Hip, Knee & Ankle Joints

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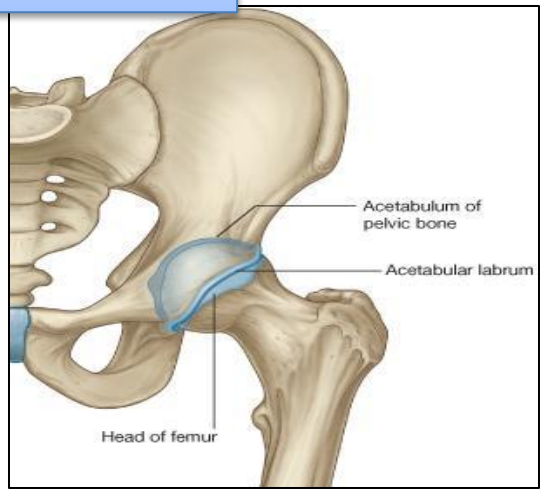
OBJECTIVES

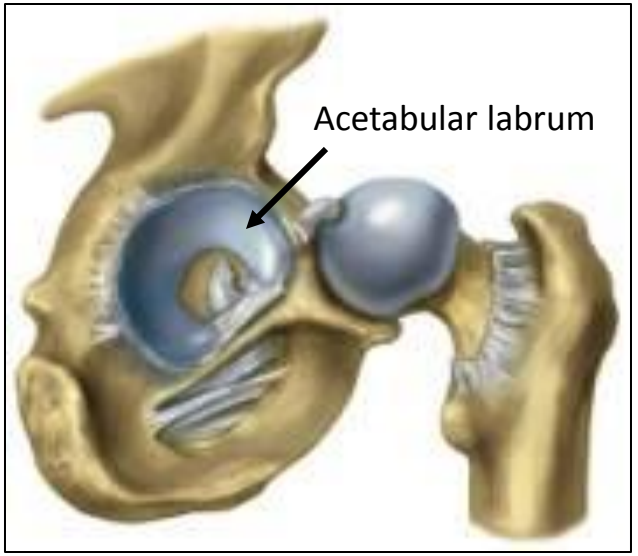
At the end of the lecture, students should be able to:

- *List the type & articular surfaces of the hip, knee and ankle joints.*
- *Describe the capsule and ligaments of the hip, knee and ankle joints.*
- *Describe movements of hip, knee and ankle joints and list the muscles involved in these movements.*
- *List important bursae in relation to knee joint.*
- *Apply Hilton's law about nerve supply of joints.*

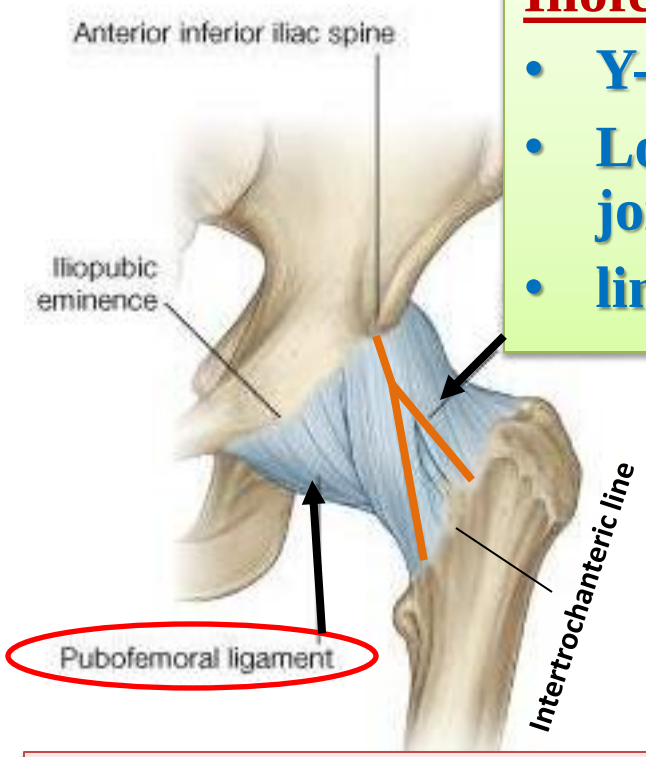
HIP JOINT

- **TYPE:**
  - **Synovial, Ball & Socket joint.**
- **ARTICULAR SURFACES:**
  - **Acetabulum of hip (pelvic) bone**
  - **Head of femur**
- **Acetabular labrum:**
- **C-shaped fibro-cartilaginous collar attached to margins of acetabulum, increases its depth for better retaining of head of femur.**





