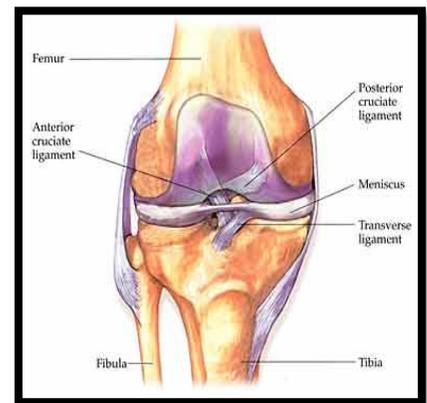


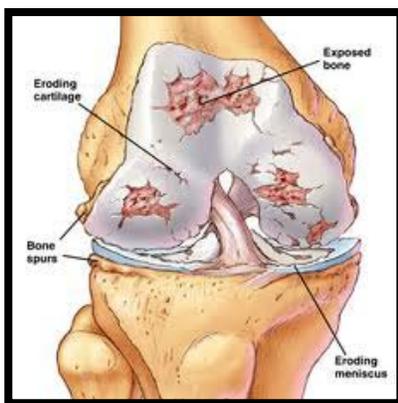
## Total Knee Arthroplasty

### Anatomy and Biomechanics

The knee is a simple hinge joint at the connection point between the femur and tibia bones. The smooth articular cartilage surface of the femur sits on top of the cushioning discs of fibrocartilage on the tibia known as the medial and lateral meniscus. These smooth surfaces that make up the knee joint will naturally wear down over time creating a rougher surface with which to weight bear on. Without smooth healthy cartilage the knee also has a hard time producing the natural joint oil (synovial fluid) that lubricates the knee during movement. Collectively, these degenerative processes that happen over time lead to the condition known as osteoarthritis. This process happens naturally overtime to everyone, but can be more severe or develop quicker in some people.



As degenerative changes in the knee advance the joint becomes more and more painful and less and less mobile. Osteoarthritis typically produces stiffness in the joint and pain during weight bearing activity, especially right after a period of immobility (ie when getting up after sitting for a long time). The pain in the joint may subside after moving around, but become worse again when standing or walking for long periods of time. As the condition of the joint deteriorates it will become harder and harder to bear weight on it and eventually the joint may lose some of its range of motion.



### Treatment Options

Regardless of the nature and severity of the osteoarthritis in your knee your physician will work with you to determine what the best course of treatment will be. When degenerative changes are not severe the associated pain and dysfunction may successfully be treated with rest, anti-inflammatory measures, activity modification and physical therapy. After a thorough evaluation your physician and their staff will recommend the most appropriate course of action to take.

Physical therapy is often recommended for treatment of pain and dysfunction associated with osteoarthritis. The physical therapist will evaluate your mobility, flexibility and strength with the purpose of determining any underlying deficits that contribute to increased stress on the painful joint. You will be counseled on which activities you can safely continue and which should be avoided. The physical therapist will teach you exercises that will help to reduce joint stress. In most cases this will include strengthening and stretching the muscles around the hip and knee.



When joint degeneration is severe and conservative measures are unsuccessful in restoring function your physician may recommend a total knee replacement procedure.

### **Surgery**

Total Knee Arthroplasty (Replacement) is a complex procedure that involves the removal and replacement of both the tibial and femoral weight bearing surfaces of the knee. First the ends of both bones are removed. Then metal implants are inserted into the ends of the femur and tibia. The metal implant that is used on the tibial side of the joint has a polyethylene (plastic) piece attached to it that serves as the weight bearing surface of the new joint. Your surgeon may elect to use bone cement to help hold these implants in place. During the knee replacement procedure the undersurface of the knee cap is often removed as well, and is replaced with a polyethylene cap. Some of the structural ligaments of the knee may also be adjusted during the procedure so as to assure that the knee is stable and well aligned after surgery.



