



Kirt M. Kimball, MD
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Total Knee Replacement Notes

My Team:

Surgeon: Kirt M. Kimball, MD
Central Utah Clinic Office Number: (801) 373-7350
Physician Assistant: Doug Fillmore PA-C, A.T.C
Executive Assistant: Sharise Smith
Administrative Assistant: Kylie Kramer
Surgical Scheduler: Carrie Nye
 Contact Number: (801) 229-6336
Office Assistant for Surgical Prior Authorizations: Donald Dunn
 Contact Number: (801) 229-6331
Orthopedic Division Office Administrator: Tony Greene
 Contact Number: (801) 229-6326

Communication and Problem Solving:

If there is an emergency, call 911.

For routine questions and non-emergency concerns call the office number listed above.

First: Call and ask for Kylie

Second: If Kylie is not available, call and ask for Sharise

Third: If Sharise is not available, ask for Doug (my PA)

Fourth: Ask for me

Fifth: For after hours emergency care, call the office number and you will be connected to the answering service. They can get in touch with the physician on call for our group. If it is an emergency, go to the emergency room.

My Locations:

Provo Office:

1055 North 500 West, Suite 121
(Across the street from Utah Valley Regional Medical Center)
Provo UT. 84604
(801) 373-7350

Orem Office:

800 North 700 West, Suite 100
(Next to Mt. Timpanogos Hospital)
Orem UT. 84057
(801) 373-7350

My Schedule: (typically)

Monday: Provo office from 8 a.m. until 5 p.m.

Tuesday: Surgery at Mt. Timpanogos Hospital, Central Utah Surgical Center or Utah Valley Regional Medical Center.

Wednesday: Orem Office from 8 a.m. until 5 p.m.

Thursday: Surgery at Utah Valley Regional Medical Center

Friday: Variable schedule

Total Knee Replacement (Total Knee Arthroplasty- TKA): surgery is done to replace the damaged joint with artificial surfaces. Even under the best of circumstances surgery cannot return the joint to its normal state. However, an artificial joint will likely diminish pain and improve functionality.

Timing of the surgery:

“When should I have my knee replaced?” This is a common question and the answer is patient-specific. It varies from patient to patient and is based on a number of variables.

- Do it when the symptoms from your knee no longer adequately respond to less aggressive treatments.
- Do it when the pain sufficiently disrupts your daily living and the worth outweighs the expense, difficulty, and risk necessary to have your knee replaced.

Sometimes, even in the presence of minimal pain, it is appropriate to do a knee replacement because a deformity is rapidly progressing, or range of motion is deteriorating. This is something we can discuss together so that you can make the best-informed decision.

With few exceptions, I tell patients that they should have the surgery when they are ready. I generally will not tell patients to do it or when to do it, but rather wait for them to tell me that they want to proceed. I also like to emphasize that I “don’t take care of x-rays; but rather, I take care of ‘patients’”. Sometimes x-rays indicate the need for knee replacement but the patient’s symptoms are insufficient to warrant such intervention.

Component selection:

There are several companies that manufacture the hardware used in a Total Knee Replacement. There are a number of variables to consider:

- Surgeons tend to prefer one or two systems based on their experience and personal preference.
- Even though systems have similarities, the choice of which system to use is a critical one.
- Systems vary in their ability to accommodate for size differences, alignment challenges, and stability issues.
- It is difficult for a patient to become completely educated with system options, and therefore, there needs to be a high level of trust between the patient and myself. Ultimately, the components chosen are those best suited for the patient’s situation.
- Some systems are more effective than others in restoring normal “kinematics” of your knee. Kinematics is a way of measuring how your knee moves, bends, and rotates compared to a normal knee.

Knees are available in two basic designs: **fixed bearing** or **rotating platforms**.

- In **fixed bearing** knees, the polyethylene insert is bonded to the tibial (shin bone) component.
- In **rotating platforms**, a poly insert is allowed to rotate, thus adding another degree of motion and, as some studies indicate, improved long-term wear.

I have extensive experience with “fixed bearing” and “rotating platform” knees. In recent years I have stopped using “rotating platform” knees because, although they have excellent wear characteristics, they are often more difficult to obtain excellent range of motion.

In Europe and Asia, almost equal numbers of Fixed Bearing and Rotating Platform knees are implanted. In the US, fixed bearing has dominated the market because until recently, only J&J/Depuy had FDA approved components. Now most manufactures have FDA approved rotating platform devices.

