

Strictly on a Knee-d to Know Basis

We have previously looked at potential causes of pain around the foot and ankle (Summer 2016) and the hip and pelvis (Winter 2016), but it is important as fellrunners that you understand the possible causes of pain around the knee joint.

According to a study I carried out in 2011, 24% of all the injuries in male fellrunners affected the knee and surrounding soft tissues – accounting for more injuries than any other area of the body. Research suggests that forces of up to 550% of total body weight are transmitted through the knees whilst running, so this combined with some of the joint positions whilst running over the fells explains why this area is at such risk.

ANATOMY

The knee comprises of 2 joints –

1. The **tibio-femoral joint** between the femur (thigh bone) and tibia (shin bone),
2. The **patella-femoral joint** between the patella (kneecap) and femur (thigh bone).

The knee is classed as a hinge joint, but there is also a small amount of rotation which occurs when the joint is fully straightening, or bending from being fully straight.

It is also a **synovial joint** which means there is a capsule (sac) surrounding the joint. This contains the synovial fluid which nourishes the joint and also provides the joint with lubrication.

There are two types of cartilage which play a major role in the joint function. The **articular cartilage**, which is the shiny surface covering the bone ends, and the **menisci** which are special, extra layers of thick cartilage. There are 2 menisci in each joint and these help the joint move smoothly and act as buffers or shock absorbers between the bones. A 'cartilage tear' usually refers to damage to one of these menisci, rather than the cartilage covering the surface of the bone.

The main **muscles** which affect the joint are the: -

- Quadriceps – the four muscles which lie over the front of the thigh and the knee joint.
- Hamstrings – the three muscles which lie over the back of the thigh and go to either side of the back of the knee joint.
- Popliteus – the muscle which lies across the back of the knee and rotates the joint to unlock it when fully straight. It also prevents forwards movement of the femur on the tibia.
- Gluteals -the muscles in your buttock which help to position the femur and align the knee joint.

Providing stability to the joint and securing the bones together are four **ligaments**:

- The medial collateral ligament stabilising the inner aspect of the joint and restraining external rotation.
- The lateral collateral ligament stabilising the outer aspect of the joint and restraining internal rotation.
- The anterior cruciate ligament which lies within the knee joint and restrains the anterior movement of the tibia on the femur.
- The posterior cruciate ligament which also lies within the knee joint and restrains the posterior movement of the tibia on the femur.

Further stability is added to the outer aspect of the joint by the **iliotibial band**. This is a very strong band of fascia which arises from the gluteus maximus and tensor fascia lata muscles at the outer aspect of the hip and extends down the outside of the thigh to attach to several areas around the outer aspect of the knee.

THE CAUSE OF THE PAIN

Accurate diagnosis is essential to receive the correct treatment and advice. Most knee injuries can be resolved – but not when misdiagnosed. Some of the most important factors which help in the diagnosis are:

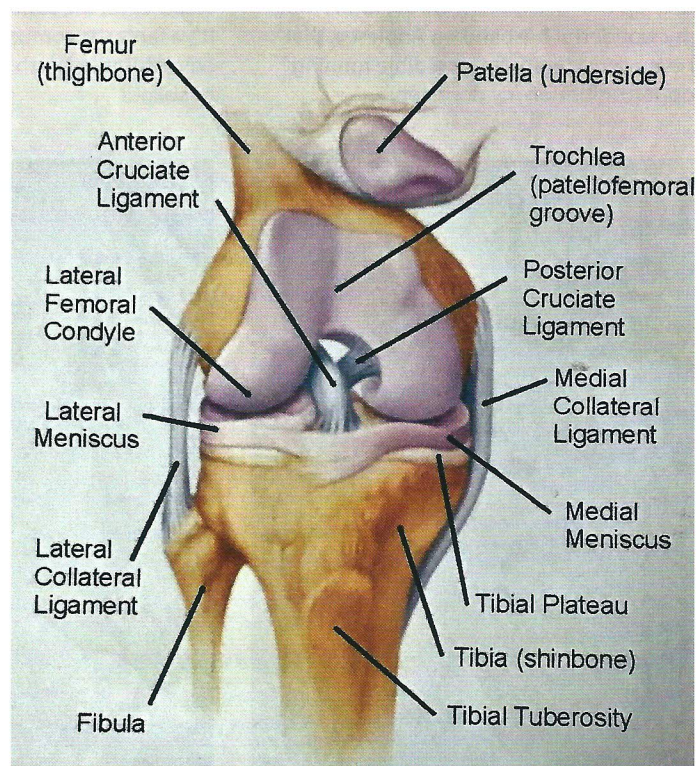
The site of the pain.

