BodyAid SOLUTIONS

Level 5 Diploma in Massage Therapy for Sports
The Knee - Complex Assessment
RQF
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FOCUS AWARDS

sta sports therapy association

The Anatomy of the Knee Joint

The knee is a synovial hinge joint. A complex structure that with stands large amounts of force, especially when playing contact sports! It's the number one in terms of pressure and weight placed upon it within our bodies. Responsible for us having the ability to flex our legs and extend them. They absorb a lot of shock and put up with a tremendous amount of force when we walk, run or jump! The joint articulates 4 leg bones and a complex system of ligaments and muscles.

So first we look at the bones of our knee. The Knee is made up of four bones-. All located in the leg. The femur or thigh bone is the largest in the upper leg, the tibia which is known as the shin bone, the fibula and patella or as we like to refer to it the kneecap. All of which are classified as ling bones, except the patella which is a sesamoid bone, specifically involved for protection of the joint.

Main movements of the knee joint occur between the femur, patella and tibia. Each are covered in articular cartilage which is an extremely hard, smooth substance designed to decrease the frictional forces as movement occurs between the bones.

The patella lies in an indentation at the lower end of the femur known as the intercondylar groove. At the outer surface of the tibia is the fibula, a long thin bone that travels right down to the ankle joint. The function of the tibia is predominantly load bearing whilst the function of the fibula is predominantly to provide a surface for muscles to attach to.

The Knee joint capsule

The Knee's joint capsule is a thick ligament like structure that surrounds the whole knee, underneath this capsule is the synovial membrane. The synovial membrane produces synovial fluid, this acts as a lubricant for the knee, like oil in a car. It allows the smooth running of the joint without any resistance or creaking! Another structure is the bursa, this has the function to absorb force and stress upon the knee from external forces.

Ligaments of the knee joint

The stability of the knee owes greatly to the presence of its multiple ligaments. Each has a individual function and helps us to maintain optimal knee stability in a variety of different positions.

The medial Collateral Ligament or referred to as the MCL, is a band that runs between the inner surfaces of the femur and the tibia. It resists forces acting from the outer surface of the knee called valgus forces and prevents the knee from collapsing inwards. The medial knee ligament has two parts to it; an inner part which attaches to the cartilage meniscus on the inside of the knee and an outer part with attaches to the tibia bone.

The lateral Collateral Ligament or LCL is on the outside of the knee and joins the outer surface of the femur to the head of the fibula. It resists impacts from the inner surface of the knee known as varus forces.

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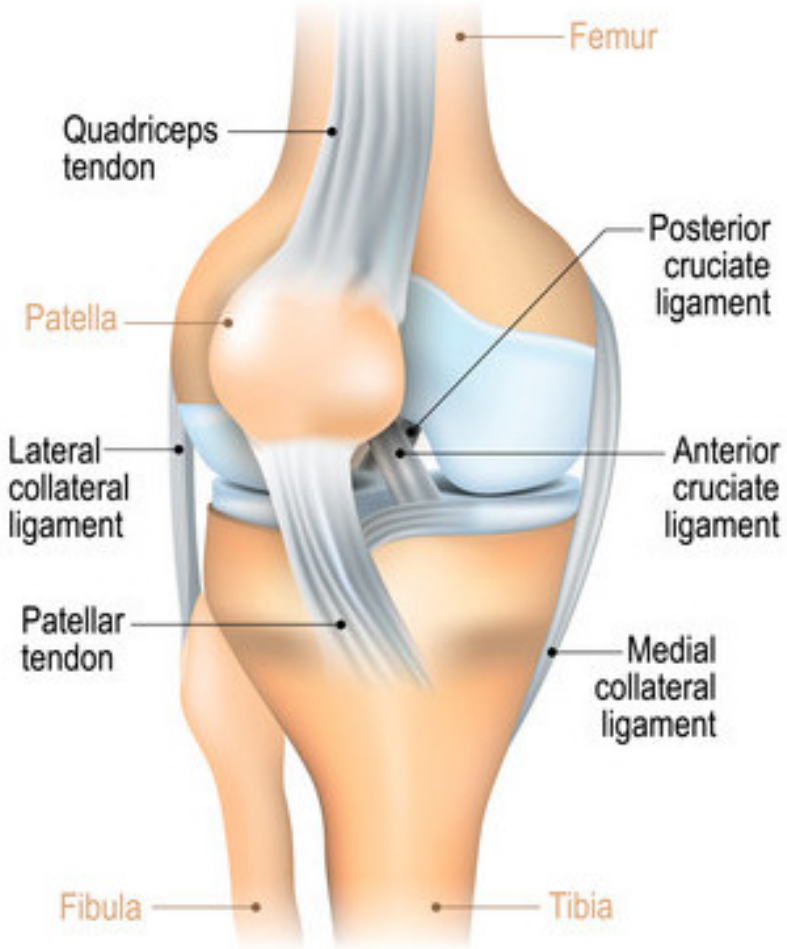
The anterior Cruciate Ligament or ACL is one of the most important structures in the knee, not least because injury to it may require extensive surgery and rehabilitation. The cruciate ligaments are so called because they form a cross in the middle of the knee joint. The ACL, travels from the anterior or front of the tibia to the posterior or back of the femur and prevents the tibia moving forward. It is most commonly injured in twisting movements.
The posterior Cruciate Ligament or PCL attaches from the posterior or back surface of the tibia to the anterior or front surface of the femur and in doing so wraps around the ACL. The posterior cruciate ligament prevents the knee joint from being bent back the wrong way.