I primarily use two systems of total knee components in my practice. I most often use a patient specific design manufactured by **ConforMis**. When a patient specific custom component is not appropriate, I use **Medacta** (a Swiss made component)

- ConforMis:
 - Patient Specific Total Knee

In the past few years I have enjoyed extensive experience with a custom made, patient specific total knee system. I have performed approximately 600 total knees with this technology. It has significant advantages when compared to “off-the-shelf” designs.

ConforMis is presently the only system in the US that manufactures patient specific total knees. All other systems can be classified as “off-the-shelf” designs. Examples of “OTS” knees include Zimmer, Biomet, Stryker, Depuy, Wright Medical, and ODC to name a few.

OTS (Off-the-shelf) knees are manufactured in bulk in a variety of sizes from which the surgeon chooses at the time of surgery. The ConforMis knee is designed from a CT scan of the patient’s knee. The CT scan is used by the manufacturer to create a component that exactly matches the patient’s knee both with respect to size and, more importantly, the actual shape of the knee. OTS knees have a “generic” shape. Individual knees vary tremendously with respect to size and shape. The ConforMis knee effectively “resurfaces” your existing knee as opposed to replacing it with a generic size and shape.

The ConforMis knee has been demonstrated to produce improved outcomes compared to OTS knees in the following areas:

1. Less bone is removed at surgery
2. Less bleeding occurs after surgery
3. Less pain occurs after surgery
4. Recovery is faster
5. Range of motion is better

6. The knee kinematics more closely matches a normal knee than any other knee on the market.
7. As such, there is a higher satisfaction rating by patients after total knee replacement that with OTS knees.

Not all patients are candidates for a ConforMis knee. In those patients I use Medacta. This is an excellent OTS knee manufactured in Switzerland.

When is a patient NOT a candidate for a Patient Specific Knee?

Severe deformity

Severe bone loss

Severe loss of motion

Severe ligamentous instability

The ConforMis knee is analogous to a “resurfacing procedure”. Some knees are so badly destroyed that resurfacing is inadequate in restoring function. In those situations I employ Medacta technology. In my practice approximately 90% of the knees I treat are good candidates for ConforMis technology.

Computer Navigation Technology:

I was one of the first surgeons in the US to routinely employ Computer Navigation in total knee replacement in the operating room. This enhanced my ability to properly align the total knee. The technology was expensive, added time to the operative procedure, but was an important improvement. With ConforMis knees, the CT scan is employed to correct alignment using Navigation technology however; it is done in the manufacturing process by creating patient specific cutting jigs along with the patient specific components. This enables the advantages of Navigation however that portion of the procedure is done prior to going to the Operating room thus reducing cost and time in the OR.

ConforMIS technology uses computer navigation technology in the manufacturing process rather in the Operating room. It uses the pre-operative CT scan of your leg.

Standard instrumentation does not use computer navigation; rather, it relies on external and internal alignment rods and jigs to help assure proper component positioning. Although it is a time proven technique it is not as accurate as Computer Navigation.

Fixation of implant:

Implants are fixed to the bone by using either **cemented** or **non-cemented** technique. Cemented technique is clearly the “**gold standard**” and according to most studies it produces the best long-term results. Sometimes non-cemented methods are appropriate. It requires ‘in’ growth of your bone into the implant to assure solid fixation. Although slightly less reliable than cemented technique, it can also produce good results.

Pain Control Protocol, Medications, and Hospital Stay

Pain Control:

For several years I have been using what is referred to as a “**multimodal**” approach to pain management. It recognizes that there are various pain receptor sites in the brain and if we block those sites before we cause pain, the effect is much better than if we cause the pain and then try to ‘catch up’ with medication. Therefore, about an hour before the surgery we administer three different types of oral pain medications. We continue those for several days after the surgery to maintain the “blockade” of the receptor sites in the brain. Studies and experience has proven that this results in far superior pain relief.

Pre-Operative Medications:

If there are medications that you have already been taking from home (home medications), we will discuss them at your pre operative appointment. There may be some that you need to stop taking before surgery.

There are three basic types of receptor sites in the brain responsible for the transmission of pain. Each receptor type can be blocked with a specific medication. It is known that if we block the receptor site before the pain stimulus occurs, the result of reduced pain is far superior to that which occurs if the blockade is not started until after the pain stimulus happens. Again, approximately one hour prior to surgery, three separate oral medications are administered.

- A narcotic (usually a small dose of a long acting morphine derivative)
- Acetaminophen (Tylenol)
- A Cox 2 analgesic (usually Celebrex)

All three of these medications are continued in relatively low doses throughout the hospital stay and for the first week or two after hospital discharge in order to keep the receptor sites constantly blocked.