Each patient will be required to go through a pre-operative educational class which will review in detail the typical patient experience in the early phases of recovery. Total Knee Arthroplasty is not an outpatient day surgery procedure. You will be required to spend a few days in the hospital to recover. If the procedure and your early recovery goes well you will typically be discharged in 3-5 days. Some more complex cases require a short stay in a rehab hospital following the procedure.

### **At Home**

You will likely receive home care visits from a registered nurse and a physical therapist after being discharged home. The nurse will help monitor your medical status and the physical therapist will help you work to restore mobility, strength and tolerance for activity. You should replace your post-op

dressing daily and have the nurse and physical therapist inspect your incision for signs of infection. If you have staples closing your incision they will likely be scheduled to be removed around two weeks after the operation. If your surgeon used stitches to close the wound do not remove the strips of tape (steri-strips) that are across your incision. Allow them to fall off on their own or to be removed at your doctor's office visit. Your home care physical therapist will work with your surgeon and their staff to determine when you are ready to attend outpatient physical therapy.

### **Showering**

You may shower after 3 days, as long as the incision is not draining. If the incision is draining try to keep it from getting wet during showering by using a water-tight dressing. It is best to use a shower bench if possible to avoid weight bearing on the surgical leg.

### **Medication**

Your surgeon will prescribe pain medicine for you after the operation. Please call the doctor's office if you have any questions regarding medication.

### **Ice**

You must use ice on your knee after the operation for management of pain and swelling. Ice should be applied 3-5 times a day for 10-20 minutes at a time. Always maintain one layer between ice and the skin. Putting a pillow case over your ice pack works well for this. The home care physical therapist can help you customize a plan on how and when to best apply ice to your knee.

### **Post Operative Visits**

Your surgeon will determine when your first post-op visit will be. It may be as early as 10 days or as late as 6 weeks after the operation. At this visit you will meet with the surgeon or their assistant. The surgeon or assistant will look at your knee range of motion, examine your incision, and remove the staples if needed. You will discuss when it will be appropriate to make an appointment to begin outpatient physical therapy. You may have an X-ray taken to make sure that the knee replacement components are aligned well. Additional follow up visits to the doctor's office will be based on your surgeon's discretion.

### **Weight Bearing**

After surgery you are allowed to put as much weight on your operated leg as you can tolerate (unless otherwise indicated by your surgeon). For the first several weeks you will require the use of a walker or crutches to help you walk. As your tolerance for weight bearing improves your physical therapist will transition you to walking with a cane. Eventually, when your gait is normal you will be able to walk without an assistive device. Most patients are able to walk without an assistive device by six weeks after the operation. Remember, proper gait pattern *must* be achieved in order to discontinue use of assistive devices.

## **CPM**

After the surgery your doctor may require you to use a CPM (continuous passive motion) machine. This is a machine that will bend and straighten your knee for you while you are lying down on your back. The machine is typically prescribed for use while you are in the hospital. Depending on their preference and how your range of motion is progressing, your surgeon may arrange for you to continue the use of the CPM while at rehab or at home.

## **Recovery/Time off Work**

Recovering from Total Knee Arthroplasty surgery is not easy. It is very important that to realize that the recovery process is difficult and time consuming. You must be an active participant during this process, performing daily exercises to ensure there is proper return of range of motion and strength. There is a large amount of variability in the time it takes to fully recover from this procedure. It is usually estimated that it will take at least 4-6 months for the patient to feel as though he or she has completely returned to a pre-injury level of activity. Some cases may take as long as 9-12 months to make a full recovery. People with desk jobs should plan to take at least 4 weeks off from work and should have an extended absence plan in place should complications arise. People with more physical jobs that require excessive weight bearing and manual labor will likely be out of work for at least 3-6 months. **Recovery is different in each case.** Your individual time table for return to activities and work will be discussed by your surgeon during post operative office visits.

