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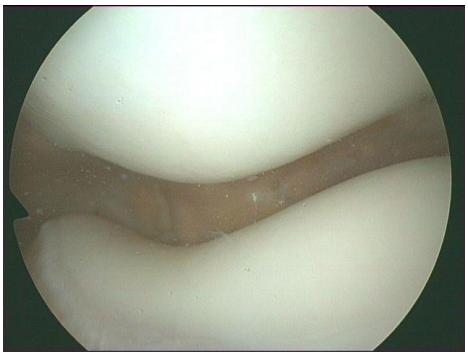
Tibial Tuberosity Transfer (TTT)

Patient Information

Introduction

When you bend your knee, the kneecap (patella) usually runs up and down the centre of a groove (trochlea) on the front of the thigh bone (femur). This coordinated movement is largely controlled by the hip and thigh muscles but depends on the anatomy (shape/position) of the bones and various ligaments.



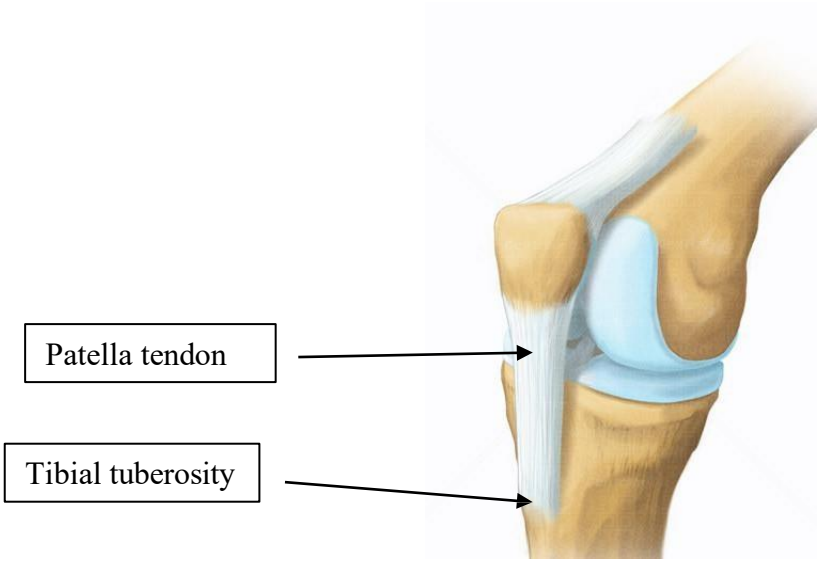
Normal patella (above) on the front of the femoral groove (below)

This leaflet should give you some understanding as to how the kneecap usually works and how it sometimes it may tend to not track down the groove but run along one side of the groove, leading to increased pressure on the outer side (facet) of the kneecap. In the longer term, this may predispose to earlier arthritic change behind the kneecap.

Normal kneecap movements

Normal kneecap movement depends on the shape and position of the bones, in particular the shape and depth of the groove and where the kneecap usually sits in relation to this groove with the leg straight. The kneecap and groove usually have a complimentary shape. If the attachment of the thigh muscles onto the shin bone (tibial tuberosity) is situated more to the outside than inside – referred to as a high tibial tuberosity/trochlea groove distance - this could also predispose to the kneecap being pulled to the side and not run centrally down the groove.

The muscles on the thigh (quadriceps) and buttocks (gluteals) are key to the movement of the kneecap because the kneecap is actually a bone embedded within the tendon of the quadriceps muscle. The inner part of the quadriceps known as the VMO (Vastus Medialis Oblique) attaches directly to the inner aspect of the kneecap and strengthening this muscle plays a key role in treating kneecap maltracking. The role of the gluteal muscles is to rotate the femur bone i.e. it can be seen as aligning the groove under the kneecap and these also needs to form part of any strengthening programme.



More recently, studies have revealed that there is sometimes a slightly unusual attachment of the quadriceps muscle on the kneecap with the muscle sitting towards the outer aspect of the thigh. This may require some surgical realignment of the muscle attachments.

The kneecap ligaments are 'check reigns' to excessive movement rather than movement controls. If an individual has generalized ligamentous laxity ("double jointed") then the movement allowed may be slightly increased. However, if the kneecap has previously dislocated, it can stretch or tear the medial patella-femoral ligament which may exacerbate any maltracking.

Patients who have kneecap maltracking rarely experience dislocation episodes. They far more frequently experience pain over the front of the knee with 'bent knee activities' e.g. walking downstairs, lunging, getting up from a seated position. However, patients who experience repeated dislocations episodes may require a tibial tuberosity transfer (TTT) in addition to a MPFL reconstruction.

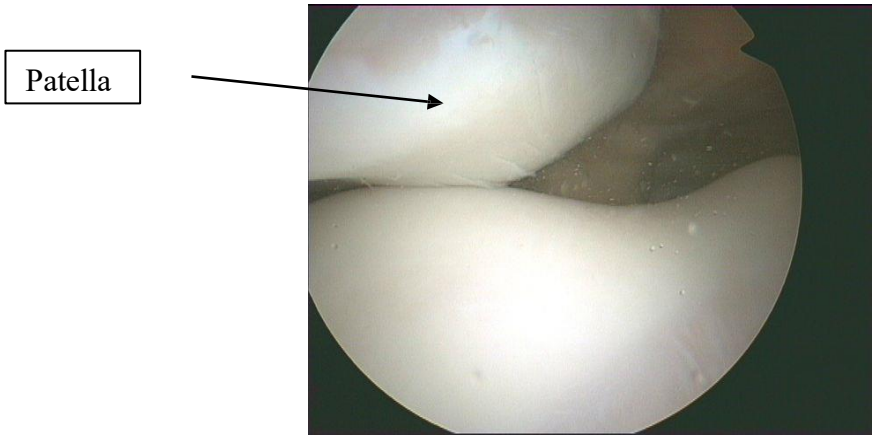
<u>Treatment of kneecap maltracking</u>

Like most conditions, the initial approach should be 'non-operative' i.e. a strengthening programme. In particular attention is focused on the quadriceps, gluteal and core muscles.