Cartilage menisci

Each knee joint has two crescent-shaped cartilage menisci. These lie on the medial or inner and lateral or outer edges of the top surface of the tibia bone. They are essential components, acting as shock absorbers for the knee as well as allowing for correct weight distribution between the tibia and the femur.



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Muscle groups surrounding the knee joint

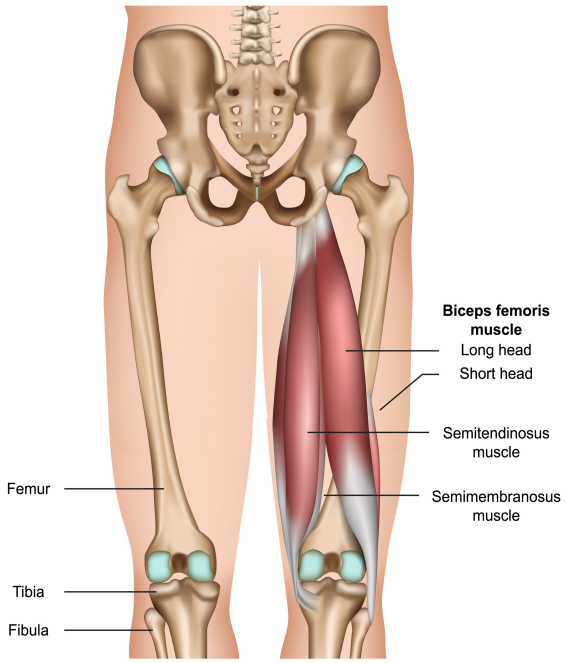
The two main muscle groups of the knee joint are the quadriceps and the hamstrings. Both play a vital role, both moving and stabilising the knee joint.

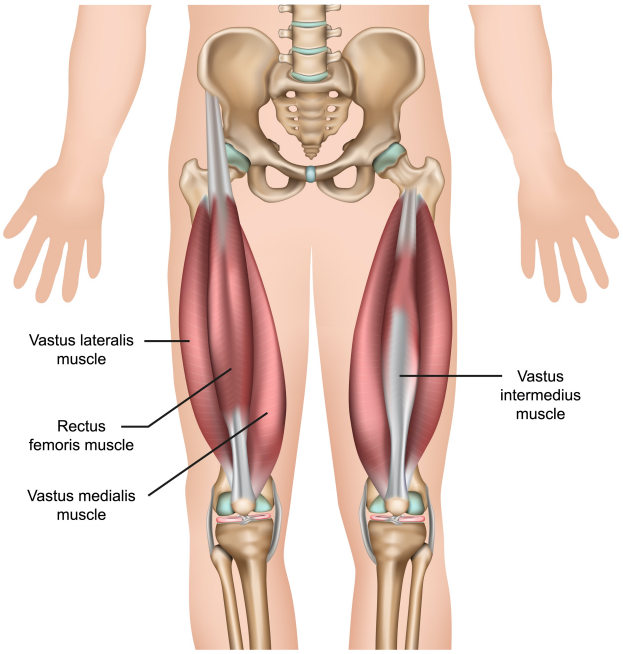
The quadriceps muscle group is made up of four different individual muscles which join together forming the quadriceps tendon. This thick tendon connects the muscle to the patella which in turn connects to the tibia via the patella tendon. Contraction of the quadriceps pulls the patella upwards and extends the knee. The quadriceps muscles consist of the biceps femoris, vastus medialis, vastus intermedius and vastus lateralis muscles.

