

Madigan Army Medical Center

Musculoskeletal Treatment Guidelines

MR and Arthroscopy of the Knee

Diagnosis/Definition

- All patients with [traumatic](#) and [anterior](#) knee injuries should have a thorough knee examination ([Hoppenfeld text](#)). Once the examination has been performed, patient care will proceed as follows:
 - All patients with knee pain should be initially treated by their PCM with NSAIDS (if clinically tolerated), physical therapy referral, activity modification (physical training profile), and radiographs.
 - There is no role for the indiscriminate use of MRI for the initial evaluation of non-specific, no-localizing knee pain.
 - Unstable knees: Patients with an unstable knee on examination will be treated with activity modification (profile), physical therapy referral, NSAIDS (if clinically tolerated), and standard radiographic knee series (WB AP, LAT). Patients with unstable knees do not require MRI prior to referral to orthopedics.\
- If there is no improvement in six to eight weeks, consideration for referral of patient to orthopedics for an evaluation only if they have mechanical symptoms of pain with palpable click, persistent effusion, and instability. Otherwise, physical therapy is to continue for another six to eight weeks.
- In a patient with a stable knee, an MRI should be considered at six to eight weeks for persistent pain only if they have physical findings (effusion/atrophy/palpable click). MRI is only useful in patients with physical exam findings.
- Patients with compromised knee range of motion should be referred to orthopedics immediately (ASAP) to evaluate for a displaced meniscal tear.
- Questions should be referred to the orthopedic surgeon on call.

Orthopedics Referral Criteria

- All patients will have documented acceptable knee examination ([Hoppenfeld Text](#) and pictures for examination) to include plain radiography results prior to referral to orthopedics.
- All patients with unstable knees ([Traumatic Knee Pain Referral Guideline](#)) will have documentation of referral to radiographic eval, physical therapy, and re-examination prior to referral to orthopedics.
- All patients with stable knees will have documentation of physical therapy attempt, re-examination, and radiographic eval prior to considering ortho referral (see [Anterior Knee Pain Referral Guideline](#)).

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- Patient education materials (below) have been copied with permission from [*The Sports Medicine Patient Advisor*](#) by Pierre Rouzier, M.D., pages 51-55 (ACL Sprain), 91-94 (Patellofemoral Pain Syndrome) and 185-192 (Physical Examination of the Knee).

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Hoppenfeld
Text

TESTS FOR JOINT STABILITY

The knee joint owes its stability to a strong and extensive joint capsule, collateral ligaments, cruciate ligaments, and surrounding muscles and tendons. The following tests evaluate the strength and integrity of those structures.

Collateral Ligaments

Ask the patient to lie supine on the table with one knee flexed just enough so that it unlocks from full extension. To test the medial collateral ligament, secure his ankle with one hand and place the other hand around the knee so that your thenar eminence is against the fibular head. Then, push medially against the knee and laterally against the ankle in an attempt to open the knee joint on the inside (valgus stress) (Fig. 44). Palpate the medial joint line for gapping, which may even be visible. If there is a gap, the medial collateral ligament is not supporting the knee prop-

erly. When stress on the injured joint is relieved, you can feel the tibia and femur "clunk" together as they close.

To test the lateral aspect of the knee for stability, reverse the position of your hands, and push laterally against the knee and medially against the ankle to open the knee joint on the lateral side (varus stress). Again, palpate the lateral joint line for any gapping (Fig. 45). As on the medial side, such a gap may be both palpable and visible. Upon the release of varus stress, the tibia and femur may clunk into position as they close.

If your fingers are too short to reach around the knee to palpate the joint lines, secure the patient's foot between your arm and body (in the axilla) so that your hands are free to palpate the joint line. In this way, your body acts as a lever on the foot and applies varus and valgus stress to the knee joint (Figs. 44, 45).

Since the medial collateral ligament is critical to stability, an isolated tear of this ligament leads to joint instability, whereas a similar defect in the lateral collateral ligament may have little effect either way. Most ligamentous injuries around the knee occur on the medial side.