Look at anatomy pictures of the knee as these may help identify the structure causing the pain. If unsure, seek an assessment by a more medically qualified practitioner to avoid wasting time. Be aware that nerve impingement in the lower back can refer pain to the knee, and the hip joint can also refer pain to the knee joint as it is supplied by the same nerve.

It sounds obvious that the site of the pain suggests the possible cause, but it is surprising how many people are told they have osteoarthritis of the knee when the site of the pain doesn't even indicate it is joint pain.

What aggravates the pain?

Exercise or rest may aggravate symptoms, as may going up or down stairs, certain knee positions, or squatting or kneeling. Pain which eases after running for some time doesn't usually suggest joint damage as the pain would generally become worse with repetitive impact. If the pain eases with running, it tends to be as a result of soft tissues which are becoming more pliable and flexible with the exercise. Pain when descending at speed can put different soft tissues under strain – the popliteus muscle at the back of the knee or the quadriceps retinaculum at the front of the knee, and running on a camber or over rough terrain for an extended period of time can strain the ligaments at either side of the knee. It is very important to consider the aggravating factors as these often help indicate the source of the pain.



Swelling.

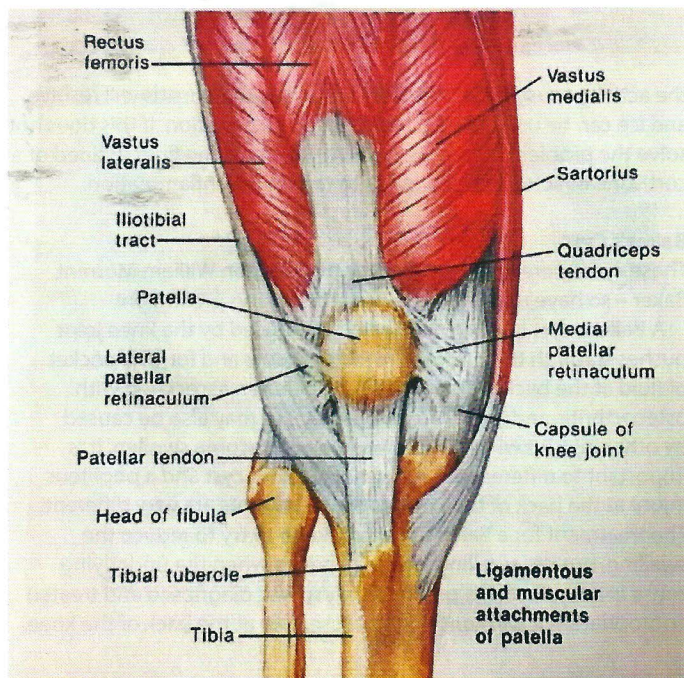
If the knee becomes swollen immediately after an injury, it often suggests there is damage to a structure inside the joint – such as the anterior cruciate ligament. If the swelling develops over several hours or days it is more likely to be a structure on the outside of the joint or damage to the meniscus. If the swelling is quite severe and there is no obvious reason, it could be due to gout or an inflammatory joint condition or infection so should be investigated further by your GP.

Movement.

The mobility of the joint can be affected for a number of reasons. When a structure is badly damaged, any movement which puts further strain on this structure will usually increase the pain. A medical practitioner will carry out a number of tests to determine which of these are painful. The tests are very important as an MRI scan may highlight other issues which aren't the cause of the symptoms, and are known not to identify up to 40% of soft tissue injuries.