The hamstring muscles at the back of the thigh function in flexing or bending the knee as well as providing stability on either side of the joint line. The hamstring muscles consist of the biceps femoris, semitendinosus and semimembranosus. See knee joint muscles for more detailed information.

Not forgetting how vital the calve muscles are in knee stability. Often forgotten by many in regards to re-hab. The, calve muscles in particular gastrocnemius.

The calf muscle has the ability to produce compression forces that are needed to support your knee during the landing phase of jumping. This is supported for example by research that The University of Western Australia's School of Sport Science, Exercise and Health (SSEH) and the department of Mechanical, Aerospace and Biomedical Engineering at the University of Tennessee carried out. Showing that during testing of 6 Australian Rules footballers that the gastrocnemius muscle produced impressive amounts of force than the hamstring group to carry out joint compression forces that are required in supporting the knee during single leg landing tasks.





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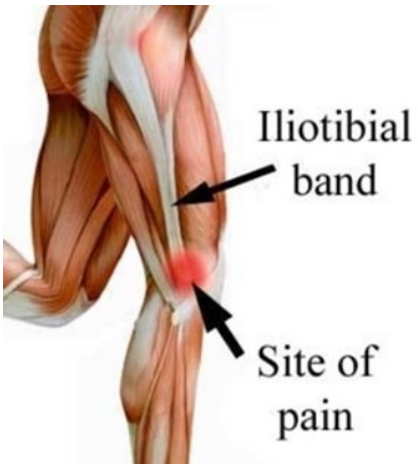
Injuries and conditions of the knee

The knee is a very strong yet highly vulnerable joint. Knee pain can often be a symptom of a dysfunction within another area such as your ankle or hip. The knee joint is also very suseptable to injury within contact sports and thus can become seriously injured. The knee is often left weight bearing and with stands great amounts of pressure and weight. Being asked to pivot and weight bear in high speed situations. Games such as basketball, football, rugby and hockey require high demands of the structure. Not only intrinsicly but extrinsic forces can also be applied onto the knees from tackles for example.

Other joints such as the hip may become compromised and unable to function effectively compensatory movement may be forced on the knee. Some of the most common injuries and conditions to the knee are presented below.

Iliotibial band (ITB) syndrome – The TFL and IT Band will aid in the stability of our hips, femur, tibia and fibia whilst doing weight bearing activities. So it's understandable that for this reason they can be excessively tight for the client. This can give rise to iliotibal band syndrome, which is most commonly known as 'runners knee'.

The overuse, excessive pronation of the foot or eccentric loading, causes friction between the lateral epicondyle of the femur and iliotibal band. This leads to swelling/inflammation and lateral knee pain.



Presentation subjective:

- History consistent with possible causes
- A sharp pain at the lateral aspect of the knee which increases whilst running, especially downhill or on a cambered surface.

Presentation objective:

- A Positive Ober's test (special test used to identify tight ITB /TFL)

If the sports massage therapist is to identify the cause or possible secondary conditions that may develop. A full ARTS analysis will have to be undertaken.

