

High Tibial Osteotomy

Eric Berkson, MD

Orthopaedic Surgery of Quincy
909 Hancock Street
Quincy MA
(617) 773-7457

HIGH TIBIAL OSTEOTOMY (HTO) is a surgical procedure aimed repositioning the knee joint, realigning the mechanical axis of the limb so that less pressure/body weight goes through the worn area of your knee. This distributes your weight more evenly through both sides of the knee. The surgical technique involves making an incision over the tibia, below the knee joint. A wedge of bone is removed, based on the surgeon's calculations, to allow the angle of the knee to be adjusted. The space created in the tibia is filled with a bone graft taken from the crest of your pelvis or hip-bone and a metal plate and screws is used to hold the tibia in position while it heals. In some cases, the doctor will perform microfracture surgery in combination with the HTO.



MICROFRACTURE is a surgical procedure is performed in order to attempt to promote articular cartilage regeneration. This arthroscopic technique involves clearing damaged tissue from the knee joint and creating tiny holes ("microfractures") in the bone area where the articular cartilage is worn and degenerated. The underlying bone marrow seeps out through the holes and becomes part of a blood clot that forms over the area. The marrow contains stem cells, which have the ability to form replacement cartilage between the bare-bone surfaces of the knee. **Appropriate rehabilitation of the knee after surgery is critical to the success of the operation.**

You will use a Continuous Passive Motion (CPM) machine at home where the knee is moved gently by the machine for 10 out of 24 hours a day for 2 weeks (6 weeks if you have an HTO plus microfracture). You will use crutches and keep all of your weight off of the joint for a period of 6 weeks, and then partial weight bearing with crutches for an additional 6 weeks. Consistent adherence to our physical therapy protocol following surgery will enhance the success of the procedure.



High Tibial Osteotomy Preoperative Instructions

Quincy Medical Center

Massachusetts General Hospital

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Here are guidelines that will help you in preparing for high tibial osteotomy surgery

WITHIN A FEW WEEKS BEFORE SURGERY

The doctor will see you in the office. He will do a preoperative history and physical examination and complete the necessary paperwork. It is recommended that you utilize a stationary cycle to maintain your knee range of motion and improve the overall function of the knee prior to surgery.

SEVERAL DAYS PRIOR TO SURGERY

Wash the knee several times a day to get it as clean as you can. This decreases the risk of infection. Be careful not to get any scratches, cuts, sunburn, poison ivy, etc. The skin has to be in very good shape to prevent problems. You do not need to shave.

THE DAY BEFORE SURGERY

Please be in touch with the doctor's office to confirm the exact time that you should report to the hospital for surgery. You can have nothing to eat or drink after midnight on the day before surgery. It is very important to have a completely empty stomach prior to surgery for anesthesia safety reasons. If you have to take medication, you can do so with a sip of water early in the morning prior to surgery (but later tell the anesthesiologist you have done so).

DAY OF SURGERY

Report directly to the hospital two hours prior to surgery.

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Phase 1: 0-2 weeks after surgery

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This protocol is a guideline for your **rehabilitation after high tibial osteotomy surgery**. Please call our office if you are having a problem with your knee or if you need clarification of these instructions.

You will go home with **crutches, cryocuff cold therapy unit and a CPM machine**.

GOALS

1. Protect the osteotomy - avoid weight bearing.
2. Ensure wound healing
3. Attain and maintain full knee extension
4. Gain knee flexion (knee bending) to 90 degrees
5. Decrease knee and leg swelling
6. Promote quadriceps muscle strength
7. Avoid blood pooling in the leg veins



ACTIVITIES

CONTINUOUS PASSIVE MOTION (CPM)

Prior to surgery, a **continuous passive motion (CPM) machine** will be delivered to your home. This is a small apparatus that sits on the bed onto which your knee rests. The CPM very slowly bends and straightens out the knee. You will be able to adjust the CPM with a hand-controlled unit. Start the machine from 0 to 50 degrees and advance to 100 degrees as tolerated.

