



GUIDE TO KNEE PAIN

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Introduction

Injuries to the knee are common and are one of the most common causes of disability in the community. Knee osteoarthritis for example, is second only to heart disease as a cause of disability in the western world.

The intention of this e-book is to describe the most common injuries and how they are managed.

It is beyond the scope of this book to describe every possible knee pathology. The ones covered here probably represent around 90% or more of knee problems. It is not meant as a treat-yourself guide, as this needs to be guided by a qualified professional.

Who is best able to manage a knee?

In Australia knee injuries are typically managed by a suitably qualified physiotherapists, sports physicians and orthopaedic surgeons. General practitioners can have an important role by ordering investigations and prescribing medication such as painkillers and anti-inflammatories.

Management is often a collaborative effort between these health professionals.

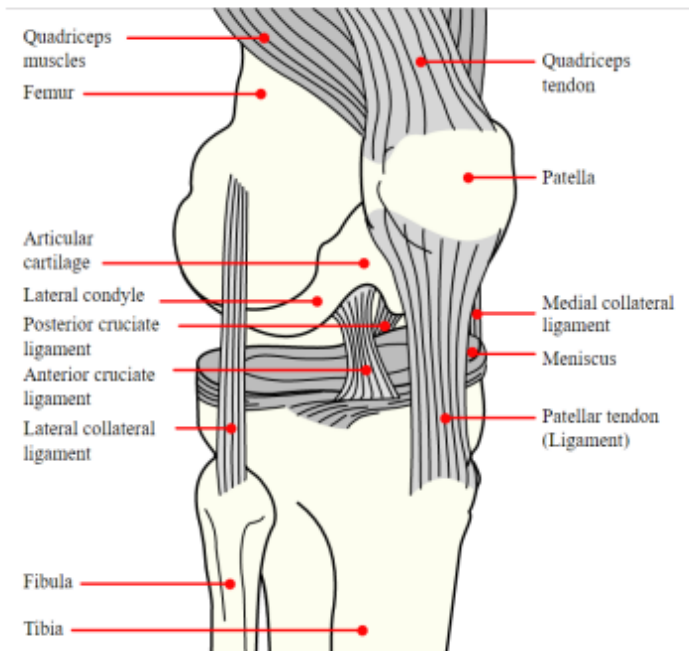
Basic anatomy

The individual anatomy covered in the sections relates to the various injuries, but it is still useful to describe the main structures in the knee. **Image 1** shows the main knee structures.

The knee is as a synovial joint. We have numerous synovial joints in the body including in the fingers and ankles and the feet. The main features of these joints is the presence of articular cartilage which covers the surfaces of the bone, ligaments which hold the bones together and synovial tissue, which is responsible for assisting to lubricate and provide nutrition to the joint.

The knee actually consists of two synovial joints. These are known as the tibiofemoral and patellofemoral joints. The purpose of having two joints rather than one is to assist with adequate distribution of the huge forces that go through the joint. These forces can be up to twenty times bodyweight in some situations.

Anterolateral View (from the outside front)



Anteromedial View (from the inside front)

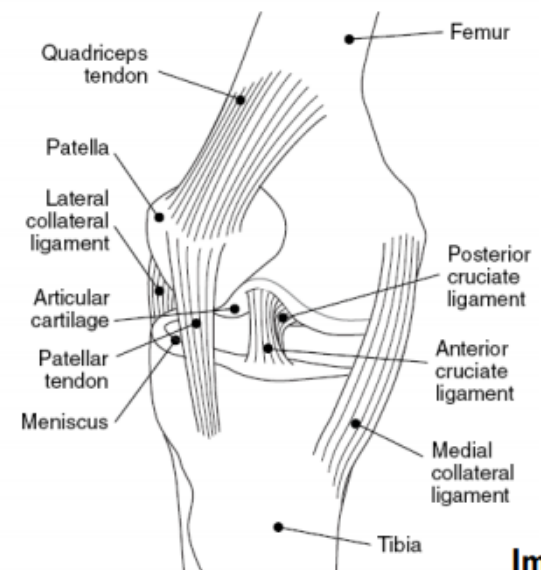


Image 1

What to expect from your treatment provider



Firstly, the healthcare provider should be an expert in the diagnosis and management of your injury. Unfortunately this is not always the case and it is reasonable to ask the person treating you what experience they have had with this problem. It may also be worth speaking to other health care providers and asking for a referral or recommendation.

Your provider needs to conduct a thorough history and needs to know any medication you are on. They need to have an understanding of any relevant family history. They also need to know your goals and expectations

After a thorough assessment which may or may not include medical imaging such as x-ray or MRI, they should be able to give you:

- A diagnosis
- Other possible or differential diagnoses
- A description of how serious the problem is and whether alternative opinions are required
- A list of reasonable treatment options, their potential benefits and side-effects
- How much treatment will be necessary, what their expectations are of you and what the financial cost will be to you

Knee pain and injuries

Unfortunately the knee is commonly injured. The forces exerted on the knee during certain activities such as sport and certain forms of work simply exceed the structural capacity of the tissues. Other knee issues can be related to wear and tear processes, usually referred to as osteoarthritis.

Injury to the following structures will be described by this e-book

- | | | | |
|-----------|---|-----------|---|
| 01 | Medial (tibial) collateral ligament or MCL | 06 | Minor growth plate over-stresses |
| 02 | Anterior cruciate ligament or ACL | 07 | Tendon |
| 03 | Lateral (fibular) collateral ligament or LCL | 08 | Fat pad irritation |
| 04 | Posterolateral corner injuries | 09 | Knee Osteoarthritis |
| 05 | Meniscus | | |

Medial ligament injuries

The medial ligament runs on the inside of the knee. It runs between the thigh bone (femur) and the tibia and resists what is known as valgus stress.

Pain and Symptoms

It is commonly injured in sport and will produce pain on the inside of the knee.