## Rehabilitation

**\*\*The following is an outlined progression for rehab. Time tables are approximate and advancement from phase to phase, as well as specific exercises performed, should be based on each individual patient's case and sound clinical judgment by the rehab professional. \*\***

### Phase 1: Post-op Phase (Day 1- Hospital Discharge)

#### Goals

- Control pain and swelling
- Protect healing tissue
- Begin to restore range of motion (ROM)
  - Knee flexion at least 80 degrees
  - Knee extension less than or equal to -10 degrees
- Establish lower extremity muscle activation
- Restore independent functional mobility

#### Precautions

- WBAT with crutches or walker unless otherwise ordered
- CPM per MD order
- Screen for sensory/motor deficits
- Screen for DVT

#### Recommended Exercises

##### Range of Motion

- Passive knee flexion and extension
- Heel slides
- Active assisted knee flexion/extension in sitting
- Ankle pumps

##### Strength

- Quad sets
- Glut sets
- Hamstring sets
- Straight leg raises (SLR) \*(no lag)\*

##### Functional Mobility

- Gait training on level surfaces
- Stair training
- Transfer training

##### Positioning (when in bed)

- Use a towel roll under ankle to promote knee extension
- Use a trochanter roll to maintain hip in neutral rotation and promote knee extension
- Never place anything under the operated knee

## Guidelines

Perform 10 repetitions of all exercises 3-5 times a day. Use ice after exercising for 10-20 minutes.

## Phase 2: Motion Phase (Hospital Discharge-6 Weeks)

### Goals

- Continue to improve ROM with a goal of 0- 110 degrees
- Begin to restore muscle strength throughout the operated leg, with special focus on the quadriceps
- Initiate proprioceptive training
- Initiate endurance training
- Normalize all functional mobility
- Wean all assistive devices, emphasizing normal gait pattern

### Precautions

- WBAT with crutches or walker, progressing to cane, then weaning devices as appropriate
- Monitor for proper wound healing
- Monitor for signs of infection
- Monitor for increased swelling

### Recommended Exercises

#### Range of Motion

- Continue with all phase 1 ROM exercises
- Heel slide with towel
- Prone knee flexion
- Heel prop (towel under ankle) and/or prone knee hang to promote full extension
- Initiate stationary biking, starting with back and forth motion progressing to full revolutions as able

#### Joint Mobilizations and Stretching

- Initiate patellofemoral and tibio-femoral joint mobilizations as indicated
- Initiate hamstring, gastroc/soleus, and quadriceps stretching

#### Strengthening

- Quad sets, glut sets, hamstring sets
- Use neuromuscular electrical stimulation (NMES) to quads if poor quadriceps recruitment is present
- SLR without lag, add resistance towards the end of this phase
- Standing hip flexion/ abduction/ adduction/ extension
- Hip abduction/ adduction/ extension against gravity, add resistance towards the end of this phase
- Progress to closed chain exercises including terminal knee extensions, mini-squats, step ups, and mini-lunges by the end of this phase

### Proprioception

- Single leg stance

### Functional Mobility

- Gait training with appropriate device emphasizing normal gait pattern
- Stair training with appropriate device

### **Guidelines**

Perform 10-20 repetitions of all ROM, strengthening, and strengthening exercises 3x/day. Hold stretches for 30 seconds and perform 2-3 repetitions of each. Bike daily for 5-10 minutes if able.

## **Phase 3: Intermediate Phase (6-12 Weeks)**

### **Goals**

- Maximize knee ROM
- Restore normal LE strength, especially normal quadriceps function
- Return to baseline functional activities

### **Precautions**

- Avoid high impact activities
- Avoid activities that require repeated pivoting/twisting

### **Recommended Exercises**

#### Range of Motion and Flexibility

- Continue ROM exercises from phase 1 and 2
- Continue biking, adding mild to moderate resistance as tolerated

#### Joint Mobilizations

- Continue with phase 2 activities as indicated

#### Strengthening

- Continue with phase 2 exercises adding and increasing resistance as tolerated
- Add resistance machines as appropriate including leg press, hamstring curl, and 4-way hip machine
- Emphasize eccentric control of quadriceps with closed chain exercises

#### Proprioception

- Single leg stance
- Static balance on Bosu/wobble board/foam/etc
- Add gentle agility exercises (i.e. tandem walk, side stepping, karaoke, backwards walking)

#### Endurance

- Biking program
- Begin walking program

## **Guidelines**

Perform ROM and stretching exercises once a day until normal ROM is achieved. Hold stretches for 30 seconds and perform 2-3 repetitions of each.

