

PARTIAL AND TOTAL KNEE REPLACEMENT: MODERN SURGERY FOR SEVERE ARTHRITIS OF THE KNEE

By John T. Dearborn, M.D.

Please read this pamphlet before your visit so that we can answer any questions that you have during our consultation.

The operation called a total knee replacement (TKR) produces the most effective and dramatic relief that can be achieved in the treatment of severe arthritis of the knee. Somewhat of a misnomer, TKR is actually a resurfacing of the diseased and badly damaged cartilage in the knee, much as we replace worn tires with new ones. The new bearing surface on the end of the femur (thigh bone) is made of metal, and it moves against a dense plastic surface inserted at the top of the tibia (shin bone). Because the results of this surgery are helpful for so many people, potential candidates should have a clear understanding of the nature of the operation, its advantages and disadvantages, its limitations and contraindications, and the technique variations available.

THE OPERATION

The basic concept of total knee replacement is entirely different from any previous surgical or medical approach to the treatment of severe arthritis of the knee. In the past, medications were given to offset or reduce inflammation. Surgery was performed to shift unused cartilage into the weight-bearing position in the joint when the original cartilage had been worn off. Other operations were done to make the knee completely stiff, or fuse it. While these measures continue to have success in select patients, they all have distinct limitations.

The revolutionary concept of total knee replacement, simply stated, is to resurface the damaged joint completely with a durable material and thereby eliminate pain. This solution is uniquely effective because the body is incapable of repairing a joint itself, and because no medicine can stimulate such a process.

For this to succeed, modern materials were needed. The plastic bearing surface is made of a special material called ultra-high molecular weight polyethylene. The plastic surface is attached to a metal piece (titanium), which is in turn fixed to the top of the tibia. The femoral component, used for the resurfacing of the lower end of the femur, must be very strong, polished to a high degree, and made of a special metal which will not corrode in the body. Generally cobalt-chrome alloys are used, but in some instances, specially-prepared titanium implants are appropriate.

A very important problem in such replacement surgery is that of fixation: keeping the new parts firmly attached to the bone. This has been resolved by using modern bone cement. Sterile methacrylate in a powder form is mixed in the operating room until it becomes like putty. After the dense bone at the very top of the tibia and the end of the femur are removed, this putty is forced into the marrow cavity and the implants are pushed into the putty. The methacrylate then solidifies (polymerize is the technical term) in the bone in the operating room in about 10 minutes. Once the putty gets hard, it holds the components rigidly in the bone.

An "uncemented" knee replacement is one in which the components are fixed without cement. Unlike uncemented hip replacements, where the results 20 years after the operation appear good, uncemented knee replacements have not been universally successful. Newer porous tantalum surfaces may fare better than their uncemented predecessors, but cemented TKR remains the best option for most patients.

PARTIAL KNEE REPLACEMENT

Unicompartmental knee replacement (UKR), also known as "partial" knee replacement is a special procedure that involves resurfacing only one of the three compartments of the knee joint. To be successful, the knee arthritis or disorder must be isolated to a single compartment only. Otherwise, damage to the remaining parts of the knee may lead to further surgery. Partial knee replacements are performed most commonly on the inner side of the knee. UKA for the outer side can be successful as well but are rarely done. On occasion, wear limited to the joint between the kneecap (or patella) and the front of the femur allows for resurfacing of only that area – termed a "Patellofemoral Arthroplasty" (PFA). Between 10 and 15% of patients are candidates for UKR.

The materials and fixation are the same as is used in total knee replacement, although the components are much smaller and made to fit the specific anatomy of the knee part being treated. Partial knee replacement has been in practice since the early 1970s and has had mixed results over the years. Modern implant designs with more reproducible instruments to implant them are lasting longer than the early types, but this operation still does not have the long-term success of total knee replacement.

The primary advantages of UKR over TKR are that it may allow a faster recovery (as the procedure is less invasive), range of motion may be better and the knee may feel closer to a normal knee, due to the preservation of the anterior cruciate ligament (ACL). These advantages have led to an increase in the number of UKRs performed in the U.S. and abroad. In the appropriate patient, excellent and durable results can be achieved. When over-utilized in the wrong patients, UKRs fail early and detract from overall value of this procedure. Beware of marketing programs for UKR! Fortunately, a patient with a failed UKR can have the implant revised to a TKR in the future if necessary.