CPM Usage Guidelines

HTO Only	HTO and Microfracture
<ul style="list-style-type: none">o Use CPM 10 out of 24 hourso Use CPM for 2 weeks	<ul style="list-style-type: none">o Use CPM 10 out of 24 hourso Use CPM for 6 weeks

Use the CPM machine at home as much as possible. Do not wear the brace when in the CPM machine. You **should use the machine at least 10 hours per day**. You may move the machine to a sofa, the floor or onto a bed as you change positions and locations. You should use the machine at night while sleeping; slow down the machine at night to facilitate sleeping. **Extension** (knee straight) on the machine should be set at **minus five degrees** at all times to help your knee extend. **It is very important that you straighten the knee completely!** The machine should be programmed to include an extension pause of 5 seconds (in other words, when the knee is straightened out, it pauses in the straight position to allow you to stretch it out straight). This flexion setting will start at around 30 - 40 degrees and should be gradually increased toward 90 degrees as you can tolerate more bending of your knee.

BRACE/CRUTCHES

Unless otherwise instructed by the doctor, use crutches when walking and **do not bear weight** on the operated leg.

CRYOCUFF (COLD APPLICATION)

You will also receive a cryocuff. The cryocuff is a closed loop cuff that circulates cold water and provides compression around your knee to help minimize swelling and pain. You can use this as often as you want to cool down the knee to reduce swelling and pain. Check your skin every time that you remove the wrap to make sure that it is intact.

If you are experiencing pain, swelling, or discomfort, we suggest icing for 15-20 minutes with at least a 60-minute break in between. Use your cryocuff or place ice in a zip lock bag and/or in a towel and apply to the injured area. Never place ice directly on the skin.

WOUND CARE

Remove your bandage on the second morning after surgery but leave the small pieces of white tape (steri strips) across the incision. You can wrap an elastic bandage (ace) around the knee at other times to control swelling. You may now shower and get your incision wet, but **do not** soak the incision in a bathtub or Jacuzzi until the stitches have been removed.

ASPIRIN / ELASTIC STOCKINGS

Take an aspirin each morning, wear an elastic stocking (TED) that extends above the knee, and do at least 10 ankle pump exercises each hour to help prevent phlebitis (blood clots in the veins).

FREE MACHINE WEIGHTS

Upper Body/Trunk Only

Do not use any lower extremity free or machine weights. If you are doing free or machine weights for the upper body and trunk, we suggest a very light resistance of 3 sets of 15-20 repetitions. Do not place yourself in a compromising position with your recently operated knee.

EXERCISE PROGRAM

QUADRICEPS SETTING - to maintain muscle tone in the thigh muscles and straighten the knee.

Sit or lie on your back with the knee extended fully straight as shown in the figure. Tighten and hold the front thigh muscle making the knee flat and straight. If done correctly, the kneecap will slide slightly upward toward the thigh muscle. The tightening action of the quadriceps should make your knee straighten and be pushed flat against the bed or floor. Hold 5 seconds for each contraction. Do 20 repetitions or more, three times a day.



HEEL PROP- to straighten (extend) the knee.

Lie on your back with a rolled up towel under your heel or sit in a chair with the heel on a stool as shown in the figure. Let the knee relax into extension (straight). If the knee will not straighten fully, you can place a weight (2 to 5 pounds) on the thigh, just above the kneecap. Try to hold this position for 5 minutes, three times a day. While maintaining this **extended position, practice quadriceps setting.**



HEEL SLIDES - to regain the bend (flexion) of the knee. While lying on your back, actively slide your heel backward to bend the knee as shown in the figure. Keep bending the knee until you feel a stretch in the front of the knee. Hold this bent position for 5 seconds and then slowly relieve the stretch and straighten the knee. While the knee is straight, you may repeat the quadriceps setting exercise. Repeat 20 times, three times a day.



