WESTERN ORTHOPAEDICS
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Knee Pain – Overuse and Overload Syndromes

Overuse and Overload

Because bending the knee increases the pressure between the patella and various point of the femur, patellofemoral pain syndrome is often classified as an overuse injury. However, a more appropriate term may be "overload," because the syndrome can also affect inactive people to. Repeated weight bearing impact may be a contributing factor, particularly in runners. Steps, hills and uneven surfaces tend to make patellofemoral pain worse. After the pain has developed, even sitting for long periods can be painful, because of the extra pressure between the patella and the femur during knee flexion.

Overview - Biomechanical Problems and Muscular Dysfunction

Muscular causes; the potential muscular cause of patellofemoral pain can be divided into "weakness" and "inflexibility." Weakness of the quadriceps muscles is the most often area of concern. However each potential cause should be evaluated and addressed appropriately.

The quadriceps muscles is comprised of four muscles that hold the patella in the patellofemoral groove. If one of the muscles begins to misfire or becomes weaker, firing of the other muscles can cause the patella to asymmetrically track within its groove (changing the Q angle). If the patella shifts out of the patellofemoral groove, it can result in pain under the kneecap.

Quadriceps muscles include the vastus medialis, vastus medialis obliquus, vastus intermedius, vastus lateralis and the rectus femoris. **Weakness** of any of these muscles may adversely affect the patellofemoral mechanism. The muscles that most commonly misfire or become weaker are the vastus medialis and vastus medialis obliquus. Weakness of the VMO (vastus medialis obliquus) allows the patella to track too far laterally. The VMO is difficult to isolate, and may need specific strengthening exercises to strengthen the muscle.

Inflexibility (tight muscles) can also be a problem that affects the patellofemoral mechanism. The iliotibial band, which runs down the lateral or outside of the thigh, can place excessive lateral force on the patella and externally rotate the tibia, upsetting balance of the patellofemoral mechanism.

Hamstring muscles flex the knee, but when these muscles are overly tight they can place too much posterior force on the knee increasing pressure between the patella and the femur.

Adductor muscles help stabilize the pelvis, but if they misfire they can cause an external rotation force which may result in compensatory foot pronation. A simple stretch can improve muscular efficiency.

Tight gastrocnemius muscles (calve muscles) can lead to compensatory foot pronation, and like the hamstrings they can increase the posterior force on the knee.

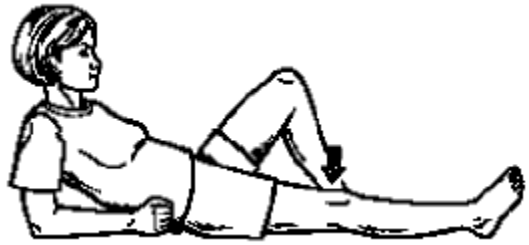
What can you do?

Regular simple stretching and strengthening of lower extremity muscle group's extremities typically is able to alleviate pain from overuse syndromes. These exercises should be performed regularly including before and after any exercise program or sport, as well as on a consistent basis outside of sporting activities to maintain optimal flexability and synchronized firing of muscle groups.

- Footwear, make sure that the footwear you have chosen, is the proper footwear for the sport that you are playing or the exercise that you are doing. There are running shoes, walking shoes, and jumping shoes. The quality and age of the footwear are more important than the brand name. And make sure that you change out your footwear when they get worn.
- Stretching, you should always stretch before and after any sporting event or any exercise program. This will keep you from getting injuries, and help to prevent you from developing patellofemoral pain syndrome.

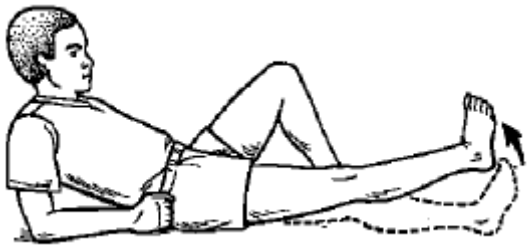
Overview – stretches and strengthening

Quad strengthening: isometrics. Position yourself as shown. Hold your right leg straight for 10 to 20 seconds and then relax. Do the exercise 5 to 10 times.



Quadriceps strengthening: straight leg lifts. Position yourself as shown. Raise your right leg several inches and hold it up for 5 to 10 seconds. Then lower your leg to the floor slowly over a

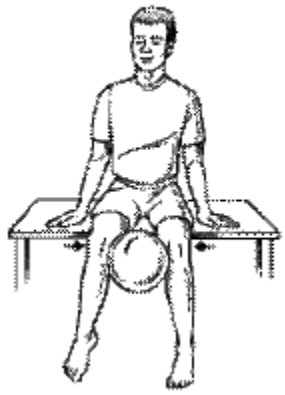
few seconds. Do the exercise 5 to 10 times.



