

Knee Injuries

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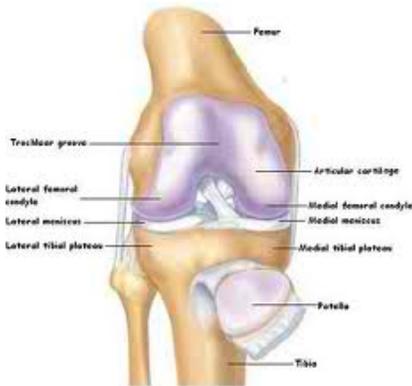


Instability of the Patella

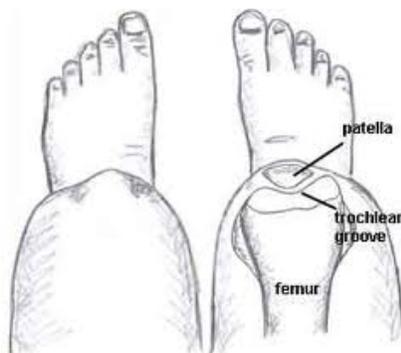
The *patella* (kneecap) has two important functions. It acts as a pulley, to transfer forces between the quadriceps (thigh) muscle and the patellar tendon. It also improves the leverage of the quadriceps. It does this by transferring the line of force further in front of the knee, for more efficient force production.



As a pulley, the patella slides in a groove in the lower end of the *femur* (the thigh bone). This is known as the *trochlear* groove. When the knee is fully straight, the patella rests at the top of, and slightly above the trochlear groove.



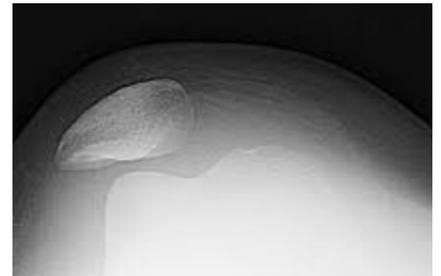
As the knee bends, it slides down and fully enters the groove. The further the knee bends, the lower and deeper the patella slides into the trochlear groove.



Instability

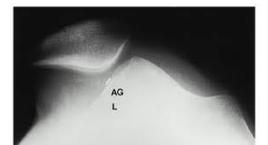
In certain situations, the patella is at risk of jumping out of the groove, either partially (*subluxation*), or fully (*dislocation*). This problem is known as *patellofemoral instability*. It is most likely to occur as the knee starts to bend, generally within the first 20° to 30°. This is because the patella becomes more stable with deeper bending, as it moves lower and deeper into the trochlear groove. The vast majority of subluxations or dislocations will occur with the patella shifting towards the outside of the knee. This is known as *lateral instability*.

Subluxation: A subluxation occurs when the patella moves towards the lateral side of the groove, but does not slide completely out of the joint. Unlike a dislocation, it will relocate



immediately due to a reflex protective muscle contraction. Some people suffer from multiple subluxations or minor dislocations. The feeling they get is of the knee suddenly 'giving way' or feeling unstable. This will be more common on going down stairs, and on running, jumping and twisting. There may or may not be associated pain and swelling. The knee will often feel normal afterwards, or may be sore for a few days.

Dislocation: In this instance the patella jumps fully out of





the trochlear groove. It may relocate by itself, but often needs to be assisted to do so. This will generally be more painful and traumatic. There will usually be tearing of the medial patellar

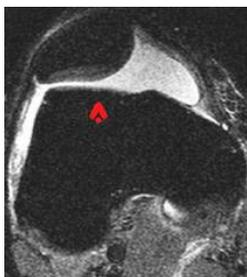
ligaments (see below), and associated bleeding and inflammation. There may also be trauma to the bones of the patella or femur. Swelling will result from soft tissue or bone injury, and may be immediate and severe. In people who are very flexible, the patella can dislocate and cause little or no damage. There will be minimal swelling and a quick recovery. Unfortunately, the risk of ongoing dislocation is high, and future episodes may be more traumatic.



