Knee surgery: total knee replacement or partial knee replacement

Kate Schrader

The University of Toledo
A Thesis

entitled

Knee Surgery: Total Knee Replacement

or Partial Knee Replacement

by

Kate Schrader

as partial fulfillment of the requirements for

the Bachelor of Science Degree

with Honors

in

Exercise Science

Adviser: ______________________

Dr. Doris Woods

Honors College Director: ______________________

Thomas E. Barden

The University of Toledo

April 2011
Abstract

Knee replacement surgery is a solution for some people with knee injuries. Osteoarthritis is a common reason for surgery, but surgery is only considered after other treatments are found to be ineffective. There are two types of surgery that may be considered for a patient: total knee replacement and partial knee replacement. From a month before surgery, the patient begins preparing for an intense procedure; after surgery, the patient recovers using follow up care and physical therapy. The details as well as the risks and benefits of each surgery are discussed to try to conclude which surgery is better for the patient.
# Table of Contents

Abstract ........................................................................................................................................... ii  
Table of Contents ......................................................................................................................... iii  
Introduction ..................................................................................................................................... 1  
Total Knee Replacement ............................................................................................................... 3  
  - Pre-Operative Care .................................................................................................................. 3  
  - Surgery .................................................................................................................................... 4  
  - Post-Operative Care ............................................................................................................... 6  
  - Outpatient Recovery .............................................................................................................. 7  
  - Risks ....................................................................................................................................... 8  
  - Benefits .................................................................................................................................. 9  
Partial Knee Replacement ............................................................................................................ 10  
  - Candidates for Partial Knee Replacement ............................................................................ 10  
  - Surgery ................................................................................................................................... 10  
  - Post-Operative Care and Outpatient Recovery .................................................................. 11  
  - Risks ..................................................................................................................................... 12  
  - Benefits ................................................................................................................................. 13  
Discussion ....................................................................................................................................... 14  
  - Conclusion ............................................................................................................................. 14  
  - Recommendations ............................................................................................................... 15  
Bibliography ................................................................................................................................. 16
Introduction

A total knee replacement, or total knee arthroplasty, is a surgical procedure used mostly for patients with osteoarthritis, where the cartilage and part of the bone of the knee joint is removed and replaced with artificial components (American Association of Hip and Knee Surgeons, 2009). A partial knee replacement is when only part of the cartilage is replaced with artificial components, and the rest of the knee is maintained without surgery (American Academy of Orthopaedic Surgeons, 2010). Patients with osteoarthritis are the primary recipients of this type of surgery; however, patients with rheumatoid and psoriatic arthritis may also use this type of treatment. Osteoarthritis is the degeneration of a joint, and some cases have idiopathic causes. Most cases, however, are caused by overuse of the joint. Over time the cartilage and the meniscus can wear down or totally away so that bone is contacting bone, causing severe pain for the patient. Knee replacement is typically the last resort for solving this condition. Other types of treatment that may effective are NSAIDs, non-narcotic analgesics, and intraarticular injections of corticosteroids (Leopold, 2009). Rheumatoid arthritis is an auto-immune disorder that affects many of the joints in the human body. The immune system mistakenly attacks the body tissue, and can cause fever and fatigue along with joint
Psoriatic arthritis is a type of arthritis that affects people who have psoriasis, a skin condition indicated by red patches of skin with silvery scales. This type of arthritis is characterized by joint pain, stiffness and swelling of any joint, whereas rheumatoid arthritis tends to be restricted to the small joints. Although the knee joint is not considered one of these “small joints,” it can still be affected in some advanced cases (Mayo Clinic, 2010). Finally, patients with a large degree of trauma to the knee, from things such as car accidents, sports-related injuries or falls, may also benefit from knee arthroplasty. Trauma in the knee usually causes tears in the ligaments, menisci, or cartilage.
Total Knee Replacement

Pre-Operative Care

Total knee replacement surgery starts with care up to a month before the actual day of operation. When the patient and their doctor choose to go forth with this surgery, they have already exhausted all other types of possible treatment, and are now preparing for surgery. Education and medical testing are major parts of this period of time. The patient learns what the surgery will entail and what type of post-operative care they will need. The patient will undergo physical therapy before surgery to maintain range of motion and stretch in the muscles and tendons surrounding the knee joint. This is important because it may affect the speed and success of post-operative care. Blood tests are done for compatibility of donor blood that may be needed during the surgery and to measure blood clotting factors. X-rays are performed to see what damage the joint has and to approximate the size of artificial components that will be placed in the surgery (American Association of Hip and Knee Surgeons, 2009). The patient may be admitted to the hospital the day of surgery or a day or two prior to the surgery. More pre-operative testing is done in hospital, especially pre-anesthesia (Department of Nursing University of Wisconsin Hospitals and Clinics Authority, 2010). The knee is initialed by the surgeon just prior to surgery, to ensure the operation is performed on the correct limb (Wheatley, 2004).
Surgery