SITTING HEEL SLIDES - to regain the bend (flexion of the knee). When sitting in a chair or on the edge of a bed, slide the heel backward as if trying to get the foot underneath the chair. Hold 5 seconds and slowly relieve the stretch by sliding the foot forward. You can help in both directions with the opposite foot. Repeat 20 times, three times a day.

ANKLE PUMPS - to stimulate circulation in the leg. You should do at least 10 ankle pump exercises each hour.



OFFICE VISIT

Please return to see The doctor approximately **ten to fourteen days** after your surgery. At this time, your sutures will be removed and your progress will be checked.

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Phase Two: 2 to 6 weeks after surgery

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Goals

1. Protect the knee from overstress and allow healing
2. Regain full motion
3. Begin muscle strengthening

Brace and Crutches

Unless otherwise instructed by the doctor, use crutches when walking and **do not bear weight** on the operated leg. When walking with the crutches follow the instructions below:

Walking ('toe-touch' non-weight bearing):

- Put the crutches forward about one step's length.
- Put the injured leg forward; level with the crutch tips.
- Touch the toe of the involved leg to the floor to help you balance but **do not bear weight** on the leg.
- While bearing all of your weight on the crutches, take a step through with the uninjured leg

Exercise Program

The following exercise program should be followed as directed by the doctor or the physical therapist. Do the exercises daily unless otherwise noted.

STATIONARY BICYCLE

Utilize a stationary bicycle to move the knee joint and increase knee flexion. If you cannot pedal all the way around, then keep the foot of your operated leg on the pedal, and pedal back and forth until your knee will bend far enough to allow a full cycle. Most people are able to achieve a full cycle revolution backwards first, followed by forward. You may ride the cycle with no resistance for 20 to 30 minutes a day. Set the seat height so that when you are sitting on the bicycle seat, your knee is fully extended with the forefoot resting on the pedal in the fully bottom position. You should then actually ride the bicycle with your forefoot resting on the pedal.

WATER WORKOUT (optional)

Utilize an Aqua jogger floatation vest to run in deep water with **no foot contact** to the pool floor or swim flutter kick only for up to 20 minutes 2 or 3 times a week

QUADRICEPS SETTING - to maintain muscle tone in the thigh muscles and straighten the knee. See figure in phase 1.

Lie on your back with the knee extended fully straight. Tighten and hold the front thigh muscle making the knee flat and straight. If done correctly, the kneecap will slide slightly upward toward the thigh muscle. The tightening action of the quadriceps should make your knee straighten and be pushed flat against the bed or floor.

Hold 5 seconds for each contraction. Do 20 repetitions three times a day until you can fully straighten your knee equal to the unoperated side.

HEEL PROP - to straighten (extend) the knee. See figure in phase 1. Lie on your back with a rolled up towel under your heel or sit in a chair with the heel on a stool **as** shown in. Let the knee relax into extension (straight). If the knee will not straighten fully, you can place a weight (2 to 5 pounds) on the thigh, just above the kneecap. Try to hold this position for 5 minutes, three times a day. While maintaining this extended position, practice quadriceps setting.

HEEL SLIDES - to regain the bend (flexion) of the knee. See figure in phase 1. While lying on your back (figure in phase I), actively slide your heel backward to bend the knee. Keep bending the knee until you feel a stretch in the front of the knee. Hold this bent position for 5 seconds and then slowly relieve the stretch and straighten the knee. While the knee is straight, you may repeat the quadriceps setting exercise. Continue this exercise until you can fully bend your knee equal to the unoperated side. Repeat 20 times, three times a day.

STRAIGHT LEG LIFT

The quality of the muscle contraction in this exercise is what counts the most, not just the ability to lift the leg!

