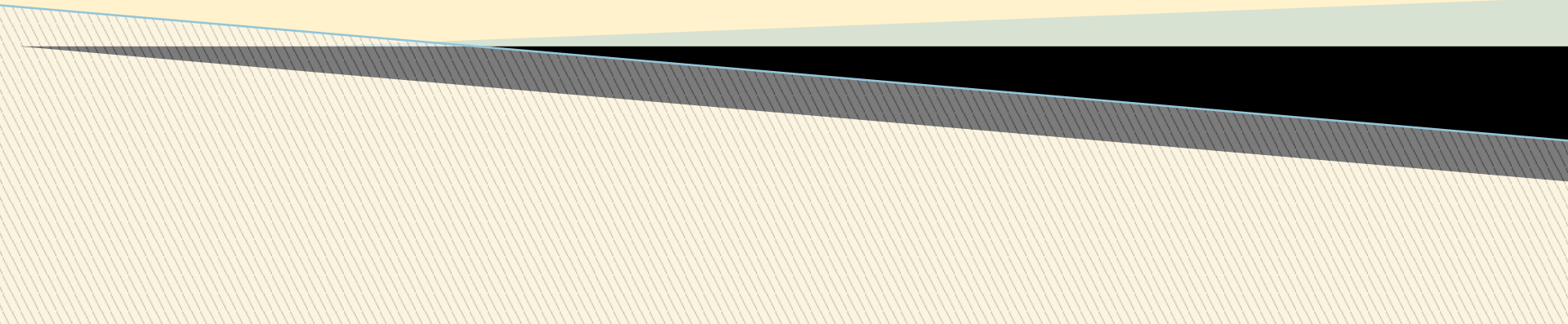


# Applied Anatomy of the knee



# The knee complex

▶ **3 joints for the price of one!**

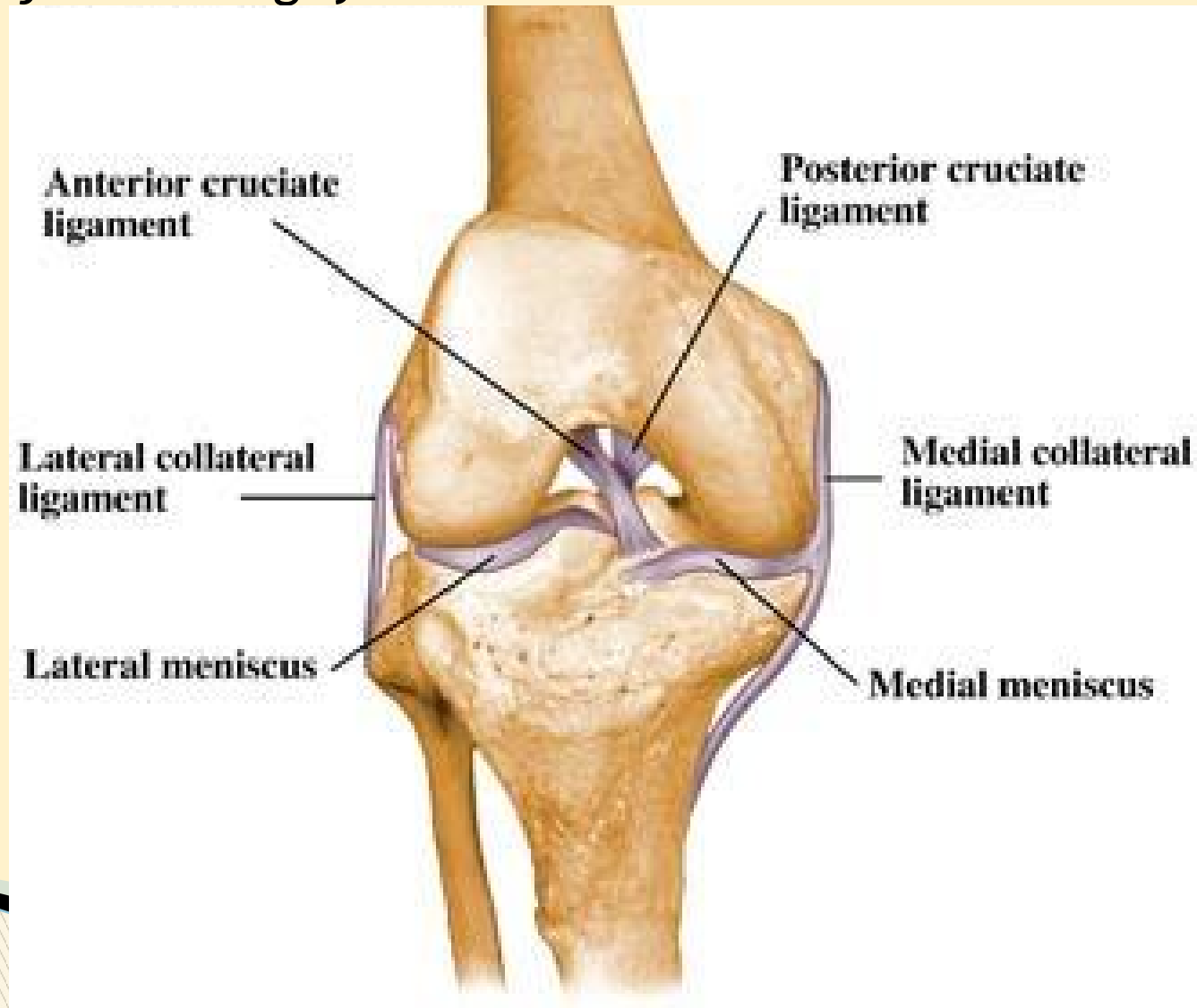
1. **Patella Femoral Joint (PFJ)**
2. **Tibiofemoral joint (TFJ)**
3. **Superior Tibiofibular joint (STFJ)**

# Important Bony Points

- ▶ Tibial Tuberosity
- ▶ Medial and Lateral femoral condyles
- ▶ Patella
- ▶ Superior Tibiofibular joint
- ▶ Knee Joint line

# Tibiofemoral Joint

- ▶ Modified synovial hinge joint.