Swelling

The knee will also usually swell, although this can be subtle.

Pain and Symptoms

It is commonly injured in sport and will produce pain on the inside of the knee.

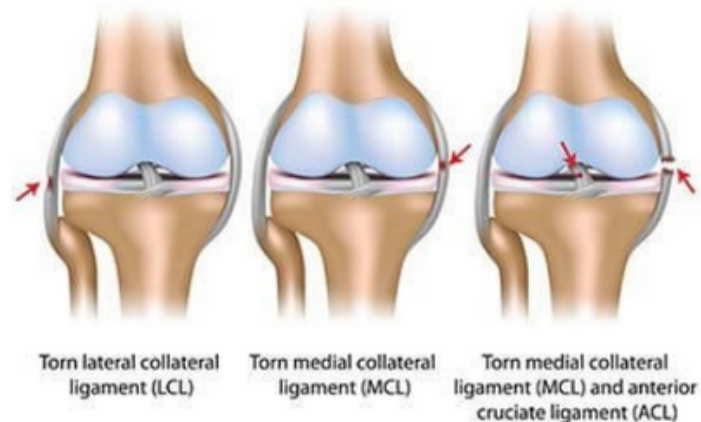
Function

With larger grade injuries the knee may feel loose or unstable, and it is likely to be painful to bend.

Causes of Injury

The most common mechanism is excessive valgus stress to the knee (*Image 2.*) This can be from a contact or non-contact mechanism. The degree of injury is usually proportional to the force involved, and this can range from a minor tear (often referred to as a grade 1), right through to a rupture of the ligament.

Image 2



Diagnosis

Clinical assessment (i.e. assessment by a professional) is usually sufficient to diagnose this. Imaging such as x-rays or MRI may be ordered to confirm the diagnosis or exclude other problems.

Treatment

Minor ligament tears do really well without surgery. Higher grade injuries are often treated surgically. All patients with a lateral ligament tear are placed on an exercise program.

Recovery Time

The time frame to recovery depends on the age and fitness of the patient, whether or not surgery was required, the degree of damage and how well the rehabilitation plan is followed.

Prevention

These are often preventable, particularly the non-contact injuries. Teaching someone to control their knee position when they land or change direction is essential. Exercises which teach this can be easily integrated into the sportsperson's training program.



Lateral ligament injuries

The lateral ligament runs on the outside of the knee. It runs between the thigh bone (femur) and the fibula and resists what is known as valgus stress.

- **Pain and Symptoms**
It is sometimes injured via trauma and will produce pain on the outside of the knee. With high grade injuries it may pop or snap when it is injured.
- **Swelling**
The knee won't usually swell, unless other structures are injured. Lateral ligament injuries are often accompanied by other major ligament tears.
- **Function**
With larger grade injuries the knee may feel loose, and it is likely to be painful to move.
- **Causes of Injury**
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Patellar tendinopathy and quadriceps tendinopathy

Tendons are structures that connect muscle to bone, and the 2 most commonly injured ones are the patellar tendon (which is technically a ligament) and the quadriceps tendon (see image 1).

Tendinopathy is a general term that means tendon disorder. It encompasses all types of tendon problems and does not imply a particular diagnosis or mode of treatment required.

Many tendinopathies including these have structural changes in the tendon related to cell death and structural disintegration. This condition can develop in anyone at any age but is more common in sportspeople particularly those in jumping and landing sports.





Pain and Symptoms

Pain is typically worsened by activity, although lower grades of injury sometimes settle as they warm up. Jumping and landing are most likely to be the aggravating activities. The pain is felt at the front of the knee frequently at the position where the tendon attaches to the bone. Sometimes there will be a small lump or swelling in the tendon.



Causes of Injury

The most common cause of injury to these tendons is a rapid increase in activity levels particularly related to jumping and landing. Overtraining and lack of recovery time can also be factors. Known risk factors apart from these physical ones include obesity, the use of certain medications such as certain antibiotics and some cholesterol lowering drugs, and diabetes.



Diagnosis

Diagnosis can usually be obtained after a thorough assessment. Sometimes medical imaging such as ultrasound or MRI can be used to confirm the diagnosis and exclude other pathologies. These are usually not required.

A close-up photograph of a person's knee being examined by a healthcare professional. The person is wearing a blue athletic sock and a white sneaker. The healthcare professional's hand, adorned with a ring, is palpating the knee joint. The background is a blurred outdoor setting.

Anterior cruciate ligament injury

Pain and Symptoms

- Associated with the injury, the person will often hear a 'pop,' 'crack' or feel a 'snap' within the knee.
- The knee often swells within the first few hours of the injury. This may be a sign of bleeding inside the knee joint. Swelling that occurs rapidly is usually a sign of a serious knee injury.
- Giving way or instability of the knee, particularly with twisting.
- Restricted movement and pain, particularly in the first few weeks following the injury.

Causes

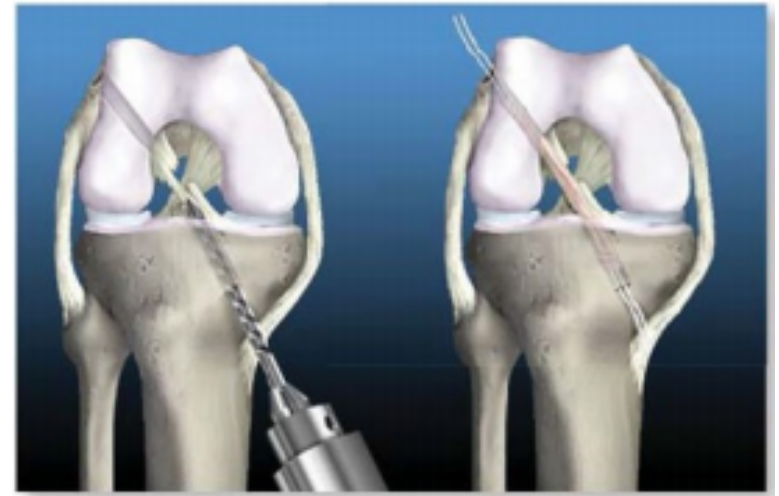
This injury usually occurs when the knee is forcefully twisted or hyper-extended. Usually the tearing of the ligament occurs with a sudden directional change with the foot fixed on the ground or when a deceleration force crosses the knee. This type of injury is common in soccer, skiing, football, and other sports with lots of stop-and-go movements, jumping, or weaving. Falling off a ladder or missing a step on a staircase are other likely causes. Like any other body part, the ACL becomes weaker with age.

