

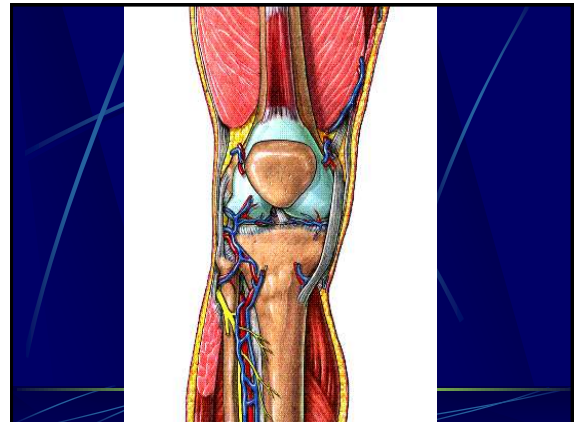
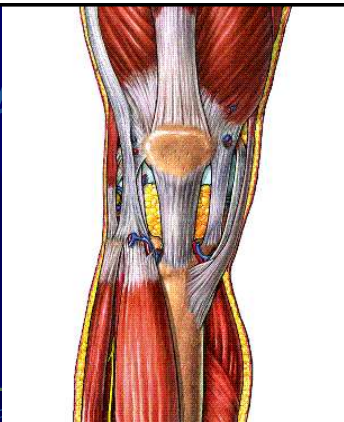
Knee Injuries

Learning Objectives

- Identification of the main injuries that occur around the knee joint.
- These include muscle injuries, ligament injuries and joint problems.
- Look at the biomechanics of the injuries and consider the various stages of these injuries.

Anatomy

- Complex combination of two joints:
 - *Patellofemoral joint*
 - *Tibiofemoral joint*
- There are 6 main ligaments, 2 menisci, numerous bursae, lots of muscle attachments, a couple of nerves, an artery or two and a joint capsule.



Ligaments

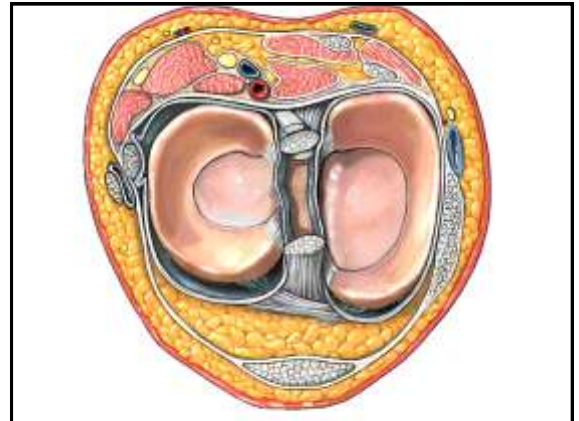
- **Medial Collateral Ligament**
 - *Superficial fibres*
 - *Deep fibres*
- **Lateral Collateral Ligament**
- **Anterior Cruciate Ligament**
- **Posterior Cruciate Ligament**
- **Oblique/Arcuate Popliteal Ligament**
- **Coronary Ligaments**

Muscles

- Lateral and Medial Gastrocnemius
- Popliteus
- Biceps Femoris
- Semimembranosus
- Semitendinosus
- Pes Anserinus (Sartorius, Gracilis, ST)
- Quadriceps
- Iliotibial Band

Menisci

- **Medial Meniscus**
 - wedge shaped, semi-lunar discs interposed between tibia and femur.
 - More C-shaped than the lateral meniscus.
 - Has an attachment with the MCL.
- **Lateral Meniscus**
 - More O-shaped than the medial.
 - Not attached to LCL, possibly attached to Popliteus tendon.



Subjective Assessment

- Questions should ascertain the history of the injury and identify the mechanism of injury.
- Need to ask special questions
- Does it ever give way?
- Does it ever lock?
- Does it swell up?
- Need to ascertain family history of arthritis

Observations

- Watch the patient as they walk in to the clinic
- Watch the patient as they walk out
- Look for obvious abnormal movements
- Identify even weight-bearing
- Postural analysis - standing, sitting

Observations From the Front

- Look at the levels of the hips, knees, ankles
- Genu varum/valgum
- Look at the position of the patellae - frog-eyed, straight, squinting patellae
- Q-angle, pelvic angle
- Pes cavus/planus
- Patellae alta/baja

Observations From the Side

- Genu recurvatum
- Camel sign - double hump at the patella
- Rotation of the femur on the tibia
- Popliteal cyst (Baker's cyst)