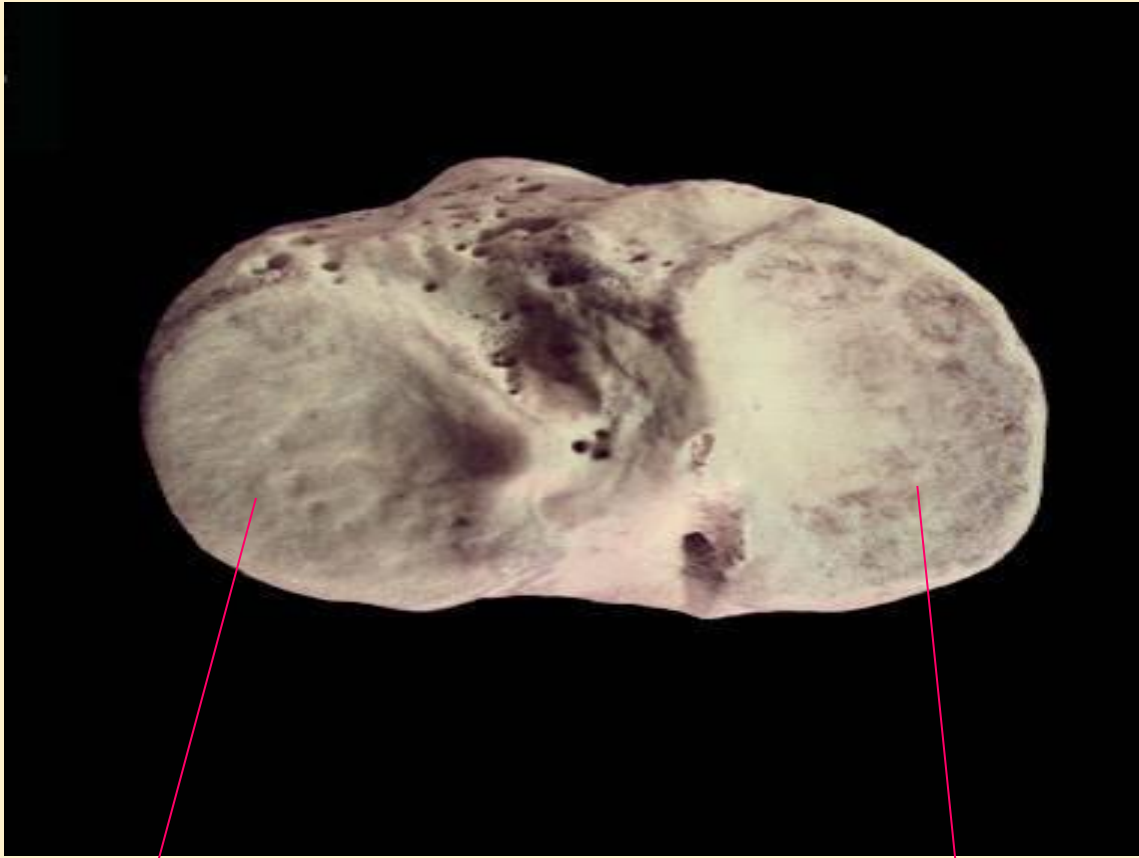


# ARTICULAR SURFACES

Femoral condyles--note the asymmetry



# PROXIMAL TIBIA



Lateral Condyle

Medial condyle

# Movements: Tibio-femoral Joint

Large range of motion

- ▶ Flexion  $130^{\circ}$ – $150^{\circ}$  (depends on hip)
- ▶ Extension  $0^{\circ}$ – $10^{\circ}$
- ▶ Medial rotation  $30^{\circ}$ – $35^{\circ}$
- ▶ Lateral rotation  $40^{\circ}$ – $45^{\circ}$

Closed packed position – full extension

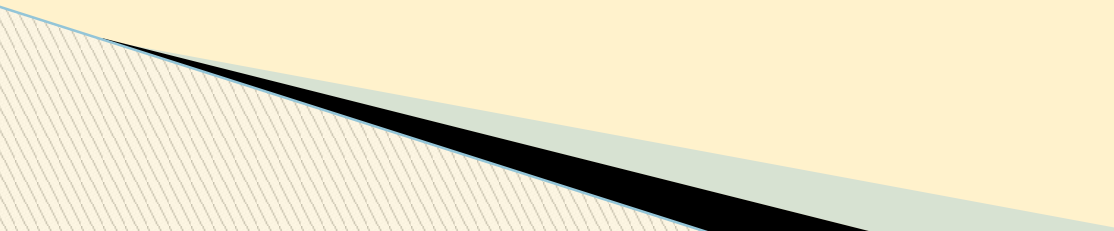
Open packed position –  $30^{\circ}$  flexion

# Stability!!

- ▶ The femoral condyles are round
- ▶ The tibial plateau is flat[---ish]
- ▶ This is a very unstable arrangement (a bit like you trying to stand on a football)
- ▶ A number of anatomical structures give stability, they can be divided into two types:
  - Passive stabilisers
  - Dynamic stabilisers