Perform strengthening exercises 3-5 times a week. Do 2-3 sets of 15-20 Reps.

Bike daily for ROM at least 10 minutes if able.

Progress to biking/walking for at 20-30 minutes 3x/week for endurance.

## **Phase 4: Advanced Phase (12 Weeks and Beyond)**

### **Goals**

- Continue to improve strength to maximize functional outcomes
- Return to appropriate recreational activities (i.e. golf, doubles tennis, cycling)

### **Precautions**

- Avoid high impact, and contact sports
- Avoid repetitive heavy lifting

### **Recommended Exercises**

#### ROM and Flexibility

- Continue daily ROM and stretching exercises

#### Strengthening

- Continue with all strengthening exercises increasing resistance and decreasing repetitions

#### Proprioception

- Continue with all phase 3 exercises, increasing difficulty as tolerated.

#### Endurance

- Continue with walking, biking, elliptical machine programs

### **Guidelines**

Perform ROM and flexibility exercises daily.

Perform strengthening and proprioception exercises 3-5x/ week, performing 2-3 sets of 10-15 repetitions.

Continue endurance program 30-45 minutes 3x/ week.

<b>Time</b>	<b>Precautions</b>	<b>Goals</b>	<b>Recommended Exercises</b>
<b>Phase 1:</b> Day 1 – Hospital D/C	<ul style="list-style-type: none"> <li>WBAT with crutches or walker unless otherwise ordered by MD</li> <li>CPM per MD order</li> <li>Screen for DVT</li> <li>Screen for sensory/ motor deficits</li> </ul>	<ul style="list-style-type: none"> <li>Control pain and swelling</li> <li>ROM: knee flexion to at least 80°, knee extension <math>\leq -10^\circ</math></li> <li>Establish LE muscle activation</li> <li>Restore independent functional mobility</li> </ul>	<u>ROM</u> <ul style="list-style-type: none"> <li>P/AA/AROM knee flexion and extension</li> <li>Heel slides</li> <li>Ankle pumps</li> </ul> <u>STRENGTH</u> <ul style="list-style-type: none"> <li>Quad/glut/hamstring sets</li> <li>SLR (NO lag)</li> </ul> <u>FUNCTIONAL MOBILITY</u> <ul style="list-style-type: none"> <li>Gait training with appropriate assistive device on level surfaces</li> <li>Transfer training</li> <li>Stair training</li> </ul> <u>POSITIONING (when in bed)</u> <ul style="list-style-type: none"> <li>Towel roll under ankle to promote knee extension</li> <li>Trochanter roll to maintain hip neutral rotation and promote knee extension</li> <li>Never place anything under the operated knee</li> </ul>
<b>Phase 2:</b> Hospital D/C – 6 weeks	<ul style="list-style-type: none"> <li>WBAT with crutches or walker, progressing to cane, then weaning all devices as appropriate</li> <li>Monitor for proper wound healing</li> <li>Monitor for signs of infections</li> <li>Monitor for increased swelling</li> </ul>	<ul style="list-style-type: none"> <li>ROM: 0 to at least 100°</li> <li>Normalize all functional mobility</li> <li>Wean all assistive devices</li> <li>Begin to restore LE strength, especially quads</li> <li>Initiate proprioceptive training</li> <li>Initiate endurance training</li> </ul>	<u>ROM</u> <ul style="list-style-type: none"> <li>Continue with all phase 1 exercises</li> <li>Heel slide with towel</li> <li>Prone knee flexion</li> <li>Heel prop and/or prone knee hang to promote full extension</li> <li>Initiate stationary biking</li> </ul> <u>Joint Mobilizations and Stretching</u> <ul style="list-style-type: none"> <li>Initiate patellofemoral and tibio-femoral joint mobilizations as indicated</li> <li>Initiate hamstring, gastroc/soleus, and quadriceps stretching</li> </ul> <u>Strengthening</u> <ul style="list-style-type: none"> <li>Quad/glut/ham sets</li> <li>Use NMES to quads if poor quad recruitment is noted</li> <li>SLR without lag, adding resistance towards the end of this phase</li> <li>Standing hip flexion/ abduction/ adduction</li> <li>Hip abduction/ adduction/ extension against gravity, adding resistance towards the end of this phase</li> <li>Closed chain exercises (TKEs, mini-squats, step ups, mini-lunges) by the end of this phase</li> </ul> <u>Proprioception</u> <ul style="list-style-type: none"> <li>Single leg stance</li> </ul> <u>Functional Mobility</u> <ul style="list-style-type: none"> <li>Gait training with appropriate device emphasizing normal gait pattern</li> <li>Stair training with appropriate device</li> </ul>

