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Patellofemoral Pain Syndrome

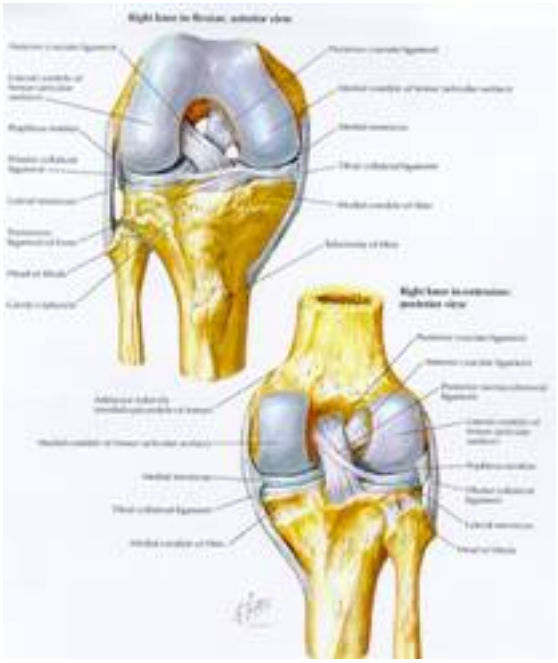
Patellofemoral pain syndrome can be defined as a Retro-patellar (behind the knee cap) or Peripatellar (around the knee cap) pain, resulting from physical and biomechanical changes on the patellofemoral joint. It should be distinguished from chondromalacia, which is an actual fraying and damage of the articular cartilage of the patella.

People that have PPS have anterior knee pain that typically occurs with activity and often worsens when going down steps or hills. The pain can occur with sitting for prolonged periods of time, and affect one or both knees at the same time.

At this time there is a lack of consensus regarding the cause and treatment of the syndrome. To understand PPS we first need to understand the anatomy.

Anatomy of the Knee

The bones that make up the knee joint are the Femur, Tibia, Fibula and Patella. The Femur has a groove that the patella sets in which is named the patella groove also known as the patellofemoral groove. It is lined with an articular cartilage, the same as the back of the patella.



Ligaments hold the knee together and keep the bones from moving; the ligaments of the knee are; Anterior cruciate ligament, Posterior cruciate ligament, Medial collateral ligament, Lateral collateral ligament, Transverse ligament, and the ligament of Wrisberg and the medial and lateral meniscus. The medial and lateral meniscus also works as a shock absorber for the femur and the tibia so that they don't collapse onto each other.

The muscles that affect PPS are the Quadriceps, Hamstrings, and Planterflexion muscles of the lower leg. The muscles of the Quadriceps are the Rectus Femoris, Vastus Intermedius, Vastus Lateralis, Vastus Medialis; the muscles of the Hamstrings are the Biceps Femoris, Semitendinosus, and Semimembranosus. The Planterflexion muscles are the Soleus and Gastrocnemius. All these muscle play a role in PPS and the treatment of the syndrome.

The patella moves within the patellofemoral grove of the femur. Several forces act on the patella to provide stability and keep it tracking properly.

One of the common misconceptions is that the patella only moves in an up and down direction. But in fact, it tilts and rotates, so there are various points of contact between the undersurface of the patella and the femur. Contact at any of these areas, sometimes combined with improper tracking of the patella that is often not seen by the eye, is one of the causes of patellofemoral pain syndrome.

Causes

Many theories have been proposed to explain patellofemoral pain. These include biomechanical, muscular and overuse theories. Literature suggests that the aetiology of patellofemoral pain syndrome is multifactorial.

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.

Biomechanical Problems and Muscular Dysfunction

When looking at Biomechanical problems, there has been more than one factor identified as a primary cause of patellofemoral pain.

Flat foot and foot pronation are often used interchangeably. Flat foot causes compensatory internal rotation of the tibia or femur that upsets the patellofemoral mechanism. Arch supports or custom orthotics can help with the internal rotation of the tibia, in patients with patellofemoral pain due to flat feet.

Normal foot compared to high arch foot provides less cushioning for the leg when it strikes the ground. This places more stress on the patellofemoral mechanism, particularly when a person is running. Proper footwear, such as running shoes with extra cushioning and an arch support can be helpful.

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.

Quadriceps muscles hold the patella in the patellofemoral groove, if one of the muscles should become weaker than the others the patella will track to the strong side and changing the Q angle. When the Q angle is changed it can cause the patella to move out of the patellofemoral groove, causing retro-patellar pain or pain under the kneecap.