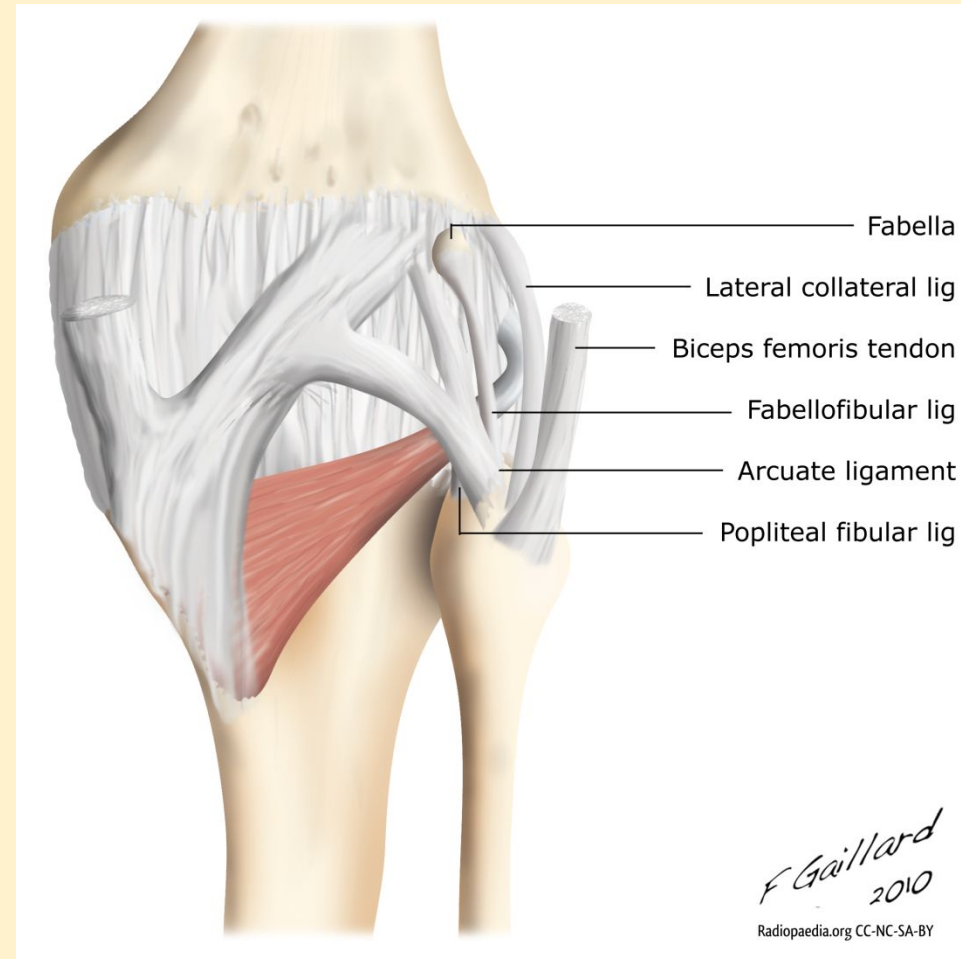


# Passive stability system

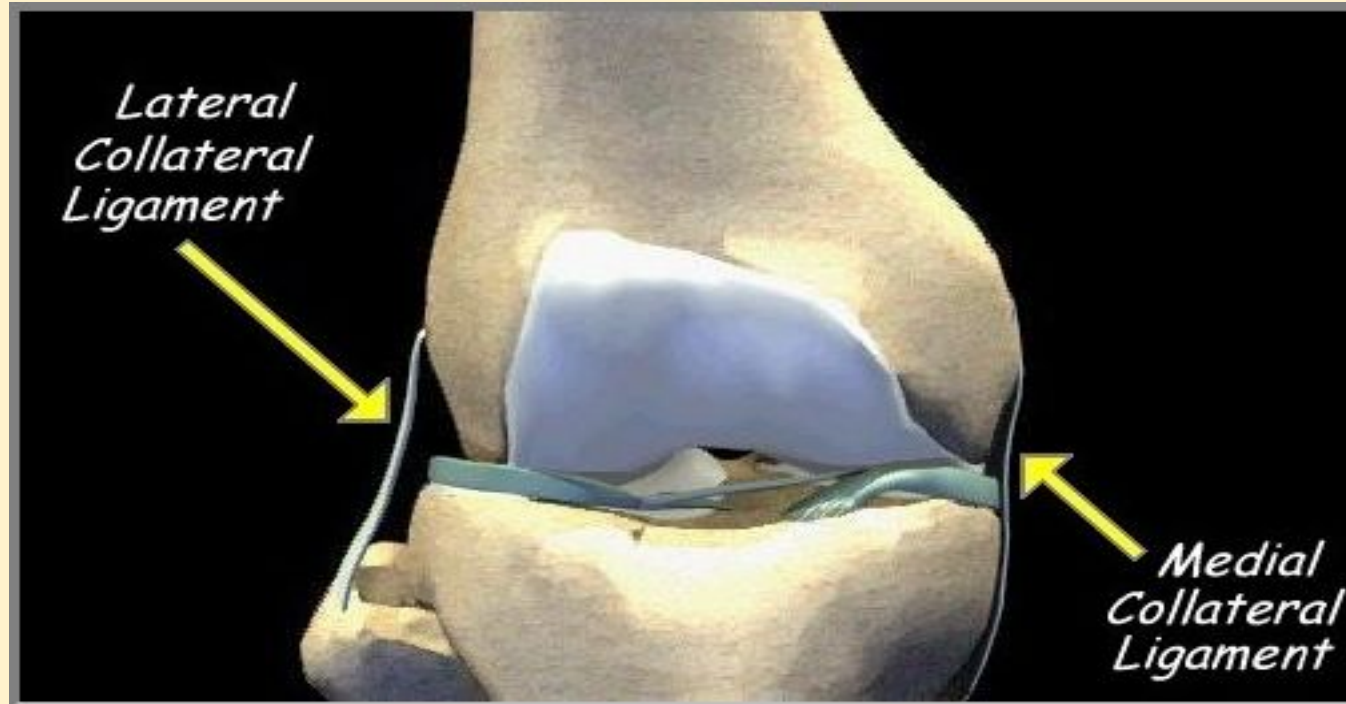
- ▶ A joint capsule
  - ▶ Ligaments inside the joint (Intra capsular)
  - ▶ Ligaments outside the joint ( extracapsular)
  - ▶ Extracapsular ligaments are thickenings of the capsule
  - ▶ Menisci inside the joint
- 

# Extracapsular ligaments

- ▶ MCL–Medial collateral, broad, flat, triangular, composed of two bands
- ▶ LCL–Lateral collateral, narrow , round, cord like.
- ▶ Behind – oblique popliteal ligament, diagonally and up from medial to lateral
- ▶ Behind– Arcuate ligament.