Diagnosis

If an injury to the anterior cruciate ligament is suspected, further imaging will be required with the aid of an MRI and a specialist orthopaedic surgeon's opinion required.

Acute Management

Initial management will focus on decreasing swelling, increasing range of motion and strengthening the leg and hip muscles. Even in situations where surgery is required this is important.



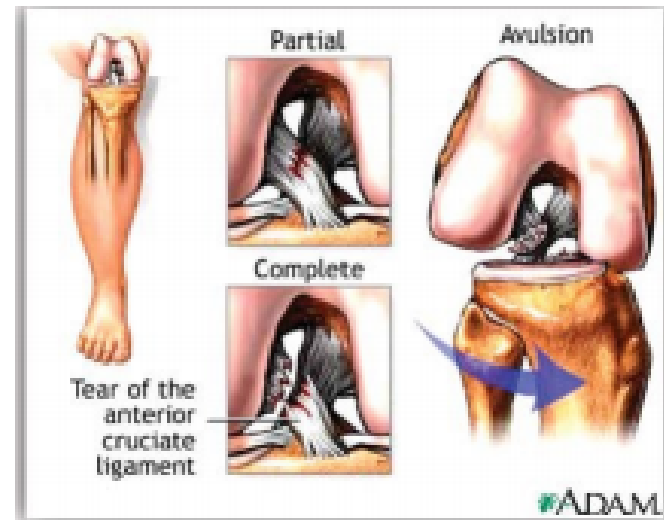
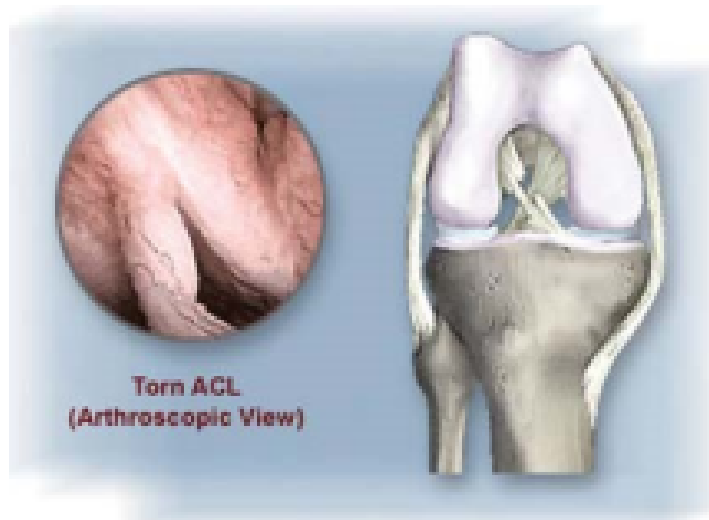
Harvested Hamstring Tendons



Braided Tendons Form A Replacement ACL

Surgery

The role of surgery is to restore the mechanical stability to the knee. The graft takes around 6 months to fully strengthen. A disrupted cruciate ligament increases the risk of re-injury to the knee due to the instability. It also increases your risk of developing early onset osteoarthritis. Surgery involves replacing the torn cruciate ligament with a graft that reproduces the normal stabilising role of the ligament. There are several procedures available and your surgeon can guide you with this. Surgery is usually performed via an arthroscope using the hamstring tendons as a graft.



Treatment After Surgery

Time: 12 + months

Initial management will focus on increasing range of motion in the knee, improving quadriceps recruitment and managing pain levels.

Further management will focus on restoring strength, fitness and balance/proprioception.

Crucial to the rehabilitation is an ACL injury prevention program.

Meniscal cartilage injury

There are two menisci in the knee; each rests between the thigh bone (femur) and shin bone (tibia). The menisci are made of tough cartilage and conform to the surfaces of the bones upon which they rest. The menisci function to distribute a person's body weight across the knee joint and to improve the shape of the joint between the 2 bones, contributing to the stability of the knee joint. Without the meniscus present, the weight of your body would be unevenly applied to the bones in your legs (the femur and tibia). The function of the meniscus is critical to the health of the knee.