Therapist aims/actions:

- treat any inflammation using PRICE
- lengthen short muscles (especially ITB /TFL)

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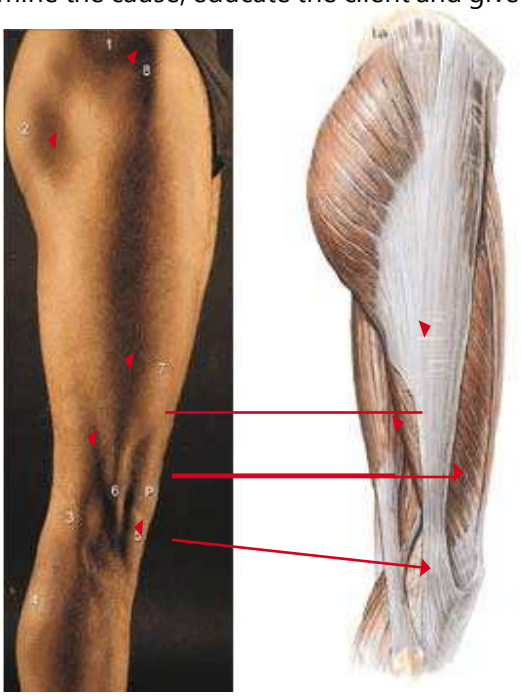
- assist the independent function of the ITB and vastus lateralis by reducing adhesions between them
- strengthen inhibited muscles (especially TFL /gluteals)
- Ensure the client has sufficient ROM, strength and proprioceptive abilities to carry out ADLswithout the need to develop compensatory movement patterns
- identify any secondary conditions which may be apparent
- try to determine the cause, educate the client and give corrective exercise



Patellofemoral pain or dysfunction – Several conditions that can affect the function of the patella and can produce pain and swelling. Although the cause of each cab be attributed in the most part to the mal-tacking of the patella itself.

The movement of the patella, within the femoral groove, is directly controlled by the 4 muscles which attach to it:

- rectus femoris and vastus intermedius - both of which pull the patella in the direction of the hip joint
- vastus lateralis – which pulls the patellalaterally
- vastus medialis – which pulls the patellamedially

If the balance between the vastus group is lost, and specifically the event of the vastus medialis becoming weak, the patella can be pulled laterally across the femoral condoyle during knee movement. This will cause the patella to 'twist' within the femoral groove. Factors that can contribute to this alteration in muscular balance are having excessive foot pronation, a wide Q-angle or tightness in the ITB or bicep femoris. Conditions associated with mal-tracking include:

Chondromalacia patellae – This condition describes the deterioration, softening and roughening of the patella's articular cartilage this can be either unilaterally or bilaterally. More common in younger clients whose cartilage and bone have not yet achieved their full density and maturity.

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Painful patella syndrome (PPS) - PPS is most often noted on eccentric loading. Although this condition may not be apparent on a daily basis, high impact or explosive activities, running (particularly downhill - runner's knee), squats with weights or even walking downstairs can initiate pain and inflammation. Left untreated, the cartilage will eventually wear away resulting in arthritis.

Presentation subjective:

- females are predisposed to the condition due to a greater Q-angle
- pain felt inside knee
- a history of horse riding, cycling, skiing, step class or any activity which engages the quadriceps but does not allow full extension will encourage a muscular imbalance to develop (as vastus medialis is mainly active in the last 20^{O} of extension)
- lack of activities which involve quadriceps. The patella is a sesamoid bone located within the quadriceps tendon. The smaller the muscle, the closer the patella to the underlying surface. This causes it to drag sooner than glide across the articular surface.

Presentation objective:

- visible patella malalignment or maltracking during contraction of quadriceps
- vastus medialis atrophy
- possible genu valgum ('knock knees')

Therapist Aims/Actions:

- treat any inflammation using PRICE
- Look at carrying out Bulge or Balltenment Tests
- Patellar Apprehension Test
- Strengthen inhibited muscles (especially vastus medialis)
- lengthen short muscles (especially vastus lateralis)
- try to determine the cause, educate the client and give corrective exercise
- Ensure the client has sufficient ROM, strength and proprioceptive abilities to carry -out ADLs without the need to develop compensatory movement patterns
- identify any secondary conditions which may be apparent
- Refer to a GP if treatment results in the knee becoming swollen or any loose bodies apparent.