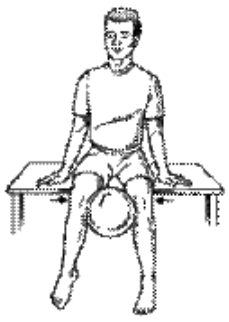
Iliotibial band and buttock stretch (right side shown). Position yourself as shown, twist your trunk to the right and use your left arm to "push" your right leg. You should fell the stretch in your right buttock and the outer part of your right thigh. Hold the stretch for 20 to 30 seconds. Do the exercise 5 to 10 times, and then switch to the other side.

Iliotibial band stretch (left side shown). Position yourself as shown, with your right leg crossed in front of your left leg. Hold your hands together and move them toward the floor. You should feel a stretch in the outer part of you left thigh. Hold the stretch for 20 to 30 seconds. Do the exercise 5 to 10 times, and then switch to the other side.

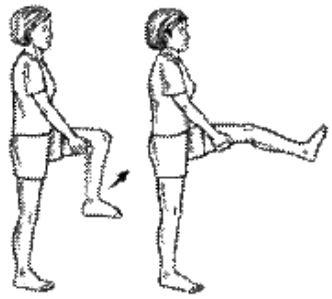
Hip adductor strengthening. While sitting, squeeze a rubber ball between your knees. Hold the squeeze for 5 to 10 seconds. Do the exercise 5 to 10 times. (If you don't have a ball, put your hands or fists between your knees and then squeeze.



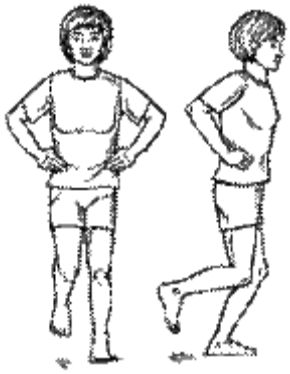
Medial quad strengthening. While sitting, put a rubber ball between your legs just above your knees. While squeezing the ball between your legs extend one leg out. Hold the squeeze for 5 to 10 seconds, returning your leg to the starting position. Do this exercise 5 to 10 times with both legs. (Again if you don't have a ball use your hands or fists between your knees and then squeeze.)



Hamstring stretch. This exercise is done on your back. Position yourself on your back, and bend your left knee. Grip you thigh with your hands to keep the thigh steady. Straighten your left leg in the air until you feel a stretch. Hold the stretch for 20 to 30 seconds. Do the exercise 5 to 10 times, and then move to the other leg.



Hip abductor strengthening (left side shown, front and side views). Position yourself as shown, standing on your left leg with the knee slightly bent. Slowly raise your right foot about 30 degrees, hold for a few seconds and then slowly lower the foot and straighten both legs. Do the exercise 10 times. Don't let your pelvis tilt (be crooked) and don't let your knees turn inward during bending make sure that you always keep your knee and feet pointing straight forward.



Hip and buttock stretch (left side shown). Position yourself as shown, with your left leg over your right leg, and place your hands over your left knee. Pull the knee slightly toward you while sitting up very straight. Hold the position for 20 seconds and then rest for several seconds. Do the exercise 6 times.

Advanced Strengthening – Reverse Step-Up

Begin by place a sturdy box, bench, or step about 6-10 inches high in front of a mirror and stand behind the bench facing it. Place the foot of your weaker or non-dominant leg on the bench, with the toes slightly turned out about 10 degrees. Keeping your hips and shoulders square to the front, slowly lift yourself up on the elevated leg without pushing or rebounding off the floor (forward step-up).

Watch what your knee does in the mirror, especially as you slowly lower back down to the floor. If your knee is wobbly, if it buckles in toward the midline of your body, or if you pitch to one side without being able to balance, then lower the step height 1-2 inches and try again. The forward step-up is mainly a strengthening exercise for the glutes and hamstrings.

To target the VMO, again by selecting a step height that will not result in excessive knee wobbling. Start in front of the step, on the floor, facing away from the step, with toes that are up on the step turned out about 5-10 degrees. Slowly step backward and onto the step, lifting up on your toes and allowing heel to return to the step (reverse step-up). Make sure the leg on the step is doing the lifting without pushing off with the leg on the floor. Then reverse the movement and slowly lower back to the floor. On each repetition, try to mentally force your knee to stay tracking right above your middle toe and slightly pressed outward rather than allowing it to collapse in toward the midline of the body. Perform this exercise 2-3 times a week, 2-3 sets of 10-12 repetitions, taking 2 seconds to lift and 2 seconds to lower.

Make sure you are warmed up first. Very often the second and third sets will feel much more stable as the legs get warmed up and familiar with the exercise. Other single limb exercises such as this, step-ups, walking lunges, and single-leg squats will improve your balance by strengthening the smaller muscles in your ankles and larger muscles around the knees and hips.