Observations During Movement

- 'W' sitting versus tailor sitting
- Squatting with heels in contact and with heels off the floor
- Squatting and then bouncing at the end of the range
- Vertical jump
- Twists and pivots

Active Movements

- Flexion - normal range 0-135°
- Extension - normal range 0-15° (hyperextension)
- Medial rotation (tibia on femur) - normal range 20-30°
- Lateral rotation (tibia on femur) - normal range 30-40°
- Repeated and sustained movements

Muscle Power

- Isometric activity of the following muscles
- Quadriceps - lag and lack
- Hamstrings
- Adductors
- Abductors

Patellofemoral Movements

- Passive range of movement - lateral, medial, longitudinal
- Patellar alignment - at rest and patellar tracking
- Ballotment test
- Patellar grind test - compression test
- Apprehension test

Assessment of the Knee

Step by Step Evaluation of the Knee Joint

Systematic Approach

- Range of motion
- Strength
- Ligamentous integrity
- Capsular integrity
- Meniscal integrity
- Static to ballistic activities

Range of Motion

- Knee RoM should be assessed with the patient in a seated position
- Flexion - 140° (active), 150° (passive)
- Extension - 0° (active), -5° (passive)
- Looking for **QUANTITY** of movement
- Looking for **QUALITY** of movement
- Look, feel and listen

Knee Flexion and Extension



Strength

- Assess isometric and isokinetic strength of the hamstrings and the quadriceps muscles
- Isometric strength tested first
- Looking for pain and inability to contract
- If weakness but no pain then isokinetic assessment to isolate weak range
- Pain on contraction indicates muscle damage

Resisted Quads and Hams



Ligamentous Integrity

- Test each of the major ligaments around the knee joint
- Usually test in pairs – ACL & PCL, MCL & LCL
- Systematically progress from one ligament to the next
- Pain and excessive mobility indicate damage
- Feel for damaged tissue

Valgus Stress Test (MCL)



- Test the knee in $0^{\circ} + 30^{\circ}$
- Place one hand at the foot and the other on the lateral side of the knee
- Palpate the medial joint line
- Apply a medial force at the knee and a lateral force at the ankle

Valgus Stress Test Findings



- A stable pain free joint is termed negative
- Positive findings include increased pain on the medial aspect, increased gapping of the medial aspect of the knee

Varus Stress Test (LCL)



- Opposite to the Valgus test
- One hand on the Medial aspect of the knee, the other on the lateral aspect of the ankle
- Pressure is applied laterally at the knee and medially at the ankle

Varus Stress Test Findings



- A stable pain free joint is termed negative
- Positive findings include increased pain on the lateral aspect, increased gapping of the lateral aspect of the knee

Testing the ACL



ANTERIOR DRAWER TEST

- Patient lies supine with knee at 90°
- PT places hands behind calf and draws leg anteriorly
- Excessive anterior translation and pain are positive findings

Lachman's Test – Gold Standard



- Patient lies supine with knee in 30° flex
- Grasp the tibia in one hand and hold the femur in the other
- An anterior drawer test is performed in this position

Findings from Lachman's Test



- Positive findings include excessive anterior translation of the tibia and/or pain
- With complete rupture of the ACL there will be excessive motion without the pain

The Lateral Pivot Shift Test



- The patient lies supine with the knee at 30°
- The PT places one hand at the knee and the other at the ankle

The Lateral Pivot Shift Test



- The lower leg is medially rotated
- The knee is flexed while under a valgus stress
- As the knee flexes a positive sign is reduction or posterior subluxation of the tibia

Other Tests for ACL

- Slocum test - anterior drawer test with the foot in 30° medial rotation
- Positive test - tibia moves forward, primarily on the lateral side.
- Indicates anterolateral rotary instability
- 2nd part of the test is performed with the foot in 15° lateral rotation

Testing the PCL – Posterior Drawer



- The patient is supine with the knee at 90°
- The PT examines the position of the affected tibia as compared to the unaffected
- The PT gently pushes the tibia posteriorly

Positive Posterior Drawer Test



- Positive sign is pain or excessive motion
- A Sag Sign is present when the affected tibia sags posteriorly with the leg held in a horizontal position

Testing Posterolateral Instability Reverse Pivot Shift Test



- Lower leg externally rotated and a valgus stress is placed on the knee
- As the knee is flexed/extended there is a reduction or subluxation of the tibia

Knee Ligament Injuries

Mechanism of injury

- Valgus
- Valgus + Ext. Rot.
- Varus
- Varus + Ext. Rot.
- Varus + Int. Rot.
- Hyperextension
- Tibia forwards
- Tibia Backwards