Anesthesia at time of Surgery:

I prefer, and almost require, regional anesthesia instead of general anesthesia, for total and partial knee replacement. Regional anesthesia means a spinal anesthetic combined with gentle sedation and a long acting local anesthetic injected in the tissues around the knee at the time of surgery.

This is superior in many ways—

- You will feel better and not as “drugged” after the surgery.
- You will have less difficulty with nausea following the surgery.
- You will have a much lower risk of blood clots and pulmonary embolism.
- It is reliable and safer than a general anesthetic, in my experience.

What is a spinal anesthetic?

This is an injection of a long acting local anesthetic medication into the spinal fluid in your low back region. It causes numbness and weakness in the legs that can last for up to 24 hours. This is not to be confused with an epidural anesthetic where the numbing medication is placed adjacent to the spinal sack rather than in the spinal sack. In my experience, epidural anesthesia is less reliable.

Intra-Operative Medications:

The anesthesiologist primarily controls medications administered during the course of the surgery. They include the anesthetic agents that are part of the spinal anesthetic, as well as muscle relaxers and tranquilizing medications. Unlike general anesthetic, you are not completely asleep, however, drugs are often administered such that you do not remember any of the details of the experience since you are generally not completely asleep as occurs during a general anesthetic.

Additionally, antibiotic medication is provided to help reduce the risk of infection as well as any other medications that may be useful considering your general medication condition and anesthetic needs.

Post-Operative Medications:

Immediately after surgery medications are given to help you wake up and recover. Intravenous antibiotics will be continued for 24 hours following surgery. Drugs are available to control nausea, provide pain relief and muscle relaxation. Most, if not all, of your “home medications” will probably be continued after surgery. If you take drugs that impact bleeding, they may be modified or temporarily halted. Anticoagulation therapy will be applied as described below in the “Blood Clot/Anticoagulation section on the following page. As part of the “multimodal” approach to pain control, I use a peri-articular long lasting local anesthetic, as well as a continued blockage of the receptor sites responsible for pain sensation as previously described (see Pre-Operative Medications- on previous page).

Medications at Time of Discharge:

When you are ready to go home you will most likely continue with any medications you were taking before you came to the hospital for this surgery. This will be discussed upon discharge.

You will also be given RX for the following:

1. Anticoagulation
2. Low dose long-acting analgesics (pain relief medication- usually for 7 to 10 days)
3. Short acting analgesics to be taken as needed according to a prescribed schedule
4. Anti-nausea medication if needed
5. Muscle relaxation medication if needed
6. Anti-inflammatory medication

Where do I go after hospital discharge?

Most of my total knee patients are discharged from the hospital on the 2nd or 3rd day following surgery. Most go directly home. This assumes that their home environment is sufficient to meet their needs. To go home, one must have sufficient help at home to help you through the first several days. If you think in-home nursing care might be needed then going to a local rehabilitation facility is probably a better choice than going directly home. An attentive spouse or family member is usually sufficient for discharge to home. If you are uncomfortable about your home situation, there are several local rehabilitation facilities that you might consider. My office can share with you our experience and recommendations.

If you go home, a home physical therapist will come to your home for 1-3 weeks and help continue the therapy program you started in the hospital. Not all home physical therapists are the same. We can advise you regarding those with whom we have good experience.

Once you are sufficiently mobile, it may be appropriate to continue your rehabilitation at a local outpatient physical therapy unit or a local gym. These decisions are dictated to a large degree based on your progress, your level of independence and your motivation.

Improved technology and improved outcomes now enable us, in some circumstances, to perform total knee replacement in an outpatient setting. In this situation you spend 23 hours in the outpatient facility and then go home or to a sub-acute skilled nursing facility for a few days. This may dramatically reduce the overall cost of total knee replacement.

Blood loss issues:

With current technology I rarely encounter the need for blood transfusion following total knee replacement. Thus it is NOT my practice to have you donate your own blood in advance, nor expect to have to receive a transfusion from someone else.

Exceptions to this are extremely rare in my experience.

Blood Clot (DVT- deep vein thrombosis) Prophylaxis/ Anticoagulation:

DVT describes the condition when blood clots within a vein, thus obstructing the vein. When the clotted or thrombosed vein is inflamed and painful, one may use the term thrombophlebitis. A DVT is a potentially dangerous condition. If the clot breaks loose from where it formed, it may move to the lungs and cause a pulmonary embolism. A pulmonary embolism can be fatal. A number of things are done both in the hospital and after hospital discharge to minimize the risk of this serious complication. Unfortunately there is no assurance that these treatments will work.

In Hospital:

Treatments done both in and out of the hospital include **mechanical measures** as well as **medicinal measures**.

