DISEASES & CONDITIONS

Patellofemoral Pain Syndrome

Patellofemoral pain syndrome (PFPS) is a broad term used to describe pain in the front of the knee and around the patella, or kneecap. It is sometimes called "runner's knee." Although it is common in people who participate in sports — especially females and young adults — PFPS can occur in nonathletes, as well.

The pain and stiffness caused by PFPS can make it difficult to climb stairs, kneel down, and perform other everyday activities.

Many things may contribute to the development of PFPS. Problems with the alignment of the kneecap and overuse from vigorous athletics or training are often significant factors.

Symptoms are often relieved with conservative treatment, such as changes in activity levels or a therapeutic exercise program.

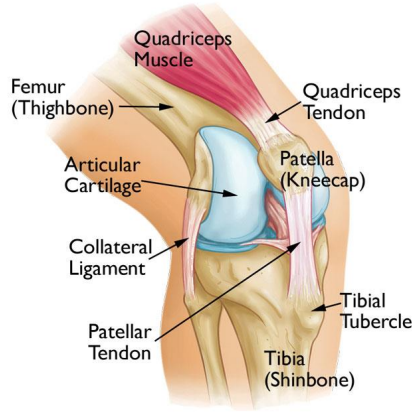
This article focuses on patellofemoral pain syndrome. Pain in the front of the knee can also be caused by arthritis. Learn more: Patellofemoral Arthritis

Anatomy

The knee is the largest joint in your body and one of the most complex. It is made up of:

- The lower end of the femur (thighbone)
- The upper end of the tibia (shinbone)
- The patella (kneecap)

Ligaments and tendons connect the femur to the bones of the lower leg. The four main ligaments in the knee attach to the bones and act like strong ropes to hold the bones together.



A healthy knee is made up of five main things: bones, cartilage, menisci, ligaments, and tendons.

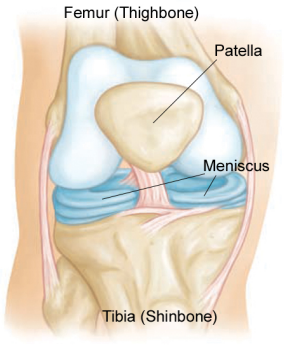
Muscles are connected to bones by tendons.

- The quadriceps tendon connects the muscles in the front of the thigh to the patella.
- Segments of the quadriceps tendon — called the patellar retinacula — attach to the tibia and help to stabilize the patella.
- Stretching from your patella to your tibia is the patellar tendon.

Several structures in the knee joint make movement easier. For example, the patella rests in a groove on the top of the femur called the trochlea. When you bend or straighten your knee, the patella moves back and forth inside this trochlear groove.

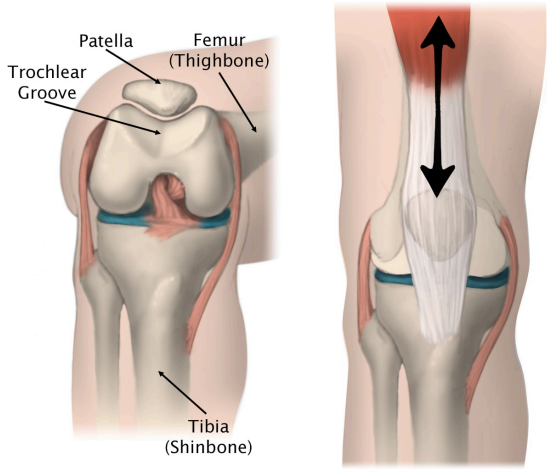
A slippery substance called articular cartilage covers the ends of the femur, the trochlear groove, and the underside of the patella. Articular cartilage helps your bones glide smoothly against each other as you move your leg.

Your knee cartilage is cushioned by menisci — rubbery, C-shaped disks that act as "shock absorbers" between the thighbone and shinbone, helping to protect and stabilize the knee joints. Each knee has two menisci — one on the outside of the knee (lateral) and one on the inside (medial). The medial and lateral menisci cushion the articular cartilage of the thigh and shin bones, but not the articular cartilage of your kneecap or the trochlear groove.



The menisci are rubbery disks that help cushion the knee joint.

Also aiding in movement of the knee is the synovium — a thin lining of tissue that covers the surface of the joint. The synovium produces a small amount of fluid that lubricates the cartilage. In addition, just below the kneecap is a small pad of fat that cushions the kneecap and acts as a shock absorber.



(Left) The patella normally rests in a small groove at the end of the femur called the trochlear groove. **(Right)** As you bend and straighten your knee, the patella slides up and down within the groove.

Description

Patellofemoral pain syndrome occurs when nerves sense pain in the soft tissues and bone around the kneecap. These soft tissues include the tendons, the fat pad beneath the patella, and the synovial tissue that lines the knee joint.