<p><b>Phase 3:</b> 6-12 weeks</p>	<ul style="list-style-type: none"> <li>• Avoid high impact activities</li> <li>• Avoid activities that require repeated pivoting/ twisting</li> </ul>	<ul style="list-style-type: none"> <li>• Maximize knee ROM</li> <li>• Restore normal LE strength, especially normal quad function</li> <li>• Return to baseline functional activities</li> </ul>	<p><u>ROM</u></p> <ul style="list-style-type: none"> <li>• Continue phase 1 and 2 exercises</li> </ul> <p><u>Joint Mobilizations and Stretching</u></p> <ul style="list-style-type: none"> <li>• Continue with phase 2 activities as indicated</li> </ul> <p><u>Strengthening</u></p> <ul style="list-style-type: none"> <li>• Continue with phase 2 exercises, increasing resistance as tolerated</li> <li>• Add resistance machines as appropriate (leg press, hamstring curl, 4-way hip)</li> </ul> <p><u>Proprioception</u></p> <ul style="list-style-type: none"> <li>• Single leg stance</li> <li>• Static balance on Bosu/wobble board/foam/etc</li> <li>• Add gentle agility exercises (i.e. tandem walk, side stepping, karaoke, backwards walking)</li> </ul> <p><u>Endurance</u></p> <ul style="list-style-type: none"> <li>• Biking program, adding mild to moderate resistance as tolerated</li> <li>• Begin walking program</li> </ul>
<p><b>Phase 4:</b> 12 weeks and beyond</p>	<ul style="list-style-type: none"> <li>• Avoid high impact, and contact sports</li> <li>• Avoid repetitive heavy lifting</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to improve strength to maximize functional outcomes</li> <li>• Work with PT and MD to create customized routine to allow return to appropriate sports/ recreational activities (i.e. golf, doubles tennis, cycling, hiking)</li> </ul>	<p><u>ROM</u></p> <ul style="list-style-type: none"> <li>• Continue daily ROM and stretching exercises</li> </ul> <p><u>Strengthening</u></p> <ul style="list-style-type: none"> <li>• Continue with all strengthening exercises increasing resistance and decreasing repetitions</li> </ul> <p><u>Proprioception</u></p> <ul style="list-style-type: none"> <li>• Continue with all phase 3 exercises, increasing difficulty as tolerated</li> </ul> <p><u>Endurance</u></p> <ul style="list-style-type: none"> <li>• Continue with walking, biking, elliptical machine programs</li> </ul> <p><u>Functional Progressions</u></p> <ul style="list-style-type: none"> <li>• Activity/sport-specific training exercises</li> </ul>

\*Reviewed by Michael Geary, MD