If the joint 'locks' it is difficult to either straighten or bend the knee. This can be due to something blocking the movement such as a tear in the meniscus or a loose body (a tiny fragment of cartilage or bone) which has broken away from the joint surface, or it can be because the pain is so severe that it prevents movement of the joint. It is sometimes possible to 'unlock' the knee by manipulating the joint which dislodges whatever is blocking the movement.

Osteoarthritis often causes pain at the extremes of both bending and straightening the joint. If you can lock the knee fully straight and it doesn't reproduce the pain, it is unlikely that the cause is the degeneration of the joint surfaces as this is when the joint surfaces are in close proximity.



ligament and tendon attachments of patella

Instability.

Stability of the joint is provided by the ligaments, so if the joint feels unstable or that it may give way, a ligament may be damaged. If the anterior cruciate ligament is ruptured, the knee often feels to collapse forwards as the ligament is unable to restrain that movement.

Joint noises.

The knee can produce various sounds, but if these noises are not painful it is not usually a cause of concern. However, if they cause pain they should be investigated further.

A 'pop' often indicates a ligament snapping, 'clicks' may suggest a meniscus tear, and grinding or crunching may be heard – or felt –

when there is joint or cartilage damage. An experienced practitioner often recognises the noises which can help with the correct diagnosis.

SOME OF THE MORE COMMON FELLRUNNING INJURIES AROUND THE KNEE JOINT

'Fellrunner's Knee'

I refer to this condition as *fellrunner's knee* because it is the most common injury I see in fellrunners. It is caused by damage to the quadriceps retinaculum (also called the quadriceps expansion) at the lower end of the kneecap and is frequently misdiagnosed by people who do not understand the sport of fellrunning. Tim Noakes, author of the book *Lore of Running*, suggested damage to the quadriceps retinaculum was the most common injury associated with distance running back in 1990, but combine distance running with an undulating, rough terrain, and it explains why this structure is so frequently affected in fellrunning.

The pain is usually located at the lower inner or lower outer aspect of the patella (not the centre as this is the site of the infrapatellar tendon which, if damaged, is a different condition). The mobility of the joint is usually unaffected, although a full knee bend can sometimes be uncomfortable when it stretches the injured tissues. The moment of injury isn't usually memorable, but instead a discomfort or pain becomes more noticeable on longer or downhill runs. Walking downstairs or sitting for longer periods may aggravate the pain, as may kneeling or squatting.

Biopsies of the soft tissues around the patella of individuals experiencing this condition have confirmed damage to the quadriceps retinaculum (or quadriceps expansion), but it may not be visible on an MRI scan.

Complete rest may make the condition worse – despite this often being recommended. If treated appropriately with physiotherapy it can be completely resolved, but it is not a condition which can be treated by surgery.

Ligament Injuries

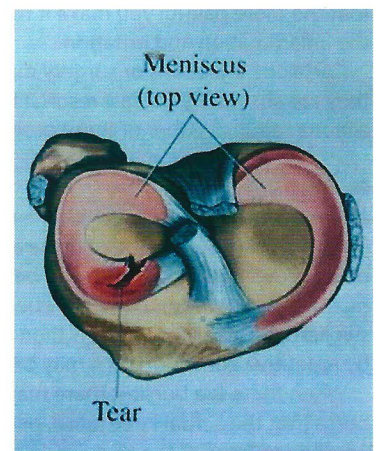
These usually occur when there is an excessive force or repetitive strain to one aspect of the knee which causes damage to the ligament stabilising the joint in that direction. If the ligament ruptures completely, there may be an audible 'pop', followed by immediate swelling. Minor ligament injuries can respond to self-treatment or physiotherapy, but if the ligament is completely ruptured or severely damaged, surgery may be necessary.