Bursitis - Any of the bursa of the knee can become irritated by an increase of friction due to movement pattern alterations, overuse or impact. If a bursa increases in size in response to trauma it can then further affect movement at a joint.

Presentation:

- swelling and tenderness local to the affected bursa
- Restricted range of movement may be presented with onset of pain as the bursa is pressed by surrounding tissues.

Therapist aims/actions:

- identify and minimise exacerbating factors such as repetitive movements
- utilise cryotherapy to reduce swelling and pain if present
- assess musculature to identify tension or excessive friction being placed on the affected bursa and treat accordingly

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Osgood-Schlatter's Disease - Growth acceleration or excessive exercise can pull the patella tendon away from the periosteum at the tibial attachment. This leads to inflammation of the bone tissue and the production of additional bone as the area attempts to increase its strength and repair damage.

This condition affects around 15% of active clients in the age group of 12 to 16 years. Healing is often spontaneous and problems seldom occur once the leg is fully developed unless changes to the bone affect the mechanics of the patella when under load. However, some individuals will continue to experience recurrent inflammatory responses throughout their life, particularly if they make changes to their activity levels, rapidly increasing the stress to the tendon attachment.

Presentation:

- pain at the tibial attachment of the patella tendon
- heat and inflammation

Therapist aims/actions:

- identify and minimise exacerbating factors
- utilise cryotherapy to reduce if swelling and pain present
- reduce tension in the quadriceps group, the rectus femoris particularly, to reduce pressure on the attachment

Menisci - Damage to the menisci of the knee joint can result from the femur rotating on the tibia with the foot fixed and the knee forcibly flexed during full weight-bearing, such as in a rapid change of direction and acceleration. This can be caused by tearing or the development of lesions of the medial and lateral meniscus.

Presentation:

- pain on the medial or lateral joint margin of the knee
- locking of the joint
- inflammation of the joint capsule
- positive special tests
- atrophy of the quadriceps

Therapist actions:

- release restrictions in the quadriceps and rectus femoris that may be applying traction and refer to GP for further investigation

Loose bodies – Fragments from the meniscus, hyaline cartilage or bone can form loose bodies within the joint. This may result from trauma or osteoarthritic disease with the fragments becoming trapped between the articulating surfaces of the joint.

Presentation:

- recurrent locking of the joint
- sharp pain often followed by swelling

Therapist actions:

- refer to GP for further investigation

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Quadriceps injury – Any injury to this muscle group may lead to a knee joint disorder as the quadriceps rapidly loses strength and bulk. Particularly the vastus medialis, if activity within this muscle group is reduced. This can begin a perpetual cycle of problems as the knee, and potential hip mechanics alter, presenting as intrinsic knee pain.

Presentation:
- weakness on contraction
- visible difference in muscle bulk from the unaffected side

Therapist aims/actions:
- encourage full use of the affected limb as long as no symptoms such as pain or inflammation are present, to prevent further atrophy
- utilise post-care advice exercises to improve muscular balance across the vastus group

Patella tendonitis – Excessive loading through the tendon, as in explosive activities, can lead to inflammation of the patella tendon. Sustained problems can lead to a degenerative condition called tendonosis.

Presentation:
- pain on eccentric loading of the quadriceps
- thickening of the patella tendon

Therapist aims/actions:
- identify and minimise exacerbating factors such as specific sporting activities
- utilise cryotherapy to reduce swelling and pain
- assess and lengthen rectus femoris if found to be tight, to reduce tension on the tendon

Ligament injuries - medial or lateral collateral ligament sprain – The MCL is more commonly damaged than the LCL. Most common in contact sports, via an excessive valgus force, with impact coming from the lateral aspect of the client's knee. Another reason is due to repetitive activities causing laxity or inflammation (swelling), such as swimming breast stroke (swimmer's knee.). Where-as the LCL will be damaged by varus forces.

Presentation:
- pain on the medial or lateral joint line
- feeling of instability if moderate to severe
- heat but not necessarily swelling
- positive special test

In some cases, there may be no visible local swelling although heat will still likely be felt.