In some cases of patellofemoral pain, a condition called chondromalacia patella is present. Chondromalacia patella is the softening and breakdown of the articular cartilage on the underside of the kneecap. There are no nerves in articular cartilage — so damage to the cartilage itself cannot directly cause pain. It can, however, lead to inflammation of the synovium and pain in the underlying bone.

Cause

Overuse

- In many cases, PFPS is caused by vigorous physical activities that put repeated stress on the knee — such as jogging, squatting, and climbing stairs.
- It can also be caused by a sudden change in physical activity, which can be related to the frequency of activity (e.g., increasing the number of days you exercise each week) or to the

duration or intensity of activity (e.g., running longer distances).

Other factors that may contribute to patellofemoral pain include:

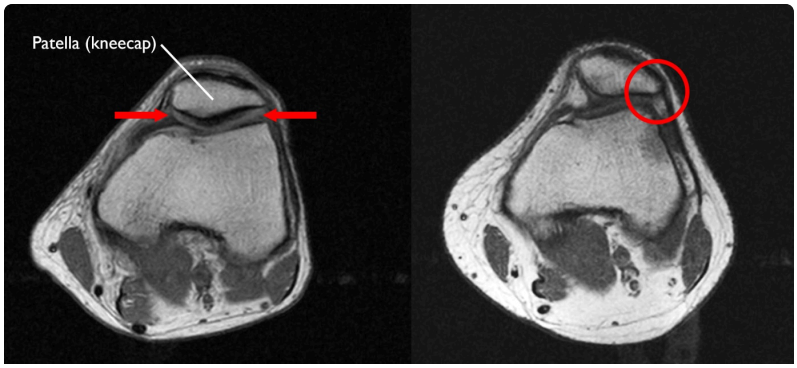
- Use of improper sports training techniques or equipment
- Changes in footwear or playing surface (e.g., switching from a natural grass field to a field with artificial turf)

Patellar Malalignment

Patellofemoral pain syndrome can also be caused by abnormal tracking of the kneecap in the trochlear groove. In this condition, the patella is pushed out to one side of the groove when the knee is bent. This abnormality may cause increased pressure between the back of the patella and the trochlea, irritating soft tissues.

Factors that contribute to poor tracking of the kneecap include:

- **Problems with the alignment of the legs between the hips and the ankles,** which may result in a kneecap that shifts too far toward the outside or inside of the leg, or one that rides too high in the trochlear groove — a condition called *patella alta*.
- **Muscular imbalances or weaknesses,** especially in the quadriceps muscles at the front of the thigh and the muscles that externally rotate and move the hip away from your body (this movement is called abduction). When the knee bends and straightens, the quadriceps muscles and tendon help to keep the kneecap centered within the trochlear groove, together with the hip muscles that help control the position of the thigh bone. Weak or imbalanced quadriceps and hip muscles can cause poor tracking of the kneecap within the groove.



(Left) In this MRI scan, the kneecap is normally aligned within the trochlear groove (arrows). **(Right)** Here, the kneecap has shifted out of the groove and is pulled toward the outside of the leg (circle).

Images courtesy of Stuart J. Fischer, MD, FAAOS

Symptoms

The most common symptom of PFPS is a dull, aching pain in the front of the knee. This pain — which usually begins gradually and is frequently activity-related — may be present in one or both knees. Other common symptoms include:

- Pain during exercise and activities that repeatedly bend the knee, such as climbing stairs, running, jumping, or squatting
- Pain on the front of the knee after sitting for a long period of time with your knees bent, such as one does in a movie theater, in a car, or on an airplane
- Pain related to a change in activity level or intensity, playing surface, or equipment
- Popping or crackling sounds in your knee when climbing stairs or when standing up after prolonged sitting

Home Remedies

In many cases, patellofemoral pain will improve with simple home treatment.

Activity Changes

Stop doing the activities that make your knee hurt until your pain goes away. This may mean:

- Changing your training routine
- Switching to low-impact activities — such as riding a stationary bike, using an elliptical machine, or swimming — that will place less stress on your knee joint
- If you are overweight, losing weight, which will also help to reduce pressure on your knee

The RICE Method

RICE stands for rest, ice, compression, and elevation.

- **Rest.** Avoid putting weight on the painful knee.
- **Ice.** Use cold packs for 20 minutes at a time, several times a day. Do not apply ice directly on skin.
- **Compression.** To prevent additional swelling, lightly wrap the knee in an elastic bandage, leaving a hole in the area of the kneecap. Make sure that the bandage fits snugly and does not cause additional pain.
- **Elevation.** As often as possible, rest with your knee raised up higher than your heart.

Medication

Nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and naproxen can help reduce swelling and relieve pain.

If your pain persists or it becomes more difficult to move your knee, contact your doctor for a thorough evaluation.