Pain and Symptoms

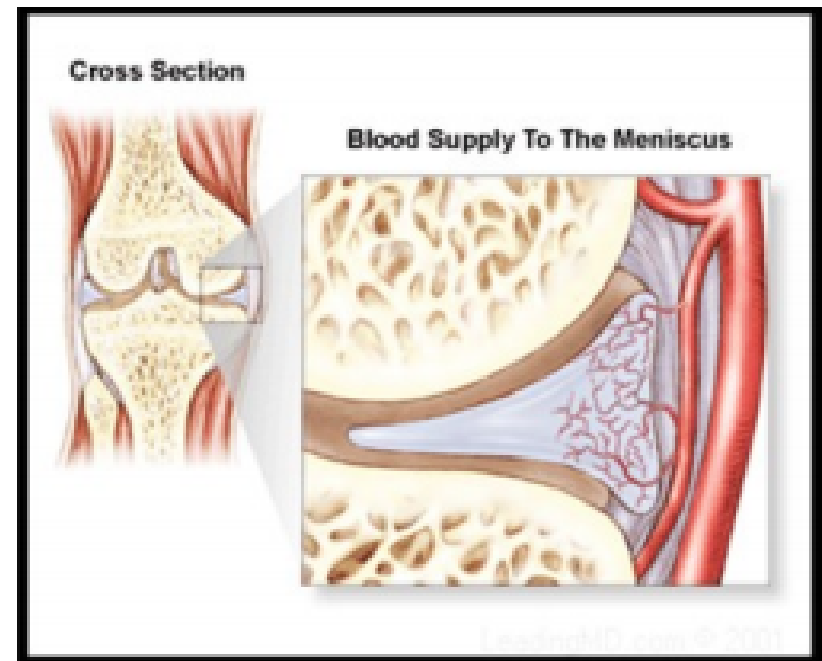
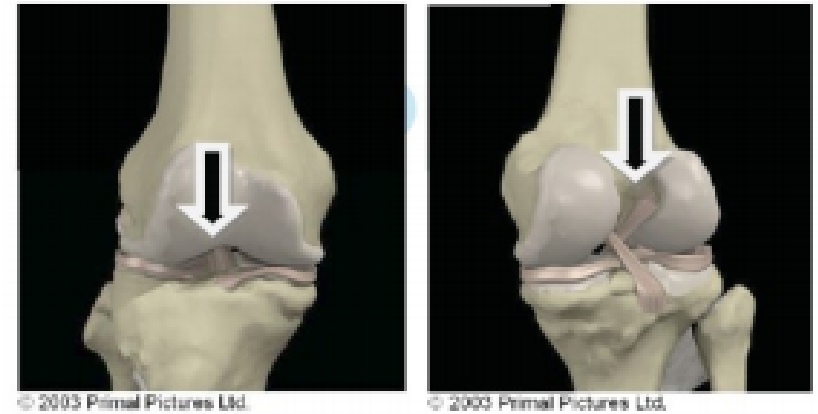
- **Pain.** The degree of this will vary according to the site and extent of the injury and the type of activity being performed. There may be severe pain if a torn fragment of meniscus catches between the tibia and femur. Sometimes, a past injury causes pain months or years later, particularly if the affected knee is injured again.
- **Swelling.** The knee may swell immediately if blood vessels are damaged with the injury, or swell more slowly as part of the inflammatory process that occurs following injury. Swelling is sometimes difficult to see.
- **Knee function.** You may be unable to straighten or bend the knee fully. In severe cases, no walking is possible due to the intensity of the pain. The knee may click, or may 'lock' from time to time if the torn fragment interferes with normal knee movement. A locked knee means that it gets stuck when it is bent and cannot be straightened without manually moving or manipulating the leg).

Causes of Injury

The two most common causes of a **meniscal tear** are due to traumatic injury (often seen in athletes) and degenerative processes (seen in older patients who have more brittle cartilage). The most common mechanism of a traumatic **meniscus tear** occurs when the knee joint is bent and the knee is then twisted. The meniscus may tear fully or partially. The seriousness of the injury depends on its size, and the exact site and shape of the tear.

In severe injuries, other parts of the knee may also be damaged in addition to a meniscal tear. For example, a person may also sprain or tear a ligament or have problems with the joint surface. Meniscal cartilage does not repair very well once it is torn since it does not have a good blood supply, except in children where some repair is possible. In the adult the outer edge of each meniscus has some blood vessels, but the area in the middle has no direct blood supply (it is 'avascular'). So, some small outer tears may heal in time, but larger tears, or a tear in the middle of a meniscus, tend not to heal. However many meniscal tears, even if they do not repair can settle sufficiently to avoid surgery.

In some cases the symptoms of meniscus injury go away on their own after a few weeks. However, in many cases the symptoms persist for longer.