Reasons for Instability

There are many reasons why the patella can become unstable. The most common of these are:

1. *Trochlear dysplasia.* This is when the trochlear groove has an abnormal anatomical shape. There are many variations to this problem, but in effect the result is that the groove is not deep enough. Adequate depth of the groove, and good conformity between the shape of the groove and patella, are important for stability. The cause of dysplasia may be genetic. There is also some evidence that it develops during childhood. A combination of genetic and developmental factors may be to blame. Many experts believe this is the most important factor leading to patellofemoral instability. It is present in up to 96% of people with recurrent dislocations. The picture on the left is an MRI cross section of the knee. The arrow shows a flat

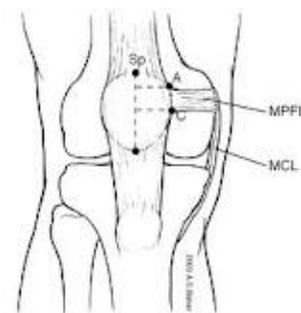


trochlear groove, which differs to the normal groove shown on the right.

2. *Patellar dysplasia.* Similarly, an abnormal patellar shape can lead to instability, due to poor conformity between the bones. This is not as common as trochlear dysplasia.



3. *Ligament laxity.* Ligaments and other tissues help to hold the patella from moving too far from side to side. The most important of these is the *medial patellofemoral ligament (MPFL)*. It will be lax in some people, and will usually be torn when the knee dislocates. It may stretch & loosen over time in certain other knee conditions.

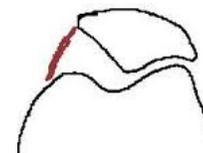


4. *Patella alta.* In some people, the patella naturally rests higher above the knee than average. For this reason, it takes longer to enter the groove as the knee starts to bend. While greater stability is



provided as the patella moves more deeply into the groove, with patella alta it takes longer to get to this point of stability. This is a common finding in people with patellofemoral instability.

5. *Lateral patellar tilt.* Tightness in the ligaments and other connective tissues that support the lateral side of the patella will tend to pull the kneecap towards the outside. This can increase lateral instability, particularly if there are other associated risk factors.



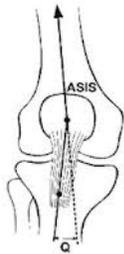
6. Poor muscle control. Lack of muscle control around the knee has long been known to be a risk factor for instability, particularly in certain people. Of equal or greater importance is poor hip muscular control. This reduces the ability of the knee to resist side to side and twisting movements, both of which increase the risk of instability.



7. General *hypermobility*. People who are naturally very flexible can be at greater risk of joint dislocations.



8. Increased '*Q angle*'. The quadriceps angle is the one formed



between the line of the muscle and the line of the patellar tendon. A large Q angle increases the forces pulling the patella toward the outside. This can occur for a number of

reasons:

(a) A *valgus* knee deformity. This is when the person is excessively 'knock-kneed'.



(b) *Femoral anteversion*.

This is when the hip joint is formed in such a way that the thigh naturally tends to twist inwards.

(c) *External tibial torsion*. In this instance the lower leg naturally twists out relative to the knee.

(d) The Q angle may be normal at rest, but increases during movement because of poor muscle control.

9. *Varus* deformity. A 'bow legged' shape can also be a risk factor.



10. *Trauma*. A patella that is stable to begin with can dislocate due to a high impact or twisting force. This is quite uncommon. The vast majority of people with instability episodes will have one or more of the above risk factors.

Diagnosis

An expert in sports medicine will be able to diagnose the problem. 'Giving way' of the knee can be due to causes other than patellofemoral instability. There are also many different forms of instability. It is important to determine the extent and type of deformity present, to decide on the best treatment options. If there has been a recent dislocation, an XRay and possibly an MRI will be recommended. This is to rule out significant bone injury. In some cases, an *arthroscope* ('keyhole' surgery) will be necessary to remove or repair damaged bone (see below).