# THE COLLATERAL LIGAMENTS



**Fibular Collateral ligament**

or

**Lateral collateral ligament**

**Tibial collateral ligament**

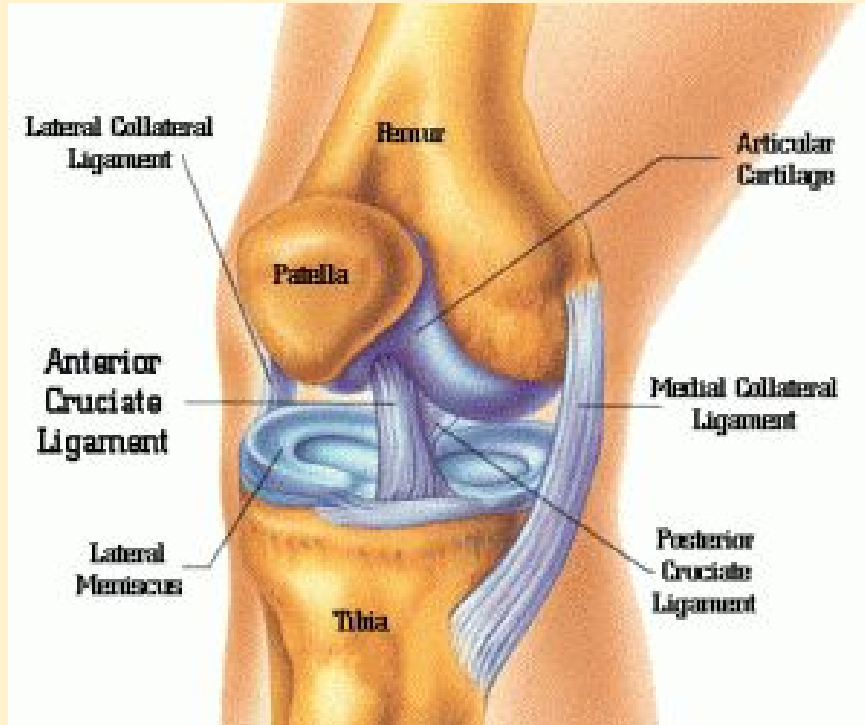
or

**Medial collateral ligament**

# Collateral Ligaments – MCL

- ▶ Triangular in shape
- ▶ Blends with the medial meniscus
- ▶ Medial stability to the knee
- ▶ Stabilises and secures the medial meniscus
- ▶ Most effective in flexion
- ▶ Mode of injury.
  - Medial valgus stress – struck on the lateral side of the leg when the foot is fixed.
  - Kicking the foot laterally when going in for a tackle.

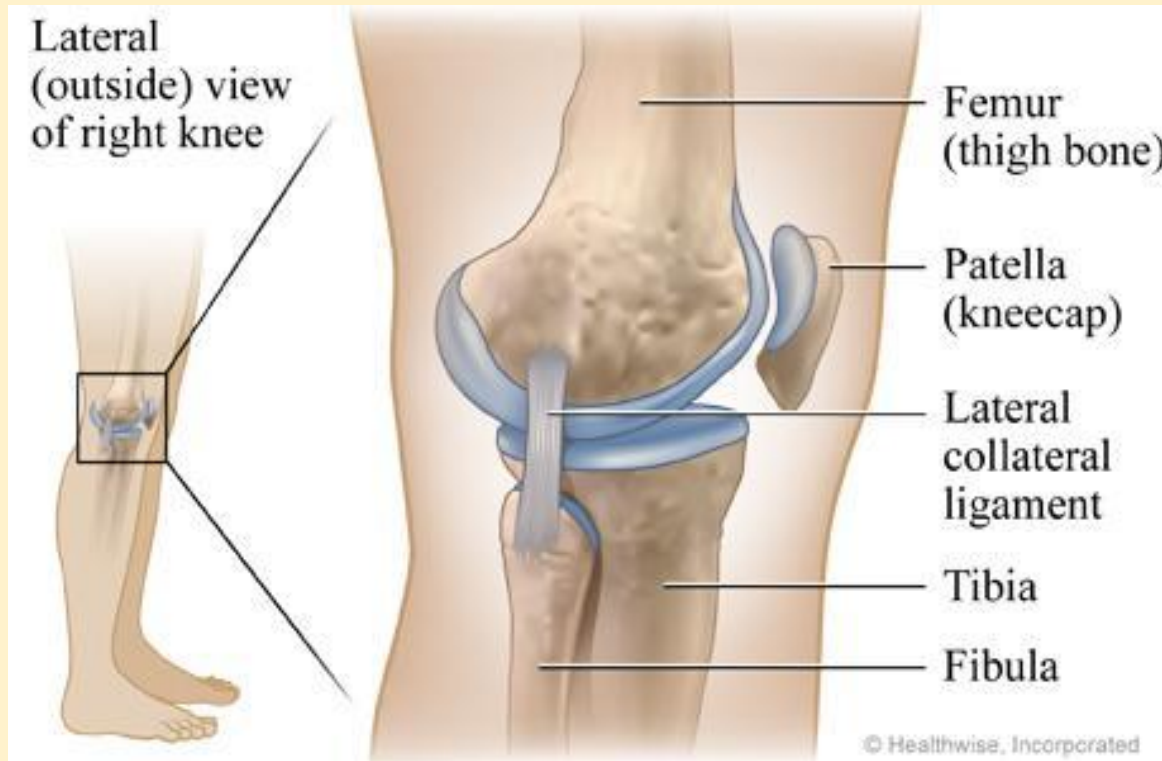
# MEDIAL KNEE



Semi **m**embranosis!

Semi **t**endonosis!

# FIBULAR COLLATERAL LIGAMENT (LCL)



# Collateral Ligaments – LCL

- ▶ Thin and pencil like
- ▶ Associated closely with the insertion of the tendon of biceps femoris
- ▶ Prevents varus stress of the knee
- ▶ This is a much less common injury

# **TENSIONING THE LCL**

**Ext: LCL under max tension**

**Flex : slackens slightly**

## **FUNCTIONS**

**Resists adduction (varus) not strong**

**Helped by Iliotibial band and popliteus**

**Not a great deal in controlling rotary movements**



# Intracapsular ligaments

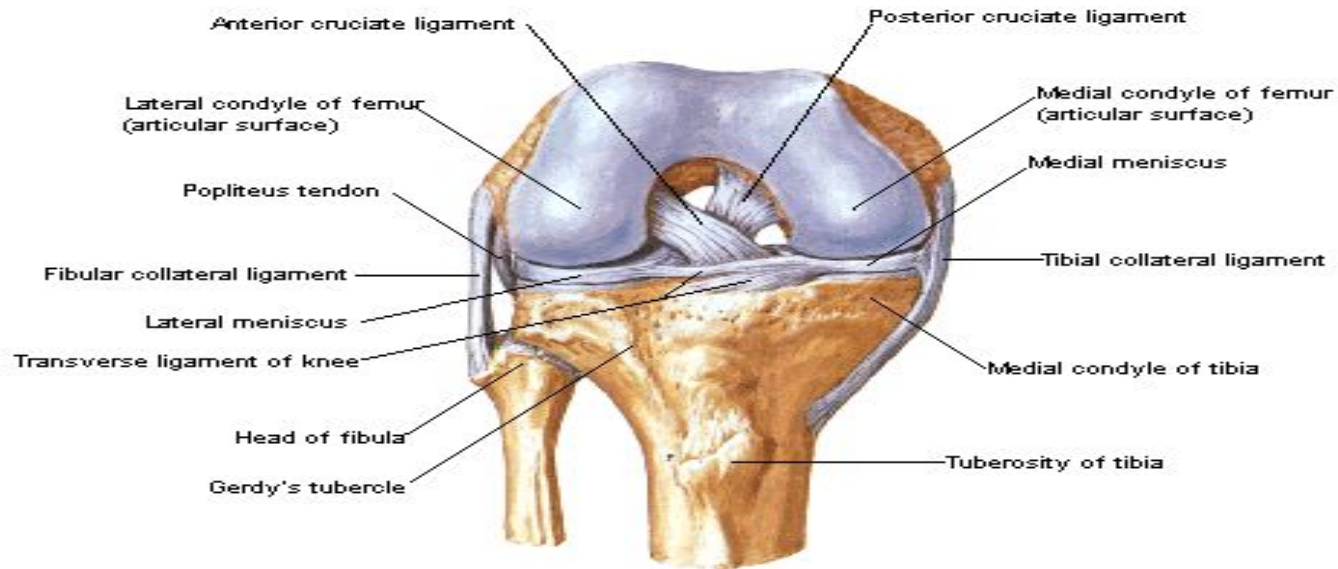
- ▶ These cross over so are referred to as the "Cruciates"
- ▶ From front to back –the Anterior Cruciate– ACL
- ▶ From back to front – the Posterior cruciate–PCL.