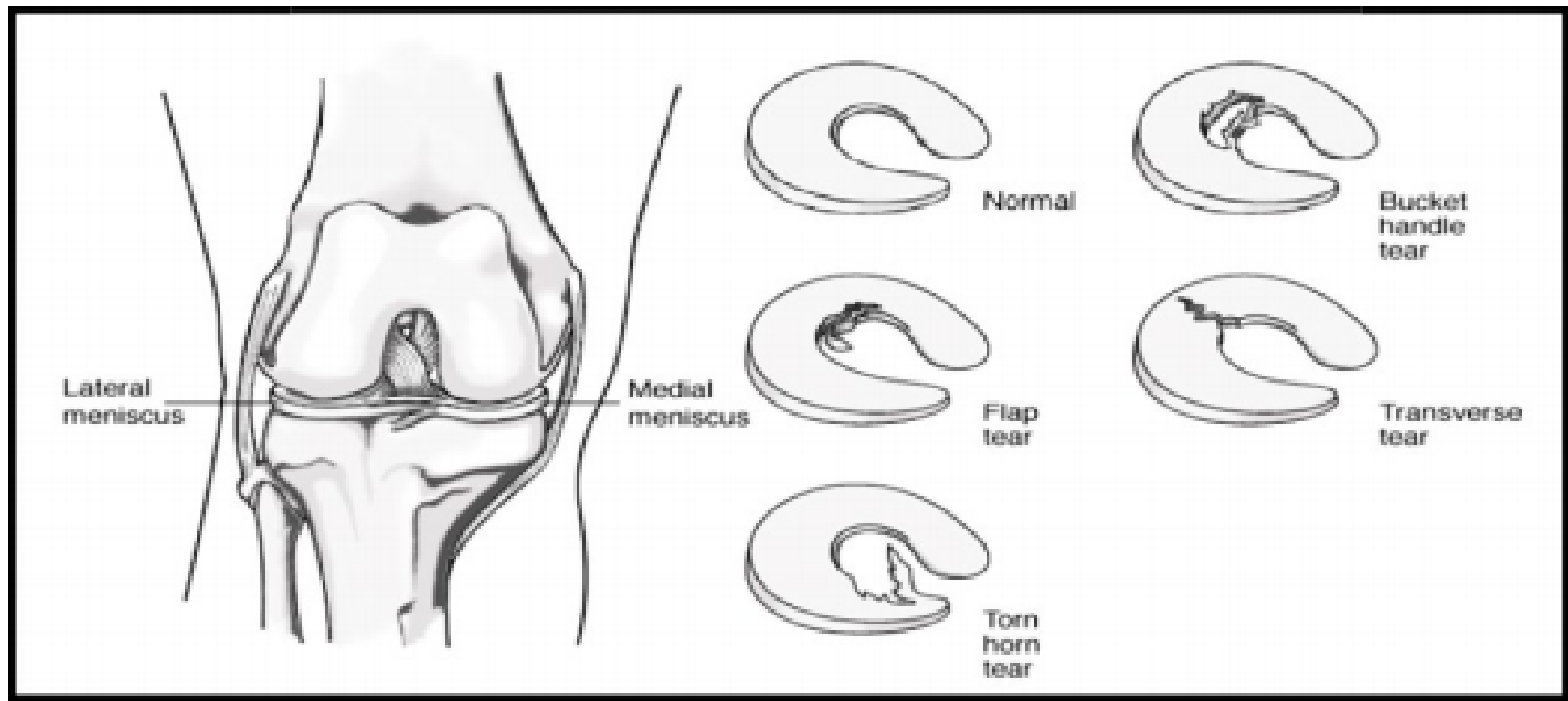


Diagnosis

All meniscal tears require a professional assessment and many require a surgical opinion. Central to diagnosis is professional clinical assessment. Further investigations such as X-Ray and MRI can be used when necessary to exclude other pathologies and to assess the extent of the injury.

Treatment

Treatment of a meniscal tear depends on several factors including the type of tear.



Non-Surgical

The blood supply is poor in certain parts of the meniscus and therefore healing is often poor with tears in the avascular zones. If the tear is small and is in the vascular zone there is a greater chance that the meniscus can repair. Also if the tear is only small or if there is only a small amount of degenerative change then a conservative program should be attempted. Treatment would usually include the following:

- **Physiotherapy.** All patients with meniscal tears should have a physiotherapy guided rehabilitation plan. The aim of the program will be to restore movement to the knee joint and strength to the surrounding musculature. Balance and sense of position (proprioception) are also affected by this injury and exercises will address any deficiencies with these areas. This will ensure the speediest recovery and will help to minimise complications.
- **Activity Modification** – Aimed at protecting the knee and also allowing the region to settle.

Surgical

With certain types of tears or if the knee has failed to settle with conservative rehabilitation then a review with a specialist would be required. Either a repair of the meniscus would be attempted or trimming of the meniscus would be performed under arthroscope. The next step is then a post-operative rehabilitation program that is controlled by your treating physiotherapist.

Recovery Time

Recovery time for conservative management is around 6-12 weeks depending on the severity of the tear. Rehabilitation post-operative is around the 8-24 week mark, but once again will be determined by the extent of the tear and whether surgery was required.

Prevention

Many of these injuries are preventable. Sports people in particular must be taught correct technique in landing and in changing direction. This is the last phase of rehabilitation and these exercises can be integrated easily into the sports person's training.

Osgood schlatters disease

This is a stress injury to the bony attachment of the patellar tendon (see *fig 1*). It is caused by repeated stress on the growth plate of the bone from activities such as running, jumping and kicking. It usually occurs in active adolescents between the ages of 11 and 15 years and presents with pain and swelling over the front of the knee (*fig 2*) below the knee cap, at the top of the tibia.

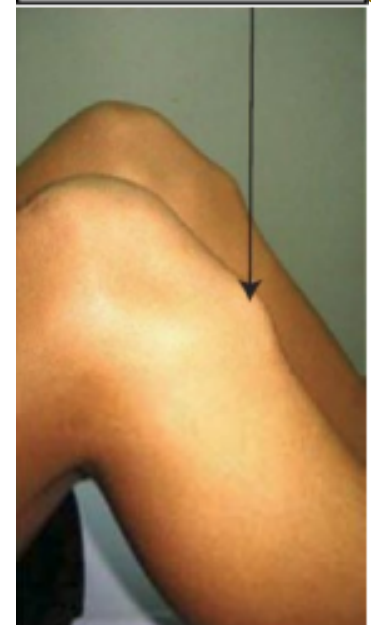
Treatment

Activity Modification - This is designed to help unload and rest the affected area. Except in extreme cases complete rest is not usually required and a reduction in the volume or intensity of activity is all that is needed. In rare circumstances where the symptoms are severe a short period of immobilisation is required. The general recommendation is that if the child has pain and limping that they discontinue their activities for the day. If they have pain and limping for three or more days they are to cease their athletic activity for a month and perform only stretching exercises.



Fig 1 The apophysis of the tibia

Fig 2 shows the appearance of the lump at the front of the knee with Osgood Schlatters Disease



Stretching Exercises – These are often recommended and are best prescribed by a Physiotherapist.

Technique Modification – Improving jumping or running technique can reduce stress through the patellar tendon and the apophysis

Supportive Straps or Tape – Can reduce stress through the apophysis

Recovery Time

This varies. Most will control their symptoms over a 6 - 12 week period. In some the symptoms can last 12 months or so. It is important to realise that these symptoms will always resolve as the growth plate matures.



Osteoarthritis (OA) of the knee

Most joints in the human body are covered in a layer of articular cartilage. The cartilage functions by assisting joint lubrication and shock absorption and provides a low friction surface for bones to move against each other. Osteoarthrosis (more commonly termed osteoarthritis) describes degeneration of the articular cartilage.

This is a condition that develops over quite a long period of time. It is more commonly associated with the older population but can occur in younger age groups for reasons stated below.