To start the total knee replacement surgery, the patient is first sedated with anesthetics and the knee is sterilized. The knee is sterilized using a betadine solution and is then covered in sterile drapes, creating a sterile field around the surgical area. The surgeon marks the line of incision to correct length and angle, followed by perpendicular hatches that will be used to ensure correct alignment of the tissues at the end of the surgery (Wheatley, 2004). The knee is placed in a partially flexed position and a 6 to 9 inch incision is made vertically into the knee, often times through the quadriceps tendon (Leopold, 2009). Once the incision has been made, retractors are used to open the surgical site, and blood vessels in the site are cauterize to reduce blood loss and increase visibility. The knee is flexed to a 90° angle to easily access the joint. The patella is then rotated laterally so that the femur and tibia can be accessed without difficulty. The Anterior Cruciate Ligament (ACL), meniscus and any bone spurs are removed. The Posterior Cruciate Ligament (PCL) is sometimes saved if it is in good condition. There are several different types of prostheses that the surgeon can elect to use. If the PCL is saved, a different type of prosthesis is used than if the PCL is damaged (Wheatley, 2004).
Regardless of which type of prosthesis is being used, a hole is drilled in the center of the femur, which will hold a jig in place for re-shaping the bone. This hole will also eventually hold the femoral prosthesis in place. The surgeon then uses jigs to saw off the end of the femur, tibia and patella to ensure a straight cut. This is to make sure that the components will fit. There is a different jig for each bone. Holes are also drilled into the tibia and patella which will hold the final components in place.

Once the bone is cut to the correct shape and size, trial components are placed to estimate the correct fit (Selesnick). In order to estimate the correct fit, the knee is bent from $0^\circ$ to $130^\circ$, which is the normal range of motion for the knee (Leopold, 2009). If the knee does not achieve full range of motion, this is an indication that the parts are too large. The components are also tested to make sure that no medial-lateral movement occurs. Medial-lateral movement would indicate that the parts are too small. Once the correct fit is found, a cement mixture specially formulated to attach plastic and metal to bone is used to secure the real components into place. They fit into the previously drilled holes, and the cement secures them into place. They are then once again tested to ensure full range of motion before the surgery is complete. The soft tissue is then sutured shut.
followed by either suturing or stapling the dermis (Wheatley, 2004). The patient is then taken to recovery, as the surgery is complete.

**Post-Operative Care**

Following surgery, the patient will be taken to their room, and will spend about three days in the hospital. Once the patient has settled in the room, they can be given ice chips and begin a clear liquid diet. Ice is applied to the incision and deep breathing exercises can begin to keep congestion from building in the lungs. A continuous passive motion (CPM) machine is used to help keep circulation in the legs and prevent blood clots. Later in the day, physical therapy begins and the patient is usually given exercises to be done lying or sitting and the patient practices standing in their room. The first day after surgery, the patient moves to a solid food diet, if tolerated. The therapy with ice, deep breathing and the use of the CPM machine is used continuously for the next three days (American Association of Hip and Knee Surgeons, 2009). Physical therapy continues and the goal of the patient is to walk a distance of around fifty feet with assistive devices, such as a walker, cane or crutches. The first day, the patient will be predominantly using the walker, and will eventually move to the other assistive devices as they tolerate them (Ingham Regional Orthopedic Hospital, 2011). A knee immobilizer is worn when moving to protect and hold the knee in place (Zeegen, 2009). Pain medication may be reduced to oral pain relief away from intravenous (IV) pain relief as the patient can withstand the pain.
The second day after surgery, the patient continues to recover and improve in the hospital. They may be taken to the physical therapy gym within the hospital, and begin to maneuver stairs. The patient should be able to walk 100 feet during physical therapy. The patient will begin to learn how to transfer into and out of a car, bathtub, or shower to begin to prepare for going home. The patient should be fairly mobile in their room, sitting to eat, and able to maneuver around the room to get where they need to go (Ingham Regional Orthopedic Hospital, 2011).

By the third day, the patient should be ready for discharge. They will continue physical therapy, with a goal walking distance around 150 feet with an assistive device and stairs are successfully climbed. The patient should be independent in transfers practiced earlier as well as dressing and eating (Ingham Regional Orthopedic Hospital, 2011). The patient will transition to home or to a rehabilitation center, depending on the needs of the patient.

