

KNEE ARTHRITIS & OTHER DISORDERS

SURGICAL TREATMENT OPTIONS FOR THE PAINFUL KNEE

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Please read this guide before your visit so we can better answer any questions during your consultation.

Joint replacement is one of the most successful procedures in modern medicine. The surgical treatment of knee arthritis and other disorders by knee replacement is typically very reliable in reduction of pain and improvement in function. Total (also known as full or complete) knee replacement (TKR) is a misnomer, as it is not a procedure of removal and replacement of the entire knee joint. Rather, the articulating surfaces of the knee joint that are exposed, usually due to severe cartilage damage, are resurfaced. The ends of the bones of the joint are resurfaced with a few millimeters of metal, and a durable plastic placed in between. As such, there is no more bone rubbing on bone, but rather metal articulating with a new plastic bearing, thereby re-establishing the surfaces of the bones in both shape and size. This guide is intended to provide information regarding partial versus total knee replacement, less invasive surgery, risks and benefits of the procedures, outpatient joint replacement, and state-of-the-art surgical techniques.

THE EVOLUTION OF KNEE REPLACEMENT

Prior to the availability of knee replacement surgery, knees with severe arthritis or other disorders were treated with walking aids, medications to manage symptoms, knee osteotomy (controlled leg fracture to change alignment of the limb), or knee fusion. While these treatment options could alleviate pain, each are associated with significant limitations and complications.

The earliest total knee replacement dates back to the 1890's with the use of an ivory hinged prosthesis. In the 1950's, a hinged knee replacement was made with metal. The major developments in modern total knee replacement designs began in the

early 1970's both in the US and abroad. The components resurface all three compartments of the knee, the inside (medial), the outside (lateral), and the front (patellofemoral) compartments. This is why the procedure is called a total, complete, or full knee replacement.

Throughout the years, the materials used in knee replacement have continued to improve. The metal surfaces are comprised of cobalt-chrome and titanium. The metals must be durable to last for years, if not decades, and must be well tolerated by the body. The femoral component (covering the end of the thigh bone) is made of cobalt-chrome because it must be scratch-resistant, as it articulates with the plastic surface below. The durable plastic is an ultra-high molecular weight polyethylene that has properties to maximize strength while minimizing wear. It too, must be able to last the many years expected, and the many knee cycles expected throughout the patient's lifetime. The tibial component (covering the top of the shin bone) is made of titanium and the plastic liner securely locks into it, so that motion does not occur at that interface.

The gold standard for fixation of knee replacement components is with the use of cement. Similar to cement used in dental procedures, methylmethacrylate is mixed together in a sterile fashion in the operating room. It is mixed with antibiotics, to help prevent infection after the surgical procedure. The mixture first is like a putty, able to fill the crevices of the bone lattice structure, and attaching to the surfaces of the knee components. As the methylmethacrylate solidifies and hardens, the implants are stable in a matter of minutes. With this technique, the implants are solidly fixed to allow immediate weight-bearing and knee motion.

An "uncemented" knee replacement is one in which the components are fixed without cement. In this case, fixation is dependent on bone growing into the porous surfaces of the implant. However, unlike its uncemented hip replacement counterparts, where the results 20 years after the operation are reliable and durable, uncemented knee components have had mixed results. Cemented knee replacement component fixation remains the current standard of care.

PARTIAL KNEE REPLACEMENT

Partial, or single (unicompartmental), knee replacement (UKR) is a specialty procedure that involves resurfacing only one of the three compartments of the knee

joint. Most commonly, partial knee replacements are performed on the inside of the knee due to the most common wear pattern being in that compartment. To be successful, the knee arthritis or disorder should be isolated to a single compartment only. Otherwise, damage to the remaining parts of the knee may progress, and pain in those other compartments may worsen. Partial knee replacement is available also for the outer part of the knee only, as well as the patellofemoral (kneecap) portion of the knee. The materials and fixation of these unicompartmental components are identical to total knee replacement. However, the components are much smaller and made to fit the specific anatomy of the addressed compartment.