1. Tighten the quadriceps (quadriceps setting) as much as you can, push the back of the knee against the floor.
2. Tighten this muscle **harder!**
3. Lift your heel 4 to 6 inches off the floor
4. Tighten the quadriceps **harder again.**
5. Lower your leg and heel back to the floor. Keep the quadriceps as tight as possible.
6. Tighten this muscle **harder again.**
7. Relax and repeat.



If the knee bends when you attempt to lift the limb off of the bed, do not do this exercise. Keep trying to do the quadriceps setting exercise until you can lift the limb without letting the knee bend.

SHORT ARC LIFT

With the knee bent over a rolled up towel or blanket of a height of 4-5 inches (the knee should be bent only 20-25 degrees), lift the foot so that the knee fully straightens. Hold the knee locked in extension for 5 seconds, then slowly lower. Repeat 20 times.





STANDING HAMSTRING CURL

Stand facing the wall, using the wall for balance and support. While standing on the unoperated limb bend the knee of the operated side and raise the heel toward the buttock. Hold this flexed position for one second. Slowly lower the foot back to the floor. Keep the thighs aligned as illustrated. Repeat 20 times.

ANKLE PUMPS - to stimulate circulation in the leg. You should do at least 10 ankle pump exercises each hour.

HIP ABDUCTION

Lie on your unoperated side. Keep the knees fully extended. Raise the operated limb upward to a 45 degree angle as illustrated. Hold one second, and then lower slowly. Repeat 20 times.



OFFICE VISIT

Please make an appointment with the doctor at 6 weeks after surgery.

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Phase Three: 7 to 12 weeks after surgery

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Goals:

1. Begin partial weight bearing
2. Regain full motion
3. Regain full muscle strength

Brace and Crutches:

Unless otherwise instructed by the doctor, continue to use crutches when walking and you can begin bearing up to 50% of your weight on the operated leg. When walking with the crutches follow the instructions below:

Walking (50 % partial-weight bearing):

- Put the crutches forward about one step's length.
- Put the injured leg forward; level with the crutch tips.
- Touch the foot of the involved leg to the floor and bear 50% of the weight of a normal step.
- While bearing half weight on the crutches and half of your weight on the involved leg, take a step through with the uninjured leg.

Exercise Program

The following exercise program will help you regain knee motion and strength. If the exercises can be performed easily after the first week, then an ankle weight may be used to increase the resistance of the exercise and to build strength. **Start** with one pound and add one pound per week until you reach five pounds. Do the exercises daily for the first week, then decrease to every other day when using ankle weights.

You may ride the stationary bicycle daily for 10 to 20 minutes.

Avoid using stair-stepper machines, doing deep knee bends and squats or any exercise that causes crunching, clicking or pain at the kneecap.

STATIONARY BICYCLE

Utilize a stationary bicycle to move the knee joint and increase knee flexion. If you cannot pedal all the way around, then keep the foot of your operated leg on the pedal, and pedal back and forth until your knee will bend far enough to allow a full cycle. Most people are able to achieve a full cycle revolution backwards first, followed by forward. You may ride the cycle with no resistance for 10 to 20 minutes a day. Set the seat height so that when you are sitting on the bicycle seat, your knee is fully extended with the H resting on the pedal in the fully bottom position. You should then ride the bicycle with your forefoot resting on the pedal.

WATER WORKOUT (optional) The water workout can continue as described in phase 2.

EXERCISE PROGRAM (see phase 2 for descriptions and illustrations)

Do the following exercises every other day for 3 sets of 10 repetitions. Follow the outline on the first page of phase three where the ankle weight program is described.

QUADRICEPS SETTING

HEEL SLIDES Do daily 20 repetitions

STRAIGHT LEG LIFT

SHORT ARC LIFT

STANDING HAMSTRING CURL

STANDING TOE RAISES

HIP ABDUCTION

Add the wall slide exercise (every other day) as described below. **Do not do the wall slide if there is pain or grinding at the knee-cap.**

WALL SLIDES

Stand upright with your back and buttocks touching a wall. Place the feet about 12 inches apart and about 6 inches from the wall. Slowly lower your hips by bending the knees and slide down the wall until the knees are flexed about 45 degrees (illustration). Pause five seconds and then slowly slide back up to the upright starting position. When doing a wall slide, you should position your thighs so that your kneecaps are in line with the tips of your shoes, or your second toe. Do 3 sets of 10 to 15 repetitions.