Ligament Injured

- MCL, Caps. ligs, ACL, PCL
- MCL, CLs, MM, ACL
- LCL, CLs, ACL, PCL
- LCL, CLs, PCL
- LCL, CLs, ACL
- PCL, Cap, ACL
- ACL
- PCL

Season Ending Knee Injury



- Medial collateral ligament or ACL damage can end a season and a career for a professional athlete

Treatment of Knee Ligament Injuries

- Specialised treatment for the ACL and PCL ligaments but treatment to all other ligaments follows basic rules of ligament treatment.
- Swelling around the knee joint must be controlled in the early stages of treatment.
- Treatment is governed by the number of ligaments injured and the severity of those injuries.

Capsular Integrity

- The capsule of the knee is made of the same tissue type as the ligaments
- The MCL reinforces the medial aspect of the capsule
- Can you distinguish between capsule and ligament damage?
- Assess the amount of swelling that occurs

Static to Ballistic Activities

- Always test from weak to strong tests
- Utilize less stressful tests first and then progress to stressing the joint more fully
- Begin with static activities, passive tests
- Progress to active assisted then to active and finish with full weight-bearing ballistic activities as tolerated

Meniscal Integrity

- Identify the causative force/action of the injury
- Consider the rotation stress put on the knee
- Assess the medial and lateral meniscus for damage by stressing each structure individually
- Include load-bearing stresses

Medial Meniscus Anatomy

- Anterior horn is attached to the non-articulating portion of the tibia just anterior to the anterior horn of the lat. meniscus and the ACL.
- Transverse ligament attaches the ant. horn of the medial meniscus to the ant. horn of the lateral meniscus
- Middle portion is held in place by meniscotibial and meniscofemoral ligaments.

Meniscus Injuries



Lateral Meniscus Anatomy

- Anterior horn attached to tibia just ant. to the inter-condylar eminence.
- Mid-portion attached to periphery by lateral meniscofemoral and meniscotibial ligaments.
- Posterior horn firmly attached to medial portion of the tibial plateau.
- More mobile than the medial meniscus.

Testing the Menisci - unreliable McMurray's Test



- Patient lies supine
- PT holds the ankle and the knee
- Rotation of the tibia on the femur occurs as the knee is flexed
- A 'clicking' sound and pain indicate meniscus damage

Apley's Compression/Distract



- Patient lies prone with knee bent to 90°
- PT stabilizes the thigh and grasps the ankle
- Compression of the knee with rotation of the tibia stresses the menisci
- Distraction tests the collateral ligament integrity

Meniscal Tears



Meniscal Tears

- One of the most commonly injured parts of the knee.
- Symptoms include pain, catching and buckling
- Signs include tenderness and possible clicking
- Meniscal tears occur during twisting motions with the knee flexed
- Also, they can occur in combination with other injuries such as a torn ACL (anterior cruciate ligament).
- Older people can injure the meniscus without any trauma as the cartilage weakens and wears thin over time, setting the stage for a degenerative tear.

Types of Tears

- **Longitudinal Tears**
 - Postero-medial segment displaced.
 - Repeated tears result in bucket-handle tear.
 - May produce locking of the knee.
 - Locking occurs in one third of complete tears.
 - Mainly in posterior section of the lateral meniscus.

● Horizontal Tears

- Horizontal cleavage tears due to cartilage degeneration.
- Initially in the substance of the meniscus and then work out to the periphery.
- Most frequent in the post. middle portion of the meniscus.
- Complete cleavage of inferior portion may detach post. leading to locking.

Signs and Symptoms

- Pain is present and increases with activity.
- Localised tenderness over joint line which may increase in the night as unguarded rotation occurs.
- Inflammatory response.
- Clicking may be heard on stair climbing.
- Knee may lock or give way.

Muscle Injuries



- Complete rupture of vastus lateralis

Lets Take a Break!

