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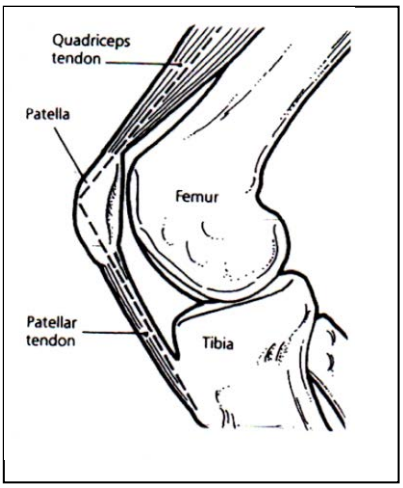
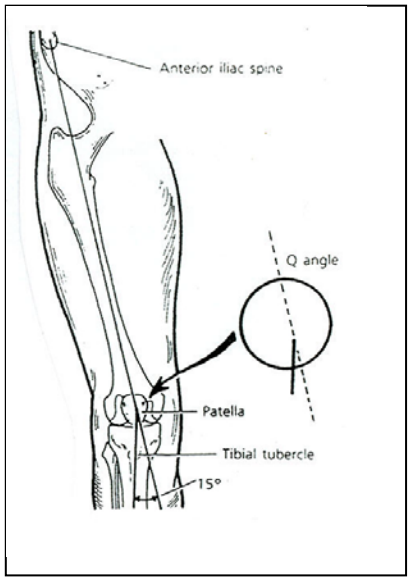
PATELLOFEMORAL INSTABILITY (SUBLUXATION AND DISLOCATION)

Anatomy and Function



The knee joint is composed of two distinctly separate articulations. The tibiofemoral joint is formed by the thigh bone (**femur**) meeting the shin bone (**tibia**). The patellofemoral joint is formed by the kneecap (**patella**) gliding along a groove (**trochlea**) of the femur. The quadriceps muscles in the front of the thigh attach to the patella and continue via the patellar tendon to insert into the tibia. When the quadriceps muscles contract, the knee straightens (extends). The patella protects the knee from a direct blow and, more importantly, creates a fulcrum that increases the mechanical efficiency of the action of the quadriceps muscles.

Patellofemoral Alignment



The **Q-angle** (quadriceps angle) is a measurement that describes the alignment of the patella with respect to the tibia and femur. If a line is drawn along the long axis of the femur to the center of the patella, and another line is drawn from the center of the patella to the insertion of the patellar tendon to the tibia (**tibial tubercle**), then an angle is formed called the Q-angle. If the Q-angle is greater than 15 degrees, there may be a tendency of the patella to "track" or move laterally (toward the outside of the knee). Lateral tracking over a long period of time, injury and other factors may cause breakdown of the patellofemoral joint surfaces. The patella can partially dislocate (**subluxate**) or completely **dislocate** from a direct sideways blow to the knee or if the Q-angle temporarily increases too much due to outward rotation of the leg and foot (such as when pivoting).

Diagnosis of Patellofemoral Instability

Pain in the front of the knee and a sensation of "looseness" of the kneecap are common complaints. If the patella partially dislocates (subluxates) the knee will "give-way" or buckle.

If this condition is suspected, Dr. Gill may order x-rays of your knee that will show the position of the patella in the trochlear groove. Patellar tracking can be tested during the physical examination. Dr. Gill may ask you to extend (straighten) your knee while he holds your tibia first rotated inward then rotated outward. If your knee feels better when

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you extend your knee while the tibia is held internally rotated (decreasing the Q-angle) and feels worse when you extend your knee while tibia is held in external rotation (increasing the Q-angle), then you may have lateral patellar instability.

Treatment of Patellofemoral Instability

The treatment for patellofemoral instability can be either non-operative or operative.

Non-operative Treatment

Non-operative treatment consists of the following:

- Bracing and lateral knee supports to help hold the patella in place.
- Exercises to strengthen the quadriceps muscles
- Activity modification - avoiding excess pivoting sports

Operative Treatment

Operative treatment for patellofemoral instability consists of surgery to re-align the patella and to decrease the Q-angle. Surgical treatment can be divided into two basic types:

- Proximal re-alignment procedures
- Distal re-alignment procedures

Proximal re-alignment

Proximal re-alignment consists of making a small incision at the knee and lengthening the restraining structures on the outside of the patella and/or shortening the ligaments on the inside of the patella. This procedure is usually used in young patients in whom the growth plates are still open. Proximal re-alignment is often done in combination with a distal re-alignment procedure.