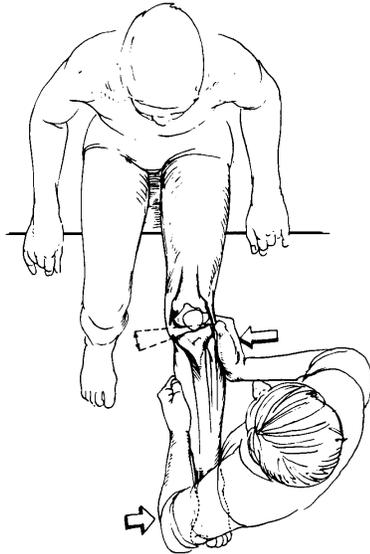


Fig. 44. To test the medial collateral ligament, apply valgus stress to open the knee joint on the medial side.

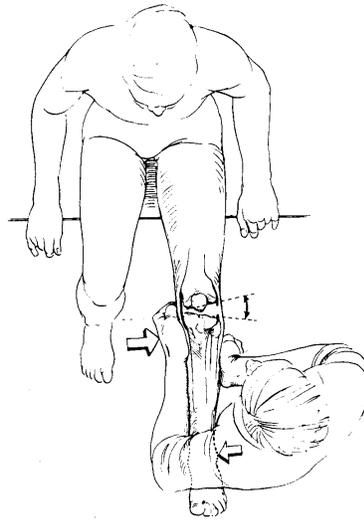


Fig. 45. To test the lateral knee for stability, apply varus stress to open the knee joint on the lateral side.

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Cruciate Ligaments

The anterior and posterior cruciate ligaments are instrumental in preventing anterior and posterior dislocation of the tibia on the femur. These ligaments are intracapsular, originating on the tibia and inserting into the inner sides of the femoral condyles.

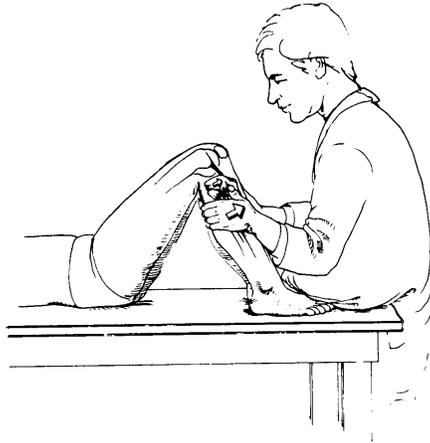


Fig. 46. Position for eliciting the anterior draw sign.

To test the integrity of the anterior cruciate ligament, have the patient lie supine on the examination table with his knees flexed to 90° and his feet flat on the table. Position yourself on the edge of the table so that you can stabilize his foot by sitting on it. Then cup your hands around his knee, with your fingers on the area of insertion of the medial and lateral hamstrings and your thumbs on the medial and lateral joint lines. Now, draw the tibia toward you (Fig. 46); if it slides forward from under the femur (positive anterior draw sign), the anterior cruciate ligament may be torn (Fig. 47). A few degrees of anterior draw are normal if an equal amount is present on the opposite side.

When you do find a positive anterior draw sign, it is important to repeat the maneuver with the patient's leg in internal and external rotation. External rotation of the leg tightens the posteromedial portion of the joint capsule; normally, there should then be reduced forward movement of the tibia on the femur, even if the anterior cruciate ligament is torn. Thus, if forward movement with the leg externally rotated is equal to forward movement with the leg in the neutral position, both the anterior cruciate ligament and the posteromedial portion of the joint capsule (and possibly the medial collateral ligament) may be damaged. Internal rotation tightens the structures on the posterolateral side of the knee. Normally, there should be reduced movement when the leg is pulled forward, even if the anterior cruciate ligament is torn. If the amount of forward movement

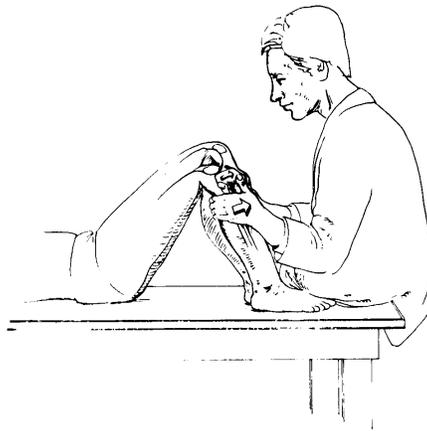


Fig. 47. A positive anterior draw sign: Torn anterior cruciate ligament.