# Cruciates– ACL

- ▶ Prevents anterior translation of the tibia on the femur
- ▶ Checks external rotation of the tibia in flexion
- ▶ Assists in controlling rolling and gliding in the knee
- ▶ Mode of injury.
  - Forced internal rotation of the knee, the foot is usually fixed.
  - Common in football and skiing.
- May be associated with medial collateral damage and meniscal damage– **the unhappy triad.**

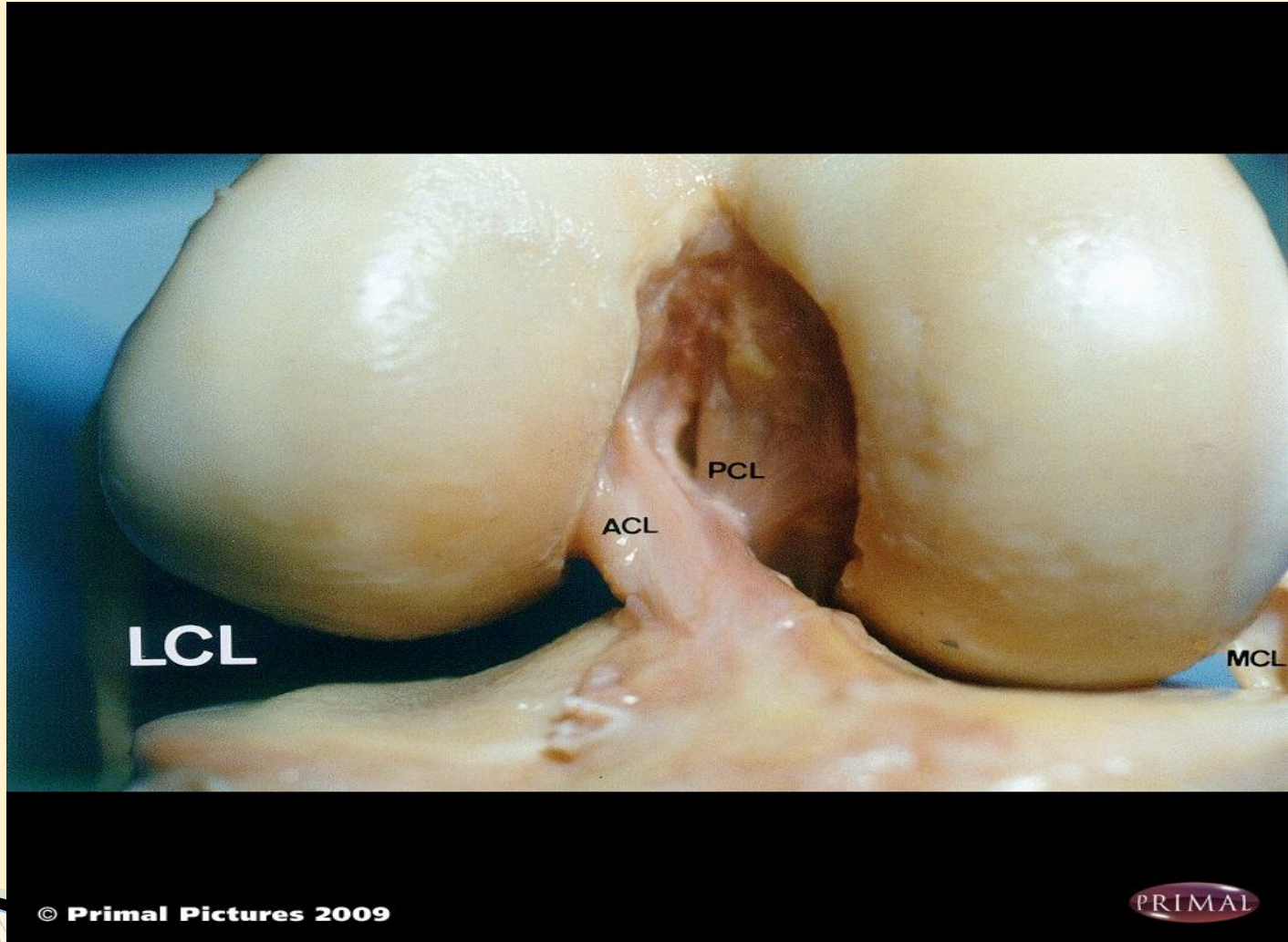
# ANTERIOR ASPECT

## Knee - Cruciate and Collateral Ligaments Right Knee in Flexion



Anterior View

# Anterior Cruciate Ligament



# Micheal Owen's ACL goes "bye-bye"

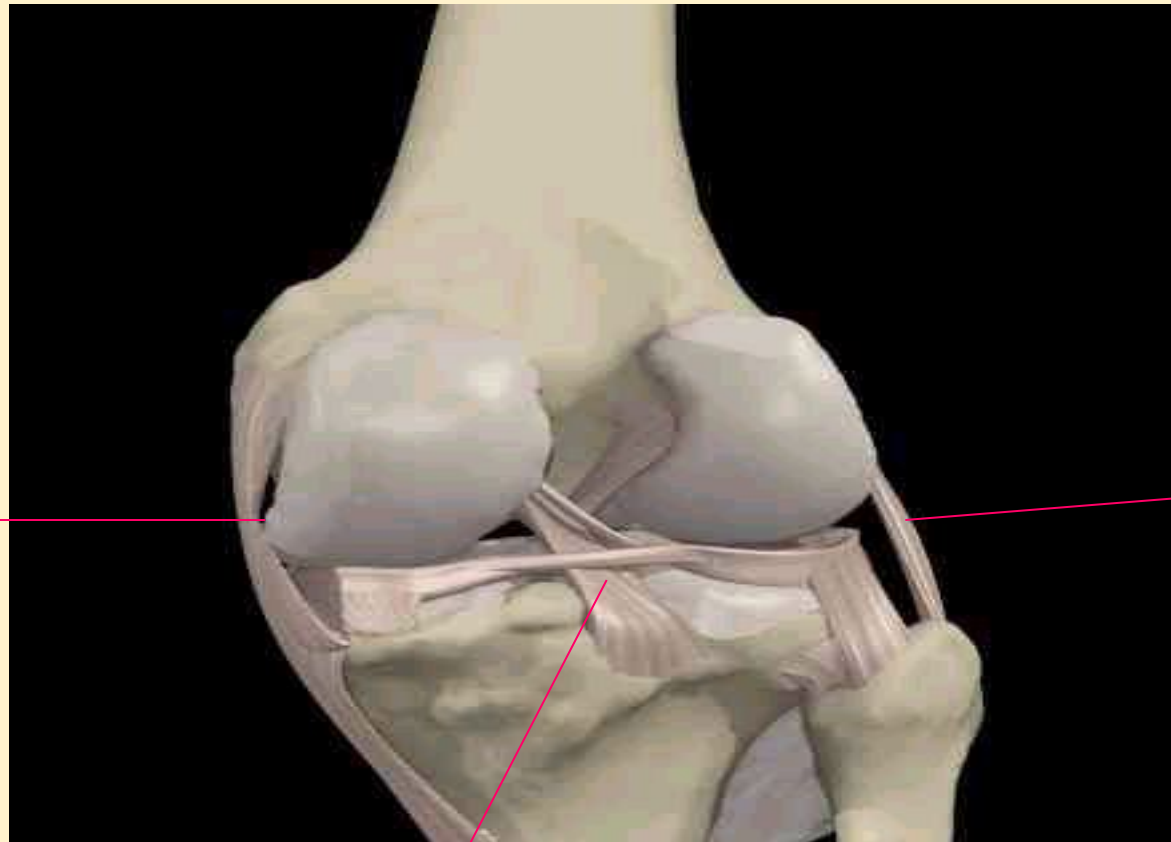
- ▶ <http://www.youtube.com/watch?v=LoFimQmMrbM>

# Cruciates– PCL

- ▶ Strongest ligament in the knee