Distal re-alignment

Distal re-alignment consist of making a small incision over the upper tibia. The surgeon then uses a bone-cutting instrument to cut the tibial tubercle (to which the patellar tendon attaches) so that the bone and patellar tendon can be moved medially or toward the inside of the knee. The piece of bone is reattached to the tibia using two screws. This procedure re-aligns the pull of the quadriceps muscles across the knee by **decreasing** the Q-angle. After surgery a knee brace is worn to protect the knee for about six weeks until the bone is healed. You may bear partial weight on the leg when using the immobilizer and crutches when you are comfortable doing so.

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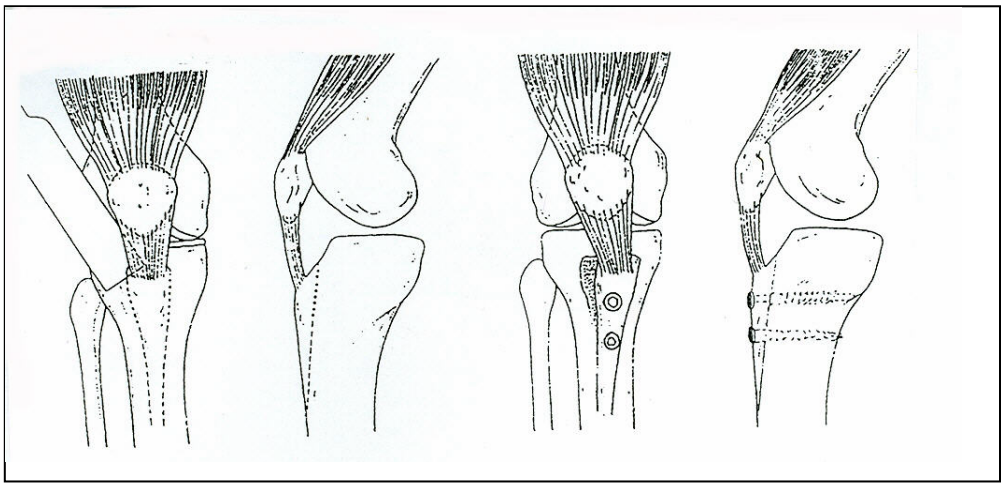
The two screws can be removed when the bone is completely healed (after about six months) if they are tender. This is a relatively minor procedure.



Results of Surgery and Risks

Results of both proximal and distal patellar re-alignment procedures are good when performed on appropriately selected patients. In patients who have pre-existing injury to the joint surfaces (such as chondromalacia), knee pain and crepitus (joint noise) can persist. In most instances, however, knee function improves after surgery due to better knee mechanics.

Risks of surgery:

- wound infection
- continued pain
- delayed bone healing
- loss of motion

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PATELLAR RE-ALIGNMENT SURGERY

PREOPERATIVE INSTRUCTIONS

Here are guidelines that will help you prepare for surgery that will re-align your patella.

WITHIN ONE MONTH BEFORE SURGERY:

Dr. Gill will see you in the office. A preoperative history and physical examination will be completed. He will write preoperative hospital orders and order laboratory tests. These tests usually include a complete blood count (and also electrocardiogram for patients over 40 years old.)

SEVERAL DAYS BEFORE 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 knee.

THE DAY BEFORE SURGERY:

Please contact the doctor's office to get the exact time you should report to the hospital for surgery. **You can have nothing to eat or drink after midnight on the evening 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 take the medication with a sip of water early in the morning prior to surgery (but later tell the anesthesiologist you have done so).

THE DAY OF SURGERY:

- Please bring any crutches, brace, ice machine, or imaging studies that you have received.

SURGERY:

If a problem inside of the knee is suspected (such as chondromalacia), arthroscopy may be done in addition to open surgery to re-align the patella. After anesthesia has been given, your knee will be cleaned and sterile drapes will be placed. To perform the patella realignment, a small incision will be made below the knee joint on the outer side of the upper tibia. The doctor will divide the tibial tubercle (where the patellar tendon inserts into bone) and move the tibial tubercle medially about one-half inch. The bone will be fixed in it's new position using two screws.

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AFTER SURGERY:

You will be given a prescription for **pain medication** to take home with you (usually Percocet, Vicodin, or Tylenol with codeine). The pain medication has a tendency to make you constipated while you are taking it and occasionally can cause nausea.

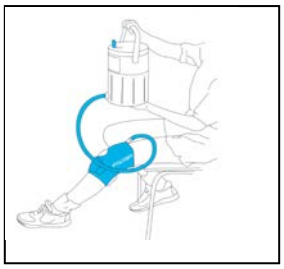
In addition to pain medication you should take one **aspirin** a day to help prevent blood clots (phlebitis) unless there is a reason to avoid aspirin.

You will have a **knee brace** applied to protect the knee. The brace can be removed for washing and sleeping, but should be used when you are up and walking for about six weeks.

You can use crutches for the first week or two to take excess pressure off of the knee.