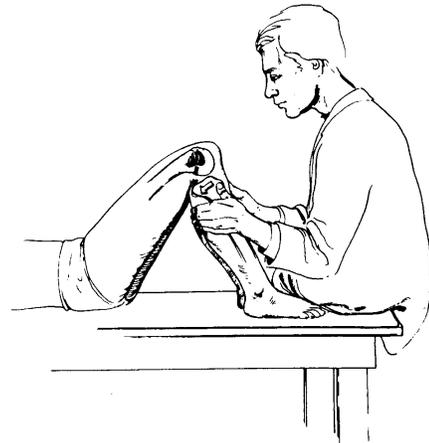


Fig. 48. A positive posterior draw sign: Torn posterior cruciate ligament.

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of the tibia on the femur in internal rotation is equal to that in the neutral position, both the anterior cruciate ligament and the posterolateral portion of the joint capsule may be torn. The anterior cruciate ligament may be torn in association with tears of the medial collateral ligament.

Test the posterior cruciate ligament in a similar manner. Stay in the same position and push the tibia posteriorly (Fig. 48). If it moves backward on the femur, the posterior cruciate ligament is probably damaged (positive posterior draw sign). The anterior draw sign is more common than the posterior sign, since the incidence of damage to the anterior cruciate is much higher than to the posterior cruciate. In fact, an isolated tear of the posterior cruciate ligament is rare.

These tests for stability of the anterior and posterior cruciate ligaments are usually performed in one continuous motion and have been separated here mainly for the purpose of instruction. All procedures should be performed bilaterally, and all findings compared.

RANGE OF MOTION

There are three basic movements in the knee joint: (1) flexion (associated with glide), (2) extension (associated with glide), and (3) internal and external rotation.

Flexion and extension are primarily the result of movement between the femur and the tibia. Internal and external rotation involve displacement of the menisci on the tibia, as well as movement between the tibia and the femur. Extension is performed by the quadriceps, while flexion is performed by the hamstrings and gravity. Internal and external rotation (which take place when the knee

is slightly flexed) are performed by the reciprocal action of the semimembranosus, semitendinosus, gracilis, and sartorius on the medial side, and the biceps on the lateral side.

Active Range of Motion

The following quick tests determine whether or not there is any gross restriction in a patient's range of knee motion.

FLEXION. Ask the patient to squat in a deep knee bend. He should be able to flex both knees symmetrically.

EXTENSION. Instruct the patient to stand up from the squatting position, and take careful notice of whether he is able to stand straight, with knees in full extension, or whether one leg is relied upon more than the other during the procedure. You may also instruct him to sit on the edge of the examination table and to extend his knee fully (Fig. 49). The arc of motion from flexion to extension should be smooth. On occasion, a patient may be unable to extend the knee through the last 10° of motion and may be able to finish extension only haltingly, and with great effort. This is referred to as *extension lag* (Fig. 50). It frequently accompanies quadriceps weakness.

Note that the leg cannot be extended fully without some amount of external tibial rotation on the femur because of the physical configuration of the knee joint and its cruciate ligaments (A. Hellet's Helix). The medial femoral condyle is approximately a half-inch longer than the lateral femoral condyle. Therefore, as the tibia moves on the femoral condyles into full extension, it uses all available articulating surface on the lateral side,

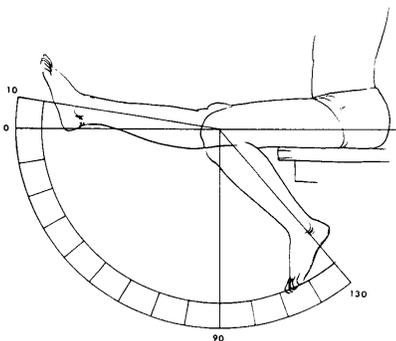


Fig. 49. The range of knee motion in flexion and extension.

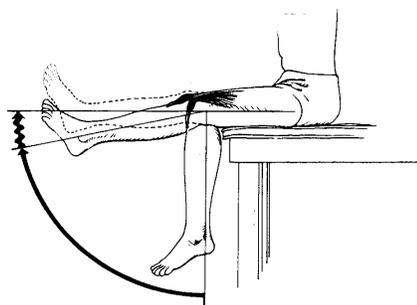


Fig. 50. Extension lag, when the last 10° or so of extension are performed haltingly and with difficulty.