- ▶ Checks posterior translation of the tibia on the femur
- ▶ Prevents hyperextension
- ▶ This is rarely injured.
  - A positive sag sign may be seen – With the knees flexed you may see some posterior shift in the tibial tuberosity on the affected side – The Horizon Sign

# POSTERIOR KNEE

MCL



LCL

PCL

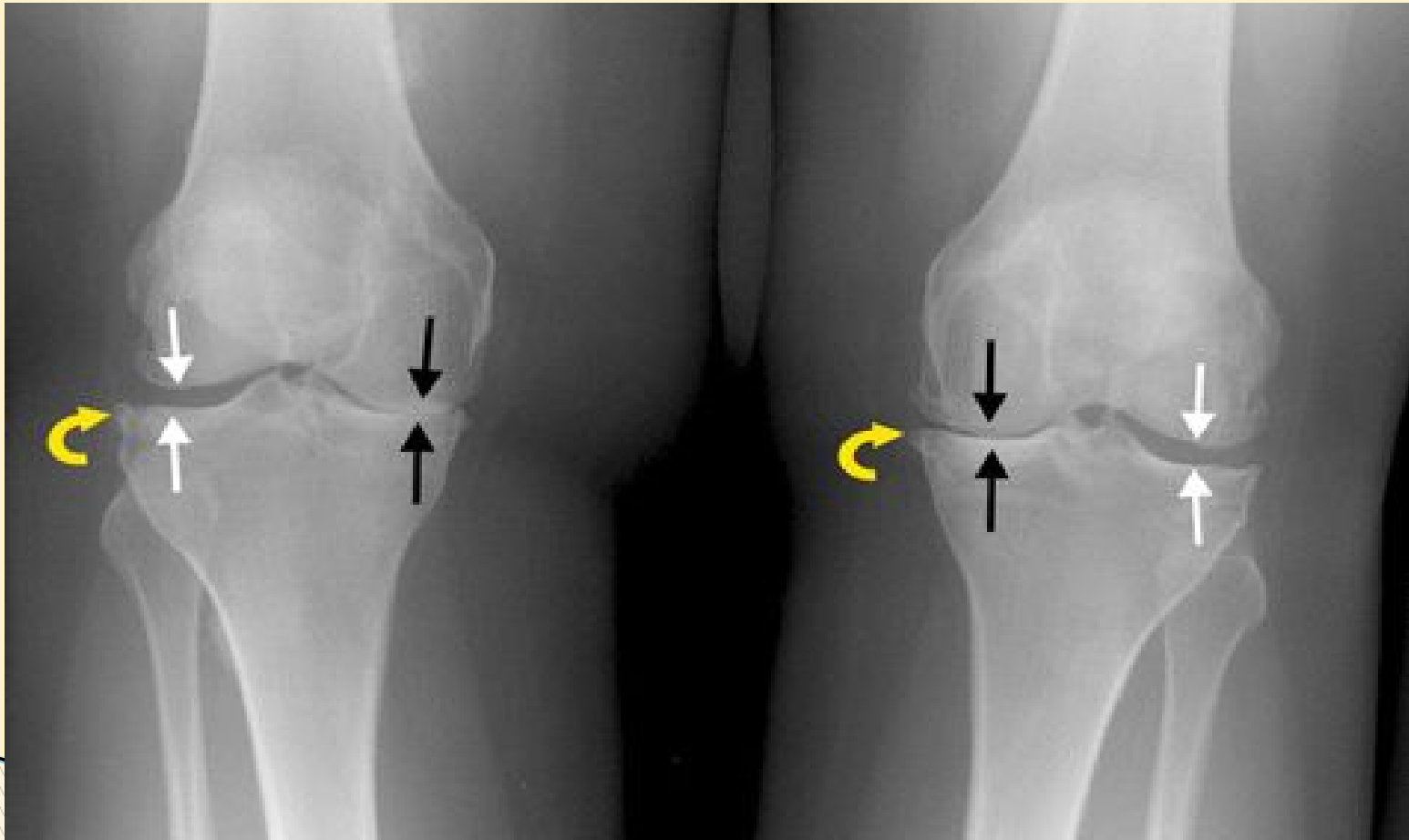


# Have a look at this plain film





# Have a look at this plain film



**Have a look at this plain film**



**Have a look at this plain film**



# Have a look at this plain film



# Intracapsular stabilisers– The Menisci

- ▶ Two 'c' shaped structures
- ▶ Fixed at either end – otherwise free to move
- ▶ Thicker at the external margins
- ▶ Continuous with the capsule
- ▶ Lateral more mobile than medial, translated backwards during flexion by popliteus