The **dressing** will be changed the day following surgery and can be removed at two days. The wound is sealed with steri-strips (small pieces of tape on the skin). You can **shower** on the second day following surgery, but be careful standing in the shower so you do not fall. It is better to have a small stool to be able to sit on. You can get the incision wet and wash the knee.

If the lower leg swells, use below-knee **elastic stockings** to control swelling. If you develop calf pain or excessive swelling in the leg, call the doctors office.



The **cryocuff** is a blue wrap that is sometimes put on the knee to make it easier to keep it cold. You can use the cryocuff or ice packs as often as you want to cool down the knee to reduce swelling and pain.

OFFICE VISIT

Please arrange an office visit approximately one week after surgery for suture removal and further instructions.

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Rehabilitation After Patellar Realignment Surgery

Phase One: the first week after surgery

Goals:

1. Control pain and swelling
2. Initiate knee motion
3. Activate the quadriceps muscles

Guidelines and Activities:

1. The **novocaine** that is put in your knee at the time of surgery lasts six to eight hours. Begin taking the pain medication when you start feeling sensation return. The knee will be painful for several days after the surgery.

2. You will go home with crutches and a knee immobilizer. You can bear full weight and **walk** on the leg with the immobilizer and your crutches unless otherwise instructed by Dr. Gill.

3. Remove the outer **bandage** when you get home and apply cold directly to the knee. Change the bandages whenever needed.

4. Apply **cold** to reduce pain and swelling. Use ice on the knee 20 minutes/on and 20 minutes/off for the first day when awake. Then apply cold as often as needed for 15 to 20 minutes at a time for the next several days. Place a towel or cloth between the skin and the ice to prevent skin injury.

5. Wrap an **elastic bandage** (ace) around the knee at other times to control swelling.

6. You may **shower** and get your incision wet. Do not soak the incision in a bath tub or Jacuzzi until the stitches have been removed.

7. Take an **aspirin** each morning, unless there is a reason not to take aspirin.

8. Wear an **elastic stocking** (TED) below the knee, and do at least 10 ankle motion exercises each hour to control swelling and to help prevent phlebitis (blood clots in the veins).

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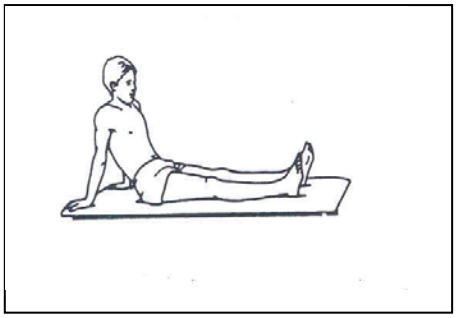
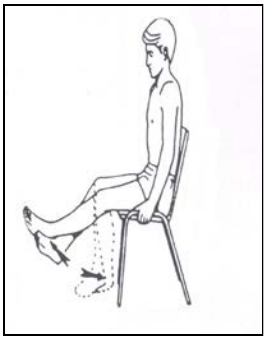
Exercise Program:

QUADRICEPS SETTING -
to maintain muscle tone in the thigh muscles (quadriceps) and straighten the knee. Lie on your back with your knee extended fully straight as in figure. Tighten and hold the front thigh muscles making the knee flat and straight. If done correctly, the kneecap will slide slightly upward toward the thigh muscles as the muscles contract. The tightening action of the quadriceps should make your nee straighten and be pushed flat against the bed or floor.
Hold for five seconds for each contraction. Do 20 repetitions whenever you think about it (many times a day).

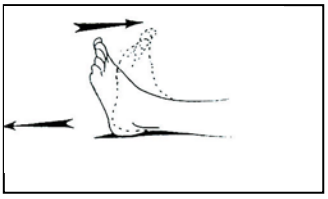


SITTING HEEL SLIDES - to regain the bend (flexion of the knee).
While sitting in a chair or over the edge of your bed, lower the operated leg, with the unoperated leg controlling, allowing the knee to bend as far as **you are comfortable.**



Hold five seconds and slowly relieve the stretch by lifting the foot upward ,with the uninvolved leg, to the straight position (passive assist).
Repeat exercise 20 times, three times a day.

ANKLE PUMPS - move the foot up and down to stimulate circulation in the leg.
Do at least 10 ankle pump exercises each hour.



OFFICE VISIT

Please return to see Dr. Gill approximately **10-14 days** after your surgery. At this time, your sutures will be removed and your progress will be checked. You will see the physical therapist for exercise instruction.

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Rehabilitation After Patellar Realignment Surgery

Phase two: Two to six weeks after surgery

This protocol is a guideline for your **rehabilitation after patellar re-alignment surgery**. You may vary in your ability to do these exercises and to progress from one phase to the other. Please call your doctor if you are having a problem with your knee or if you need clarification of these instructions.

