

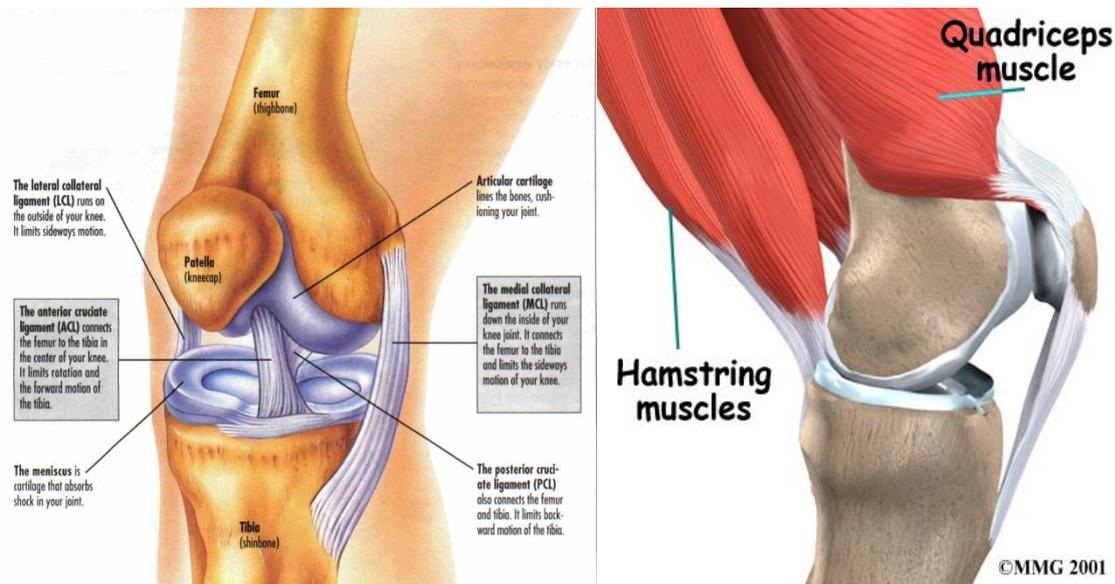
## The Knee Joint

### General structures of the knee:

The knee is considered a hinge joint, which allows for bending, straightening and small amounts of rotation in the lower leg. Four bones including: the femur, tibia, fibula and patella act as the structure of the knee joint and provide multiple sites for attachment of muscles, tendons and ligaments.

Muscle of the knee are formed into two basic categories: those that straighten the knee i.e. quadriceps, and those that bend the knee i.e. hamstrings. Both muscle groups start from the hip and end at the top of the tibia, which are attached by multiple tendons. Ligaments of the knee include the anterior and posterior cruciate ligament (ACL and PCL); and the medial and lateral collateral ligaments (MCL and LCL). These ligaments provide some resistance against any excessive forces and movements the knee is not usually use to and support the general structures.

To further support movement in the knee, cartilage is capped on the end of each bone and within the joint for protection. There are two types: articular and meniscal (end caps of the bone and spongy joint protection). As you can tell the knee is a very complex structure.



### Common traumatic injuries to the knee:

An acute injury has occurred which has been related to a specific event i.e. a football tackle that hit the outside of the knee causing pain on the inside. These injuries vary in location and may have different types of pain i.e. dull ache vs sharp pain.

**Medial meniscus tear** is a tear to the cartilage meniscus on the inside of the knee usually from trauma or twisting of the knee and often in occurs with a medial ligament sprain. Pain is be felt on the inner surface of the knee along the joint line. Swelling may occur within 48 hours of injury.

**Lateral meniscus tear** is a tear to the cartilage on the outside of the knee. Pain is usually felt along the joint line with swelling developing within 24 to 48 hours. Bending the knee or squatting may also reproduce knee pain.

**MCL injury** sprain or tear of the medial ligament on the inside of the knee. Usually caused by trauma to the outside of the knee which will stretch the inside of the knee.