Therapist actions:
- utilise cryotherapy to reduce swelling and pain if present
- identify MOI and if due to repetitive actions minimise if possible
- following acute phase mobilise to reduce the risk of adhesion formation
- following acute phase mobilise to prevent protective spasm becoming a permanent adaptive change to the muscle length, affecting long term range of movement
- strengthen supporting musculature to aid joint stability
- refer to GP if severe pain or excessive instability is being experienced

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Anterior or posterior cruciate ligament sprain - An ACL sprain is a common injury of the knee and can be caused by rapid, excessive rotation or severe hyperflexion of the knee, often occurring when landing. A PCL injury can also occur as a result of dynamic rotational forces at the knee or when receiving an impact to the front of the knee while the leg is in extension / hyperextension this is rare however. Often the client will hear or feel a 'pop' or 'crack' at the time of occurrence and may initially experience a loss of stability at the joint. However, if this has been a severe sprain swelling will be very rapid and would be capable of making the joint appear stable again within a few minutes. This is usually an indicator that the ACL has been almost completely or fully ruptured, and the artery linked with it is filling the joint cavity with blood.

Presentation:

- initial joint laxity that may then disappear in the event of a severe sprain
- rapid, severe swelling of the joint
- heat
- pain deep in the joint
- reduced ROM

Therapist actions:

- Take advantage of cryotherapy to reduce swelling and pain if present
- following the acute phase mobilise to reduce the risk of adhesion formation
- following the acute phase mobilise to prevent protective spasm becoming a permanent adaptive change to the muscle length, affecting long term range of movement
- strengthen supporting musculature to aid jointstability
- Refer to GP if severe pain or excessive instability is being experienced or a full rupture is suspected.

Note: Often if the ACL is a complete rupture MCL damage may also be apparent.

Patella Fracture: - A fracture is a break in the patella, or kneecap as commonly referred too. , It is the small bone (sesamoid) that sits at the front of your knee. Your patella will act as protection, a shield for the knee joint, thus due to its nature it is vulnerable to fracture if you fall directly onto your knee or take an excessive force such as a kick in a game scenario. A fracture to your patella is a very serious injury that can make it difficult or even impossible for your client to straighten the knee, thus enabling them to walk and carry out daily activities successfully.

Presentation:

- Bruising
- Rough edges felt by therapist on palpation
- Inability to straighten the knee or keep it extended in a straight leg raise
- Inability to walk
- There may-be large amounts of blood in the knee joint
- Painful swelling

Therapist actions:

- Refer to GP

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Assessment of the Knee

After completing range of movement testing on the knee, we can look to set out further tests to help identify any problems with mobility and joint condition. Often the knee is prone to swelling when there is injury or an issue with the biomechanical function.
Its, also important to consider referred pain that might be felt at the knee but the causality is in the hip or ankle for example.

Knee Swelling

Bulge Test

Occasionally known as the swipe test. Visually for the most of the time you will see when a joint is swollen. Especially if you are comparing and contrasting against the other non-afflicted knee for example. Size, dis-colouration are obvious signs. How-ever if it is not obvious then a simple bulge test can be applied to help identify any swelling within the area. Looking for a wave of fluid both medially and distally (away from midline of the body) where it bulges. This indicates a joint swelling or effusion as often referred too.

1. Client should be supine with legs outstretched.
2. As therapist stroke medially towards the hip 3 to 4 times.
3. The repeat in the same manor laterally at the side of the knee.

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Ballottement Test

Also called the patellar tap test in many publications. A positive outcome in this test the patella (knee cap) returns to its normal position after the 'tap' from the therapist. Or there is a click when pushing into the patella. Which highlights some fluid behind it.

1. Clients is positioned supine on the couch/bench with their knee extended.
2. The therapist produces a stroking motion on the client's knee. A 'milking' of the patella. The strokes run distally (away from the midline.).
3. The therapist opposite hand strokes distally to medially (inward) on the client's tibia and stops just before the apex of the knee. Apex of the patella is located inferiorly and is basically the start of the patella bone.
4. The therapist is applying downward pressure, using the index finger to tap on the patella.