The 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 seem to become weaker then the others quadriceps muscles 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 can place excessive lateral force on the patella and can externally rotate the tibia that can upset the balance of the patellofemoral mechanism.

Hamstring muscles we know flex the knee, but tight hamstrings can place more posterior force on the knee, which causes pressure between the patella and the femur to increase.

Adductor muscles play a role in the stability of the pelvis, which can cause an external rotation that may result in compensatory foot pronation. A simple stretch can improve muscular efficiency.

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

As you can see simple stretching can help to alleviate the pain from patellofemoral pain syndrome and other muscle skeletal pains. And with proper stretching before and after any exercise program or sport you can help to alleviate PPS before it starts.

Patellofemoral Pain Syndrome Treatment, what can you do?

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.

Knee Exercises

Strengthening the muscles that support the knee with knee exercises is most important in protecting your knees from injury and knee pain.

Weak or fatigued muscles cannot adequately support the knee joint or absorb shock before it gets to the knee and the extra stress placed upon the knee can cause injury to the structures of the knee. Strengthening exercises can make the muscles tight, so follow strength exercises with stretching exercises.

Stretching the muscles that support the knee with knee exercises is also important in preventing injury. Flexible muscles are not as easily injured as tight muscles. Tightness of muscles connected to the knee can also pull the knee out of alignment.

When doing stretching knee exercises, be careful to go slowly and not to overstretch. You do not want to tear a muscle.

You need to increase the duration of your knee exercises gradually to avoid overuse injuries and knee pain. Be patient. You will see results.

Strength must be built up gradually. When muscles, tendons or ligaments are stressed slightly beyond their limits, microscopic tears occur. This is normal, and as these tears heal the muscles actually become bigger, firmer and stronger. These microscopic tears must be given adequate time to heal or chronic problems can develop. Try not to exercise the same muscle groups two days in a row to give your body a chance to recover. Doing strengthening knee exercises three or four times a week is enough. Stretching knee exercises can be done more often.

The goal is to prevent injury and knee pain, not cause it.
Don't ignore pain. Pain is your body's way of protecting you from hurting yourself further. It is not unusual to experience mild stiffness and aching of the muscles that lasts up to a day after exercising. But hardly being able to move for a few days after exercising means you have overdone it. It's difficult to know when to quit when you doing knee exercises. Often, the pain doesn't' set in until a day or two later. It happens. If it does, you will have a greater understanding of your body's limitations.

When you have overdone your knee exercises.
Rest is important for inflamed muscles/tendons. Applying ice wrapped in a cloth can help reduce inflammation and pain and speed up healing. Knee pain should be completely gone before fully resuming your knee exercises program, however, lightly exercising the sore muscle may help decrease muscle soreness.

If you are currently experiencing knee pain or have a knee condition/injury and/or have a very limited range of motion, or are simply not sure which knee exercises are safe for

you to do, see a physical therapist (physiotherapist). An osteopath can assess your condition and give you a customized treatment / exercise plan.

Strengthening Knee Exercises

Note: If you are experiencing knee pain or have a knee injury or condition, ask your doctor or physical therapist what exercises are appropriate (safest and most effective) for you to do before performing knee exercises.

How Often to do Knee Strengthening Exercises

In general, any strengthening exercises should only be done about every second day or three times per week on non-consecutive days to allow healing and to avoid overuse injury.

How Many Repetitions and Sets

If you are a beginner to exercise, start with five repetitions of each exercise - or less if the exercise is difficult. If you do not have post exercise pain, slowly add a couple of repetitions each week until you reach 10 - 15 repetitions. To increase endurance add a second set of 10 -15 repetitions after you can handle one set. When two sets because easy to do, you can add a third.

*NOTE: There are several strengthening exercises to choose from for some muscles. Choose one per exercise session.

Do not exercise the same muscle group on consecutive days.

WARM UP first! Warming up with 5 minutes of low-impact aerobics, such as walking or riding a stationary exercise bike, increases blood supply to the muscles to help prevent injury.

Quadriceps Strengthening

Note: Only do one quad strengthening exercise per exercise session with the exception of the quad strengthening contractions, which can be done additionally.

Quad Strengthening Contractions:

Sit in chair. Move forward so that you are sitting at edge of chair. Extend legs, heels to floor. Keep knees straight (or as straight as possible if you have arthritis.) Tighten thigh muscles. Hold for count of 10. Relax for count of 3. Do 10 repetitions. You can do this

several times throughout the day. You can build up to 2 or 3 sets of 10 repetitions at a time.