Causes

Knee osteoarthritis is a condition that will usually develop over a long period of time. Common predisposing factors are:

- Overweight (high Body Mass Index)
- Previous Injury, damage to cartilage or ligamentous instability
- Congenital or developmental deformities
- Certain occupations – for example high intensity manual labour
- Genetic factors
- Poor lower limb strength



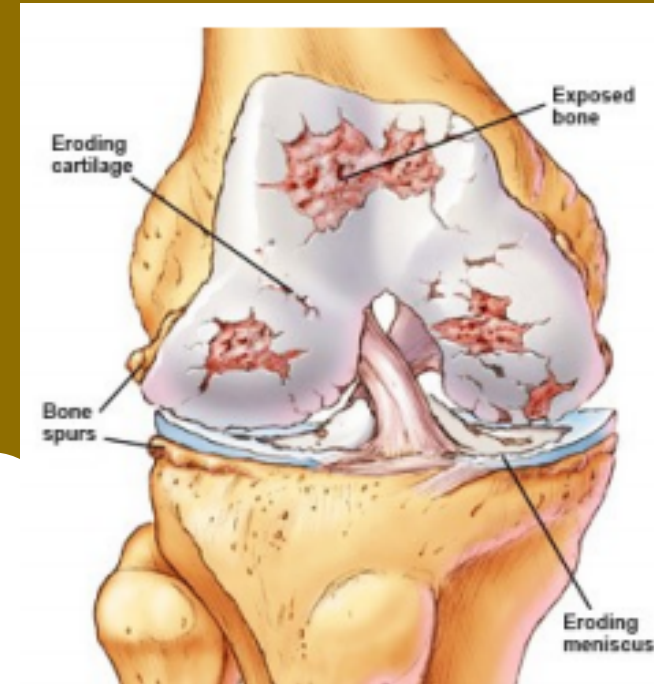
X-ray showing narrowed medial compartment of the knee due to advanced OA

Clinical Features of Knee Osteoarthritis

- Joint space narrowing on x-ray
- Pain
- Swelling
- Deformity
- It is typically progressive and worsens with advancing age
- It is usually made worse by high-intensity activity (although some lower-intensity activities seem to benefit symptoms)

Diagnosis

A detailed history and skilled clinical examination are important. Xrays are sensitive to moderate to severe changes and MRI provides a large amount of detail. These investigations assist in grading the degree of the pathology, and assist in excluding other sources of pain.



Treatment

Physiotherapy should always be included in a knee osteoarthritis treatment program.

- *Activity Modification* – To help protect the knee and allow the knee to settle. Low impact activities like cycling and swimming will be best suited to help maintain and improve fitness levels.
- *Strengthening* – A thorough graded (impact sparing) lower limb strengthening program will be developed by your physiotherapist to help improve your lower limb function.
- *Weight Loss* – Physiotherapists can assist with giving exercises that will assist with weight loss whilst keeping potentially damaging impact off the joint.

Diagnosis

Your doctor can advise you regarding diet and other areas of weight management.

Patella dislocation

This injury results in the patella (knee cap) moving outside of its natural groove in the joint and dislocating to the outside of the knee. The injury can either be traumatic with a history of trauma, or non-traumatic or spontaneous occurring in individuals who are generally lax (or hypermobile) throughout the body.

Usually occurs with a twisting or jumping incident often in which the knee will feel as though it has given way. Frequently the knee will relocate spontaneously but in some cases will require medical assistance.

What Structures can be injured?

- Patella and femur joint surfaces
- Medial retinaculum, medial patellafemoral ligament

Medial Retinaculum



Factors that Predispose to Dislocation

- Shape of patella and femoral groove
- Weak connective tissue
- Poor lower limb strength/control
- Poor lower limb biomechanics
- Previous dislocation or history of subluxation
- Age and gender. This is particularly common in teenage girls

Pain and Symptoms

- With the traumatic injuries there is often quite a large effusion swelling
- Feeling of something going out of place
- Obvious dislocation of the patella sitting laterally
- Pain

Diagnosis

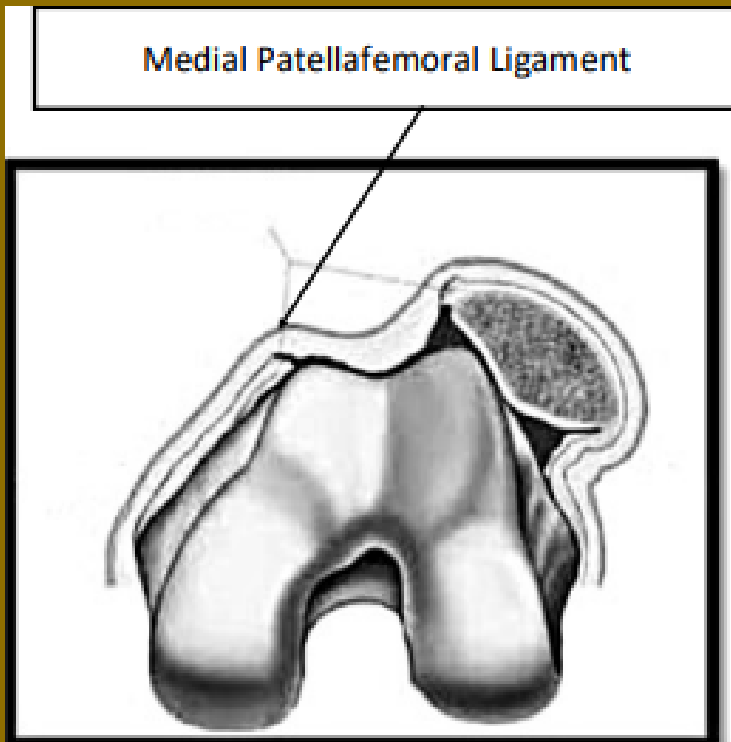
Often a dislocation can be confirmed with history and clinical examination. An x-ray is usually performed to rule out any fracture or other injury. MRI is frequently used to further assess the knee.

