

**IMPORTANT:** Before undertaking any new exercises you should contact a Doctor or Physical Therapist to make sure that they are appropriate for you do. Without doing so, carrying any exercises out described in this article is at your own risk.

## Kneecap Pain

*By Karen Doyle, Physical Therapist*

There are many types and causes of knee pain, but in this article I am going to talk about non traumatic pain involving the kneecap (patella). You may have heard of the terms patellofemoral pain (PFP), chondromalacia patellae or runners knee – all used to describe pain around or under the kneecap.

This problem is not limited to runners; athletes active in sports such as cycling, skiing, football or other sports where a lot of pressure is put through their knees can suffer with it. It is common with up to 25% of sport participants of the population complaining of this type of pain.

### Symptoms

Common symptoms of patella femoral pain can include:

- Pain located around or under the kneecap noticed when running, prolonged sitting, stair climbing, kneeling, hopping, cycling
- Gradual onset, not related to any traumatic event such as a fall, twist, or knock
- Stiffness after sitting for long periods
- Crepitus or crunching noises under the knee cap

### What causes the pain?

In order to understand how it occurs, it is useful to understand the structure of the knee and the kneecap. The kneecap is a triangular shaped bone that runs in a groove formed by the thigh bone (or femur). At the top the quadriceps tendon inserts into it, below the patellar tendon connects it to the shin bone (or tibia) and from each side attachments from the fibrous tissue that surrounds the knee joint, and from the right side it also receives attachments from the vastus medialis (VMO).

The kneecap moves in this groove when the knee bends and straightens. When the kneecap does not track properly in the groove, it can rub on the sides of the groove leading to pain and inflammation. In these cases the kneecap tracks too laterally i.e. it tends to track more the outside of the knee. Due to the excessive lateral tracking, stress can also be placed on the fibrous tissue on the inside of the knee. This can also be a source of inflammation and pain.

Anything that changes the way the kneecap moves in the groove can lead to patellofemoral pain.

This can include:

- Imbalances between the muscles on the outside (lateral quads, ITB) of the leg versus the inside (VMO) as they put a greater lateral pull on the kneecap. The VMO is particularly susceptible to weakening after knee injury where the leg is immobilised or full range of knee motion is restricted for a period of time. Sometimes clients (both runners and cyclists) will report a feeling of strain or tenderness just to the top inside of the knee which they can feel

by pressing when the knee is bent. They notice it during running, cycling or stair climbing. This can be a sign that the VMO is weak, and if not addressed could later lead to pain around the kneecap.

- Studies have shown that tight ITB, weak gluteus medius and abductors, weak external rotators, and weak core can give rise to instability in the pelvis. Pelvic instability can cause the thigh bone (femur) to rotate inward more than usual. This changes the orientation of the groove so the kneecap does not track in it properly leading to pain. A rough test of your pelvic stability would be to perform a lunge or squat and note whether the knee rolls inwards as you perform it. Your knee should keep pointing straight and not dip or turn inwards.
- Increased foot pronation. Pronation is the rolling inwards of the foot during walking or running. While this movement happens at the foot, it also causes a compensatory movement in the shin bone which affects the alignment at the knee impacting the kneecap and causing pain.
- The position of the shin bone (tibia), excessive inward or outward rotation of the lower leg can affect the alignment at the knee. It has been suggested that people with low arches may be more susceptible to PFP than those with normal arches.
- When cycling, a seat set to far forward will increase patellofemoral forces and the likelihood of knee pain. You can check your saddle position by using methods such as the plumb bolt method.

### What can you do to help it?

The best thing to do is to get assessed and treated by your Physical Therapist. They will advise you on what needs to be strengthened, work out tight muscles, perform gentle mobilisations to realign the pelvis if needed, tape your knee, and determine whether to refer you for orthotics should you need them.

Just a note on taping: Tape can be applied to the kneecap to put it into the correct alignment and try and reduce pain when training or racing and is often used as part of the rehabilitation process. Kinesio tape (the bright blue, pink or black tape you might see people wearing) can also be used to help align the kneecap, as well as supporting the VMO, and reducing the tension through the tight muscles. But at the end of the day you need to fix the root cause – muscle imbalance, gait or feet, pelvic instability – to get longer term relief from knee pain.

Often *prevention is better than cure* so the following are worth considering:

- Prevent imbalances around the knee:
  - Stretch lateral quads, hamstring, ITB (or use foam roller) and the calfs to keep all muscles around the hip and knees flexible
  - If you notice strain or pain on the inside of the knee strengthen the VMO. See sample exercises below.
- Prevent imbalances at the pelvis
  - Strengthen the gluteus medius. The gluteus medius is a key muscle in maintaining pelvic stability. See exercises below.
  - Stretch or use a foam roller for the ITB

- Stretch the hip flexors. Tight hip flexors can contribute to pelvic instability
- Consider core work to improve overall pelvic stability.
- **Massage**
  - Massage can be useful to help loosen out tight muscles such as quads, ITB, calfs and hamstrings
  - Use a foam roller self massage the ITB
- **Shoes/runners**
  - Ensure that you are wearing the right pair of runners for your gait. Gait scans in some sports shops can help identify your running style and suggest shoes that are correct for you. Some clients have reported that since wearing the proper type of shoe for their feet they have not had any knee pain.
- **If a cyclist adjust the seat position.**
  - If you are a time trailer or tri-athlete a forward seat height can give aerodynamic advantage but consider adjusting seat height back to relive the forces on the knee when training on long distance cycles.