Mechanical Measures:

Some of the following measures MAY be used to attempt to reduce the risk of developing a blood clot:

- Active leg exercises and early return to function. Nothing works better than active muscle contractions in encouraging good circulation.
- Compression of the veins in the legs to minimize pooling of stagnant blood that may lead to clot formation.
- Use of elastic stockings or other devices to compress leg veins.
- Use of elastic wraps or similar devices to compress leg veins.
- Use of mechanical devices that compress veins in the foot and increase circulation. These are often used during surgery of all types to aide blood circulation in your legs even though you may be asleep under a general anesthetic.
- Elevation of legs to facilitate blood return to the heart.

Medicinal Measures:

Depending on your specific "risk" factors, some of the following measures may be used in attempting to reduce the risk of a blood clot during and following your procedure:

- Use of blood thinning medication
 - Coumadin
 - Heparin or Lovenox or similar medication
 - Aspirin

- Use of a filter inserted in the major vein (inferior vena cava) below the heart to catch clots and prevent them from getting to your lungs and causing a pulmonary embolism. This procedure is done by a cardiologist (usually 24 hours prior to the planned surgery).

My Approach to DVT/Pulmonary Embolism Prophylaxis: I prefer to maximize mechanical and medical measures. This means:

- Compression devices on foot/calf.
- Early range of motion and out of bed walking after surgery as soon as possible.
- Use of oral anticoagulant medication is started on the day following surgery.
- Continue oral anticoagulants 7-10 days following hospital discharge. Sometimes we go longer if the risk appears to be higher than normal.
- Unfortunately sometimes we do everything we can and we still experience DVT and Pulmonary Embolism! If that does occur, we attempt to recognize it early and treat it aggressively.

Infection Concerns:

A post-operative infection can be a significant and major complication. It may lead to complete failure of the surgery. A number of things are done to minimize this risk, although the risk can never be completely eliminated.

My Approach to preventing infection:

- Delay surgery if there appears to be a source of acute or chronic infection anywhere in your body.
- Start intravenous antibiotics approximately 1 hour prior to the start of surgery.
- Continue intravenous antibiotics 24 hours after the start of surgery.
- Employ strict sterile techniques in the operating room to prepare the operative site and minimize risk of contamination.
- ConforMis technology employs disposable single use instruments rather than instruments that are used over and over by other patients and surgeons. There is evidence that this method further reduces the risk of infection.
- Use surgical techniques that minimize the duration of the surgery. Evidence shows that the longer the operation, the higher the infection rate.
- Monitor patient and surgical wound post operatively to identify and treat early signs of infection.
- Sometimes infection occurs even though everything possible to prevent it was done. Signs of infection should be carefully monitored. If any signs of infection are found, the infection will be treated aggressively.

Physical Therapy

Before Surgery:

Physical therapy and exercise therapy when performed prior to surgery has some limited value. Unfortunately most patients anticipating surgery are in pain, and aggressive exercise often only makes the pain worse. Efforts to improve range of motion prior to surgery are not often effective. Resistive exercises to improve strength are encouraged. Recent studies demonstrate that efforts at physical therapy PRIOR to total knee replacement REDUCE the need for physical therapy after the surgery and improve outcomes.

In Hospital:

Physical therapy and rehabilitation starts on the day of surgery. I prefer that you get out of bed and are at least standing, if not taking a few steps, on the afternoon following surgery. I start active and passive range of motion exercises on the day of surgery and continue through the hospital stay and at home following discharge. I employ **CPM**, which is a **C**ontinuous **P**assive **M**otion machine to help you gain range of motion after surgery.

After Discharge from the Hospital:

Home physical therapy is arranged to assist you for the first week or two following hospital discharge. It consists primarily of doing much of the same exercises that you started in the hospital. It will include use of the CPM as well as therapist directed exercises. Your specific need for these services will vary with your own difficulties and motivation. As soon as you are able to successfully continue on your own or in an outpatient facility home physical therapy can be discontinued.

Outpatient therapy is sometimes needed as an adjunct to home physical therapy. This involves going to a local facility and receiving instruction and assistance in gaining range of motion, strength and endurance. We can assist you in selecting a physical therapist with expertise in total knee rehabilitation.

Long-Term Issues

Why do total knees fail?

- **Implant design:** Some systems seem to wear better than others.
- **Surgical Technique:** If your surgeon puts in the knee in less than ideal alignment it is more likely to fail early.
- **Postoperative rehabilitation and compliance:** As the patient, you play an important role in the immediate and long-term success of your surgery. Knee surgery is harder to recover from than hip surgery. You must be ready to work very hard post-operatively, or you will likely not be happy with your result.