GOALS:

1. Protect the patellar re-alignment – avoid falling
2. Ensure wound healing
3. Maintain full knee extension (knee straight)
4. Initiate passive knee flexion exercises
5. Decrease swelling in the knee and leg
6. Promote activation of the quadriceps muscle
7. Avoid blood pooling in the leg

ACTIVITIES:

1. BRACE/CRUTCHES

Use the knee brace (immobilizer) when you get out of bed and walk. The brace is set for full extension (straight). You can put your full weight on your operated leg while wearing the immobilizer. You should use the crutches if you need extra support when you are walking. After one or two weeks, you can begin to using one crutch on the side opposite of your surgery if you are comfortable and gradually stop using the crutch when the knee feels strong enough to do so (but continue to use the knee immobilizer).

2. COLD APPLICATION (CRYOCUFF OPTIONAL)

Fill the blue cryocuff by putting ice water in the container and elevating the container above the knee so the cold water runs into the cryocuff. Use the cryocuff for 20 minutes at a time whenever you want to, but especially after exercising. You can use the cryocuff as much as you like to cool the knee area. If you do not have a cryocuff, put ice into a plastic bag. Put a thin towel over the knee and apply the ice pack.

3. WOUND CARE

Remove your bandage on the second morning after surgery but leave on the small pieces of white tape (steri strips) that cross 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.

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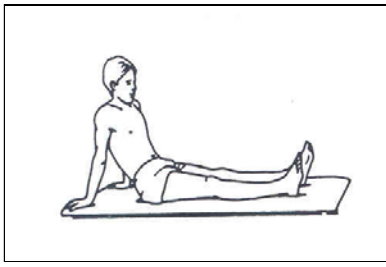
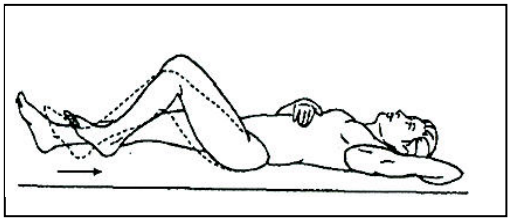
4. **ASPIRIN / ELASTIC STOCKINGS**

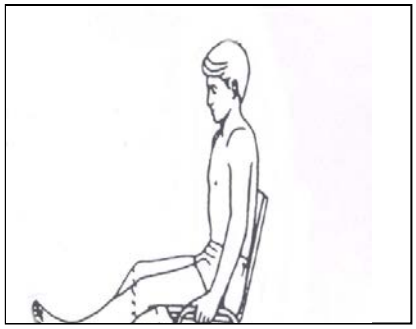
Continue to take an aspirin each morning (unless there is a reason not to take aspirin) to reduce the chance of developing phlebitis (blood clots). Wear an elastic stocking (TED) below the knee to reduce swelling. Do at least 10 ankle pump exercises (moving the foot up and down) each hour to help prevent phlebitis (blood clots in the veins).

QUADRICEPS SETTING - to maintain muscle tone in the quadriceps (thigh) muscles and (extend) straighten the knee. Lie on your back with the knee extended fully straight as illustrated. Tighten (contract) and hold the front thigh muscle (quadriceps) making the knee flat and straight. If done correctly, the kneecap will slide slightly upward toward the thigh muscles. The tightening action of the quadriceps muscles should make your knee straighten and be pushed flat against the bed or floor. Hold five seconds for each contraction. Do 20 repetitions at least three times a day.



HEEL SLIDES - to regain the bend (flexion) of your knee**.** While lying on your back, use your muscles to 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 five 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 KNEE FLEXION - to regain the bend (flexion of

While sitting in a chair or over the edge of your bed, support the operated leg with the uninvolved leg. Lower the operated leg, with the unoperated leg controlling, allowing the knee to bend as far as you are comfortable.

Hold five seconds and slowly relieve the stretch by lifting the foot upward ,with the uninvolved leg, to the straight position (passive assist). Repeat exercise 20 times, three times a day.

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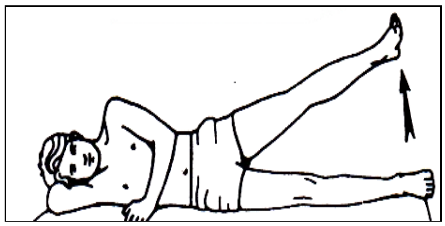
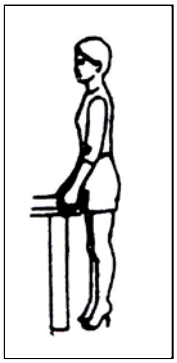
HIP ABDUCTION - lie on your unoperated side. Keep the knees fully extended. Raise the operated limb upward to a 45 degree angle as illustrated. Hold one second, then lower slowly. Repeat 20 times, once or twice a day

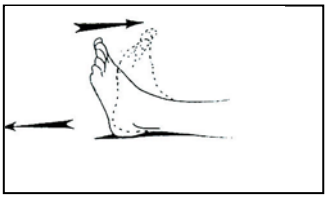


STANDING TOE RAISES

With the knee brace on, use a table for support and balance. Tighten the quadricep 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.