# MENISCI



# The Menisci: Function

- ▶ Deepen the articular surface
- ▶ Shock absorbers –
  - transmit 50–70% of the load (Ghosh and Taylor, 1987)
- ▶ Provide stability – allows the rounded surface to fit to the flat surface.
- ▶ Proprioception
- ▶ Nutrition
- ▶ Removal may hasten arthritic changes

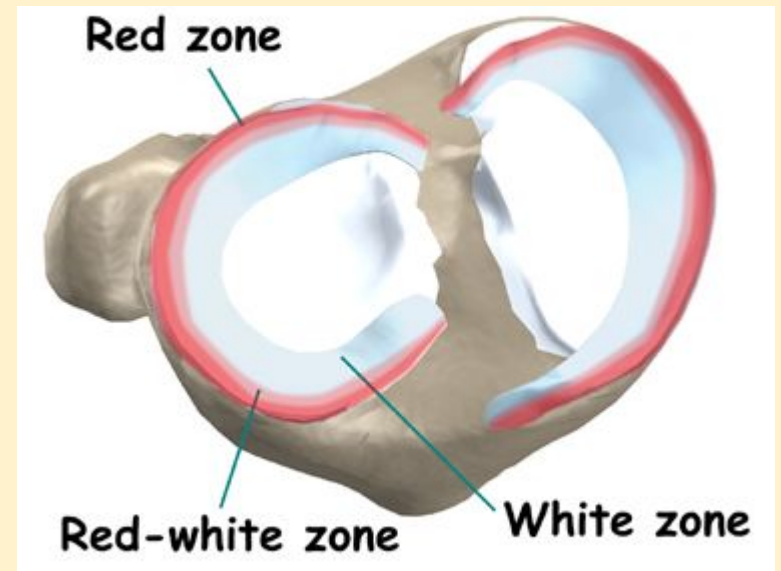
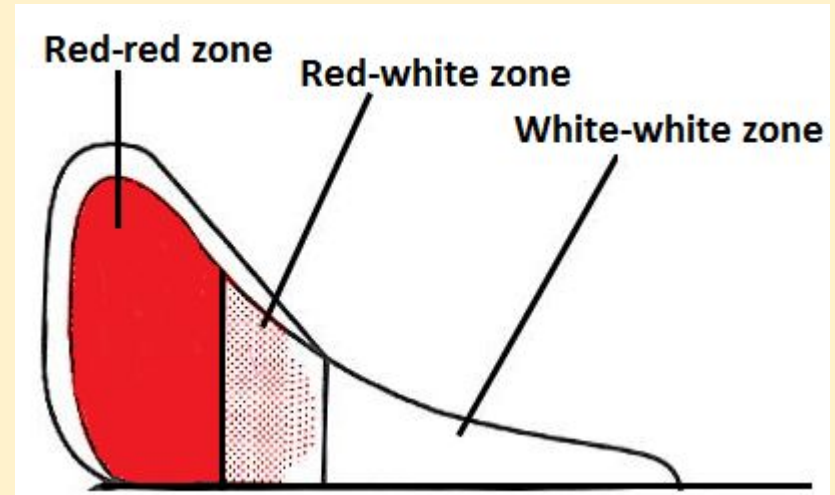
# Meniscal Injury

- ▶ Mode of injury– twisting on a semi flexed knee with the foot fixed on the floor.
  - Football and tennis are the main culprits for injury
- ▶ Medial meniscus tears occur 10 times more frequently than lateral ones.
- ▶ Medial tears more longitudinal, lateral more radial



# Meniscal Injury

- ▶ Outer rim of the meniscus has a good blood supply
- ▶ This reduces as we move inwards
- ▶ Implications for management?