Partial knee replacement is a specialty procedure, either not performed by most surgeons, or performed only infrequently. I trained specifically in fellowship to perform this procedure, where the longest published data in the US has been performed, showing survivorship of over 90% at 20 years. These outcomes are a result of proper patient selection and advanced surgical techniques. Evaluation by a specialist who regularly performs partial knee replacement is required to determine whether the procedure is appropriate for the individual patient.^{**} Over the recent years, I have performed some of the highest number of partial knee replacements in California.[§] Many patients are not offered, or made aware of, partial knee replacement options because the surgeon does not perform them. Roughly 10-15% of the population are candidates for partial knee replacement, but are not made aware of it as an option.

Partial knee replacement has many advantages over total knee replacement. Remember, total knee replacement has excellent outcomes with durable results. Yet, partial knee replacement can allow an even faster recovery (as Director of the Outpatient Joint Replacement Program, I was first in the region to perform the surgery on an outpatient, home same day, basis since 2014)^{**}, better knee range of motion, less bleeding and pain, preservation of all knee ligaments, and the knee feels and acts more like the normal knee. While rare, if repeat surgery is required, a partial knee replacement can be converted to a total knee replacement with results similar to a first-time knee replacement when performed by a specialist, thereby burning no bridges.

[†] Lead investigator of United States, Zimmer partial knee evaluation, 2016-present

[†] **Alexander Sah**, "Historical Evolution of Partial Knee Replacements"

• *Presentation at West Regional Recon Hip and Knee Meeting, San Francisco, 2016*

[‡] **Alexander Sah**, "Partial knee replacement- Tips and Technique"

• *Presentation at Contemporary Solutions in Joint Surgery, Newport Beach, 2016*

[§] Industry national database, 2016

^{**} **Alexander Sah**, "Outpatient Joint Replacement: Practical guidelines for your program based on evidence, success, and failures"

• *Moderator at AAOS Annual Meeting, New Orleans, 2018*

MINIMALLY INVASIVE TOTAL KNEE REPLACEMENT

Traditional knee replacement surgery, in practice since its beginning in the 1960s in the United States, has typically utilized an extensive, 8 to 12 inch incision on the front of the knee. Exposure into the knee joint requires entering the capsule and splitting the quadriceps tendon enough to flip and retract the kneecap out of the way. The muscle and soft tissue trauma associated with this exposure can result in weeks to months of recovery.

About 15 years ago, minimally invasive knee replacement techniques gained popularity. The intention was to minimize soft tissue injury, allow a faster recovery, while maintaining the excellent and durable outcomes of traditional surgery. MIS surgery is more difficult to perform, which is why not all surgeons use the technique. Studies have shown that the majority of joint replacements in the US are performed by surgeons who perform fewer than 30 cases per year. Studies also show that joint replacement done by high-volume surgeons and at high-volume institutions have better results and fewer complications. As a result, MIS knee replacement surgery should only be performed by a specialist.