ANKLE PUMPS - move your foot up and down at the ankle to stimulate circulation in the leg. You should do at least 10 ankle pump exercises each hour.



OFFICE VISIT

Please return to see Dr. Gill approximately six weeks after your surgery.

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Rehabilitation After Patellar Realignment Surgery

Phase three: 6 to 12 weeks after surgery

Goals:

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

Activities:

1. You may discontinue the knee immobilizer when you feel safe walking without it.
2. Bear full weight and **walk** on the leg. Try to avoid limping and walk slowly but normally.
3. Continue to ice the knee if there is pain and swelling. Place a towel or cloth between the skin and the ice to prevent skin injury.

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 heel resting on the pedal in the fully bottom position. You should then ride the bicycle with your forefoot resting on the pedal.

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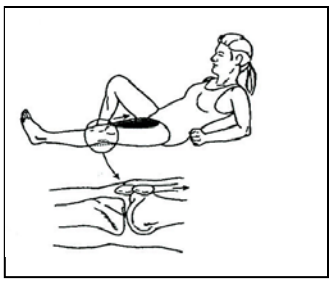
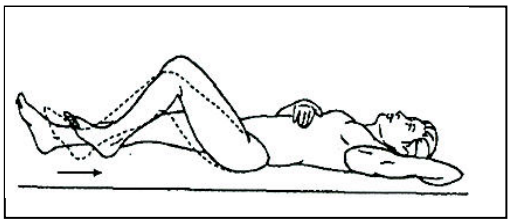
QUADRICEPS SETTING - **to maintain muscle tone in the thigh muscles and straighten the knee. See figure in phase 1.**



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 SLIDES - to regain the bend (flexion) of the knee.

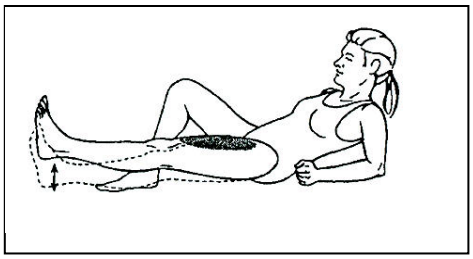


While lying on your back(figure), actively slide your heel backward to bend the knee. Keep bending the knee until you feel a stretch in the front of the knee. Hold this bent position for five seconds and then slowly relieve the stretch and straighten the knee. While the knee is straight, you may repeat 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.

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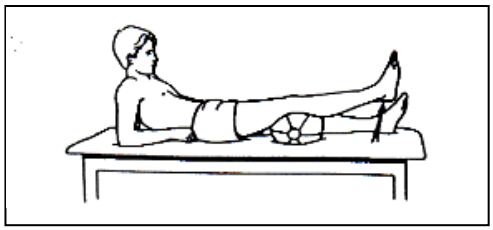
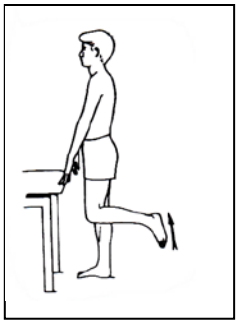
SHORT ARC LIFT

With the knee bent over a rolled up towel or blanket, lift the foot so that the knee fully straightens. Hold the knee locked in extension for five seconds, then slowly lower. Repeat 20 times.



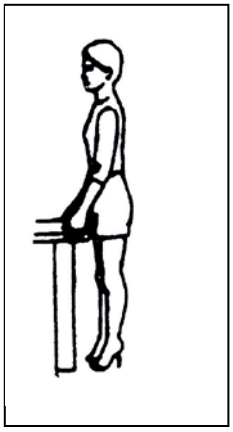


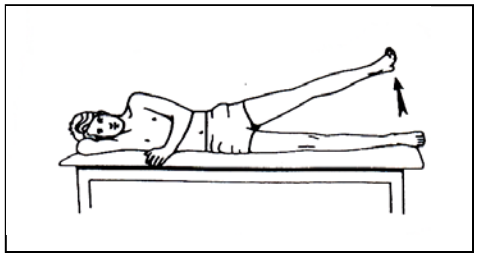
STANDING HAMSTRING CURL

Stand facing a table, using the table 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.

STANDING TOE RAISE

Stand facing a table, hands on the table 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.





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, then lower slowly. Repeat 20 times.