Quad Strengthening Leg lifts:

Lie flat on back. Bend left knee at 90-degree angle, keeping foot flat on floor. Keeping the right leg straight, slowly lift it until right foot is the height of the left knee. Hold for a count of 3. Repeat 10 times. Switch sides. Work up to 10 sets of 10 over several weeks.

Safety Tip:

Leg lifts: Lifting both legs at the same time causes excessive stress on your lower back so

only lift one leg at a time; the opposite leg should be kept slightly bent with foot on floor.

Quad Strengthening Short-Arc Leg Extensions:

Sit or lie on floor. Place a rolled up towel under your thigh for support. Keep you leg straight and raise your foot about six inches off the floor. Hold for 5 seconds. Slowly lower your foot, bending your knee. Do 10 repetitions. Switch sides.

Quad Strengthening Knee Dips:

Stand with knees slightly flexed. Point your toes straight ahead.

Make sure your kneecaps are also pointed straight ahead.

Lift one leg up and balance on the other leg. Slowly lower yourself up and down ONLY a few inches. Keep the knee of the leg you are balancing on slightly flexed. Your knees must remain pointing straight forward. Do not let them turn inward. Stand straight, do not lean you body to one side. Do 10 dips. Switch sides.

If you feel pain in your knees, start with fewer dips.

Quad Strengthening Partial Squats:

Stand. Keep back straight, knees hip-width apart and pointing straight ahead. Slowly lower and move your buttocks backward as if you were sitting in a chair (don't bend your knees beyond a 90-degree angle, if 90 degrees is too difficult bend even less). Hold position for a count of 5. Do ten squats. Stop if you feel pain in your knees.

Safety Tip: Make sure your knees do not extend beyond your toes when doing partial squats. Keeping your weight behind your knees reduces the pressure on the knee joint

during the squat. Bending the knees beyond 90 degrees (a right angle) places excessive strain on the knee.

Hamstring Strengthening

Note: Only do one hamstring strengthening exercise on the same day.

Seated Hamstring Strengthening Contractions:

Sit in chair, with knees bent to 45 degrees and heels on floor (toes lifted up). Don't move heels but pull back on them, digging heels into floor. You will feel tension in you hamstrings. Hold for count of 5 - 10 seconds. Relax for count of 3. Do 10 repetitions.

Lying Hamstring Strengthening Contractions:

Lie on back, knees bent about 45 degrees. Dig heels into floor. You will feel tension in your hamstrings. Hold for count of 5 - 10 seconds. Relax for count of 3. Do 10 repetitions.

Hamstring Strengthening Curls:

Lie on stomach. Place left foot onto the back of the right heel. Slowly pull your right heel toward your buttocks - resisting with the left leg. This contracts the hamstrings. Hold for a count of 10. (Keep pressing your left foot and right heel against each other) Hold for a count of ten and relax for count of 3. Do 10 repetitions.

Walking backwards helps to develop the hamstrings. When walking backwards, your weight is distributed more evenly, resulting in less strain on your knees.

Other Strengthening Exercises for Knee Stability

Hip Adductors / groin muscle and inner quad muscle (VMO) Strengthening:

Sit in chair, put fist between knees, squeeze together knees. Hold for count of 10. Relax for count of 3. Do 10 repetitions.

Lie on floor on your right side, shoulder and hips aligned. Use your right hand to prop up your head. Place the left hand on floor in front of you to help balance yourself. Bend left leg and bring it to the floor in front of you. Slowly raise your right leg about 10 inches off the floor then, hold for a second, then slowly lower leg to ground. Lift 10 times on each side.

Hip Abductors (Outer Thigh) strengthening:

Lie on floor on your right side, shoulder and hips aligned.

Bend right leg (leg on floor) to 90 degrees.

Slowly raise you left leg about 18 inches, hold for a second, then slowly lower leg.

Do 10 repetitions. Repeat on other side.

Glutes Strengthening Backward leg swing:

Hold onto back of chair for support. Swing leg back at a diagonal until you feel your buttocks tighten. Tense muscles as much as you can and swing leg back a couple more inches. Return leg to floor. Repeat 10 times.

Switch sides .Do 10 repetitions. Repeat on other side.

Balancing Knee Exercises

(Helps in knee stability)

Hold onto back of chair or counter top for support. Stand on one leg for one minute. Switch sides.