## Exercises

I have included some sample exercises to help prevent or assist with knee pain. If you are suffering from knee pain a therapist will tailor a more specific rehabilitation programme for you based on your individual assessment and requirements.

### Neuromuscular control of VMO

This exercise ensures that the VMO is contracting correctly. This ability to contract correctly and at the right time (called neuromuscular control) can be inhibited by pain or swelling in the knee. Sit on the ground with your leg outstretched in front of you. Put your hand just above the knee and a little to the inside – this is the VMO. Now try and bring the back of your knee to touch the floor, i.e. straighten the leg more. You should feel your VMO contract. If not repeat this exercise until you can feel the VMO start to contract, and continue it until the VMO is contracting for each repetition.

### VMO Alphabet

Once the VMO is contracting properly, this exercise will help to continue strengthen it.

1. Sit on the floor and support your body weight on your hands
2. Raise your leg approx 6 inches (15 cm) off the floor.
3. Keeping your leg straight, point you foot and using your foot as a “pen” draw the alphabet in the air.
4. The movements should be small and you should feel the VMO working as you do the exercise.

### Strengthening the gluteus medius.

1. Lie on your side with the side to be strengthened on top
2. Bend the lower leg slightly at the hip and knee for stability
3. Bring the leg **backwards** so it lies behind the hip.
4. Slowly raise the upper leg until 1-2 inches over the hip

5. From this position slowly lower the leg (1 repetition)  
Repeat: 10-12 repetitions on each side, and build up to being able to perform 3 sets.

**Note:** place your hand on the gluteus medius – this is located above and to the outside of your jeans back pockets. You should feel the contraction here as you raise your leg upwards. It is important to keep the leg behind you as this localises the effort to the gluteus medius muscle, if it comes forward too much other muscles become involved. Also do not raise the leg much over the level of hip, raising it higher just involves use of the back muscles and it's not working the gluteus medius. Add ankle weights if 3 sets can be done easily.

### Lunges or squats

When you have built up the strength of the VMO and gluteus medius perform a lunge or squat exercise. With weak pelvic stabilisers, the knee can roll inwards when performing a squat or lunge. The aim of this exercise is to develop knee control and to further strengthen the quads, abductors and gluteal muscles so that the knee does not roll inward. When performing the exercise ensure the knee stays in line with the toes and does not move inwards over the side of the foot. Use a wall or stable surface for balance to help you get the movement right and under control. Make sure to stretch quads after these exercises. Repetitions: 10-12. No of Sets: 3

### References:

- Brukner P, Kahn K 2007. *Clinical Sports Medicine 3<sup>rd</sup> Edn*. McGraw-Hill, North Ryde
- Brushø C, Imich P, Nielsen M, Albrecht-Beste E 2008. *Acute patellofemoral pain: aggravating activities, clinical examination, MRI and ultrasound findings*. British Journal of Sports Medicine 42, pp.64-67
- Dierks, T, Manal K, Hamill, J, Davis, I 2008. *Proximal and Distal Influences on Hip and Knee Kinematics in Runners With Patellofemoral Pain During a Prolonged Run*. Journal of Orthopaedic & Sports Physical Therapy 38 pp.448-456
- Fagan V, Delahunt E 2008. *Patellofemoral pain syndrome: a review on the associated neuromuscular deficits and current treatment options*. British Journal of Sports Medicine, 42, pp.789-795
- Hertling D, Kessler R 2006. *Management of Common Musculoskeletal Disorders 4<sup>th</sup> edn*. Lippincott Williams & Wilkins, Philadelphia
- Lin Y, Lin J, Cheng C, Lin D, Jan M 2008. *Association Between Sonographic Morphology of Vastus Medialis Obliquus and Patellar Alignment in Patients With Patellofemoral Pain Syndrome*. Journal of Orthopaedic & Sports Physical Therapy 38, pp.196-201
- Lowry C, Cleland J, Dyke K 2008. *Management of Patients With Patellofemoral Pain Syndrome Using a Multimodal Approach: A Case Series*. Journal of Orthopaedic & Sports Physical Therapy 38 pp.691-702
- S M Cowan, K M Crossley and K L Bennell 2009. *Altered hip and trunk muscle function in individuals with patellofemoral pain*. British Journal of Sports Medicine 43, pp.584-588