**ACL injury** occurs from a sudden twisting or usually medial trauma to a slightly bent knee weight-bearing. Symptoms include pain in the knee with immediate swelling. An audible pop or crack at the time of injury and a feeling of instability.

**Articular cartilage injury** is damage to the tough cartilage that lines the ends of bones. There may be locking of the knee due to broken off bits of cartilage floating within the joint.

**PCL injury** occurs when the knee is bent back the wrong way. Symptoms typically include pain which over time may also be felt in the calf region. There may be swelling and instability of the joint.

**Patella (knee cap) dislocation** occurs usually to the outside of the knee joint. Pain is felt immediately at the time of injury and is likely to be swelling in the joint with an obvious displacement of the kneecap. Often the kneecap may briefly dislocate and then return to its normal position

**Patella tendon rupture** is a tear of the patella tendon and can be partial or complete. Often severe pain is felt just below the knee cap with rapid swelling.

**Quadriceps tendon rupture** is a tear of the quadriceps or thigh muscle along the top of the knee cap.

**LCL injury** occurs on the outside ligament of the knee. It is often caused by impact on the inside of the knee which stretches the outside of the knee.

**Knee bursitis** is a swelling of a bursa or small sack of fluid in the knee. The most common is pre-patella bursitis causing swelling on the front of the knee cap.

**Acute fat pad impingement** is where the fat pad below and underneath becomes impinged under the knee cap. Usually as a result of over-straightening or the excessively bending the knee backwards.

**Biceps femoris avulsion** occurs when the outside hamstring muscle tears at the tendon pulling a small piece of bone away with it. Symptoms include sudden pain at the back of the knee where the tendon inserts along with swelling.

**Tibiofibular joint dislocation** occurs most commonly when the athlete sustains an impact or falls with their knee in a fully bent position. It is a dislocation of the tibia and fibula bones at the top near the knee.

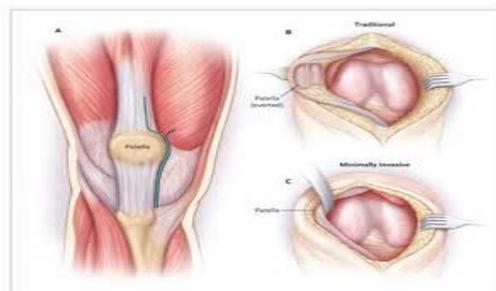
**Tibial plateau fracture** is knee injuries resulting in a fracture of the top of the tibia bone.

**Quadriceps tendon rupture** is a tear of the tendon along the top of the knee cap.



### Generalised symptoms of knee injuries:

- Ligament
- Pain often severe and sudden
  - A loud popping sound may have been evident
  - Quick swelling (usually more for ACL)
  - A feeling of looseness in the joint
  - Inability to put weight on the point without pain
- Meniscus
- Pain at site of injury – usually at the side or centre of the knee
  - Gradual swelling over 2-3 days – can be quicker if larger tear
  - Knee feels stiff and limits bending
  - Turning, twisting, squatting and rising from a seat position causes pain
- Muscle tear
- pain at site of tear in muscle
  - Unable to weight bear on affected knee
  - Feel sudden giving way feeling in muscle
  - Bruising around affected area
  - Pain on active movements of associated muscle i.e. hamstring pain when bending knee against resistance.
  - Tender to touch at site of pain
  - Muscle may spasm.
- Fracture
- Severe pain and unable to weight bear
  - Widespread swelling
  - Tenderness
  - Bruising
  - Obvious deformity or shortening of leg
- Dislocation
- Severe pain
  - Visibly deformed or out of place
  - Swollen and/or discolouration
  - Immovable
  - May experience numbness/tingling below knee
- Bursa
- localised pain
  - Swelling/inflammation
  - Increased pain at night
  - Pain on movement
  - Stiffness
  - Tender on palpation



### Diagnosis of knee injuries:

From the information given, there are many common symptoms for different conditions within the knee joint. For this reason a diagnosis (despite a thorough physical examination) may be difficult to identify. If so, imaging and scans may be performed in order to help create a diagnosis. Typically an x-ray of the knee will be done first followed by a Magnetic Resonance Image (MRI) and/or an ultrasound (US).