Muscle and Tendon Injuries

The quadriceps and hamstring muscles and their attachments can all be damaged around the knee and the site of the pain often indicates which structure is at fault. Tension of the quadriceps or pressure against trying to straighten the leg may reproduce pain at the site of a quadriceps injury, whilst resisted knee bend will indicate a hamstring problem. These injuries are not always visible on MRI scan, so are best diagnosed clinically by a medical expert if they are not resolving.

Meniscus Tears

Damage to the meniscus (the cartilage shock-absorber between the joint surfaces) may be due to a specific injury, or gradual fraying of the edges of the meniscus over a period of time. There is usually pain and swelling, and movement of the joint may be restricted. 'Clicks' may be heard when bending or straightening the leg, and the joint may feel to lock as the damaged meniscus prevents normal movement.



It might also be painful to do a full squat depending on the site of the damage.

If there is a suspected tear to the meniscus, the knee should be assessed by a medical practitioner to decide on the best course of action. Some tears repair without surgical intervention, but this depends on the site of the damage. It is now considered important to try to retain as much of the shock absorber as possible, so a small portion of the meniscus may be removed by arthroscopy rather than removal of the total meniscus as previous.

Patellar tendinopathy

The patellar tendon attaches the lower aspect of the kneecap to the tibia and is the main attachment for the quadriceps muscle. The condition is often referred to as 'jumper's knee' as the tendon becomes irritated and inflamed by the repetitive activities of jumping sports, but is experienced by fellrunners due to jumping over obstacles and steep descents. The repetitive action causes microscopic tears which then results in thickening of the tendon.

The pain is usually directly over the site of the tendon and the tendon may feel to 'creak' when the knee joint is moved, which is referred to as crepitus.

As with Achilles tendinopathy, the activity causing the problem needs to be avoided, but the tendon requires specific loading to encourage repair.

Some surgeons are now recommending PRP (platelet-rich plasma) injections for this condition as they are thought to stimulate tendon healing, but there is still a lack of evidence to support this treatment.

Iliotibial Band Syndrome

The iliotibial band (ITB) is the thick band of fibrous tissue which according to medical textbooks extends from just above the outer aspect of the hip joint to the outer side of the tibia just below the knee. In reality, the more superficial fibres of the band extend much further than that so may cause fascia-related symptoms above or below the hip and knee joint. Several muscles insert into the ITB which then all provide stability to the outer side of the knee. Tension within these muscles can have an adverse effect on the flexibility or tightness of the ITB.

If the ITB becomes irritated it can cause pain at the outer aspect of the knee, and there may be some localised swelling. It might also feel as though something is snapping or popping as the band crosses the structures on the outside of the knee.

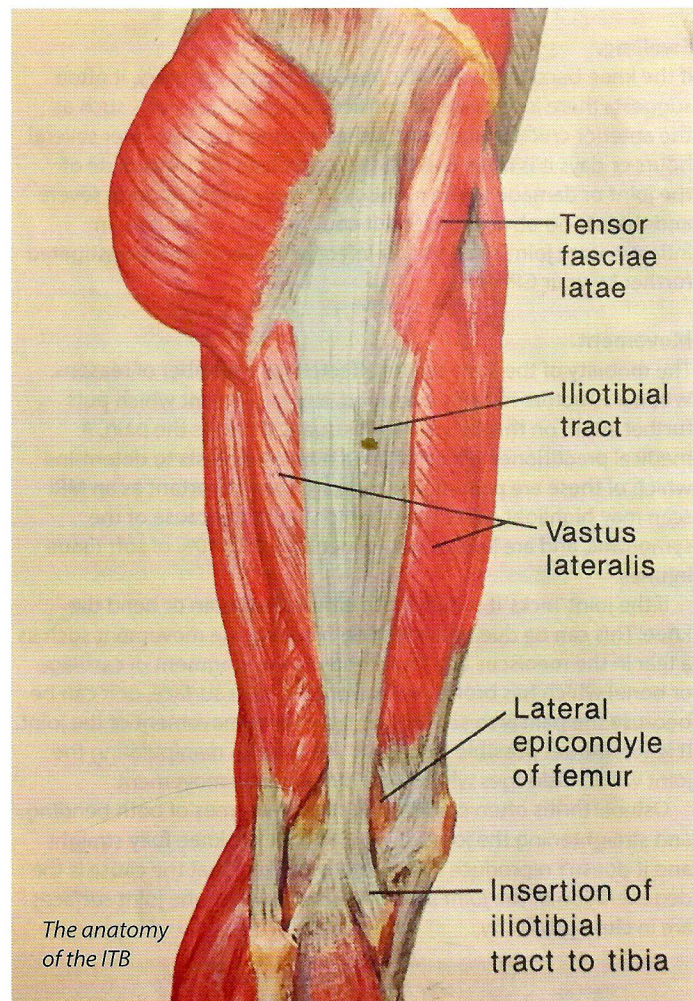
This condition is usually caused by an increase in mileage, so the initial treatment is to reduce the activity that aggravates the symptoms. Other activities may still be possible, so it doesn't require total rest – just a modification of activities. It might also be necessary to address the muscles which insert into the ITB, as tension in those areas could contribute to the problem. Strengthening exercises to these muscles may help with the biomechanics and position of the joint, as may checking your footwear in case that is affecting your knee joint position. Sensible rolling may help, but the fascia does not respond favourably to deep rolling so do not be tempted to think that the more painful you make it the better it is – this may prolong the inflammation and irritation.