**Outpatient Recovery**

Once the patient leaves the hospital, they have a number of things to pay attention to. The patient must keep the incision clean, changing the dressing daily to help it stay clean and dry. The patient must also remember to ice the incision several times a day to help with pain and swelling (Department of Nursing University of Wisconsin Hospitals and Clinics Authority, 2010). Pain medications should be taken as directed to reduce the pain and better allow the patient to move and accomplish tasks. A nurse may be able to help the patient in home or in the rehabilitation center (Ingham Regional Orthopedic Hospital, 2011).
One of the most important things to recovery of a total knee replacement is physical therapy. This began in the hospital, and the patient should have been given some sitting exercises focused at strengthening the knee (Ingham Regional Orthopedic Hospital, 2011). Some such exercises include ankle pumps, straight leg raises, and knee bends in a laying or sitting position. Other activities may include short and long-arc quads and heel slides, as well as gluteal, quadriceps, or hamstring sets. These exercises, along with a walking program assisted by the physical therapist, are essential to regaining strength in the knee (American Association of Orthpaedic Surgeons, 2011). The patient will attend physical therapy sessions several times a week, whether in-home, or at a clinic. As the patient improves and progresses throughout therapy, some resistance training will be added to help the muscles become as strong as they will need to be for the patient to be fully independent. This can include adding weights to the exercise program, or manual resistance given by the therapist, a resistive device, or a machine. This will continue for about six to eight weeks, when the patient should be able to walk without an assistive device (American Association of Orthpaedic Surgeons, 2011). While this may seem like a long time, the patient will see improvements as time continues and needs to remember that this process takes time and effort, and that the end result will be much better and more pain-free than prior to surgery.

**Risks**

There are many risks associated with total knee replacement, as with any major surgery. The most common risk is blood clots after surgery, which commonly occurs due to decreased movement. This is prevented using a continuous passive motion machine, which squeezes the leg to promote blood flow, similar to movement. Infection is another
common risk, but with broad-spectrum antibiotics, good care of the incision, keeping it clean and dry, the incision has a reduced risk of infection (American Association of Hip and Knee Surgeons, 2009). During surgery, risks include heart attack, stroke, and blood loss. Often, the patient will donate their own blood prior to surgery, in case a blood transfusion is needed. Allergic reaction to medications is possible, but is usually verified before surgery to ensure this does not happen. Kidney failure, bladder infections, constipation, and pneumonia can also occur. The patient is asked to breathe deeply and cough often to keep phlegm from building up in the lungs which could be a cause of pneumonia (Selesnick). Constipation can be treated or prevented with laxatives (Department of Nursing University of Wisconsin Hospitals and Clinics Authority, 2010). Ligament, nerve, or blood vessel injury is possible during or after surgery, but precautions are taken to see that this does not happen. If injury does occur during surgery it is usually fixed while still in the operating room (Selesnick).

Benefits

A total knee replacement could mean a whole new lifestyle for someone suffering from knee pain. After a total knee replacement and a successful recovery the patient will have substantially reduced pain and increased function. This could increase activity level and quality of life when they find that they are able to once again do daily activities without pain (American Association of Hip and Knee Surgeons, 2009). A knee replacement surgery can correct a leg deformity, if that is the cause of the patient’s pain and increase range of motion if the patient is unable to bend or straighten their knee (Selesnick). While the list of risks seems longer, most patients agree that the benefits outweigh the risks after recovering from a total knee replacement.
Partial Knee Replacement

Candidates for Partial Knee Replacement

Not all patients with knee pain are good candidates for partial knee replacement. The main qualification for partial knee replacement is injury limited to only one compartment of the knee (medial, lateral, or patellofemoral) (Boettner, 2009). Surgery is only performed if other non-surgical treatments have been unsuccessful. The patient is usually older, with a relatively sedentary lifestyle, and is not overweight or obese. The sedentary lifestyle is preferred because the prosthesis does not withstand high impact well. Finally, the ligaments around the knee should be in good condition, as they are not replaced during surgery (American Academy of Orthopaedic Surgeons, 2010).

Surgery

Surgery for partial knee replacement is similar to that of a total knee replacement. Preparation for surgery (pre-operative care) is the same in both cases. Once in surgery, only one compartment is cut open with a three to five inch incision on the side of the patella. The surgeon will check to ensure that other compartments are not also affected by
injury. If there is injury in other compartments, the surgeon will carry out a total knee replacement instead (American Academy of Orthopaedic Surgeons, 2010).