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SPECIAL TESTS

McMURRAY TEST. During knee flexion and extension, a torn meniscus may produce a palpable or audible "clicking" in the region of the joint line. Tenderness elicited in palpation of the joint line on either side suggests the possibility of a torn meniscus. Posterior meniscal tears are difficult to identify, and the McMurray test was originally developed to assist in this difficult diagnosis.

Ask the patient to lie supine with his legs flat and in the neutral position. With one hand, take hold of his heel and flex his leg fully (Fig. 58). Then, place your free hand on the knee joint with your fingers touching the medial joint line and your thumb and thenar eminence against the lateral joint line, and rotate the leg internally and externally to loosen the knee joint (Fig. 59). Push on the lateral side to apply valgus stress to the medial side of the joint, while, at the same time, rotating the leg externally (Fig. 60). Maintain the valgus stress and external rotation, and extend the leg slowly as you palpate the medial joint line (Fig. 61). If this maneuver causes a palpable or audible "click" within the joint, there is a probable tear in the medial meniscus, most likely in its posterior half.

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PHYSICAL EXAMINATION OF THE KNEE

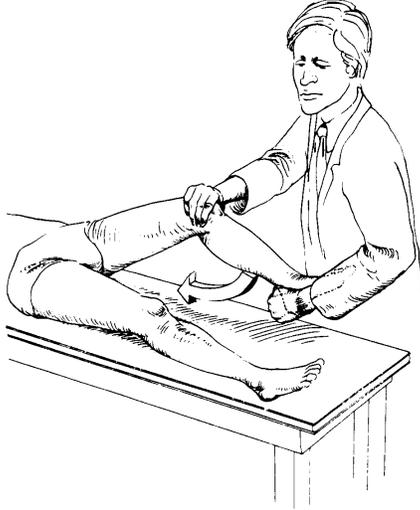


Fig. 58. The McMurray test for meniscal tears. Flex the knee.

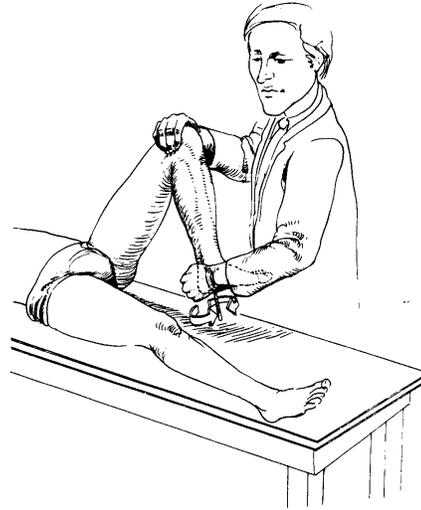


Fig. 59. With the knee flexed, internally and externally rotate the tibia on the femur.

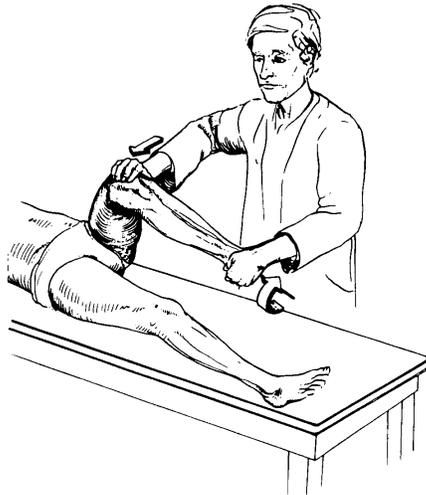


Fig. 60. With the leg externally rotated, place a valgus stress on the knee.

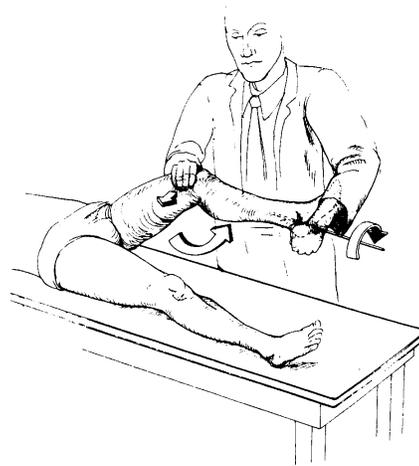


Fig. 61. With the leg externally rotated and in valgus, slowly extend the knee. If click is palpable or audible, the test is considered positive for a torn medial meniscus, usually in the posterior position.