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Anterior Cruciate Ligament Injury

A very common knee injury. Accounting for around 40% of all sports injuries. You can tear your ACL if your lower leg extends forwards too much. It can also be torn if your knee and lower leg are twisted. They occur more frequently in sports involving pivoting, a twist and quick change of direction such as for example football, rugby, basketball and netball. It's a main stabiliser of the joint , especially during rotation, and thus can come under immense pressure

Lachman

The Lachman's is a very popular and common test when identifying an ACL injury. A positive test will be indicated when the tibia is moved forward with a loose feel to the joint. The anterior of aspect of the tibia will move forward around 6mm more than the non-effective knee.

1. Client is lying supine (on back.).
2. Knee flexed between 30-40 degrees, with therapist knee under for support. Slightly externally rotated.
3. Using the outside hand, the therapist stablises the leg from the femur, just above the knee laterally.
4. Therapist then takes a hold of the tibia from the posterior aspect medially. Then pulls the tibia anterior.

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Anterior Draw Test

The anterior drawer test is a test that will look at the stability of the client's anterior cruciate ligament (ACL). A positive test will be indicated when the tibia (shin bone) has excess movement in comparison to the uninjured site and there is a excessively loose feel.

1. Lying in the supine with the knee in 90 degrees flexion. With feet flat on the therapists couch/table.
2. The client will fixate the leg by sitting on the client's foot.
3. The therapist will palpate the joint using their thumb and grab on the tibia posteriorly.
4. Then the therapist brings the tibia forward in an explosive movement.

Lelli's Test

Also known as the Lever Sign A simple and effect test, which can be performed in a number of places. Especially useful in sport on court for example. A positive outcome will see the heel unable to be lifted off the floor/table. So, a suspected ACL tear. Showing a good accuracy to identify whether the ACL is torn or not.

1. Place client in the supine position.
2. Making a fist the therapist places it under the clave around 1/3 down from the knee.
3. With a small amount of force the therapist then applies downward pressure upon the distal part of the femur, just above the knee cap.

Posterior Cruciate Ligament Injury

Not as common as their ACL counterparts. The PCL tear makes up less than 20% of knee ligament injuries. Often injuries that tear the PCL have often damaged some of the other ligaments within the knee also.

Posterior Draw Test

Very similar in its execution as that of its anterior named cousin. The Posterior draw test will be indicated as positive when there is excess movement posterior once the test is conducted, the joint will also feel looser in-comparison than the unaffected knee/joint.

1. Client is lying supine, with knee flexed at 90 degrees and hip at around 45 degrees. Again, as before the position is fixed by the therapist sitting onto the client's foot. Feet are to be flat on the couch/table.
2. The therapist then palpates the knee joint line and takes a hold of the tibia anteriorly.
3. Then with a short and sharp movement, force is applied to move the tibia posteriorly.

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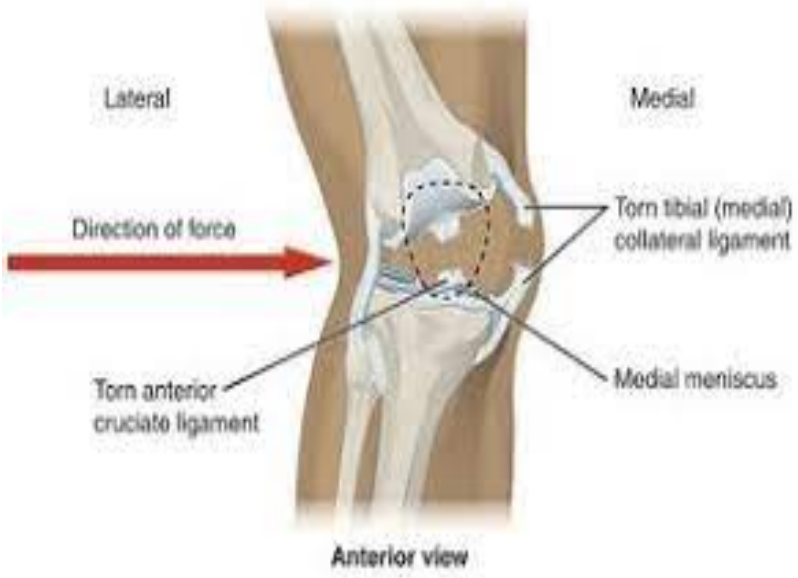
Collateral Ligament Injury