Surgical

Surgery is usually only required if there is a history of recurrent dislocation with the role of the surgery to stabilise the patellofemoral joint.

Recovery Time

Compliance with your rehabilitation program is essential in achieving a good result following this injury. It can take 3 – 6 months to regain normal function.



Treatment

Treatment regime for patella dislocation for the first time will usually consist of a Physiotherapist prescribed and supervised exercise program. If a recurrent dislocation has occurred then a review with an orthopaedic surgeon is advised.

Physiotherapy would usually involve the following:

Activity Modification -Treatment regime for patella dislocation for the first time will usually consist of a Physiotherapist prescribed and supervised exercise program. If a recurrent dislocation has occurred then a review with an orthopaedic surgeon is advised.

Exercise -A thorough graded lower limb strengthening program will be developed by your physiotherapist to help restore your full function and assist with return to pre-injury activity. The program should also include a balance and proprioceptive component and finally an injury prevention component.

Patellofemoral Pain

Patellofemoral Pain Syndrome (PFPS) is the term used to describe pain at the front of the knee in or around the knee-cap or patella. It is often self-limiting but if it persists it can cause significant loss of function.

Patellar Anatomy and Biomechanics

The patella has several functions. It acts as a fulcrum to increase the leverage of the quadriceps musculature, it protects the anterior part of the knee from external force and it reduces stress through the tibiofemoral joint by reducing the quadriceps force.

The Patella articulates with the femur at about 15 degrees flexion and moves up and down the trochlea as the knee flexes and extends. Therefore only pain felt after 15 degrees flexion can be patellofemoral in origin.

Up to 20 times body weight is borne by the patellofemoral joint with athletic activities and even negotiating steps can load the joint with 3 - 4 times body weight. The patellar articular cartilage (shown on the MRI below) is the thickest in the body reflecting the forces involved. Factors which increase the force through the joint, or alter the position of the patella in relation to the femur can predispose to patellofemoral pain.

Common Symptoms

Pain is usually at the front of the knee. It is sometimes accompanied by giving way due to quadriceps inhibition. The pain is often aggravated by stairs (up and down) sometimes walking and particularly hills, and prolonged sitting. Running is painful. Patellofemoral Pain Syndrome (PFPS) is the term used to describe pain at the front of the knee in or around the knee-cap or patella. It is often self-limiting but if it persists it can cause significant loss of function.

Causes

1. Poor Bony Alignment

2. Soft tissue imbalance

- Weakness of the quadriceps has been shown to predispose to patellofemoral pain.
- Tightness of the lateral retinaculum has been shown to cause excessive lateral movement of the patella and hence an overstress at the joint.

3. Overstress through overuse or excessive body weight

4. Poor foot mechanics

5. Weakness or poor control of the hip muscles

Treatment

Because PFPS is frequently multifactorial, treatment will usually address a range of factors

Correction of quadriceps imbalance -Quadriceps strengthening as a treatment for PFPS is supported by biomechanical studies which show lower PFJ force with stronger VMO and clinical studies which show that it is an effective treatment. (Neptune et al 2000 – Clinical Biomechanics). This program should go over approximately 8 weeks. The type and volume of exercises chosen must be sufficient to stimulate adaptive changes in the muscle but must be done in such a way as not to aggravate the condition.

Correction of biomechanics -Hip muscle strengthening can reduce the forces through the patella.

Patella taping -It is not conclusively known why it works but patellar taping reduces symptoms and can promote early return to activity. (Crossley et al 2002)

Footwear advice -shoes that are inappropriate can lead to less pain

Posterior cruciate injury

This is an injury that affects one of the major ligaments in the knee. The posterior cruciate ligament helps with stability of the knee.

Causes

The mechanism of injury often involves knee hyperextension on a fixed foot or a forceful blow directly to the upper tibia as shown in the rugby tackle below. It is frequently injured in conjunction with other knee structures such as the anterior cruciate and menisci in major knee trauma.

Diagnosis

Clinical examination is sometimes sufficient to diagnose this condition. Other forms of diagnostic testing may be required to obtain more detailed information and to exclude other pathology.

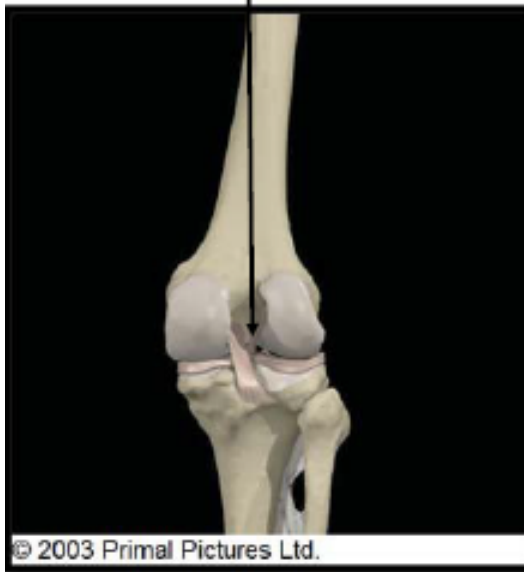
If a posterior cruciate ligament injury is suspected the best form of imaging is an MRI. In a younger patient if an avulsion is suspected in which the attachment is pulled off the bone then an X-ray may be needed. Injuries to the PCL are graded on a scale of 1 – 3.

Grade 1 – Sprain of the ligament

Grade 2 – Partial tear of the ligament

Grade 3 – Full rupture/tear of the ligament

Posterior Cruciate Ligament



Treatment

The treatment regime for a posterior cruciate ligament is best undertaken with a physiotherapist, unless there is an acute avulsion of the ligament which requires a surgical opinion.

Management would usually involve the following:

- Activity Modification – whilst the knee settles. Cross training can be implemented to maintain fitness levels.
- Strengthening – A graded lower limb strengthening program will be developed by your physiotherapist to help restore your full function and assist with return to sport.
- High Level Sport Specific Training – If required, a sport specific training program will be developed to help with your return to sporting activities.