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Anterior Cruciate Ligament (ACL) Sprain

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Anterior Cruciate Ligament (ACL) Sprain

What is an anterior cruciate ligament (ACL) sprain?

A sprain is a joint injury that causes a stretch or a tear in a ligament. Ligaments are strong bands of tissue that connect one bone to another. The anterior cruciate ligament (ACL) is one of the major ligaments in the middle of the knee. It connects the thigh bone (femur) to the shin bone (tibia). This ligament, along with the posterior cruciate ligament, helps keep the knee stable and protects the femur from sliding or turning on the tibia.

Sprains are graded I, II, or III depending on their severity:

- grade I sprain: pain with minimal damage to the ligaments
- grade II sprain: more ligament damage and mild looseness of the joint
- grade III sprain: the ligament is completely torn and the joint is very loose or unstable.

How does it occur?

The anterior cruciate ligament is frequently injured in forced twisting motions of the knee. It may also become injured when the knee is straightened

further than it normally can straighten (hyperextended). It sometimes occurs when the thigh bone is forcefully pushed across the shin bone, such as with a sudden stop while you are running or a sudden transfer of weight while you are skiing.

What are the symptoms?

There is usually a loud, painful pop when the joint is first injured. This is often followed by a lot of swelling of the knee within the first several hours after the injury. This swelling is called an effusion and is made up of blood in the knee joint.

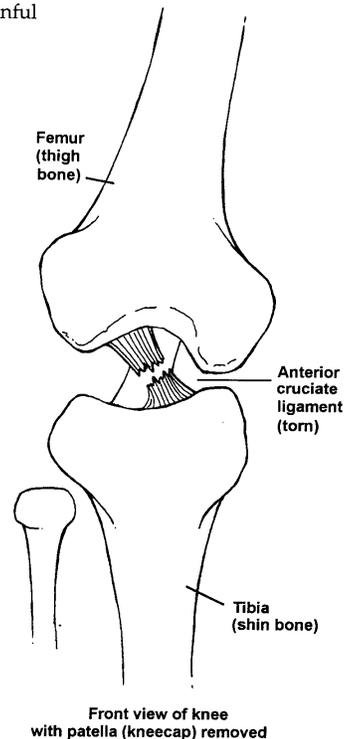
If you have torn your anterior cruciate ligament in an injury that occurred months or years ago and you haven't had reconstructive surgery, you may have the feeling that the knee is giving way during twisting or pivoting movements.

How is it diagnosed?

Your doctor will examine your knee and may find that your knee has become loose. If you have swelling in the joint, your doctor may decide to

remove the blood in your knee with a needle and syringe. You may need x-rays to see if there is an injury to the bones in your knee. An MRI (magnetic resonance imaging) scan may

Anterior Cruciate Ligament Tear



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Anterior Cruciate Ligament (ACL) Sprain

also be done and should clearly show the condition of your ACL (as well as that of other ligaments and cartilage).

How is it treated?

Treatment includes the following:

- Put an ice pack on your knee for 20 to 30 minutes every 3 to 4 hours for 2 or 3 days or until the pain goes away.
- Keep your knee elevated whenever possible by placing a pillow underneath it until the swelling goes away.
- Do the exercises recommended by your doctor or physical therapist.

Your doctor may recommend that you:

- Wrap an elastic bandage around your knee to keep the swelling from getting worse.
- Use a knee immobilizer initially to protect the knee.
- Use crutches.

For complete tears, you and your doctor will decide if you should have intense rehabilitation or if you should have surgery followed by rehabilitation. The torn anterior cruciate ligament cannot be sewn back together. The ligament must be reconstructed by taking ligaments or tendons from another part of your leg and connecting them to the tibia and femur.

You may consider having reconstructive ACL surgery if:

- Your knee is unstable and gives out during routine or athletic activity.
- You are a high-level athlete and your knee could be unstable and give out during your sport (for example, basketball, football, or soccer).
- You are a younger person who is not willing to give up an athletic lifestyle.
- You want to prevent further injury to your knee. An unstable knee may lead to injuries of the meniscus and arthritis.