Doctor Examination

Physical Examination

During the physical examination:

- Your doctor will discuss your general health and the symptoms you are experiencing.
- They will ask when your knee pain started, about the severity and nature of the pain (dull vs. sharp), and which activities make the pain worse.
- To determine the exact location of the pain, the doctor may gently press and pull on the front of your knees and kneecaps.
- They may also ask you to squat, jump, or lunge during the exam in order to test your knee and core body strength.

During the examination, your doctor will check your knee for problems in patellar tracking,

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To help diagnose the cause of your pain and to rule out any other physical problems, your doctor may also check:

- Alignment of the lower leg and the position of the kneecap
- Knee stability, hip rotation, and range of motion of knees and hips
- The kneecap for signs of tenderness
- The attachment of thigh muscles to the kneecap

- Strength, flexibility, firmness, and tone of the hips, quadriceps (front thigh muscles), and hamstrings (back thigh muscles)
- Tightness of the heel cord and flexibility of the feet

Finally, your doctor may ask you to walk back and forth in order to examine your gait (the way you walk) and look for problems with your gait that may be contributing to your knee pain.

Imaging Tests

X-rays. Usually, your doctor will be able to diagnose PFPS with just a physical examination. However, in most cases, they will also order an X-ray to rule out damage to the bones that make up the knee.

Magnetic resonance imaging (MRI) scans. An MRI scan provides clear images of the body's soft tissues, such as ligaments, tendons, and muscles. Your doctor may order an MRI if, after a period of time, your symptoms do not improve with physical therapy and home exercise.

Treatment

Medical treatment for PFPS is designed to relieve pain and restore range of motion and strength. In most cases, patellofemoral pain can be treated nonsurgically.

Nonsurgical Treatment

In addition to activity changes, the RICE method, and anti-inflammatory medication, your doctor may recommend the following:

Physical therapy. Specific exercises will help you improve range of motion, strength, and endurance.

It is especially important to focus on strengthening and stretching your quadriceps and strengthening your hip muscles, since these muscles work together to stabilize your kneecap.

Core exercises may also be recommended to strengthen the muscles in your abdomen and lower back.

Orthotics. Shoe inserts can help align and stabilize your foot and ankle, taking stress off of your lower leg. Orthotics can either be custom-made for your foot or purchased "off the shelf."

Shoe inserts take stress off your lower leg by aligning your foot and ankle.

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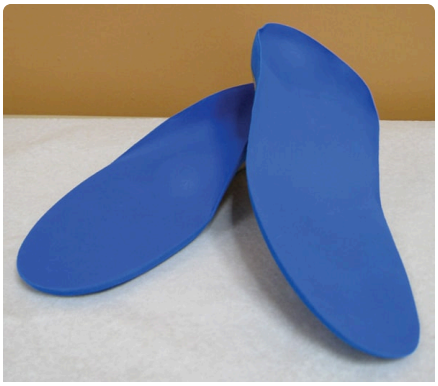

Surgical Treatment

Surgical treatment for patellofemoral pain is very rarely needed and is performed only for severe cases that do not respond to nonsurgical treatment. Surgical treatments may include:

Arthroscopy. During arthroscopy, your surgeon inserts a small camera, called an arthroscope, into your knee joint. The camera displays pictures on a monitor, and your surgeon uses these images to guide surgical instruments.

- **Debridement.** In some cases, removing damaged articular cartilage from the surface of the patella can provide pain relief.
- **Lateral release.** If the lateral retinaculum is tight enough to pull the patella out of the trochlear groove or tilt the patella, a lateral release procedure can loosen the tissue and correct the patellar malalignment.

Tibial tubercle transfer. In some cases, it may be necessary to realign the kneecap to take stress off of damaged cartilage by moving the patellar tendon along with a portion of the tibial tubercle — the bony prominence (bump) on the tibia (shinbone).

A traditional open surgical incision is required for this procedure. The doctor partially or totally detaches the tibial tubercle so that the bone and the tendon can be moved toward the inner side of the knee. The piece of bone is then reattached to the tibia using screws. In most cases, this transfer allows for better tracking of the kneecap in the trochlear groove.

Prevention

Patellofemoral pain syndrome is usually fully relieved with simple measures or physical therapy. It may come back, however, if you do not adjust your training routine or activity level.

It is essential to maintain appropriate conditioning of the muscles around the knee and hip, especially the quadriceps, hip abductor, and hip external rotator muscles.

There are additional steps that you can take to prevent patellofemoral knee pain from coming back. They include:

- Wearing shoes appropriate to your activities
- Warming up thoroughly before physical activity
- Incorporating stretching and flexibility exercises for the quadriceps and hamstrings into your warm-up routine, and stretching after physical activity
- Increasing training gradually
- Reducing any activity that has hurt your knees in the past
- Maintaining a healthy body weight to avoid overstressing your knees

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