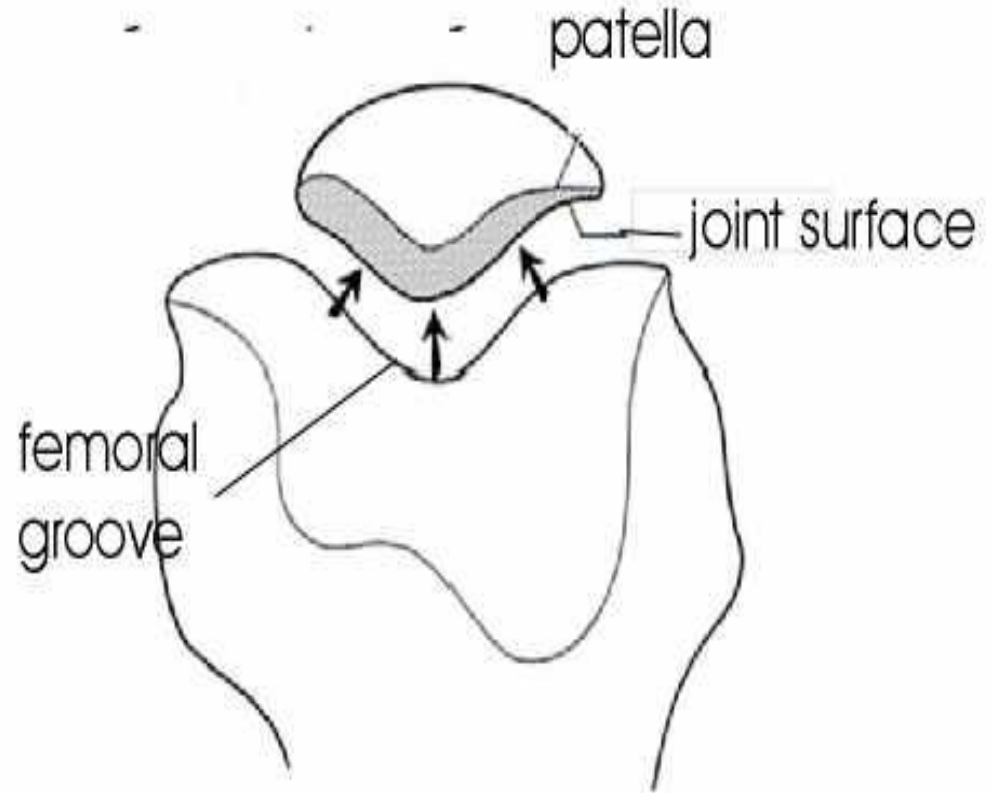
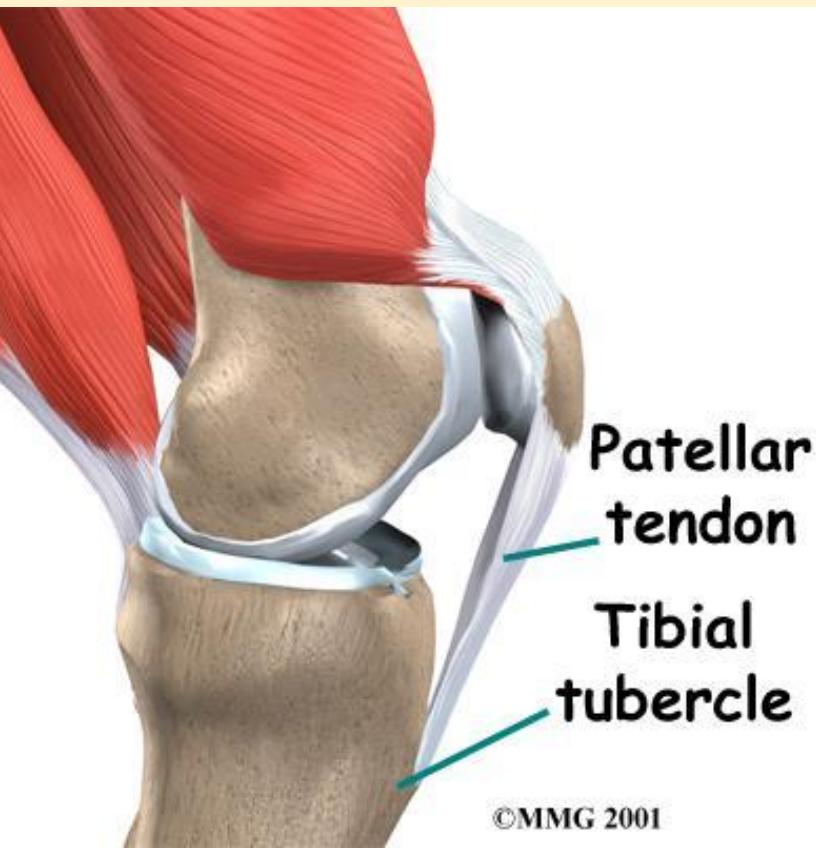


# Dynamic Stability – Muscles

Physiological Movement	Group	Primary
Flexion	Hamstrings	Semimembranosus Semitendinosus Biceps femoris
Extension	Quadriceps	Rectus femoris Vastus lateralis Vastus medialis Vastusintermedialis
Rotation Internal		Popliteous unlocks
Rotation External		Biceps femoris locks

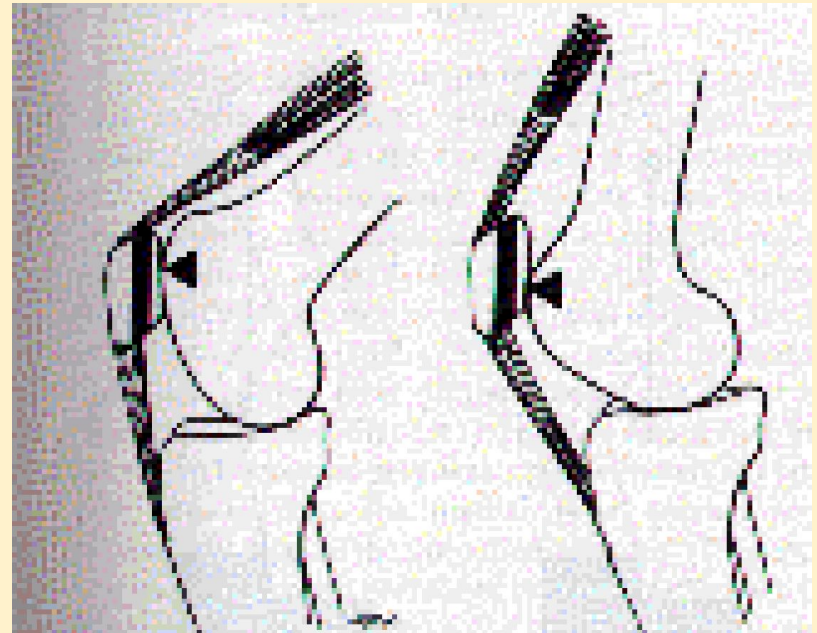
# Patello –femoral Joint

- ▶ Modified synovial plane joint
- ▶ Sellar (saddle)
- ▶ Patellar tendon attaches apex of patella to tibial tuberosity

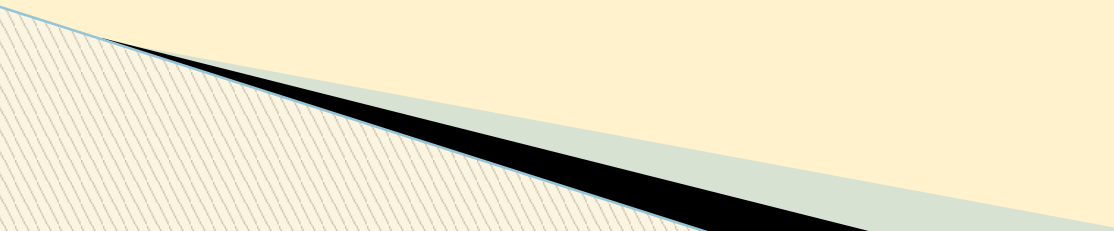


# The Patella- Femoral joint – Movements

- ▶ Shift – tilt – rotate
- ▶ Moves up (cephalad) on femur with knee extension
- ▶ Moves down (caudad) on femur with knee flexion



# Patellar Tracking

- ▶ During knee flexion and extension the patella is not static but undergoes a degree of shift, tilt and rotation on the patellar surface of the femur as well as supero-inferior movement.
  - ▶ Different parts of the patella will articulate with the femur at different parts of the flexion/extension range.
  - ▶ The posterior surface of the patella has different facets for changing areas of articulation.
- 

# . Bursa of the knee