You may consider not having the surgery if:

- Your knee is not unstable and is not painful and you are able to do your chosen activities without symptoms.
- You are willing to give up sports that put extra stress on your knee.
- You are not involved in sports.

If a growing child tears an ACL, the doctor may recommend that surgery be postponed until the child has stopped growing.

When can I return to my sport or activity?

The goal of rehabilitation is to return you to your sport or activity as soon as is safely

possible. If you return too soon you may worsen your injury, which could lead to permanent damage. Everyone recovers from injury at a different rate. Return to your activity will be determined by how soon your knee recovers, not by how many days or weeks it has been since your injury occurred. In general, the longer you have symptoms before you start treatment, the longer it will take to get better.

You may safely return to your sport or activity when, starting from the top of the list and progressing to the end, each of the following is true:

- Your injured knee can be fully straightened and bent without pain.
- Your knee and leg have regained normal strength compared to the uninjured knee and leg.
- The effusion is gone.
- You are able to jog straight ahead without limping.
- You are able to sprint straight ahead without limping.
- You are able to do 45-degree cuts.
- You are able to do 90-degree cuts.
- You are able to do 20-yard figure-of-eight runs.
- You are able to do 10-yard figure-of-eight runs.

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Anterior Cruciate Ligament (ACL) Sprain

- You are able to jump on both legs without pain and jump on the injured leg without pain.

If you feel that your knee is giving way or if you develop pain or have swelling in your knee, you should see your doctor. If you've had surgery, be sure that your doctor has told you that you can return to your sport.

How can I prevent an anterior cruciate ligament sprain?

Unfortunately, most injuries to the anterior cruciate ligament occur during accidents that are not preventable. However, you may be able to avoid these injuries by having strong thigh and hamstring muscles and maintaining a good leg

stretching routine. In activities such as skiing, make sure your ski bindings are set correctly by a trained professional so that your skis will release when you fall.

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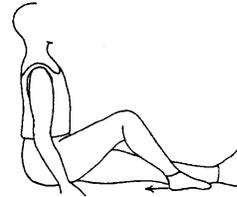
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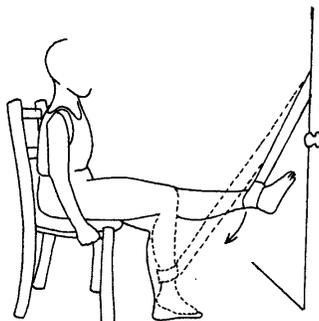
Anterior Cruciate Ligament Sprain (ACL) Rehabilitation Exercises

You may begin exercising your knee when the swelling has gone down and you are able to stand with equal weight on both legs.

1. Heel slide: Sit on a firm surface with your legs straight in front of you. Slowly slide the heel of your injured leg toward your buttock by pulling your knee to your chest as you slide. Return to the starting position. Repeat this 20 times.
2. Prone knee flexion: Lying on your stomach, bend your injured knee and try to touch your buttock with your heel. Slowly return to the starting position. As this gets easier, you can add an ankle weight of 3 to 5 pounds. Repeat 10 times. Do 3 sets of 10.



Heel slide



Theraband hamstring curls

3. Thera-Band hamstring curls: Sit in a chair facing a door and about 3 feet from the door. Loop and tie one end of the tubing around the ankle of your injured leg. Tie a knot in the other end of the Thera-Band and shut the knot in the door. Bend your knee so that your foot slides along the floor and moves back underneath the chair, stretching the tubing. Slowly let your foot slide forward again. Repeat this 10 times. Do 3 sets of 10.



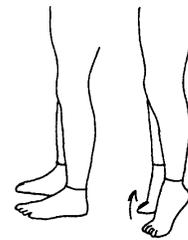
Prone knee flexion

You can challenge yourself by moving the chair farther away from the door and increasing the resistance of the Thera-Band.

4. Heel raises: Stand on both feet, raise your heels off the floor and come up onto your toes. Hold this position for 2 seconds and slowly lower yourself back down. Do 3 sets of 10 repetitions.

To challenge yourself, stand only on your injured leg and raise up on your toes, lifting your heel off the floor. Do 3 sets of 10.