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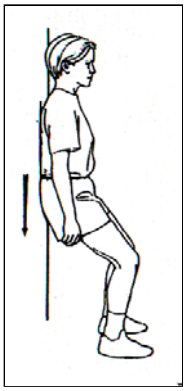
WALL SLIDES

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 nd then slowly slide back up to the upright starting position. Do 3 sets of 10 to 15 repetitions.



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Rehabilitation after Patellar Realignment

Phase four: twelve weeks after surgery onward

ACTIVITIES

1. **Walking/Stairs**
You should be walking without the aid of a brace or crutches. If you feel confident walking on the operated limb and have good strength and knee motion, you can begin attempting to walk up-stairs on the operated limb. It is not recommended that you lower yourself down-stairs on the operated limb until you complete the enclosed 'Step up-down progression'.

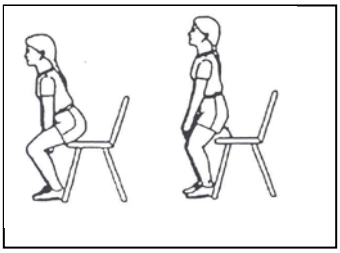
2. **Knee Support – for excess activities**
Buy an elastic knee sleeve (made of neoprene rubber) at a sporting goods store. It should have an opening for the kneecap and velcro straps but does not need hinges on the sides. Use this support if you are on your feet for a prolonged period of time.

3. **Stationary Bicycle – good exercise**
Utilize a stationary bicycle to both strengthen the thigh muscles and increase knee flexion. If you cannot yet 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. You may ride the cycle with mild resistance for up to 10 minutes a day. Set the seat height so that when you are sitting on the bicycle seat, your knee is fully extended with the heel resting on the pedal in the fully bottom position. You should then actually ride the bicycle with your forefoot resting on the pedal.

4. **Swimming –good exercise**
Swimming is good exercise at this time, if available.

5. **Exercises**
You should add the following exercises, every other day, as instructed by the physical therapist:

CHAIR SQUAT



In the chair squat exercise, you lower your buttocks toward the chair until your knees are flexed 45 to 60 degrees. Pause and then slowly return to the standing and starting position. Remember to keep your head over your feet and bend at the waist as you descend. After the first week, you may hold dumbbells while performing this exercise. Start with 3 to 5 pounds in each hand. You may add 2 to 3 pounds per week until you reach 10 pounds in each hand. Do 3 sets of 10 to 15 repetitions.

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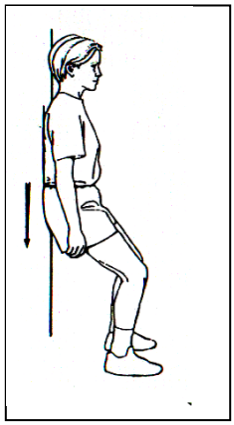


WALL SLIDES

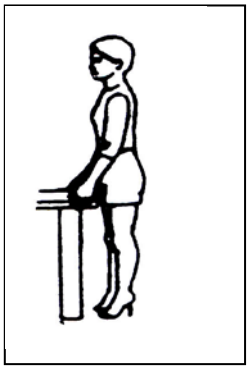
Stand upright with your back and buttocks touching a wall. Place the feet about 12 inches apart and about 6 inches from the wall. Slowly lower your hips by bending the knees and slide down the wall until the knees are flexed about 45 degrees (illustration). Pause five seconds and then slowly slide back up to the upright starting position. Do 3 sets of 10 to 15 repetitions.

SINGLE LEG STRENGTHENING PROGRESSION

At this time, it is important to begin the development of single-leg strength. Begin to follow the "Progression for Single Leg Strengthening" included in this packet if you are able to do the exercises without pain. The instructions estimate a time period of 10 to 12 weeks for you to progress through the whole program. This time line will vary for different people and knees, depending upon the presence of other knee problems. If these exercises cause pain or overload at the kneecap, you should not do them.

ONE-LEGGED TOE RAISES

Continue the toe-raises from phase 2, but now try to raise up and down slowly on just the operated side. Hold the unoperated foot off the floor and hold the wall or a chair or table for balance and support.
Build to 3 sets of 15 repetitions.



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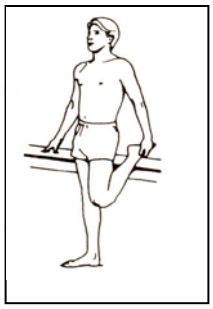
HAMSTRING STRETCH

Perform this stretch in the position illustrated. 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.

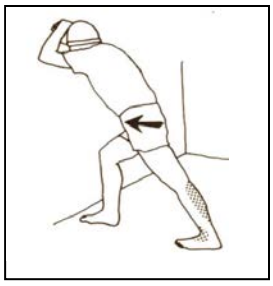
QUADRICEPS STRETCH



This stretch is performed in the position illustrated. Lean gently backward as if bringing you 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.