Injuries to the medial collateral ligament make up about 40% of all serious knee injuries. This makes it the most common knee injury to have. As we weight bear medially towards the midline, its not surprising. Often a MCL rupture also coincides with an ACL tear. The MCL is more commonly and more likely to be injured than that of the LCL due to the anatomy of the lateral aspect of the knee. If your LCL is injured is very likely the other structures are also injured.

Valgus Stress Test

The valgus stress test or medial stress test, is a test for damage to the medial collateral ligament of the knee. It involves placing the leg into extension, with one hand placed as a pivot on the knee. A positive test occurs when pain or excessive gapping occurs (some gapping is normal at 30 degrees). Be sure to not include rotation of the hip in your application of force.

1. Place your client in the supine position.
2. Take a hold posteriorly just above the ankle joint and place your other hand laterally on the femur to ensure stability.
3. Place a passive force to the knee moving the knee medially. Looking for excessive gapping and loose feel.



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Meniscus Injury

A common knee complaint with many and in-particular contact sports persons, a meniscus injury can be a painful one. The meniscus is a C-shaped piece of tough, rubbery cartilage that acts as a shock absorber between your shinbone and thighbone. It can be torn if you suddenly twist your knee while bearing weight on it. Degenerative tears of the meniscus are more common in older clients. With 60% of the over 65s having some sort of degenerative damage.

Apleys Stress Test

The Apley's grind test is a test used to gain insight into an individual's problems of the meniscus in their knee. A positive testis when a client reports pain and discomfort when compression/pressure and rotation are performed in comparison to traction and rotation.

1. Place client in prone position lying on the couch/table
2. The therapist will take a grip of the distal part of the tibia just above the malleoli, whilst fixing the femur to the table with the therapist's knee closest.
3. Then the therapist rotates both laterally and medially
4. Finally, the therapist gives compression with the body or their forearm (dependant on client size) and again rotating.

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Joint Line Tenderness

During the application of this test the client will feel tenderness and pain upon the therapist palpating the area. Again, a very easy and simple test with a very good level of accuracy.

1. Position the client supine. With knee flexed to 90 degrees, allowing more access to the joint.
2. Therapist internally rotates the tibia and palpates the medial meniscus at the joint line.
3. This is then repeated (step 2), laterally.

McMurray Test

An effective test, where a positive outcome with have the client reporting locking, pain and clicking may even be heard in the knee.

1. Client is to be in the supine position with knee fully flexed.
2. The therapist then rotates the tibia medially and brings the leg into a position of extension. This procedure is the repeated a number of times with slightly different positions when the knee is flexed.
3. Then the tibia is rotated laterally, repeating step 2.

Thessaly test

A simple and effective test. Testing the integratey of both medial and laterally meniscus.

1. Client stands with arms outstretched and knees slightly flexed around 20-30 degrees.
2. Therapist supports clients outstretched hands.
3. Client pivots both laterally (externally) and medially (internally), 3 to 4 times.

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Patellofemoral Pain Syndrome (PFPS.).

A common condition that 1 in 4 knee injuries are attributed too. A condition believed to be brought on by overuse. Patellofemoral pain syndrome is a general term that describes pain at the front of your knee, behind, or around your kneecap (patella). It's thought to be a result of stress on the joint between your kneecap and your thigh bone (femur. It can last for weeks or even months if not treated correctly. A very common condition with runners.

Patellar Apprehension Test

A simple test to identify any apprehension in your client when moving the patella. A positive outcome will see the client trying to straighten the knee or stop the therapist from moving the patella laterally.

1. Client is seated and legs outstretched on table/couch with the knee of complaint flexed to around 30 degrees. Ensure they are relaxed and muscles not in contraction.
2. As a therapist pressuring on the medial side of the patella, with both thumbs, look to move the patella laterally.

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