Cortisone injections or surgery may be treatment options, but they are absolutely the last resort. I have never suggested that anyone requires either of these procedures.

Bursitis

A bursa is a thin sack filled with the body's own natural lubricating fluid and there are several of these around the knee joint. The bursa prevents friction occurring between different tissues such as muscles and tendons, but if they become irritated they can become swollen and inflamed which is then called bursitis. It can be caused by repetitive kneeling, but it may be due to a fall or sudden impact.

When there is a bursitis, there may be visible swelling of the bursa, (not the actual knee joint), painful movement of the knee and possible redness of the skin overlying the inflamed bursa. Usually if



the activity causing the irritation is avoided the bursitis will resolve, and ice can be used to help reduce the inflammation. If this does not solve the problem, it may be necessary to have the fluid drained or a cortisone injected into the bursa to reduce the inflammation.

Baker's Cyst

These cysts were first described by the surgeon William Marrant Baker – so have nothing to do with the baking profession!

A Baker's cyst is when excess fluid produced by the knee joint pushes through the back of the joint capsule and forms a pocket of fluid at the back of the knee. They are often associated with osteoarthritis and rheumatoid arthritis, but may also be caused by other injuries which cause the knee to become swollen. It is important to differentiate between a Baker's cyst and a popliteus injury at the back of the knee as the treatments are very different. The treatment for a Baker's cyst would be to try to reduce the swelling, but the swelling will only reduce when the underlying cause is addressed. If a popliteus injury isn't diagnosed and treated appropriately, it will continue to cause pain at the back of the knee.

Cartilage Damage

This isn't damage to the meniscus as described above, but is damage to the cartilage which covers the joint surface of the bones. It may also be referred to as chondral damage or a chondral defect.

This kind of damage can affect a very localised area of the cartilage on the femur, the tibia or the patella. It can relate to a specific injury affecting a particular area of cartilage which may have encountered a severe impact or shearing force, or it can be due to continued aggravation eventually causing damage to the smooth cartilage surface exposing the bone below.