CALF 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 for 3 to 5 repetitions.

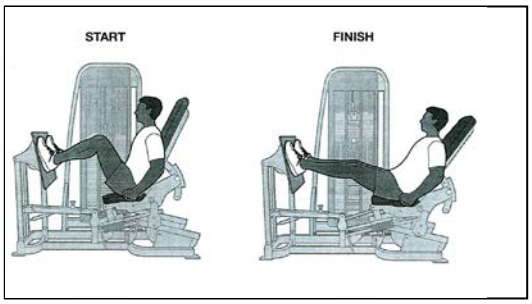


OPTIONAL ADDITIONAL EXERCISES

The following exercises may be added to your exercise program at ***16 weeks*** after surgery:

LEG PRESS

As the starting weight for this exercise, use an amount of weight that feels easy enough to perform 20 repetitions. 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. In this exercise, avoid letting the knees snap or extend suddenly when reaching the fully straightened position. Avoid starting the exercise with the knees excessively bent. Do not bend the knee so far that your calves and back of thighs touch. Adjust the seat position to limit the excursion of the machine.



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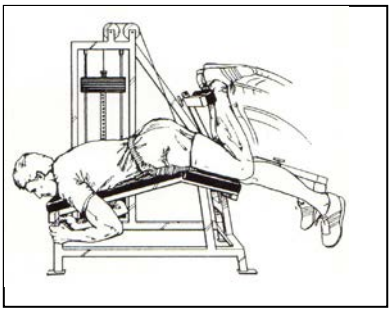
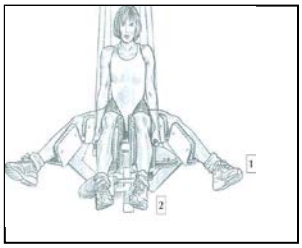
RESISTED HAMSTRING CURLS

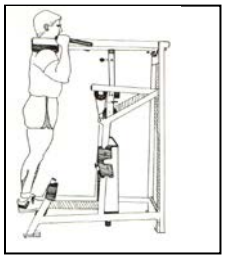
If you have access to a hamstring curl machine (illustration), you may start using it. As with the leg press, start with a reasonable weight and use that weight for the first week. You may increase the weight by 3 to 5 pounds every 10 days as long as you can perform 3 sets of 20 repetitions slowly, with good form. If you do not have access to a hamstring machine, continue doing the standing hamstring curl adding an ankle weight for resistance. Start with 3 to 5 pounds and add 1 pound per week until you build to 10 pounds for 3 sets of 15 repetitions.

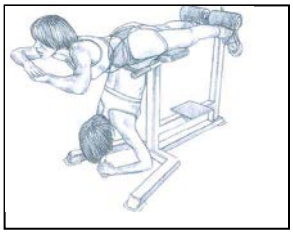


Additional Weight Training

Hip Abductor/Adductor machine
Roman Chair
Calf Raise Machine







<u>Phase 4 Exercise Program Summary</u>:
Frequency: 3 times a week
Sets and repetitions: 3 sets of 15 repetitions
Exercises:

- Leg Press
- Hamstring Curl
- Wall Slides
- Roman Chair
- Chair Squat
- Calf Raises or Calf Raise machine
- Hip Abductor/Adductor machine
- Single leg strengthening progression
- Hamstring, Calf and Quadriceps stretching
- Quadriceps setting 20 repetitions, 3 times a day

If you do not have access to gym equipment, the following exercises from phase 3 should be continued using ankle weights. In general, start with 1 lb and add 1 lb per week:

- Straight leg raise
- Side lying abduction
- Standing hamstring curl
- Toe raises

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Precautions When Exercising

- Avoid pain at the tendon repair site
- Avoid pain and/or crepitus at the patella
- Build up resistance and repetitions gradually
- Perform exercises slowly avoiding quick direction change and impact loading
- Exercise frequency should be 2 to 3 times a week for strength building
- Be consistent and regular with the exercise schedule

Principles of Strength Training

- Warm-up prior to exercising by stationary cycling or other means
- You are "warmed –up" when you have started sweating
- Gently stretch all muscle groups next
- Do exercises involving multiple muscle groups first and individual muscle groups last
- Do aerobic workouts ***after*** strength workouts
- Cool-down by stretching after finishing exercise

The following exercises are not recommended because they may overload the patella and the tendon repair:

1. Knee extension using a weight lifting machine
2. Lunges
3. Stairmaster
4. Step exercises with impact
5. Running
6. Jumping
7. Pivoting or cutting

Progression for Single Leg Strengthening

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 progression starting with 3 sets of 5 repetitions
Add one repetition per set 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 process of progression from 3 sets of 5, to 3sets of 10 (about 2 weeks)
Do not continue to raise the height of the step if there is pain or crepitus at the kneecap.