Recovery Time

Grade 1 – 3 - 4 weeks

Grade 2 – 6 - 8 weeks

Grade 3 – 10 - 12 weeks

Sinding-Larsen-Johansson disease

What is this?

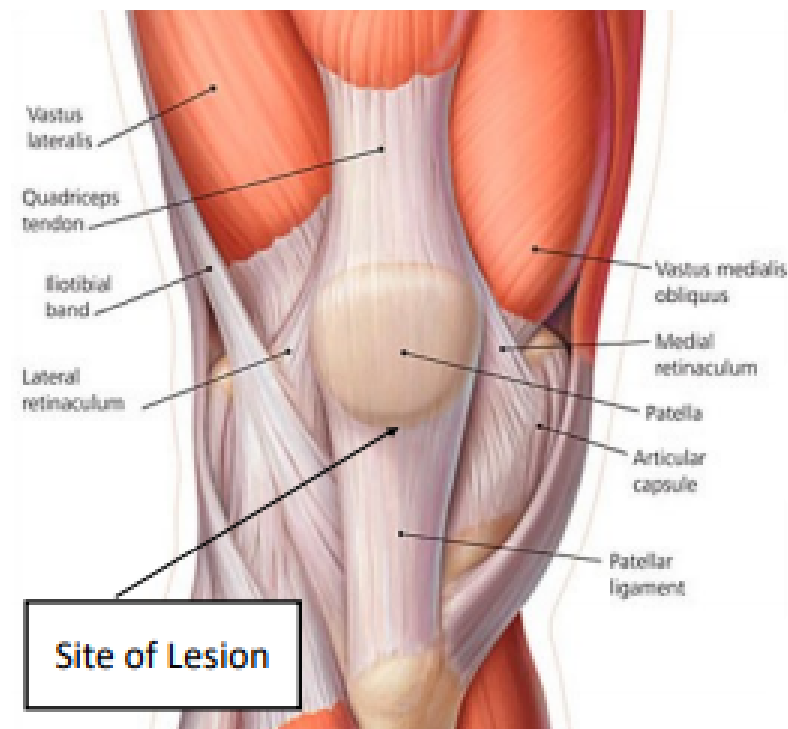
Sinding-Larsen-Johansson disease (SLJ) affects the proximal end of the patellar tendon as it inserts into the inferior pole of the patella, and represents a chronic traction injury of the immature junction between these structures. It is closely related to jumpers' knee or patellar tendinopathy, which is the adult manifestation of this disorder.

Demographics and clinical presentation

Unlike jumpers' knee which is seen at any age, Sinding-Larsen-Johansson disease is seen in active adolescents typically between 10 - 14 years of age. It is usually associated with sports that involve higher volumes of running and jumping. It is also common in young athletes who are overtraining. The patient typically presents with point tenderness at the inferior pole of the patella associated with focal swelling.

Prognosis

This is a self-limiting condition in that it is safe to continue playing sport but the pain will limit the level of function whilst performing the activity. This condition will always resolve long term but can sometimes take until the growth plates start to fuse in the body.



What Structures can be Injured?

Proximal attachment of Patella Tendon

Pain and Symptoms

Symptoms can include some or all of the following:

- Pain with activity especially running, kicking or jumping
- Pain is at the inferior pole of the patella and is often tender to touch

Diagnosis

Diagnosis is usually made on clinical assessment and there is usually no need for further investigations.

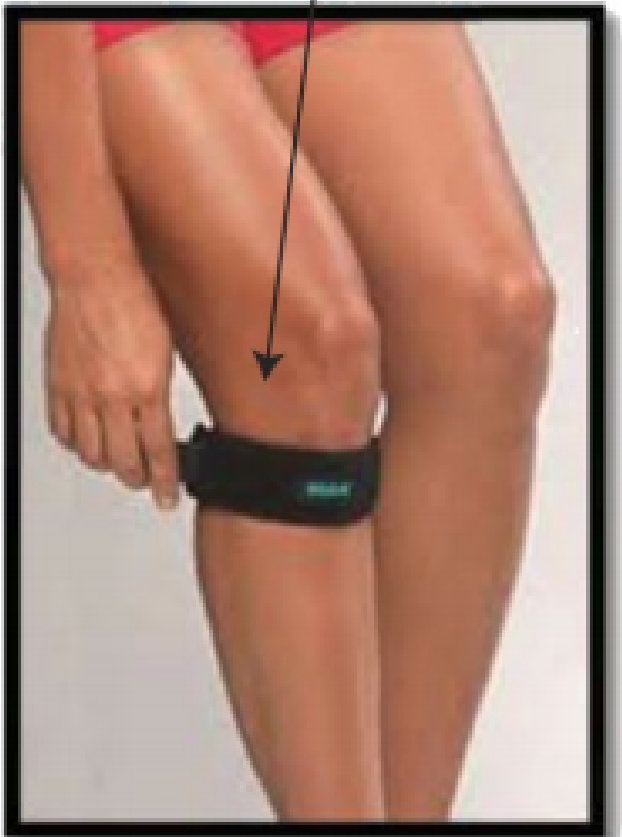
Treatment

- **Activity Modification** – this may range from complete rest to minor modifications in training depending on the severity of the pain and extent of disability
- **Strengthening** – If there is an obvious lower limb weakness in an area a strengthening program may help increase the control through the lower limb and help unload the patella tendon
- **Patella Tendon Taping** – Used to help try and distribute the force through the patella tendon and therefore unload the irritated region.

Recovery Time

Highly variable for each individual. In some individuals the symptoms may last up to 24 months before the growth plate fuses. It is important to realise that this is a self-limiting condition that will always settle as the tendon/bone interface matures.

Example of a patellar unloading strap.





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