Treatment

It is important to minimize the trauma due to the injury. The dislocated patella should be relocated as soon as possible, then RICE treatment commenced.

See [http://www.cssphysio.com.au/pdfs/RICE_Procedure\(1\).pdf](http://www.cssphysio.com.au/pdfs/RICE_Procedure(1).pdf)

It is important to stabilize the patella in the early stages, to ensure it does not re-dislocate. This may require the wearing of a knee brace, however strapping tape may be just as effective.



Walking and muscle strengthening is encouraged from the start, but the exercises should be supervised. It is important to avoid putting the knee into positions where it is vulnerable to re-injury. It is also important to settle the swelling and inflammation as soon as possible. Strengthening of muscles around other joints, particularly those of the hip, can be commenced from the start.

Recovery time will be very much determined by the extent and type of injury. When possible, resisted full-weight-bearing exercises will be commenced early. It is important to be guided through these exercises, to ensure good alignment of the pelvis, hips, knees and feet. Strengthening of certain muscles is particularly important. These include the lumbopelvic core muscles, the gluteals, hip external rotators, and quadriceps.

Before return to normal function, including sport, it will be necessary to ensure adequate strength is regained. It will also be necessary to test that the knee will be able to cope with the demands of sport.

Surgical Management of Patellofemoral Instability.

When the knee is very unstable surgical correction may be required. This will generally be considered for people who have had two or more dislocations. This is because research has shown that after a second episode on the same knee, the likelihood of ongoing dislocation is high.

The choice of surgical technique for patellofemoral instability is one of the most contentious areas of orthopaedic & sports medicine. Over the past century, close to 100 different operations have been described. These range from minor ligament repair to major reconstruction of bones and reshaping of the joint surfaces. If surgery does become necessary, it is important to ensure that the operation is tailored to the patient. Because there are many different anatomical reasons for instability, changes to certain of these anatomical structures will be appropriate for some people and not for others.

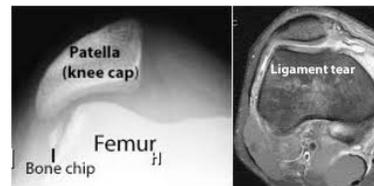
Even today there are many different surgical procedures being performed. The type of surgery will often be dependent on the preference of the surgeon, and what specific injuries have been sustained. This is determined by examination, MRI scan, and possibly at the time of surgery.

The more common surgical procedures for patellofemoral instability are described below. A combination of two or more of these procedures may be performed.

1. *Arthroscopic resection or repair of bone fragments.* Sometimes it will be necessary to have surgery soon after the injury. If there is bony damage, and particularly loose bodies in the knee, these may need to be removed or repaired. As the patella dislocates, or more particularly as it relocates, it is common for bony injury to occur. This will generally be at the medial aspect of the patella (above), or the lateral side of the *femoral condyle* (the bony prominence on the outside of the trochlear



groove, shown in the picture on the left).



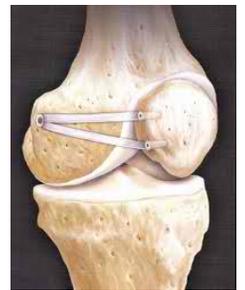
During surgery, the whole knee can be assessed to determine if

damage to other structures has occurred.

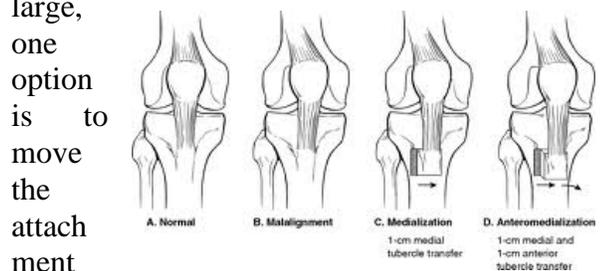
2. *Medial patellofemoral ligament repair.* The image on the right above is an MRI taken after patellar dislocation. The ligament to the right of the patella is stretched and loose (dark wavy line). This ligament is almost always torn with a dislocation. This is one of the major factors associated with re-dislocation. If the knee is otherwise stable, it may be possible to repair this ligament and have a good long-term result.

