding the use of opioids in medical practice, and provides the most up-to-date information about the appropriate indication for opioids in clinical practice. Topics cover the basics of opioids, evidence-based guidelines for opioids, medication monitoring, tapering and legal considerations. Other issues to be covered include opioid addiction, difficult patient conversations and guidelines to standardize the practice of opioid prescribing.

28th Annual Mayo Clinic Symposium on Sports Medicine 2018
Nov. 9-10, 2018, in Rochester, Minn.
This course continues to feature evidence-based, cutting-edge diagnostic and treatment strategies for sports-related and musculoskeletal conditions. The program is multidisciplinary, with expert lecturers representing a spectrum of sports medicine fields. Multiple educational formats include case presentations, interactive question-and-answer sessions, and live demonstrations of physical examination, anatomy, ultrasound and arthroscopy.