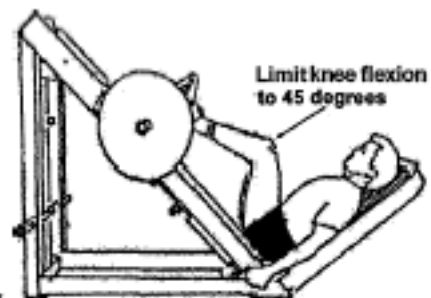


STANDING TOE RAISE

Stand facing a wall, hands on the wall for support and balance. Keep the knees extended fully. Tighten the quadriceps to hold the knee fully straight. Raise up on 'tip-toes' while maintaining the knees in full extension. Hold for one second, then lower slowly to the starting position. Repeat 20 times.

SEATED LEG PRESS

If you are using a leg press machine for strengthening, use an amount of weight that feels easy enough to perform 20 repetitions as the starting weight for this exercise. Use this weight for the first week before raising the weight. The weight may be increased by about 5 pounds every 7 to 10 days thereafter, as long as you can perform 20 repetitions per set for 3 sets, and as long as the weight used does not exceed body-weight when using both legs, or $\frac{1}{2}$ body weight when using the one leg. In this exercise, avoid letting the knees snap or drop suddenly into extension when reaching the fully straightened position. Avoid starting the exercise with the knees bent past 45 degrees. Adjust the seat position to limit the excursion of the machine.



STRETCHING EXERCISES

Times per day: 1-2

Days per week: 5-7

Hamstring Stretch 3-5 reps holding for 15-30 sec

Quadriceps stretch 3-5 reps holding for 15-30 sec

Calf Stretch 3-5 reps holding for 15-20 sec

Quadriceps Stretch Prone

This stretch is performed in the position illustrated at the right. Bend your knee, grasping your toes, foot or ankle. If you are too tight to do this, loop a belt or towel around your ankle and grasp that. Pull the heel toward the buttock. When a stretch is felt in the front of the thigh and knee, hold 15 to 20 seconds for 3 to 5 repetitions.



Hamstring Stretch

Perform this stretch in the position illustrated at the right. Bend slowly forward at the hips, keeping the knee fully extended until you feel gentle stretch in the back of your thigh and knee. Hold the stretch for 15 to 20 seconds and repeat 3 to 5 times.



Calf/Achilles Stretch

In the position illustrated, keep the heel flat on the floor and the knee fully extended. Lean forward at the hips with the arms supporting your weight. When you feel a gentle stretch in the back of your calf and knee, hold for 15 to 20 seconds, 3 to 5 repetitions.

OFFICE VISIT

Please set up an appointment to see the doctor in 6 weeks (12 weeks after surgery).

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Phase Four: 12 weeks after surgery and onward

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Goals:

1. Walk normally
2. Regain full motion
3. Regain full muscle strength

Weight bearing instructions

If instructed by Dr. Berkson, you may begin to progressively bear full weight and walk on the leg. Try to avoid limping and walk slowly but normally. Start by walking with 50-75 % weight and both crutches for 7 days. If pain free, then wean to one crutch on the opposite side of surgery for 7 days. Discontinue the crutch after that when you can walk normally with no pain or limp.

Exercise Program

Continue to follow the exercise program outlined in phase 2 and 3 on a three times a week basis. Ankle weights can be built up gradually, but not so much that you overload the knee. The step-up progression, chair squats, and the following stretches can be added to the exercise program at this time as long as they do not cause any pain or swelling.

