

**Kirt M. Kimball MD**  
(Drkimball.com)  
**Total Knee Replacement Notes**

**My team:**

Surgeon: Kirt M. Kimball MD  
Physician Assistant: Doug Fillmore PA-C, A.T.C.  
    Contact number: 801.373.7350  
Executive Assistant: Sydney Bills  
    Contact number: 801.373.7350  
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: Dick Johnson  
    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 or specific numbers listed above and ask for the appropriate person:

- 1<sup>st</sup> call and ask for Sydney
- 2<sup>nd</sup> if Sydney not available, call or ask for Doug (my PA)
- 3<sup>rd</sup> ask for Dr. Kimball
- 4<sup>th</sup> ask for the “on-call” physician for after hour concerns

**Dr. Kimball’s Locations:**

**Provo Office**

1055 North 500 West (State Street across the street from Utah Valley Hospital)  
Suite 121  
Provo, Utah 84604  
801 373-7350

**Orem Office**

800 North 700 West (Next to Timpanogas Hospital)  
Suite 100  
Orem, Utah 84057  
801 373-7350

**My Schedule: (usually)**

**Monday:** Provo office from 9:00 a.m. until 5:00 p.m.

**Tuesday:** Surgery at Timpanogas Hospital and Central Utah Surgical Center

**Wednesday:** Orem office from 9:00 a.m. until 5:00 p.m.

**Thursday:** Surgery at Utah Valley Regional Medical Center

**Friday:** variable schedule: Orem office or surgery

**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 very likely diminish pain and improve function.

**Timing of the surgery:**

*-When should I have my knee replaced?*

This is a common question and the answer is patient-specific.

- Do it when you have to.
- Do it when the symptoms from your knee no longer adequately respond to less aggressive treatments.
- Do it when the pain sufficiently disturbs your life that it becomes worth it to you to endure 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. Discussing these issues with your physician can help you decide.

With few exceptions, I tell my patients that they should have the surgery when they are ready. I generally will not tell patients 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:**

When selecting the company or the “hardware” to use, there are a number of issues to consider:

- As a rule, surgeons tend to prefer one or two systems based on their experience and personal preference.
- All systems have significant similarities as well as subtle differences.
- Systems vary in their ability to accommodate for sizing differences, alignment challenges, and stability issues.
- It is difficult for a patient to become adequately educated to be able to participate fully in some of these decisions.

In simple terms, 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.
- Most manufacturers now offer both designs, although J&J/Depuy has been the leader in Rotating Platform technology in the U.S.A.

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

I use and have experience with the systems as listed below. Each system has advantages and disadvantages. I can review those with you as we discuss your specific knee and the unique needs of your anatomy and function.

Recently Zimmer corporation began marketing and selling a “**gender specific knee**”. This is based on evidence that some women have a slightly different bone structure than men. Because of this factor, Zimmer made slight modifications in some of its components to better meet this need. Not all women have “female” shaped bones and not all men have “male” shaped bones, therefore decisions are made at the time of surgery as to which specific component is best for you. The decision is made according to your bone structure rather than your gender. Most currently available systems adequately address these issues. The following are the component systems I prefer:

- **J&J/Depuy:**
  - Rotating platform
  - Fixed bearing
  
- **Zimmer:**
  - Rotating platform (new in the market.) I am not using this device because of a lack of long term data validating its success.
  - Fixed bearing (Gender specific)
  
- **OrthoDevelopment:**
  - Fixed bearing

**Component selection issues:** When considering component choices there are a number of issues that can impact what is best for you:

- Age of the patient and anticipated activity level
- Wear characteristics of the components
- Stability of the joint
- Range of motion needed after joint replacement
- Alignment and implant placement

When performing total knee replacement surgery it is important that the implant be properly aligned and ligaments be balanced through the range of motion. The latest system that assists in accomplishing alignment employs **computer navigation** technology. I was one of the first surgeons in this region to regularly use this technology and, to date, have performed more than **1,000 knee replacements** in this fashion. Computer navigation is especially useful when performing knee replacement where **significant deformity** of the leg exists.

**Standard instrumentation** does not use computer navigation but rather relies on external and internal alignment rods and jigs to help assure proper component positioning. This is a time proven technique but not quite 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 appears by most studies to produce the best long term results. Sometimes non-cemented methods are appropriate. These require ‘in’ growth of your bone into the implant to assure solid fixation. This is a bit less reliable than cemented technique, but 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 stimulate 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 have taught that this results in far superior pain relief.

**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 supplemented with a femoral nerve catheter. This is superior in many ways--

- You will feel better and not be 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 local long acting numbing 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.

**What is a femoral nerve catheter?** This is a tiny, flexible, tube placed adjacent to the femoral nerve just below your “groin” area. It is accurately positioned with the aid of ultrasound. Local anesthetic is administered through the tube. It is well tolerated and can be left in place for two or three days. It blocks the majority of pain to the front of the leg.