An X-ray is useful to identify changes to soft tissue (even fluid within knee), bone quality (shape/bone thinning), alignment of joint, space within joint, spurs and fractures (particularly at top of tibia and patella).

An MRI will identify all the above structures in an X-ray, however will give an overall picture of other structures too including ligaments, cartilage, muscle and collection of fluid. An MRI is usually performed when an abnormal finding is found on the X-ray. An MRI is useful when:

- Evidence of swelling and fluid build up
- Infection of knee joint
- Knee cap injury
- Knee pain with fever
- Knee locking when walking or moving occurs
- Knee pain does not get better with treatment

Ultrasound is not as widely used to image the knee, however, recently has become more popular amongst health professionals. Ultrasound is used to see problems with muscle tendons, ligaments and cysts within the knee. This may be done if health care professionals are still unsure of the pathology affecting the knee.



### What we do as physiotherapists:

As physiotherapists in a private practice we aim to help diagnose a condition and provide conservative treatment that is evidence based. This includes gathering a detailed verbal and physical assessment and discussing and administering the best quality treatment.

Verbal assessment: This is gathering the “who, what, when, why and feelings” of the patient’s condition. By understanding who the patient is, the area of injury, how long ago it happened, why and how it happened and the pain/discomfort the patient is feeling is vital to helping us diagnose

the problem. I.e. a person who has had knock to the side of the knee and now feels pain inside the joint may be more likely to have an ACL injury rather than a quadriceps tear.

Physical assessment:

For the knee there are specific tests that we go through in order to check the range of movement (ROM) within the knee joint, the strength and feel of the muscle and if there is damage to particular structures ( such as ligaments, tendons and cartilage). It is important that we test these structures if indicated and also test the knee joint in a functional way (how we cope with movements in everyday life) to decide on an appropriate treatment.

Some of these tests are shown on the next page:

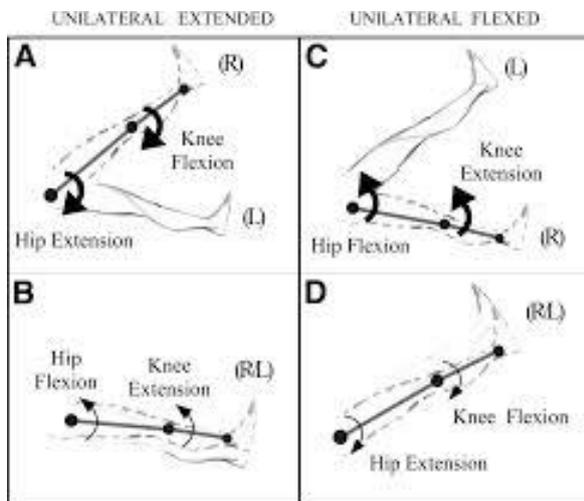


Figure 1 Testing knee range of motion

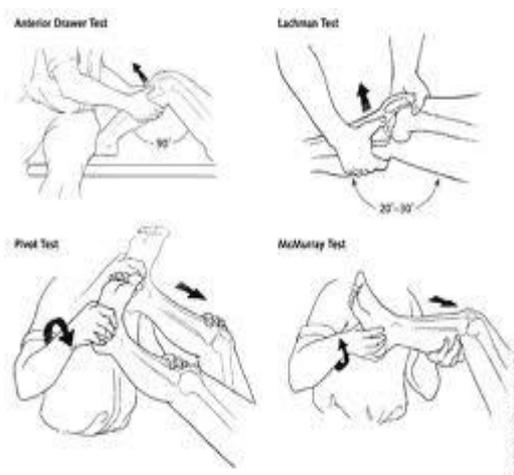


Figure 2 Ligament and cartilage testing 1



Figure 3 Muscle testing of hamstrings 1



Figure 4 Function test: single leg squat 1

## **Rehabilitation of the knee:**

Depends on the structure affected and the stage of the injury. However, there are certain exercises and techniques that are used for a wide variety of knee conditions. Exercises which maintain range of movement (ROM) in the knee and strengthen the quadriceps and gluteal muscles are commonly used for knee pathologies. **Exercises** commonly used include:

### Heel slides – knee ROM – figure 1

- Whilst laying on back, slide heel towards buttocks with the affected knee
- The knee should gently bend up
- Move the knee until pain presents or cannot move any further
- Perform 3-5 times per day with 10 repetitions every day

### Stationary knee straightening – Knee ROM – figure 2

- Whilst laying on back, elevate leg by placing heel on a slightly higher surface
- Straighten out knee as much as possible so the lower leg is completely straight
- Hold for 5 minutes and relax for 2 minutes (can use 2kg rice bag to weigh down knee)
- Perform 3 sets, every day

### Straight leg raise – Hip and quadriceps strength – figure 3

- Whilst laying on back, keep leg straight and gently raise whole leg off the bed
- Raise leg to about 45 degrees and then gently lower back down
- Perform 3x10 repetitions each leg, every second day

### Inner range knee straightens – quadriceps strength – figure 4

- Whilst laying on back, place a rolled up towel underneath affected knee so it is slightly bent.
- Straighten out leg so the heel comes slightly off the bed
- Hold for 3 seconds and gently lower the leg
- Perform 3x10 repetitions each leg, every second day

### Step ups – quadriceps and gluteal strengthening – figure 5

- Using a step, lead with affected knee and step up onto the raised surface
- Come to a complete stop once two feet are placed onto the step and lead back down with the affected leg.
- Repeat on opposite side
- Perform 3x 10 repetitions each leg, every second day.

### Mini squats – quadriceps and gluteal strength – figure 6

- Stand with back against the wall with legs slightly in front of the body
- Feet should be placed approximately shoulder width apart and evenly distributed weight
- Gently bend through the hips, knee and ankles and slide down wall
- Bend to approximately half way down from a knee bend and push back up using legs
- Perform 3x10 repetitions, every second day

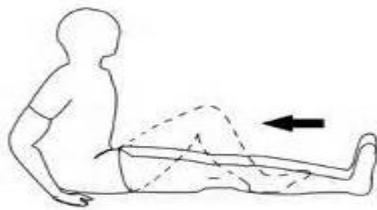


Figure 1 heel slides 1

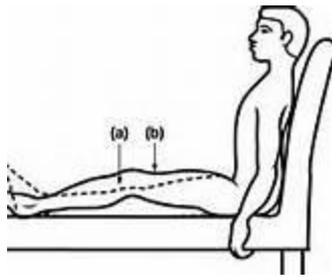


Figure 2: Stationary knee straightening

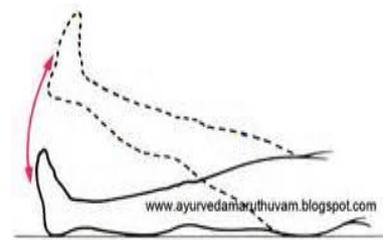


Figure 3: Active straight leg raise

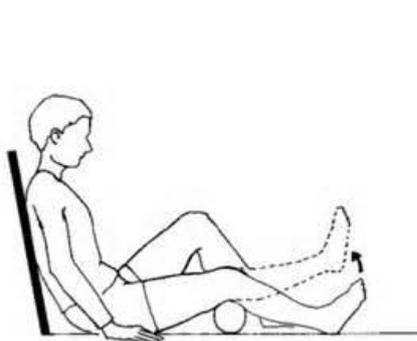


Figure 4: Inner range leg straightens.