Patellofemoral Joint Injuries

Assessment of the PFJ

- The patellofemoral joint is an important part of the knee complex and must be assessed
- Full knee flexion/extension are impossible without free movement of the patella
- Altered biomechanics at the knee can lead to serious problems at the PFJ
- For all lower limb pathologies the PFJ should be examined to ensure its integrity

Observation of Lower Leg Posture



- Simple observation can indicate which aspect of the patella may be damaged
- Squinting patellae can lead to wearing of the medial retropatellar pole due to simple biomechanics

Assessing Patellar Motion



- The patient lies supine with the knee extended
- The PT grasps the patella and checks the motion in medial, lateral, caudal and cephalad directions
- Assess quantity and quality of motion

Lateral Patellar Apprehension test



- The patella is moved laterally and the patient observed for signs of apprehension
- If the patient feels the patella will dislocate they usually contract the quads or indicate they feel pain

Medial Apprehension Test



- The patella is moved medially and the patient is observed for apprehension or any indication of pain or discomfort

Swelling Measurements - Girth



- Girth measurements are taken at the center of the patella
- Measures are made every 5cm above and below the center of the patella
- Compare results to other side

Suprapatellar Plica Assessment



- Foot and tibia are held in medial rotation
- Palpation of the suprapatellar plica on the medial aspect of PFJ
- Pain on palpation is a positive sign

Hughston's Plica Test

- The patient lies supine, PT flexes the knee and medially rotates the tibia with one hand
- The other hand presses the patella medially and palpates the medial femoral condyle.
- Positive sign with a 'popping' of the plica

Tests for Swelling

- **Ballotable patella test** - patient's knee is extended and PT applies a slight tap on the patella.
- The patella should float above the condyles

Patellofemoral Stress Syndrome

Lateral Patellar Compression Syndrome

- The patella is pulled laterally by the lateral retinaculum or by a muscle imbalance.
- Increased stress on the lateral facet causes pain, tenderness, swelling and crepitus.
- Patients react to compression tests and lateral facet palpation.

1. Patellar Tendonitis



Patellar Tendonitis

- Due to high deceleration or eccentric forces of the quadriceps at the knee during landing
- As you land the hamstrings cause your knee to flex to absorb the shock of impact
- In order to control or decelerate the flexion produced by the hamstrings, the quadriceps muscles contract eccentricly
- Eccentric contractions occur as the muscle is being lengthened or stretch
- Eccentric contractions produces high amounts of force, and therefore stress to the patellar tendon

Patellar Tendonitis

- Prevention: strong quadriceps muscles



Squats

Lunges

Patellar Tendonitis

- **Jumper's Knee** - inflammation of the patellar tendon due to overuse.
- Patients complain of pain over the patellar tendon.
- May be swollen or hot to touch.
- Difficulties in running, jumping or landing.
- Treated with P.R.I.C.E., DTF's, PUS, better shoes.

Subluxation of the Patella

- Partial dislocation of the patella
- Complete dislocation is rare and is due to sudden (acute) trauma
- Weak vastus medialis muscle may contribute



Chondromalacia

- A softening & fissuring of the articular cartilage of the patella
- Causes
 - 1. Aging
 - 2. Mechanical defects

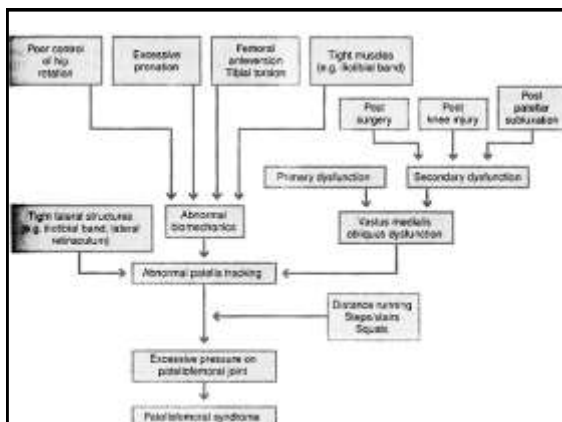


Retropatellar Pain Chondromalacia Patellae

- Roughening of the posterior surface of the patella due to malaligned tracking of the patella in the femoral groove.
- Pathological conditions and ageing lead to this condition.
- Patients complain of retropatellar pain with each step.
- Treated with ice and rest, orthotics to alter biomechanics, surgery.

Risk Factors: Subluxation and Chondromalacia

1. Training errors
 - Increasing intensity too soon
2. Weak vastus medialis muscle
3. Large Q angle
 - Greater than 25 for women and 20 for men
4. Pronation of the foot causing the tibia to medial rotate
5. Gender - more common in women



Patellar Dislocation



Management of PFJ Problems

- Identify the causative factors
- Especially need to consider the biomechanics of the lower leg
- PFJ problems may be unilateral (medial or lateral poles) or bilateral (both poles)
- Unipolar conditions demand relief of the causative forces on the affected poles

Exercises for PFJ Patients



Exercises for PFJ Patients



● **Any Questions?**