**Pre-operative medications:** 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 in reduced pain is far superior to that which occurs if the blockade is not started until after the pain stimulus happens. Thus, 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.

### **Intra-operative medications**

Medications administered during the course of the surgery are primarily controlled by the anesthesiologist. They include the anesthetic agents that are part of the spinal anesthetic, those associated with the femoral nerve catheter as well as muscle relaxers and tranquilizing medications. Drugs are often administered such that you do not remember any of the details of the experience since you are generally not completely asleep which 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 medical 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 also be continued after surgery. Those drugs which impact bleeding will be modified or temporarily halted. Anticoagulation therapy will be applied as described elsewhere in this discussion. As part of the “multimodal” approach to pain control, we continue the femoral nerve catheter as well as a continued blockage of the receptor sites responsible for pain sensation as is described elsewhere.

### **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.

You will also be given Rx for the following:

1. anticoagulation
2. low dose long-acting analgesics (for 7-10 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

## Where do I go after hospital discharge

Most of my total knee patients are discharged from the hospital on the 3<sup>rd</sup> or 4<sup>th</sup> 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.

**Blood loss issues:** Anytime major surgery is contemplated the potential need for a blood transfusion must be addressed. There are two ways to treat potential blood loss. I prefer to use auto-transfusion.

- **Auto transfusion** is a system where a drain tube is placed in the knee joint at the end of the procedure. As bleeding occurs, the blood is collected via the drain tube in a sterile closed collection system. As the blood volume accumulates it is then filtered and re-infused back into you (the patient) through your intravenous line. Thus, most of the blood you “lose” is given directly back to you. With this method it is rare, following knee replacement, to require any further blood transfusions.
- Another option is to use **self-donated autologous blood**. In this circumstance you (the patient) donate your own blood to the blood bank a few weeks prior to the anticipated date of surgery. At the time of surgery, if there is a need, your blood is then given back to you. This system is safe in that you are given your own blood rather than risk potential disease transmission from the blood of another individual. This method is not inexpensive as there are significant costs associated with preparing and storing your own blood. This option is often used in hip replacement surgery, but is less often needed in total knee replacement because of the efficiency of auto transfusion systems.
- Of course if neither of the above systems are used and blood loss is significant to require treatment, **donated “bank” blood** can be infused. This is the least safe method and not one I prefer.

**My approach to blood loss:** I prefer to use a closed auto transfusion system for the first 24 hours following surgery. I monitor your blood count and can order an additional transfusion if necessary. I use intra-operative surgical techniques known to minimize or reduce post operative bleeding.

**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:**

- 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 or stagnant blood that may lead to clot formation
- Use of elastic stockings or other devices to compress leg veins
- Use of elastic wraps or other 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:**

- Use of blood thinning medication
  - Coumadin
  - Heparin or Lovenox or similar medication
  - Aspirin
- Other medications
- Use of an "umbrella" inserted in the major vein (inferior vena cava) below the heart to filter clots and prevent them from getting to your lungs and causing a pulmonary embolism. This procedure to insert this filter 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 injectable anticoagulants starting 24 hours after surgery. To start this medication earlier increases the risk of excessive bleeding.
- Use of oral anticoagulant medication starting on the evening of surgery. This medication works slowly and actual anticoagulation from this approach lags 2-3 days following the start of therapy.
- Use of an inferior vena cava filter if patient is at high risk for DVT/Pulmonary Embolism.

- Continue oral anticoagulants 7-10 days following hospital discharge. Sometimes we go longer if the risk appears to be higher than normal.
- Hope for the best. 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 is 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 infection prophylaxis:**

- 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.
- Use usual techniques in the operating room to prepare the operative site and minimize risk of contamination.
- 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.
- Hope that everything works as desired and infection doesn't occur.
- Sometimes infection occurs even though everything possible was done. I do not ignore it but treat it 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.

**In hospital:** Physical therapy and rehabilitation starts on the day of surgery. I prefer to get you out of bed and 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?

- **Patient selection:** Doing the right operation on the wrong patient.
- **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:** The patient has the ability to make the surgeon look good, or bad, based on his efforts to recover. 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.

**Wear and Implant failure:** Most patients want to know how long their total knee will last. There are a number of factors that contribute to the answer.

- Some knee systems have better long term experience than others.
- Some of the best long term outcome data has been reported with rotating platform knees with some studies demonstrating 96% survival at 20 years after implant.
- 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
- Prosthesis fracture
- 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 (tricompartmental). 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.

**What are the indications for Unicompartmental Knee Replacement?** Every person's case is different so you should discuss what is right for you with your orthopedic surgeon. But 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 or 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.