Chondral damage usually requires further investigation by an experienced medical practitioner. Several surgical options are now being explored to re-surface the damaged area successfully, as previously the only procedure available has been a knee replacement which is not the ideal solution for younger or more active individuals. Some of the surgical options now available or

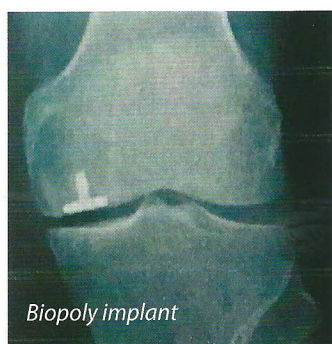
being developed are: -

- micro-fracture of the bone. The damaged area has several tiny fractures induced into the exposed bone which results in localised trauma and causes the formation of a scab which re-covers the joint surface.
- Cartilage and stem cell grafts. Cartilage or stem cells are removed from the individual which are re-implanted at the site of damage a later date. These then slowly develop into a new cartilage surface.
- Implants and biological scaffolds are currently being developed to be put into the area of damage. It is hopeful that the person's own cartilage will then to grow into the implant to provide a new covering to the exposed bone.

This is an exciting time in the development of treatments for chondral defects. It is hoped in the future that individuals will be able to have a treatment which will allow them to remain physically active without causing further damage to the joint, or wearing out a knee replacement which then needs to be re-replaced. I have been privileged to have worked with individuals who have had pioneering cartilage and stem cell grafts, and implant surgery, and whilst the rehabilitation process is still quite lengthy, most of the results have been very promising. However, teamwork is very important and the surgeon, the physiotherapist and the patient must work very closely together to achieve the optimum results.

Osteoarthritis

Osteoarthritis (OA) is a form of damage to the cartilage covering the ends of the bones. It is very common, but is only symptomatic in 10% of men and 13% of women over the age of 60. Whilst it may be visible on x-ray, it does not produce symptoms in up to 27% of over 45-year olds, so if an x-ray identifies OA, the symptoms need to match those of the condition.



OA is often graded as mild, moderate or severe, although it is sometimes graded 1-4 with 4 being the more worst form. It is important to remember that an ageing cartilage is not the same as an osteoarthritic cartilage, which is the result of progressive degeneration of the cartilage surface.

The most common symptoms of OA are:

- Pain in and around the joint
- Pain walking up or down stairs
- Stiffness and swelling of the joint
- Sharp pain after a sudden movement
- Warmth to the touch
- Increase in pain with any weight-bearing activity – not a pain that eases with running.

Some of the causes of OA in the knee are abnormal joint anatomy or alignment, previous injury to the joint, previous knee surgery, joint instability, or an above average body weight. If a runner has

any of these predisposing factors, it may explain the cartilage degeneration, but there is no evidence that running causes damage to the joint surfaces. Published studies have shown that:

1. individuals who carry out strengthening and endurance exercises and maintain the strength of the muscles, not only prevent damage to the articular surface, but also help to relieve symptoms if mild to moderate arthritis is already present. (Shrier, 2004; Fransen, McConnell, 2004; Thomas, 2002).
2. runners do not show a higher risk of developing arthritis in their lower extremities, and the frequency of OA is significantly higher in inactive and obese persons. (Frohnauer, 2006)
3. there is no association between frequency, pace or weekly training mileage and arthritis of the hip or knee (Hootman, 2003).
4. long distance running might actually have a protective effect **against** joint degeneration (Cymet, 2006)

'Running causes joint damage' is a statement often quoted by the non-running population but there is still no evidence to support this, or that an individual needs to stop running once diagnosed with mild to moderate OA.

Knee pain is such a widespread problem in fellrunning that it is important to diagnose the exact cause of the pain for the most appropriate advice and treatment. I still feel it is an area which is frequently mis-diagnosed, and the recommendation to stop running is the easy option. Hopefully this article will help you to make a provisional self-diagnosis and then seek out the most appropriate treatment.



Denise Park's physiotherapy practice is based in Clitheroe and offers four chartered physiotherapists specialising in sports-related injuries, and a sports masseur. For further information and contact details go to: www.deniseparkphysio.co.uk

 **DENISE PARK**
CHARTERED PHYSIOTHERAPIST

Denise M Park
Musculoskeletal Chartered Physiotherapist
MSc MSCP SRP Grad Dip Phys
World Mountain Running Association Accredited Physio

Tel: 01200 423181
www.deniseparkphysio.co.uk

29 Peel St, Clitheroe, Lancs, BB7 1NH