3. *Medial patellofemoral ligament reconstruction.*

If the ligament repair fails, or the patella is quite unstable, the surgeon may opt for a reconstruction. This is one of the most common procedures performed. Tissue is taken from some other part of the body (usually from a hamstring tendon), and a new ligament reconstructed from this. There are dozens of subtle variations in how this procedure is done. Basically, the tendon is drilled both into the medial patella, and the medial femur, in the same location as the ligament. The graft will be much stronger than the original ligament.



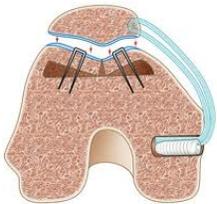
4. *Medial or anteromedial tibial tuberosity transfer.* When there is a large Q angle, or the forces pulling the patella laterally are large,



one option is to move the attachment of the patellar tendon. By placing it medially (toward the inside of the knee), the patellar and muscle pulley system can move more

straight up and down, with minimal sideways glide of the patella. Sometimes the attachment will also be moved forward (*anteromedially*), in an effort to reduce compression forces between the patella & the femur.

5. *Lateral retinacular release*. A popular surgical technique is to cut the lateral ligaments and other connective tissues (*retinaculum*) on the outside of the patella. The theory is that this will result in less lateral forces pulling the patella out of the groove. Years of experience has shown that this procedure is unlikely to be successful if performed on its own. These days, it is often combined with other of the above surgical techniques. Even then, it is a technique that can have unpredictable results. When performed inappropriately, it can result in medial patellar dislocation, or worsening of lateral instability.



6. *Trochleoplasty*. When there is trochlear dysplasia (flattening of the groove), some surgeons will reconstruct the *femoral condyles* (the bony prominences on either side of the groove).

This will be to deepen the groove and provide greater mechanical support for the patella. Because this procedure is often performed for severe instability, it is often combined with ligament reconstruction (as shown in the picture).

7. *Techniques to treat damaged articular cartilage*. Patellar instability often leads to injury to the articular cartilage (the cartilage layer on the back of the patella or front of the femur). These injuries are often treated surgically, unfortunately with mixed results. Some of the techniques which might be performed include:

(a) *Debridement*. This refers to shaving and smoothing of damaged cartilage, to assist with smoother gliding of the joint surfaces.

(b) *Flap resection*. Sometimes, trauma causes a cartilage ‘flap’ to lift away from

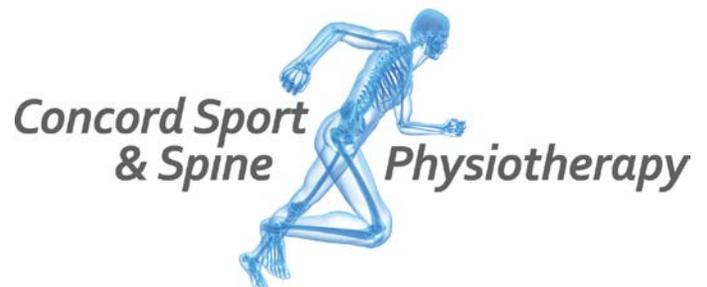
the joint surface. This will often cause a catching or locking sensation during movement, which can be quite painful. The flap will be removed to leave a smoother joint surface.

(c) *Microfracture arthroplasty*. This is a common procedure when there has been irreversible localised cartilage loss. The theory is that creating microfractures to the bone surface will stimulate the body to produce a scar or *fibrocartilage*. This is not as durable as the original cartilage, and will generally be a short term solution.

(d) *Autologous chondrocyte implantation*. This is a relatively new procedure. Cartilage cells are taken from healthy cartilage in an area of the joint that bears little weight. These are then grown in a laboratory for approximately 6 weeks, before being re-implanted into the area where the cartilage is damaged. Results have been variable.

For information on all types of injuries visit:

<http://www.cssphysio.com.au/forpatients.html>



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