MINIMALLY INVASIVE KNEE REPLACEMENT

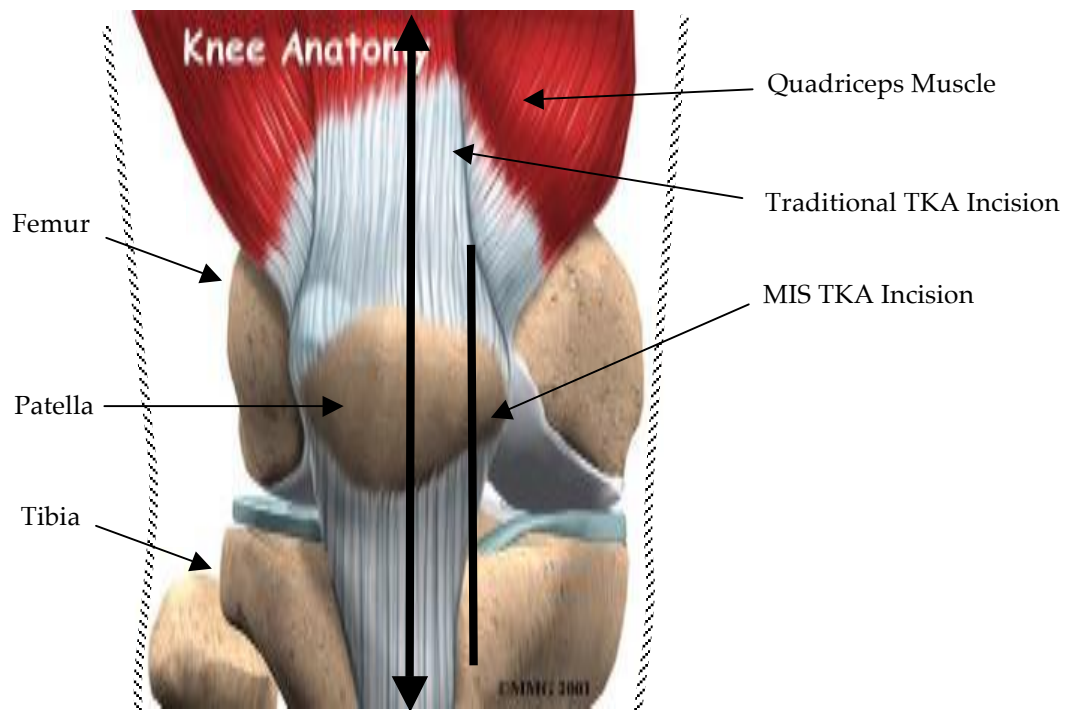
In our opinion, the term “minimally invasive surgery,” or “MIS,” is ambiguous and should be replaced with the term “less invasive,” and accompanied with a description of how a procedure differs from the standard method as well as data to support its use.

Traditional knee replacement surgery, in practice since the late 1960s in the United States, has typically utilized an extensive, 8 to 12 inch incision on the front of the knee. The actual size of the incision depends on the size of the patient. The deep portion of the dissection splits the mechanism that extends the knee extensively (the quadriceps muscle and tendon) and requires that the kneecap be dislocated and flipped over on itself. Although the extensor mechanism heals eventually, the surgical trauma takes months to resolve.

A handful of knee replacement specialists in this country have developed specialized techniques and instruments to allow the same operation to be done with a very limited incision and dissection. We began using this technique in February 2004, and based on

our data showing improved early motion compared with the standard method, we have been proponents of this procedure since then. The skin incision is typically four to six inches in length, depending on the size of the femoral component required. More importantly, the muscle in the thigh is left alone and the kneecap is simply shifted to the side. Minimally invasive UKA has been performed using similar techniques since the late 1990s.

The advantages of this approach are many, including earlier return of knee motion and a faster recovery for the patient. The length of stay in the hospital has also been reduced to approximately one day for a single knee replacement and two days for two knees replaced simultaneously. Partial knee and some single knee patients are candidates for same-day discharge and can have their procedure performed in an outpatient surgery center. These improvements have also made knee replacement surgery available to many patients with health problems severe enough to preclude the traditional procedure. Our extensive experience with this procedure (over 7000 cases) has allowed us to extend the use of this technique to even large legs and those with major deformity.



Knee joint viewed from the front

ADVANTAGES

The advantages of knee replacement surgery are striking indeed. The time required to do the operation – usually well under an hour -- is less than that for prior forms of knee surgery. Furthermore, TKR allows the surgeon to correct the deformity that the arthritis has created. Partial knee replacements do not correct alignment to the same degree.