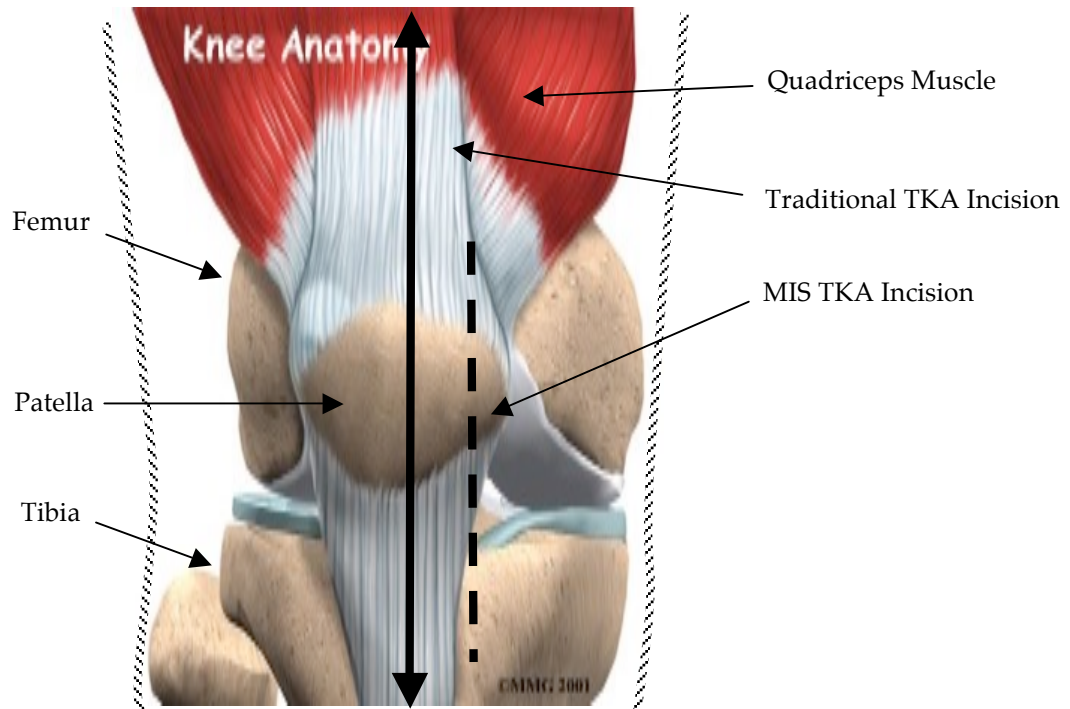
With this technique, the skin incision is roughly 4-6 inches in length, the underlying tissue is minimally exposed, and the kneecap shifted aside rather than twisted and dislocated. These techniques result in much less soft tissue trauma. This minimally invasive surgery requires specialized surgical instruments and techniques to be performed successfully. I trained specifically in fellowship with mentors who developed and popularized many of the techniques used today. Results have proven to be equal, if not better in some ways, than traditional techniques, and also has allowed more rapid recovery. The procedure takes about one hour to perform. With a rapid two-day stay after total knee replacement since 2008, my patients have now routinely been able to go home 24 hours after surgery since 2014 with an updated rapid recovery protocol that I developed.^{††††} This protocol has been safe and effective for patients in their 40's to patients in their 90's. In 2017, I have been able to perform total knee

[†] Alexander Sah, "Initial experience with nonselective patient next day discharge after total knee arthroplasty"

• Poster at AAHKS Annual Meeting, Dallas, 2016

^{††} Alexander Sah, "Rapid Recovery Joint Arthroplasty"

replacement on select patients at our Outpatient Surgery Center so that patients have gone home just hours after the procedure.^{SS***+++}



Knee joint viewed from the front

ADVANTAGES

With these techniques and advancements, I developed a new protocol at the Institute of walking patients the same day of their surgery. While traditional thinking would worry of excessive pain or knee swelling, research performed on my patients and at other centers alike, found that patients could recover faster with less pain and better knee motion. While initially counterintuitive, this protocol has now become standard of care at the Institute. I have a focus on optimizing pain and blood management after surgery, and frequently lecture at national meetings and teach other surgeons how to incorporate these techniques into their practices. Participating in research and collaborating with peers across the country has contributed to the development and success of these protocols.^{###SSS****}