After your hamstrings have become stronger and you feel your leg is stable, you can begin strengthening the quadriceps (a large muscle in the front of the thigh). A good way to do this is to do a wall squat with a ball.



Heel raises

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Anterior Cruciate Ligament Sprain (ACL) Rehabilitation Exercises



Wall squat with a ball

5. Wall squat with a ball: Stand with your back, shoulders, and head against a wall and look straight ahead. Keep your shoulders relaxed and your feet 1 foot away from the wall and a shoulder-width apart. Place a rolled up pillow or a Nerf ball between your thighs. Keeping your head against the wall, slowly squat while squeezing the pillow or ball at the same time. Squat down until your thighs are parallel to the floor. Hold this position for 10 seconds. Slowly stand back up. Make sure you keep squeezing the pillow or ball throughout this exercise. Repeat 20 times.

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Patellofemoral Pain Syndrome (Runner's Knee)

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Patellofemoral Pain Syndrome (Runner's Knee)

What is patellofemoral pain syndrome?

Patellofemoral pain syndrome is pain behind the kneecap. It has been given many names, including patellofemoral disorder, patellar malalignment, runner's knee, and chondromalacia.

How does it occur?

Patellofemoral pain syndrome can occur from overuse of the knee in sports and activities such as running, walking, jumping, or bicycling.

The kneecap (patella) is attached to the large group of muscles in the thigh called the quadriceps. It is also attached to the shin bone by the patellar tendon. The kneecap fits into grooves in the end of the thigh bone (femur) called the femoral condyle. With repeated bending and straightening of the knee, you can irritate the inside surface of the kneecap and cause pain.

Patellofemoral pain syndrome also may result from the way your hips, legs, knees, or feet are aligned. This alignment problem can be caused by your having wide hips or underdeveloped thigh muscles, being knock-kneed, or having feet with arches that collapse when walking or running (a condition called overpronation).

What are the symptoms?

The main symptom is pain behind the kneecap. You may have pain when you walk, run, or sit for a long time. The pain is generally worse when walking downhill or down stairs. Your knee may swell at times. You may feel or hear snapping, popping, or grinding in the knee.

How is it diagnosed?

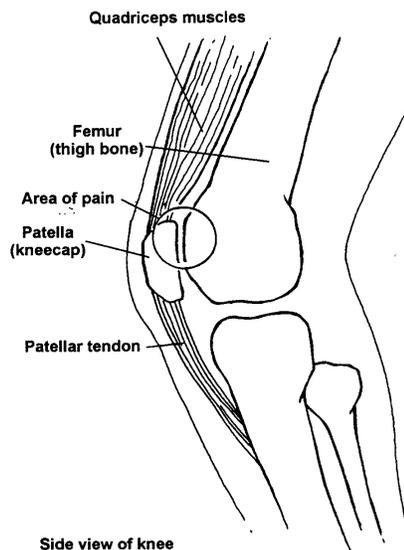
Your doctor will review your symptoms, examine your knee, and may order knee x-rays.

How is it treated?

Treatment includes the following:

- Place an ice pack on your knee for 20 to 30 minutes every 3 to 4 hours for the first 2 to 3 days or until the pain goes away
- Elevate your knee by placing a pillow underneath your leg when your knee hurts.
- Take anti-inflammatory medication, such as ibuprofen, as prescribed by your doctor.

Patellofemoral Pain Syndrome (Runner's Knee)



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Patellofemoral Pain Syndrome (Runner's Knee)

- Do the exercises recommended by your doctor or physical therapist.

Your doctor may recommend that you:

- Wear custom-made arch supports (orthotics) for over-pronation.
- Use an infrapatellar strap, a strap placed beneath the kneecap over the patellar tendon.
- Wear a neoprene knee sleeve, which will give support to your knee and patella.

While you are recovering from your injury, you will need to change your sport or activity to one that does not make your condition worse. For example, you may need to bicycle or swim instead of run. In cases of severe patellofemoral pain syndrome, surgery may be recommended. Your doctor will show you exercises to help decrease the pain behind your kneecap.

When can I return to my sport or activity?