Ligaments: (3) Extracapsular



Iliofemoral ligament:

- Y-shaped
- Located anterior to joint
- limits extension

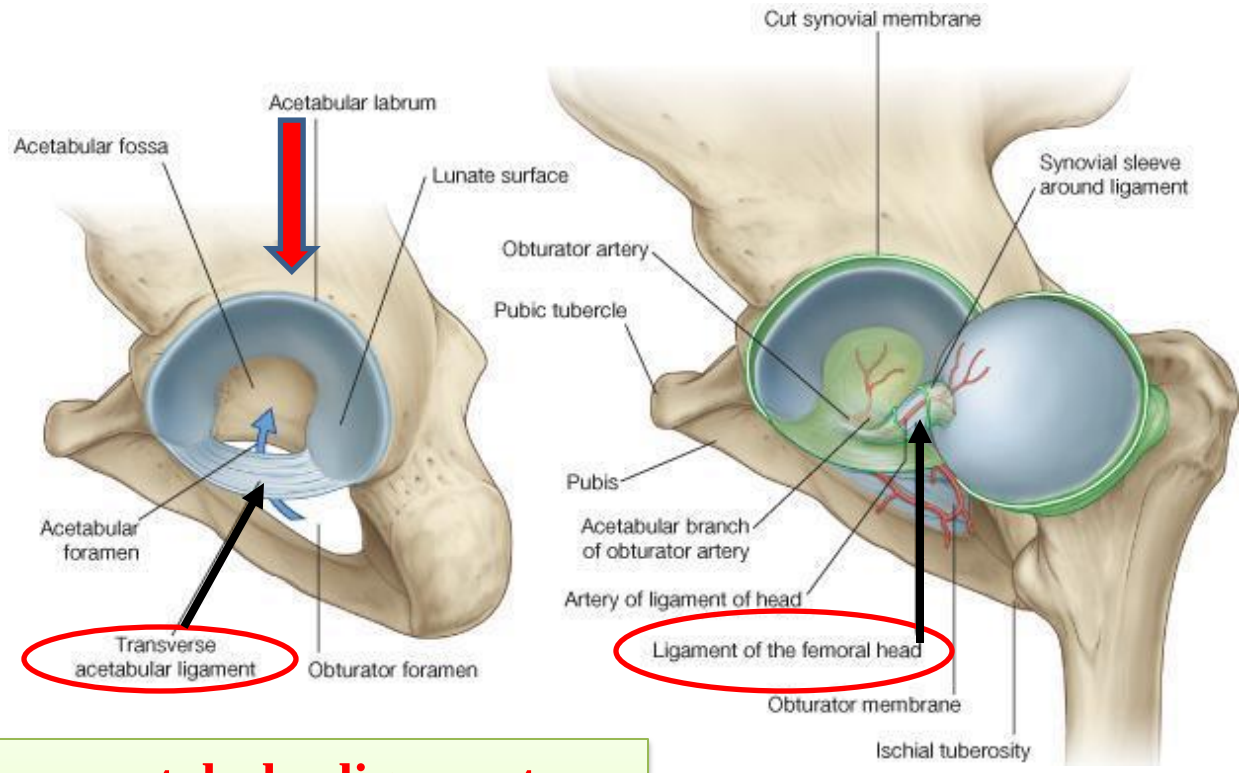
Pubofemoral ligament:

- Located antero-inferior to joint
- limits abduction & lateral rotation

Ischiofemoral ligament:

- Located posterior to joint
- limits medial rotation

(3) Intracapsular



Transverse acetabular ligament:

converts acetabular notch into foramen through which pass acetabular vessels

Ligament of femoral head:

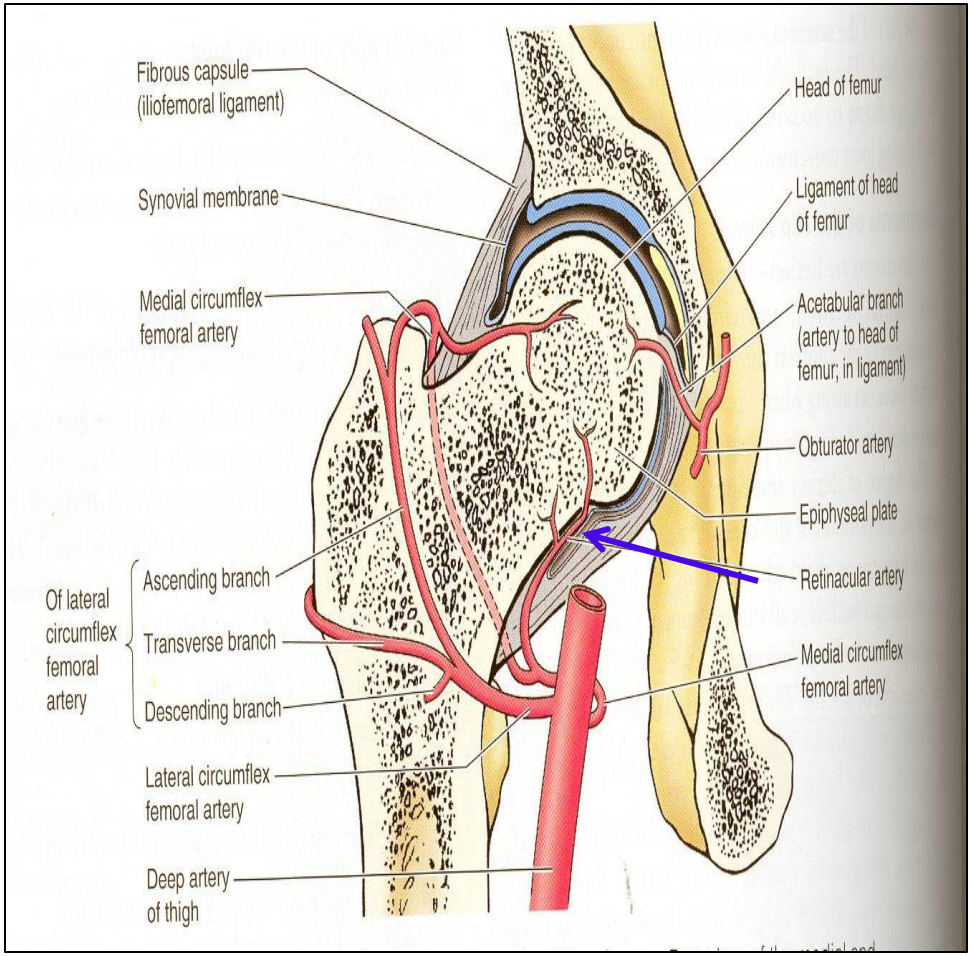
carries vessels to head of femur

- **Acetabular labrum**

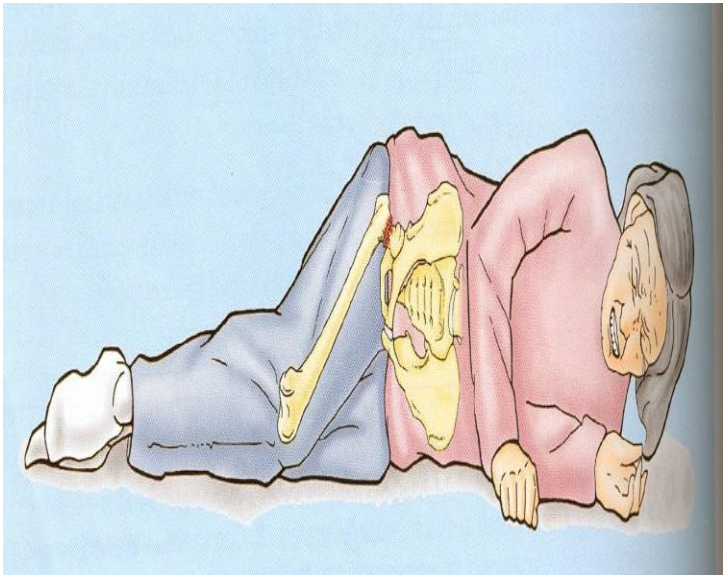
Movements

- **Flexion:** Iliopsoas (mainly), sartorius, pectineus, rectus femoris.
- **Extension:** Hamstrings (mainly), gluteus maximus (powerful extensor).
- **Abduction:** Gluteus medius & minimus, sartorius.
- **Adduction:** Adductors, gracilis.
- **Medial rotation:** Gluteus medius & minimus.
- **Lateral rotation:** Gluteus maximus, quadratus femoris, piriformis, obturator externus & internus.