Rehabilitation is easier and shorter as well, compared to old methods of knee surgery. The exercise program necessary for full recovery from knee replacement is generally simple. Patients are taught most of the necessary exercises by a therapist in the hospital and then continue these at home after discharge. Additional therapy in an outpatient clinic is very helpful. Expect to have more pain, swelling and disability than before surgery for at least three weeks. Most patients have less pain with walking than prior to surgery by six weeks. Patients with a severe or complex problem or those having both knees operated upon may take longer to recover, while those having partial knee surgery generally recover more quickly.

All of these advantages – important as they are, however – would be of no real significance were it not for the single most important feature of total knee replacement, namely the excellent results for most patients. The relief of pain is usually dramatic. The restoration of function for sedentary adult activities is often complete. Eighty-five percent of the patients who have their first knee operation for common arthritic problems of the knee have no pain or at most only a little pain. About the same percent are able to rise from a chair without using their arms and walk smoothly without using a cane or crutch. For ordinary activities patients are able to function exceedingly well. It is the pain relief and restoration of function that make total knee replacement such a life-changing operation.

WHO SHOULD HAVE A KNEE REPLACEMENT?

Since knee replacement does involve major surgery and the risks inherent therein, it should not be done for just minor or even moderate symptoms or disability. TKR is the optimal treatment (in those patients of sufficient age and having a serious problem) for a number of conditions, including primary osteoarthritis, secondary osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, traumatic arthritis, avascular necrosis, failed prior knee surgery, arthritis secondary to ochronosis, gout, pseudogout, Paget's disease, certain tumors of the knee and, in some instances, infection. It is not ideal for

paralytic or spastic condition, although in some instances it may be required here too. Partial knee replacement should not be performed in cases of rheumatoid or other inflammatory arthritis.

One special feature is the presence of or a history of infection in the knee. If infection has ever been present in a knee, even if it has been many years since infection occurred, surgery may occasionally make it flare up. Because the reactivation of infection after a total knee replacement is a serious complication (and may force the surgeon to take the entire implant out), great caution must be exercised in considering such surgery for cases where infection has existed in the past. Even more risky are those cases with active infection existing currently in the knee.

Since we are as yet unsure of the durability of the operation, in general it is not routinely recommended for patients under age fifty. However, there are certain conditions occurring in younger patients which are not at all well treated by any other method. These conditions do warrant partial or total knee surgery at a younger age.

LIMITATIONS, DISADVANTAGES AND COMPLICATIONS

To achieve the advantages that knee replacement may offer, however, each patient must accept certain limitations, be exposed to a number of significant potential complications and run some risks. First, the artificial knee joint of a total knee replacement is not a normal knee. It is a good knee, but not a normal knee. For example, a TKR is not able to withstand repeated heavy impact, meaning that such things as jumping, singles tennis, jogging, volleyball, etc., are not recommended. Swimming, golf and bike riding are safe. Skiing, hiking and other activities can be done with caution and modification. Partial knee replacements feel more normal and allow for a broader range of activities, but they will not stand up to high impact activities either.

Secondly, some questions remain in terms of the durability of the total knee replacements. The total implant can be vulnerable at several locations, namely the cement, the bony ingrowth, the metal and the polyethylene. The cement may work loose in the bone, or the cement itself may crack. A cementless TKR may come loose. A partial knee may stay well-fixed but wear in another compartment can force a revision. Finally, the polyethylene plastic used as a bearing surface may show some signs of wear. The wear rate is very low. Polyethylene surfaces have been used now for over 35

years and many have held up very well. In some cases, however, it wears more rapidly. Large studies looking at the long-term results of well-performed TKR suggest that knees implanted in patients under age 65 will last 20 years in around 80%. For patients over 65 years old, this figure increases to 90%. Partials fair nearly as well in some studies. We have many reasons to believe that the implants in use today, especially with recent improvements in the durability of the polyethylene bearing surface, will perform better than those placed 20 years ago.

It is because of this uncertainty factor of long-term durability that we try to avoid doing total knee replacement on young people, except for unusual circumstances. Twenty years may seem like a long period for someone sixty-seven years old, but it is only a fraction of the anticipated life expectancy of someone aged thirty-seven. Often alternate types of operations, such as osteotomy, may be preferable in younger patients who perform heavy work. However, so much improvement has been made in total knee surgery in younger adults that the outlook is now much better. When the operation is clearly indicated, we do not hesitate to do a total knee replacement in young adult patients. When possible, we may recommend a partial knee replacement in this setting, since a total knee replacement is unlikely to last a lifetime in the very young.