The goal of rehabilitation is to return you to your sport or activity as soon as is safely possible. If you return too soon you may worsen your injury, which could lead to permanent damage. Everyone recovers from injury at a different rate. Return to your sport or activity will be determined by how soon your knee recovers, not by how many days or weeks it has been since you were injured. In general, the longer you have symptoms before you start treatment, the longer it will take to get better.

You may safely return to your sport or activity when, starting from the top of the list and progressing to the end, each of the following is true:

- Your injured knee can be fully straightened and bent without pain.
- Your knee and leg have regained normal strength compared to the uninjured knee and leg.

- You are able to jog straight ahead without limping.
- You are able to sprint straight ahead without limping.
- You are able to do 45-degree cuts.
- You are able to do 90-degree cuts.
- You are able to do 20-yard figure-of-eight runs.
- You are able to do 10-yard figure-of-eight runs.
- You are able to jump on both legs without pain and jump on the injured leg without pain.

How can I prevent patellofemoral pain syndrome?

Patellofemoral pain syndrome can best be prevented by strengthening your thigh muscles, particularly the inside part of this muscle group. It is also important to wear shoes that fit well and that have good arch supports.

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Patellofemoral Pain Syndrome (Runner's Knee) Rehabilitation Exercises

You can do the hamstring stretch (exercise 1) right away. You can start doing exercise 2 as soon as it is not too painful to move your kneecap. When the pain in your knee has decreased, you can do the quadriceps stretch and start strengthening the thigh muscles using exercises 4 through 6.

1. Hamstring stretch: Stand with the heel of your injured leg resting on a stool that is about 15 inches high. Keep your knee straight. Gently lean forward from your hips, keeping your shoulders in line with your trunk, until you feel a stretch in the back of your thigh. Hold this position for 30 to 60 seconds. Return to the starting position. Do not round your shoulders and bring your head toward your toe. This will stretch your low back instead of your hamstrings. Repeat this exercise 3 times.



Hamstring stretch

2. Patellar mobility: Sit with your injured leg outstretched in front of you and the muscles on the top of your thigh relaxed. Take your index finger and thumb and gently press your kneecap down toward your foot. Hold this position for 10 seconds. Return to the starting position. Next, pull your kneecap up toward your waist and hold it for 10 seconds. Return to the starting position. Then, try to gently push your kneecap inward toward your other leg and hold for 10 seconds. Repeat these for approximately 5 minutes.

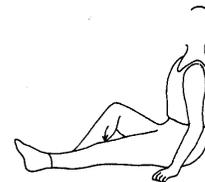


Patellar mobility



Quadriceps stretch

3. Quadriceps stretch: Stand an arm's length away from a wall, facing straight ahead. Brace yourself by keeping the hand on your uninjured side against the wall. With your other hand, grasp the ankle of the injured leg and pull your heel up toward your buttocks. Don't arch or twist your back. Hold this position for 30 seconds. Repeat 3 times.
4. Quadriceps set: Sit on the floor with your injured leg straight out in front of you. Try to tighten up the muscles at the top of your thigh by pushing the back of your knee down into the floor. Concentrate your contraction on the inside part of your thigh. It is very important to strengthen this part of your quadriceps muscle, called the vastus medialis, for your rehab to be successful. Hold this position for 5 seconds. Repeat 10 times. Do 3 sets of 10.



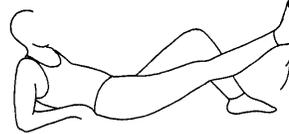
Quadriceps set

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Madigan Army Medical Center Musculoskeletal Treatment Guidelines

Patellofemoral Pain Syndrome (Runner's Knee) Rehabilitation Exercises

5. Straight leg raise: Sit on the floor with your injured leg straight and the other leg bent so the foot is flat on the floor. Pull the toes of your injured leg toward you as far as you can comfortably while tightening the muscles on the top of your thigh. Raise your leg 6 to 8 inches off the floor. Hold this position for 3 to 5 seconds and then slowly lower your leg. Repeat 10 times. Do 3 sets of 10.



Straight leg raise

6. Weight lifting - leg extension: Do these if you have access to a weight lifting bench with a leg extension attachment. Sit on the bench with the weight attachment in front of your lower legs. Extend your knees by straightening your legs. Be sure your legs straighten completely. The last 15 degrees of extension are the most important. Use enough weight to cause fatigue but not pain. Do 3 sets of 10.

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