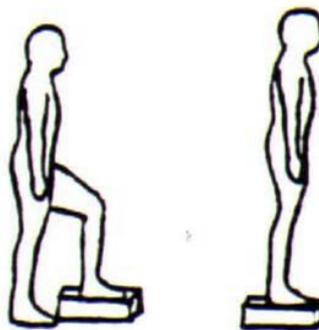


Figure 5: Step ups.

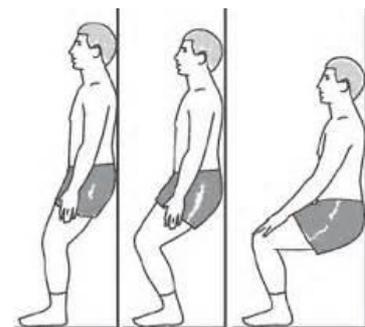


Figure 6: Mini squats.

It is important to remember that these exercises may vary for different conditions of the knee and consultation with a physiotherapist is advised to tailor a program specifically for you. This will involve an appropriate demonstration, monitoring of technique and a prescription of frequency, intensity, type and time of the exercise.

#### **Physiotherapy techniques** include:

##### Icing – swelling and inflammation

- Used to control swelling and inflammation around the knee joint
- Put ice/icepack into two layers of towel which is slightly wet
- Place ice onto swollen knee for 15-20 minutes
- Can do up to 3-5 times per day
- Usually done from first initial injury for 2-4 day afterwards

##### Compression bandage – swelling and inflammation

- Tubi-grip usually applied for compression
- Pushes fluid and inflammation back up leg to be reabsorbed

##### Heating – improve blood supply and makes soft tissue more elastic

- Place heat pack in two-three layers of towel
- Put heat pack on affected area for 20-30 minutes
- Can be done 2-3 times per day
- Usually after 3-4 days after inflammation and swelling has disappeared

### Electro-physical agent treatments

- Includes therapeutic ultrasound, interferential and TENs
- Used to help body reabsorb loose fluid, control pain and realign fibres
- Has specific parameters and should be administered only by a trained health professional.

### Soft tissue massage

- Help move extra fluid around knee, improve extensibility of muscles, realign fibres and increase blood flow to affected area.
- Self-massage may be quite effective in knee pain management.

### **Knee surgery and implications**

#### Why people have knee surgery?

- If a complete (rupture) or severe tear of the ligaments has occurred, surgery is needed to reattach or mend the ligament to its original bony site. Usually, a piece of the hamstring or quadriceps tendons is used to fill in the pieces of the torn ligament.
- If the cartilage has been damaged badly and the knee begins to “lock up” – generally the patient will have the cartilage shaved or a piece taken out of the knee.
- Complete tear of tendon or muscle. Similar to reconstruction of a ligament but the tendon is reattached and stapled down to the site.
- A total knee replacement (TKA) is performed when there is too much general “wear and tear” of the joint. Conditions such as severe osteoarthritis are a classic example of when a joint will need replacing. Knee joints usually replaced by titanium.

#### How surgery knee surgery is done?

- For ligaments, cartilage and tendons an arthroscopy is usually performed in modern medicine. This means a very small camera is inserted into the knee by a small incision to repair the damaged structure.
- Open surgery is used for total knee replacements where a large incision is made at the front of the knee and the whole joint is exposed and then replaced.

#### Do I need physiotherapy after surgery?

Yes! After knee surgery the joint, muscles and overall function of the knee will be inhibited. A physiotherapist will help with:

- Pre-operative exercise programs designed to increase muscle bulk and strengthen muscles around the knee to help with functional rehabilitation surgery.
- Control swelling, inflammation, pain and wound management after surgery.
- Improve movement within the knee whilst managing the repaired structure in a safe way.
- Strengthen muscles around the knee for stability and the best possible function.

If no physiotherapy is done or in an improper way the function of the knee will be limited and possible need for further surgery may be inevitable.