If the cement fails, a new total knee can usually be put in, but it is a more difficult operation. If the bearing surface wears out, often a new one can be inserted without removing the entire knee prosthesis. In some failed TKR, weakening of the bone around the implant requires more extensive reconstruction if revision surgery is needed.

The risks of total knee replacement that are specific to this operation itself are low blood pressure, fracture of the thigh or shin bones, limited motion because of excessive scarring, damage to the peroneal nerve or popliteal artery, and loosening of the implants. Infection, which can occur after any operation, but which causes severe trouble after a total knee replacement, used to be quite high a risk, but nowadays is low. In most centers today, the risk of infection is about 1 in 500. The risk of having a serious complication, one of the major things listed above or indicated is less than 2%.

In addition to these and other complications specifically related to knee replacement surgery, there are the general risks of any major operation. The number of potential complications is large but the percentage of patients having a serious complication is small. The risks to be considered are things such as heart attacks, stroke, kidney failure,

blood clot formation, pulmonary embolism, heart failure, hepatitis, bleeding, bladder infection, nerve palsy, etc. There is about one chance in a thousand of not surviving the operation based on national figures, but we have never lost a patient during surgery.

In summary, there are risks but they can usually be avoided, prevented or corrected, and there are about 2 chances in 100 of having some type of complication, as we understand the problem today. With improved knowledge and control over such factors as anesthesia, blood clot formation, prophylaxis against infection, etc., this figure has been reduced. However, as more patients use their new knees longer, late complications such as wear or cement failure or weakening of the bone may increase.

THE FUTURE

The current treatment options are highly effective and the outlook for the future is, hopefully, even brighter. This form of surgery produces generally excellent results. Considerable improvement has already been made in reducing the remaining small percentage of serious complications. For example, real progress has been achieved in reducing infection, preventing thrombophlebitis, controlling bleeding and designing better implants with greater longevity. Further advances are bound to come.

ALTERNATIVES

For all patients, medicines, ice, and a cane will often provide relief in the earlier stages of arthritis. For some patients with more advanced knee arthritis, other operations, such as knee arthroscopy or osteotomy, may give 5 - 10 years of satisfactory pain relief. Partial knee replacement may be preferable to osteotomy for patients with arthritis involving only one side of the knee. Knee replacement is almost always an elective operation and should be done only when other measures are no longer effective.

REOPERATIONS

Revision operations, or operations done to repair the failure of a prior total knee replacement, are more difficult than the first or primary TKR. The surgery takes longer, is subject to more complications and carries more risks. The recovery is slower, the need for crutches or a cane is longer, and knee stiffness may be more of a problem. Nevertheless, for most patients we can build quite a good knee even in the revision

setting. Occasionally in severe failure of prior total knee replacements, it is not possible to redo the operation, but that is very rare.

SUMMARY

Knee replacement surgery is by far the most effective method of treatment of severe arthritis of the knee in older adults. In fact, it ranks among the top in efficacy in any listing of major surgical procedures of any type. Cemented knees generally give excellent results for 20 years for over 90% of the patients who are 65 years old or more at the time of surgery. Relief of pain is usually very good. Restoration of knee motion and function is often remarkable. Accurate expectations predict patient satisfaction.

The chief limitations are that approximately 2% have a major complication, some patients do not do quite as well as expected, the prosthesis does not withstand repetitive heavy impacts as well as the normal knee, and that questions about the ultimate durability of the operation still exist.

From this material and from our discussions and questions during the consultation, you have a broad understanding of the surgery and the risks involved. Prior to accepting you as a patient for total knee surgery, we need you to read (or reread if necessary) this document at your leisure. We recommend that you discuss it with your family. Please contact us if you have any further questions.

You will be asked to sign the last page of this document, attesting that you have read and understand this material prior to surgery. Please file a copy in your records. Final arrangements for your surgery will not be made until we receive the signed copy for our records. Thank you.

**PARTIAL AND TOTAL KNEE REPLACEMENT:
SURGICAL OPTIONS FOR SEVERE ARTHRITIS OF THE KNEE**

By. John T. Dearborn, M.D.

I have read this document entitled "Partial and Total Knee Replacement: Surgical Options for Severe Arthritis of the Knee" under quiet conditions at my leisure away from Dr. Dearborn's office and I have discussed it with those family members I feel should be aware of its content. I understand its contents and accept the inherent risks in such major surgery.

Patient: Sign Your Name Here

Print Your Name Here

Date

Witness: Sign Your Name Here

Print Your Name Here

Date