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- Presentation at 25th Annual California Orthopedic Association meeting, Laguna Niguel, 2016
 - * Alexander Sah, "The Road to Outpatient Joint Replacement"
 - Presentation at Contemporary Solutions in Joint Surgery, Newport Beach, 2016
 - Alexander Sah, "Same Day Surgery- Top 5 Tips for Outpatient Joint Replacement"
 - Presentation at CA Orthopedic Assoc Annual Meeting, Carlsbad, 2017
 - *** Alexander Sah, "Outpatient Joint Arthroplasty- Postop considerations and preventing readmissions"
 - Presentation at Road to Outpatient Joint Replacement Symposium, AAHKS, Dallas, 2016
 - ### Alexander Sah, "Immediate Impact of Tranexamic Acid in Blood Conservation in Primary Total Joint Replacement"

Importantly, the benefits of knee replacement remain the same with correction of knee deformities, resurfacing the worn knee joint, and early return to function. The long-term goal is also the same, of providing the most long-lasting pain relief and improved mobility as possible. After surgery, patients are taught flexibility exercises to first maximize knee range of motion. In the second stage, leg strengthening helps restore the atrophied muscles in the leg from prior to surgery. Exercises begin immediately and continue at home under the guidance of a physical therapist. Patients often begin golf-like activities at 6 weeks after surgery, and can soon after return to hiking, biking, swimming, tennis, skiing, and other such activities. Most patients have little or no pain after their knee replacement procedure, and the vast majority have near normal mobility. For these reasons, nearly one million knee replacements are performed in the US each year.

CONSIDERATIONS BEFORE SURGERY

As fast as the recovery has now become, I find it important to emphasize that knee replacement is still a significant surgical procedure. Whenever anesthesia is involved, there are potential risks. However, in nearly all patients, the preferred method is regional anesthesia, an epidural or spinal. This involves numbing the waist down, so that general anesthesia and intubation can be avoided. This minimizes anesthesia risks, as patients can remain awake, breathing on their own, or be sedated for the one-hour procedure. Nonetheless, prospective patients would benefit from optimizing their health prior to any elective surgical procedure.

LIMITATIONS, DISADVANTAGES, AND COMPLICATIONS

As impactful as knee replacement is on improving quality of life, the components are limited because they are man-made. As such, while rare and unusual, there are limitations and risks to the procedure. First, the knee replacement is not a “normal” knee. The knee functions very well, treats knee pain, and allows return to activities. However, it does not function completely like a normal knee, mostly because of the changes to the ligaments centrally located in the knee (typically the ACL and PCL). In

• *Presentation at ICJR 3rd Annual Pan Pacific Orthopedic Congress, Kona, Hawaii, 2016*
• **Alexander Sah**, “Blood and Pain Management in Modern Joint Replacement”
• *Presentation at Contemporary Solutions in Joint Surgery, Salt Lake City, 2017*
• **Alexander Sah**, “The Use of Multimodal Analgesia in Treating Acute Pain”
• *Presentation at HANA Annual Meeting- Oahu, 2015*

contrast, partial knee replacement spares these ligaments, and therefore will function more naturally, but even a partial knee is not completely normal. This is because these implants are not made with the intention of withstanding significant knee forces associated with running, jumping, soccer, basketball, etc. Activities such as swimming, golfing, biking, doubles tennis, golf, skiing, and others are lower-impact and more recommended.

Second, the artificial materials can be subject to loosening or wear. These failure mechanisms are infrequent, but possible. The cement acts as a grout, so it has the potential to loosen from the bone over time or with excessive loads. The plastic bearings can potentially wear, though modern materials are so durable that this is rare. Polyethylene surfaces have been used for decades, with durability over 30 years in many cases. Most joint replacements will outlive the patient. Studies typically suggest that implant failure is less than 1% per year, meaning that over 80% of knee replacements should be functioning well over 20 years later.

While knee replacement used to be a procedure only for the elderly, the average age for the procedure continues to decrease. Younger, more active, patients are often wearing their knees faster and earlier, leading to the need for knee replacement as young as in their 40's. On the other side of the spectrum, the procedure is safe and effective for patients even in their 90's. The same rapid recovery protocol can be appropriate for both sets of patients, and those in between.