Range of Motion and Strengthening Exercises

Days per Week: 3 Times per Day: 1

Cycling

Days per week: 3-4

Times per day: 1

Stationary or outdoor (mountain or road bikes)
(Stay on flat terrain and remain on seat)

30-40 minutes

Progressive moderate resistance

Stretching Exercises

Times per day: 1-2

Days per week: 5-7

Hamstring Stretch 3-5 reps holding for 15-30 sec

Quadriceps stretch 3-5 reps holding for 15-30 sec

Calf Stretch 3-5 reps holding for 15-20 sec

Straight Leg Lift

Side Abduction Leg Lift

Short Arc Lift (30 degrees or less)

Standing Hamstring Curls

Add 1 lb. per week to reach 5 lbs.

3 sets of 15 repetitions



Squat to Chair

In the chair squat exercise, you lower your buttocks toward the chair until your buttocks touch the chair. Do not sit or rest at the chair, but instead immediately and slowly return to the standing and starting position. Remember to keep your head over your feet and bend at the waist as you descend. When doing a squat, you should position your thighs so that your kneecaps are in line with the tips of your shoes, or your second toe.



For patellar/trochlear microfracture patients, do only a partial squat about 1/3 way to the chair. The angle at the knee should not exceed 30 degrees to avoid excess stress on the healing cartilage. Do not do this exercise if there is pain or grinding at the kneecap. After the first week, you may hold dumbbells while performing this exercise and the wall slide. Start with 3 to 5 pounds each hand. You may add 2 to 3 pounds per week until you reach 10 pounds in each hand. 3 sets of 10 to 15 repetitions.

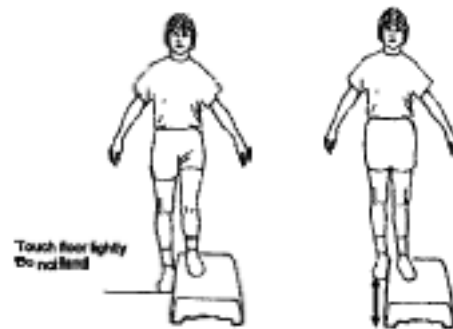
Wall Slides

Stand upright with your back and buttocks touching a wall. Place the feet about 12 inches apart and about 6 inches from the wall. Slowly lower your hips by bending the knees and slide down the wall until the knees are flexed about 30 degrees (illustration). Do not slide down deeper than 45 degrees at the knee to avoid kneecap problems (This instruction is especially important for patellar and trochlear microfractures.) Pause for five seconds and then slowly slide back up to the upright starting position. When doing a wall slide, you should position your thighs so that your kneecaps are in line with the tips of your shoes, or your second toe. Do 3 sets of 10 to 15 repetitions.



Step Up- Down Exercise

Place the foot of the operated limb on a stool or step. Maintain balance, if necessary, by holding onto the wall or a chair (illustration). Standing sideways to the step, slowly lower the opposite foot to touch the floor. Do not land on the floor, just touch gently and then step up onto the stool by straightening the knee using the quadriceps muscles. Try to keep an upright posture and avoid bending forward during the exercise. When doing a step up-down, you should position your thigh so that your kneecap is in line with the tip of your shoe, or your second toe. Do 3 sets of 10 to 15 repetitions.



Progression for Step Up-Down Exercise

Start with a step of 3 inches in height. Start with 3 sets of 5 repetitions. Add one repetition per set, per workout, until you can do 3 sets of 10 (about 2 weeks) If pain free, progress to a step of 6 inches in height. Repeat the above progression starting with 3 sets of 5 repetitions. Add one repetition per set, per workout, until you can do 3 set of 10 (about 2 weeks). If pain free, progress to a step of 9 inches in height (the height of a standard stair). Repeat this process of progression from 3 sets of 5, to 3 sets of 10 (about 2 weeks).

OFFICE VISIT

Please make an appointment to see the doctor in 12 weeks (6 months after surgery).