As your balance improves, use one hand only for support. Next use one finger only for support, then progress to letting go, but keeping your hands within a couple of inches above chair in case you lose your balance. Do not lean your trunk to one side.

To increase difficulty, shift weight onto the ball of the foot.

Stretching Knee Exercises

Note: If you are experiencing knee pain or have a knee injury or condition, ask your osteopath what exercises are appropriate (safest and most effective) for you to do.

How Often to Stretch

In general, stretching exercises may be done daily but every second day or 3 times per week is enough. Stretching exercises are often prescribed twice per day or more by physical therapists for the treatment of knee pain, the specific exercises recommended depend on the cause of the pain.

How Long to Hold a Stretch

For stretching exercises, the stretch should generally be held for a total of about 60 to 90 seconds. Holding a stretch for 30 seconds only requires 2 or 3 repetitions. Some people prefer to do more repetitions of 5 or 10-second stretches or just one 60-second stretch.

WARM UP before stretching with 5-10 minutes of low-impact aerobics (e.g. walking, stationary bike). Warmed up muscles are more responsive to stretches and less likely to tear.

Stretches should be performed without any bouncing and in a slow & controlled fashion

Calf Muscles Stretch:

To stretch left calf muscle, step back with left leg, forward with right. Bend right knee (keep left leg and back in a straight line as you lean forward) until you feel a gentle stretch in the left calf. Do not roll foot out to side. Keep heel flat, foot forward. Hold 30 seconds. Repeat on other side.

Quad Muscle Stretch:

Stand. Bend right knee, grab front of right ankle and bring heel to buttocks with hand. Keep knees together. Do not arch back. Do not let leg go to side. Point knee toward floor. Tighten buttocks and tuck tailbone under to increase stretch.

Hold for 30 seconds. Repeat on other side.

Hamstring Stretch:

Standing position

Keep one leg on ground; put one foot on chair with leg straight. Bend forward at the hip. Hold for 30 seconds. Repeat on other side. *Do not attempt to touch your toes as this will stretch your back, and the goal of this exercise is to isolate your hamstring muscles in the leg that is being supported by the chair.

Sitting in chair hamstring: Straighten one leg, keeping heel on floor. Lean forward at hips, keeping back straight. Don't try to touch your toes. Hold for 30 seconds. Repeat on other side.

Iliotibial Band Stretch:

Standing position:

Stand up. To stretch the right side, cross right leg behind left leg. Bending from the hip, lean torso to the left - pushing hips to the right. The stretch is felt on the outer right hip and thigh. Keep right leg straight, left knee slightly bent. Hold for 30 seconds. Repeat on other side.

Sitting position:

Sit in chair or on floor. Bring right foot to outside of left leg, bringing knee towards opposite shoulder so that the knee crosses the midline of the body. Hold for 30 seconds. Repeat on other side.

Hip Adductors (Upper Inner Thigh) Stretch:

Standing: Step off to the side with the right leg. Bend left knee slightly (do not extend knee beyond toe) and move your right foot further to right until your feel a stretch in your right inner thigh. Hold stretch for 30 seconds. Repeat on other side.

Sitting position: Sit on floor, spread legs into a V position. Slowly lean forward from your hips, keeping your back straight, until you feel the stretch. Do not bounce. Then lean towards the right, foot then left foot. Hold for 30 seconds.

Hip Abductors (Upper Outer Thigh) Stretch:

Sit on the floor, legs extended in front of you.

Bend right leg and place right foot on floor on outside the left knee.

Twist upper body to right and use left elbow to gently push against outside of right knee until you feel a gentle stretch in the right hips, buttocks, and lower back.

Hold for 30 seconds. Repeat on other side.

Hip flexors (front of hips) Stretch:

Tightness in these muscles can affect the alignment of the knee bones.

Standing Exercise: Step forward with the right leg, bending right knee (to increase the stretch, take a larger step). Do not extend right knee past toes. Keep left knee slightly bent with heel off the ground. Keep back upright. This stretches the front of the hip on the left side. Push the left hip forward to increase the stretch.

Hold for 30 seconds. Repeat on other side.

Gluteal Stretch (back of hips / buttocks):

Stand in front of chair, about two feet away from chair. Place left foot on chair, leg bent. Bring your chest towards your knee, keeping back straight. Hold for 30 seconds. Repeat on other side.

*Of all the above knee exercises, the quadriceps strengthening contraction is probably the easiest, safest and most important exercise you can do to prevent knee pain and

injury. Those who have trouble fitting in exercises into their schedule can always do this exercise while watching television.