Specific risks to total knee replacement surgery include infection, bone fracture, knee stiffness, peroneal nerve or popliteal injury, ligament or soft tissue injury, continued pain, or implant failure. These risks are rare, lower than 1% in most cases. Other surgical complications include heart attack, stroke, kidney failure, blood clot, pulmonary embolism, heart failure, bleeding, nerve palsy, and others. The most common complications are usually nausea or constipation from the pain medications. Some patients have pre-existing conditions that may increase their risk for a particular complication somewhat, and consultation is necessary to assess these risks.

THE FUTURE

With knee replacement already a very successful procedure, most advancements have centered on improving patient recovery and speeding rehabilitation.

Improvements in pain management with a multimodal approach focuses on using many different medications at lower doses, to achieve an overall better analgesic effect. Blood management strategies have essentially eliminated the need for blood transfusion, blood donation, or surgical drain use. Rapid recovery protocols have allowed 24 hour discharges, and in some cases same-day surgery. By participating as faculty at national meetings and continuing with research and leadership committees, I am able to bring the most current treatment options and surgical techniques to my patients. ****# ssss *****

REOPERATIONS

Revision knee surgery is infrequent, but is required in some cases. If cement fails by loosening or fracture, a new total knee can replace the prior one. Revision surgery is more complicated, takes longer to perform and recover, and is associated with an increase in complications and risks. However, knee revision can be performed safely, and since 2014 have been part of my same rapid recovery protocols as my first-time knee replacement patients. In rare cases, some patients have had multiple revision surgeries on the same knee, and still are able to function satisfactorily. Everything is done to avoid the need for revision surgery in the future, but it can be performed safely when necessary.

CONCLUSION

Knee replacement surgery, whether partial or total, is one of the most successful procedures available in modern medicine. For patients with severe knee arthritis or other disorders, replacement restores function and alleviates pain. Patients can return to most activities and regain their active lifestyle. Durability is expected to achieve excellent results for decades.

Risks and complications are infrequent, and techniques and protocols are constantly modified to reduce risks even further. Involvement with research and participation in meetings is essential to remaining current in these evolving techniques.

**** *Multimodal Pain Management for Total Hip and Knee Arthroplasty: Current Concepts and Controversies Symposium, Dallas, 2016*

*** *Same Day Surgery- Road to Outpatient Joint Replacement Symposium, Dallas, 2016*

ssss *Optimizing the Episodes: Improving Total Joint Outcomes and Cost in the Era of CJR Symposium, Dallas, 2016 (moderator/speaker)*

**** *Contemporary Solutions for Joint Surgery, Salt Lake City, Utah, 2017*

**** *California Orthopedic Association Annual Meeting, San Diego, 2017 (program co-chair)*

**** *AAOS Annual Meeting, Moderator Instructional Course Lecture, Outpatient Joint Replacement, 2018*

Even with the success of current protocols, I continue to look for ways to improve patient outcomes and recovery.

The purpose of this guide is to provide a general understanding of knee replacement surgery and the associated benefits and possible risks. Hopefully, the information presented has answered some questions, and possibly generated new ones. I recommend that you read this guide thoroughly, and at your leisure prior to your consultation. I recommend that you discuss it with your family or caretaker. Please feel free to contact us if you have any questions.

You will be asked to sign and acknowledge that you have read and understood these materials prior to surgery. Please file a copy in your records and keep as a resource. Thank you for your interest and taking the time to read this guide. We look forward to meeting you soon.

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I have read this document entitled “Knee Arthritis & other Disorders: Surgical Treatment Options for the Painful Knee” under quiet conditions at my leisure away from Dr. Sah’s office. I have discussed the information with those family members I feel should be aware of it. I understand its contents and accept the inherent risks in the surgery described.

Patient: Sign Your Name Here

Print Your Name Here

Date

Witness: Sign Your Name Here

Print Your Name Here

Date