After checking the other compartments and finding them free of injury, the damaged bone is removed from the injured compartment and part of the tibia and femur are cut to allow room for the prosthesis. The prosthesis still includes a femoral component, a tibial component and a plastic spacer, but is altogether smaller, covering only one half of the knee joint (Boettner, 2009). The partial knee prosthesis is then secured into place with bone cement. The surgeon will check to ensure a good fit before closing the incision. The incision is closed with sutures (Ma, Unicompartmental knee arthroplasty, 2010).

**Post-Operative Care and Outpatient Recovery**

Following surgery, a similar post-operative plan of care to that of the total knee replacement is followed. However, due to a less invasive surgery, the time spent at the hospital and recovery is shorter. There is less pain and swelling involved at the surgical site, which increases patient mobility. The stay at the hospital is reduced to one to three days, and there is normally no need for the patient to spend time at a rehabilitation center after discharge from the hospital (Ma, Unicompartmental knee arthroplasty, 2010). The patient will still begin physical therapy right away after surgery. The same procedures from the total knee replacement for taking
care of the surgical incision and the new knee are followed (American Academy of Orthopaedic Surgeons, 2010).

After discharge from the hospital, the patient returns home and begins exercises to increase strength and range of motion, which is similar to the recovery for a total knee replacement. However, only a few weeks of walking with an assistive device is needed before the patient is able to walk on their own, and the patient can usually return to usual activities after six weeks of physical therapy (Ma, Unicompartmental knee arthroplasty, 2010).

**Risks**

The risks of a partial knee replacement are very similar to that of a total knee replacement, but because the incision is smaller, there is a reduced risk of infection. The patient is still at risk for blood clots due to decreased mobility. This risk is combated using a continuous passive motion machine, as it was after the total knee replacement surgery. The patient does not donate their own blood, because of a reduced risk of blood loss during surgery with the smaller incision (American Academy of Orthopaedic Surgeons, 2010). Other effects on the body due to decreased mobility stay the same, including the risk of pneumonia and constipation.

The main concern associated with partial knee replacement is a possible need to have surgery again if another compartment becomes affected. In this case, the patient would have their partial knee prosthesis removed, and it would be replaced with a total knee prosthesis (Cluett, 2010).
Benefits

The benefits for a partial knee replacement are similar to a total knee replacement in that mobility is increased while pain is decreased in everyday function. Other benefits unique to a partial knee replacement include shorter surgery and shorter recovery time. There is also less pain and less blood loss in a partial knee replacement (Cluett, 2010). Some patients prefer a partial knee replacement, saying that it feels more natural and flexes more normally because part of the original knee joint is still working and the original ligaments are still in place (American Academy of Orthopaedic Surgeons, 2010).
Discussion

Conclusion

The total knee replacement and the partial knee replacement are both surgeries that can change the lifestyle of a person living with osteoarthritis or another knee condition that causes continuous pain. While there are many risks involved with this surgery and a long recovery process, the outcome is worth the work in most cases. The total knee replacement is a more invasive surgery where the bone is cut away and the entire joint is replaced with a prosthesis. Recovery is difficult, and usually takes six to eight weeks of intense physical therapy. A partial knee replacement is slightly less invasive, because only one compartment of the knee is cut and replaced, which allows for a quicker recovery and decreased risks. Because only one compartment is replaced, it is less common than a total knee replacement since many patients have injury in more than one compartment and are not eligible for this surgery. The patient still needs physical therapy, but should be able to walk without assistive devices sooner. Both surgeries have their limitations, as full range of motion may never be reached and the patient should refrain from participating in high impact sports such as running. This is because the large amount of force on the knee can degrade the prosthesis more quickly, causing a need to have it replaced sooner.
**Recommendations**

The total knee replacement and the partial knee replacement are both effective at reducing pain in the knee. However, both surgeries are useful for different populations. There is more information about the total knee replacement because it is more common, and generally attracts a larger population. If the patient has injury to more than one compartment of the knee, they are not eligible for a partial knee replacement. This would only correct part of their problem, because only part of the knee is replaced. However, if the patient only has injury to one compartment, they are eligible for the partial knee replacement. The patient may need to decide which surgery is best for them. If their condition may progress and cause injury in additional compartments, they may want to consider a total knee replacement in case a revision may be needed in the future. If the patient’s condition will not get worse, a partial knee replacement would be very beneficial. It would require a shorter hospital stay and a quicker recovery, and less pain throughout the whole process. There are also fewer risks throughout the surgery and recovery process. This would be beneficial to the patient and their well being.
Bibliography