BLOOD SUPPLY

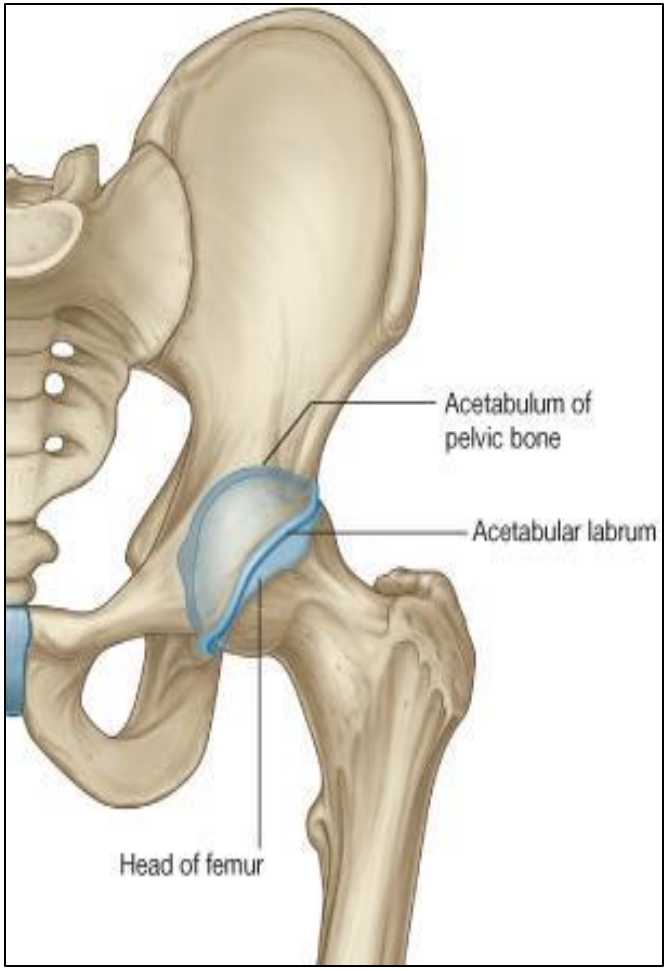


- The main arterial supply is from branches of the **circumflex femoral** arteries especially the **medial**).
- The blood passes to the joint through :
- (1) Retinacular fibers of the neck.
- (2) Ligament of the head of the femur.



- Damage of the retinacular fibers as in **fracture neck** of the femur can results in
- **A vascular necrosis** of the head of the femur.
- Fracture neck of the femur is common after age of (60) years especially in women because of **Osteoporosis**.

STABILITY OF THE JOINT



- The hip joint is one of the **most stable** joints of the body because of :
- **(1)** The **Head of the femur** fits very accurately in the acetabulum due to the following
- **A.** The acetabulum is very deep and its depth is increased by the labrum acetabulare.
- **B.** The labrum acetabulare forms a firm grip on the head of the femur.
- **C.** The atmospheric pressure resists separation between the head of the femur and the acetabulum.
- **(2)** The three strong **Extrinsic ligaments.**
- **(3)** The surrounding strong **Muscles.**