If this is not successful, then an operation may be recommended to try and improve the tracking and reduce the 'patella overload' and so reduce the pain.

The position of the tibial tuberosity is not the same in everyone and sometimes it is positioned towards the outer (lateral) side of the shin bone which may predispose to maltracking. If this is the case and symptoms persist, it can be moved and fixed in a position which is more towards the inner aspect of the shin, thus improving the tracking.

Patella sitting towards the outer
(lateral) aspect of the femoral groove



Key hole view (from above) of a 'mal tracking' kneecap running
down the outer (lateral) aspect of the femoral groove.

The position of the tibial tuberosity is described relative to the center of the groove on the front of the femur (trochlea) as a tibial tuberosity – trochlea groove (TTTG) distance. This is determined either by MRI or CT scan and is usually in the range of 10-12mm for both males and females. A value of 20mm or greater is considered abnormal. This value will determine the amount by which the bony attachment should be moved.

In some patients, it may be important to consider the 'rotational profile' of the whole leg, including the hip joint. This is because it may not be just the tibial tuberosity that is malpositioned but the whole tibia (shinbone) may be significantly externally rotated. This is a discussion that may involve assessment of the hip joint as well by a colleague.

Surgical treatment

Following anaesthesia a tight inflatable band (tourniquet) is wrapped around your thigh which restricts bleeding into and around the knee during the operation. An arthroscopy (key-hole surgery) may be performed to assess the tracking before and address any irregularities on the articular surfaces. A longitudinal incision is then made on the front of the shin to expose the bony prominence (tuberosity). The prominence (with the attached patella tendon) is then undercut by a saw to create a long bony segment.

The prominence is then moved towards the inner aspect of the shin by a predetermined distance (depending on the initial TTTG value). It is then secured by 1 or 2 screws which compress the bony surfaces in their new position and allows the cut surfaces to heal together.
If the kneecap is also sitting higher than normal (usually with kneecap instability) it can also ne moved further down the shin bone to move the kneecap into the groove on the femur (distalisation).

The wounds are closed with sutures and a wool / crepe dressing applied to the knee.

When the bone cut is fully united these screws can be removed as they may be palpable and cause some discomfort when kneeling or loading the front of the knee.

Post surgery

Following the operation you will be required to mobilise 'partial weight bearing' using crutches for 1 month to reduce the load which is put through the front of the knee. This will protect the operation site whilst the bony surfaces start to unite.

You will have no splints, casts or braces and will be encouraged to regain a full range of movements as soon as possible.

This procedure is uncomfortable and you may find that the quadriceps muscles wastes after the operation. This emphasizes the importance of getting the muscles as developed as possible in the pre-operative phase.

Potential risks and complications

- **Post-operative bruising**

Due to the nature of the operation some bruising of the area is inevitable and there may be discomfort in the lower leg is blood tracks down into the calf.

- **Altered wound healing / sensation**

There may be some alteration of the sensation on the front of the knee which improves with time but may never fully recover.

- **Wound infection**

Despite the routine use of antibiotics wound infections may occasionally occur. Another operation may be required to wash out any infected wounds.

- **Anterior knee pain / Quadriceps wasting**

Any surgery involving the front of the knee is uncomfortable, with subsequent wasting of the quadriceps muscle. This may cause some difficulty with kneeling, squatting etc. Your physiotherapist will use techniques to reduce this pain and strengthen the muscles.

Approx. 1-5 / 100 patients

- **Blood clots (Deep Vein Thrombosis)**

These can occur in the lower legs following such surgery and can occasionally enlarge and move through the blood stream to the lungs (pulmonary embolus). However, having cut the bone and left exposed bony surfaces the use of blood thinning agents will significantly increase the risk of post-operative bruising and are avoided. Early ankle movements are essential to reduce the risk of clots and you will be encouraged by the physiotherapist to regularly undertake these exercises.

Approx. 1-5 /1000 patients

- **Stiff Knee**

Although rare, stiffness may occur following surgery. In some patients a manipulation and arthroscopy may be required to restore knee movement.

- **Severe pain**

Pain, stiffness and loss of use of the knee (complex regional pain syndrome) is rare and the cause is unknown. If this happens you may need further treatment including painkillers and physiotherapy. The knee can take months or years to fully recover.

Physiotherapy after your operation

Physiotherapy is an essential part of the surgical procedure, both to reduce the risk of post-operative complications and to ensure that you attain the best functional result. You must be committed to this in the weeks (and months) following the procedure if you want to do well.

Soon after your operation the physiotherapist will advise on some exercises to do whilst you are in bed to help reduce the likelihood of thrombosis. On the first post-operative day you will be helped to get out of bed and to start mobilising. You will rapidly progress to using crutches and be shown how to negotiate stairs. A booklet of recommended exercises will be provided for you to follow whilst at home.

When you are safe on crutches and the physiotherapist and surgeon are happy you can go home, usually on the day following surgery.