At this point, you can begin to add the single leg wall slide exercise. The strength workouts should be practiced 3 times a week (every other day).

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Single Leg Wall Slide

Start with 3 sets of 5 repetitions. Limit knee bend to 45 degrees.
Add one repetition per set, per workout, until you can do 3 sets of 10 (about 2 weeks minimum). **Progress to this exercise only if there is no pain or crepitus at the kneecap.**

At his point, you can begin to add the single leg squat exercise. The strength workouts should continue every other day at the most, with more time between workouts if the knee gets sore after a session. Continue doing the step-up exercise each workout. Alternate the workouts between the single leg wall slide and the single leg squat, e.g.,

Monday Single leg squat
Wednesday Single leg wall slides
Friday Single leg squat

Single Leg Squat

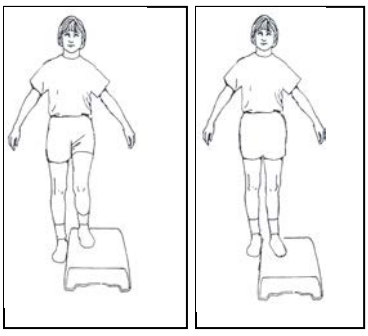
Start with 3 sets of 5 repetitions. **Limit knee bend to 45 to 60 degrees**.
Add one repetition per set, per workout, until you can do 3 sets of 10 (about 2 weeks minimum).

After working up to the point where you can do 3 sets of ten of all three drills, you can hold dumbbells to add resistance. Start with 3 pounds in each hand and add 1 to 2 pounds a week until you reach 10 pounds in each hand.

As you get stronger and gain better control of your leg muscles, try not to hold onto anything for balance.

When you return to sports or recreational activities, decrease the strength workouts to 2 times a week and do 1 set of 10 of each of the three drills only, as a maintenance workout.

Instructions for Single Leg Exercises



Step Up- Down Exercise

Place the foot of the operated limb on the stool. Maintain balance, if necessary, by holding onto the wall or chair (illustration). Standing **sideways** to the step, slowly step up onto the stool and slowly straighten the knee using the quadriceps muscles. Slowly lower the opposite foot to touch the floor. Do not land on the floor, just touch gently and repeat the step up

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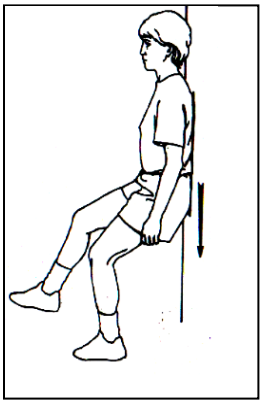

Single Leg Wall Slide Exercise

Stand on the single leg with your back and buttocks touching a wall. Place the foot about 6 inches from the wall. Slowly lower your body by bending the knee and slide down the wall until the knee is flexed about 45 degrees (illustration). Pause five seconds and then slowly slide back up to the upright starting position. Keep the hips level and be sure you are using your knee muscles to perform the exercise.

Single Leg Squat Exercise

In the single leg squat exercise, you stand on the single leg and then lower your buttocks toward the chair. Slowly return to the standing and starting position. Remember to keep your head over your feet and bend at the waist as you descend. You do not have to squat all the way to the chair, instead, try to stay in a comfortable range of motion where there is no knee pain. As you gain strength, try to do the exercise without holding on to anything

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Rehabilitation after Patellar Realignment Surgery

Post-op Phase	Weight bearing status	Use of brace	Passive ROM and Active ROM	Strength training	Return to running and sports	Recommen Restrictio
Phase One The first week after surgery	WBAT crutches	Knee immobilizer or post-op brace locked in full extension	Quad sets, assisted knee flexion, ankle pumps	None	None	Weight bear on flexed kn No stairs
Phase Two 2 to 6 weeks after surgery	WBAT Wean crutches	Continue knee immobilizer for walking	Quad sets, active knee flexion, side leg lifts, toe raises	None OK for non-involved limbs	None	No SLRs ye No active kn extension exercises antigravity No stairs.
Phase Three 6 to 12 weeks after surgery	FWB	Usually discontinued	Full ROM Active stretching all muscle groups Stationary bike	Progressive leg lifts antigravity, progress to ankle weight PRE	Progressive walking	Avoid patellofemor overload Limit OC an CC knee extensi arc to 0-30
Phase Four 12 weeks after surgery onward	FWB	Patellar stabilizer for sports	Same as phase 3 Elliptical trainer	Progressive strength training	Progressive walk/jog 12 to 16 weeks post-op Progressive run/agility training 16 to 20 weeks post-op Return to sports 20 to 24 weeks post-op	Avoid patellofemor overload