What about infection?

It is known that patients with joint replacements who are having invasive procedures performed or who have other infections are at increased risk of the infection spreading to their prosthetic joint. Antibiotic prophylaxis may be considered for those patients who are at risk. Most recent recommendations are that antibiotics be employed on the day of the procedure for such things as dental work and other more invasive procedures. This should be done for at least the first two years following implantation of your new joint. Some believe that it should be done indefinitely. I will discuss with you the best approach for your particular situation.

Wear and implant Failure:

How long will a total knee last?

There are a number of factors that contribute to the answer.

- Some knee systems have better long-term experience than others.
- Many off the shelf total knees done, 20 years ago using technology that we no longer use, have demonstrated survivals in the 90% range at 20 years. Based on current science we believe the technology we are currently using will exceed the results obtained in the past.
- To assure the longest wear it is important that the device be properly aligned and that your use is reasonable and appropriate.

- I am often asked if it is permissible to run, ski, jump, etc. on a replaced knee. The answer is not known. There are no good studies addressing the impact of high energy sports on the survival of knee replacements. Most patients are happy to have a knee that doesn't hurt and works well for normal daily activities. One company has recently started marketing an "all terrain" knee. The implication, though not stated, is that somehow this knee will better handle aggressive activity. Some also market a "sports total knee". I am sorry to admit that there is NO DATA to support these claims. These statements, in my opinion, are marketing claims and wishful thinking.

The Most Common Reasons why total knees fail and require revision:

- Infection
- Loosening
- Instability
- Patellofemoral complications
- Polyethylene wear

Minimally Invasive Total Knee Replacement:

Recently there have been attempts to do this operation through a smaller incision. Many surgeons use a 10-12 inch incision. My standard incision is approximately 6 inches; however the opening varies with the size of the patient. It is possible to do the surgery through a 3 ½ inch incision. Recent studies however, have shown there is a high complication rate, higher incidence of poor component alignment, and no significant advantage to the patient. Some still advocate this approach. However, experience has taught that I can produce a more reliable result through a 6-inch incision. This is a decision I believe should be left to the surgeon. The fact that your incision is a couple of inches shorter will offer little pleasure if your knee fails prematurely, or does not work as anticipated.

Partial knee replacement (Unicompartmental knee replacement)

What is a partial knee replacement?

Knee replacements can be classified in several ways. One way is according to the portion of the knee replaced. For example one portion can be replaced (unicompartmental), or two (bicompartmental) or three (tricompartamental). Therefore a unicompartmental knee replacement is a resurfacing or replacement of one compartment of the knee. It is just one of the surgical options for the treatment of osteoarthritis of the knee.

History/ Background:

The idea of replacing one portion of the knee is not a new concept. It has been studied and performed since the 1970's. Though it developed at the same time as total knee replacement, the procedure has taken time to gain widespread acceptance in the orthopedic community. This was in part due to early reports of poor results after the procedure. However, further review of these studies shows that those poor results may be attributed to patient selection, the type of artificial component used, and the surgical technique. Identification and correction of pitfalls in the technique, plus the development of better implant designs, have renewed enthusiasm for unicompartmental replacement in certain selected patients. The addition of computer navigation to precisely place the components has added significantly to this technically demanding operation.

ConforMis has employed patient specific technology in creating custom partial knee replacements for approximately 10 years. When properly performed for the correct indications it comes closer to producing a “normal feeling knee” than any other procedure designed for the osteoarthritic knee. This system very accurately “resurfaces” the worn out compartment of the knee and usually is associated with a very rapid recovery. Patient satisfaction studies comparing total knee to partial knee patients highly favor the partial knee results.

What are the indications for Unicompartmental knee replacement?

Every person’s case is different so we should discuss what is right for you. Here are the general indications that I use for patients who undergo unicompartmental replacement:

- Pain with weight bearing on one side of the knee (the inside of medial side of the knee)
- X- Ray showing narrowing at predominately one side of the joint.
- Failure to respond to non-operative care or operative efforts at cartilage treatment (repair, replacement, or regeneration of articular cartilage.)

Relative Contraindications for the Procedure:

- Inflammatory arthritis like rheumatoid arthritis, lupus arthritis, psoriatic arthritis, arthritis inflammatory bowel disease.
- Severe curvatures of the legs like severe bowleg or knock-knee. Mal-alignment can usually be corrected when total knee replacement is performed, however little if any alignment correction can be obtained when performing partial knee replacement.
- Obesity: Results of partial knee replacement in the obese is less predictable