DISLOCATION OF HIP JOINT

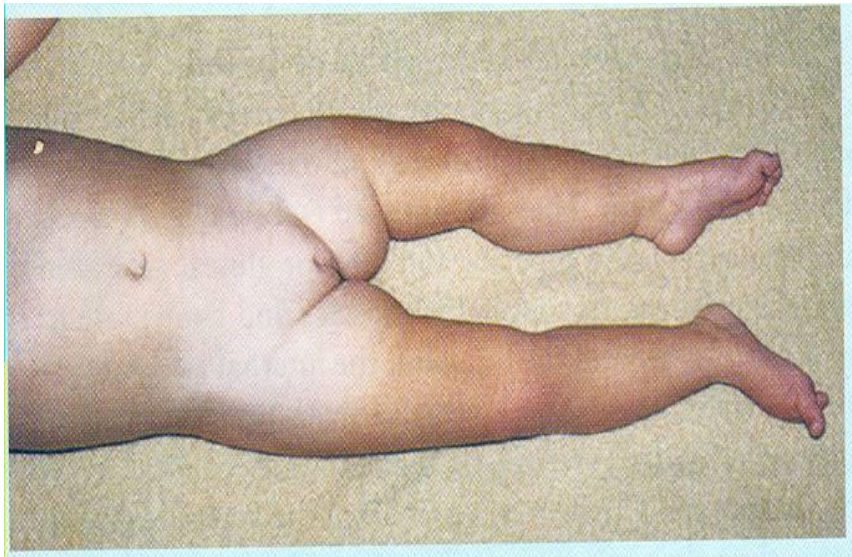
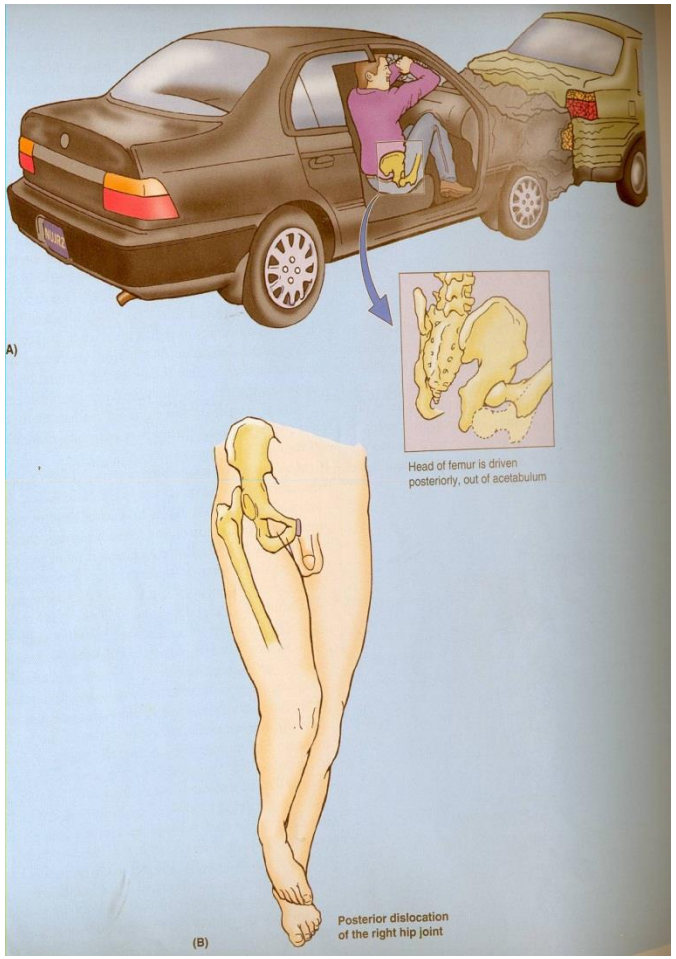


Figure 15.16 Congenital dislocation of left hip – note the extra skin creases in the upper thigh

- **CONGENITAL**
- More common in girls and associated with **inability** to adduct the thigh.
- The upper lip of the acetabulum fails to develop adequately.
- The head of the femur rides up out of the acetabulum onto the gluteal surface of the ileum.



- **TRAUMATIC:**
- It is common in motor vehicle accidents when the thigh is flexed and adducted.
- The dislocated head is displaced **posteriorly** to lie on the posterior surface of the ileum.
- In **posterior** dislocation the **sciatic nerve** is liable to be injured.

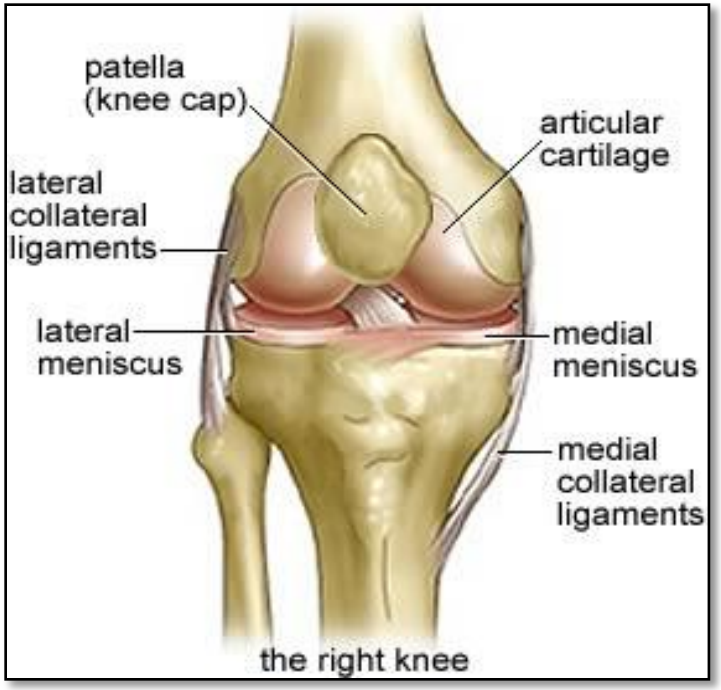
KNEE JOINT

- **FUNCTIONS:**
- **1.** Weight bearing.
- **2.**Essential for daily activities: standing walking & climbing stairs.
- **3.**The main joint responsible for sports: running, jumping , kicking etc.

Type & Articular Surfaces

Knee joint is formed of:

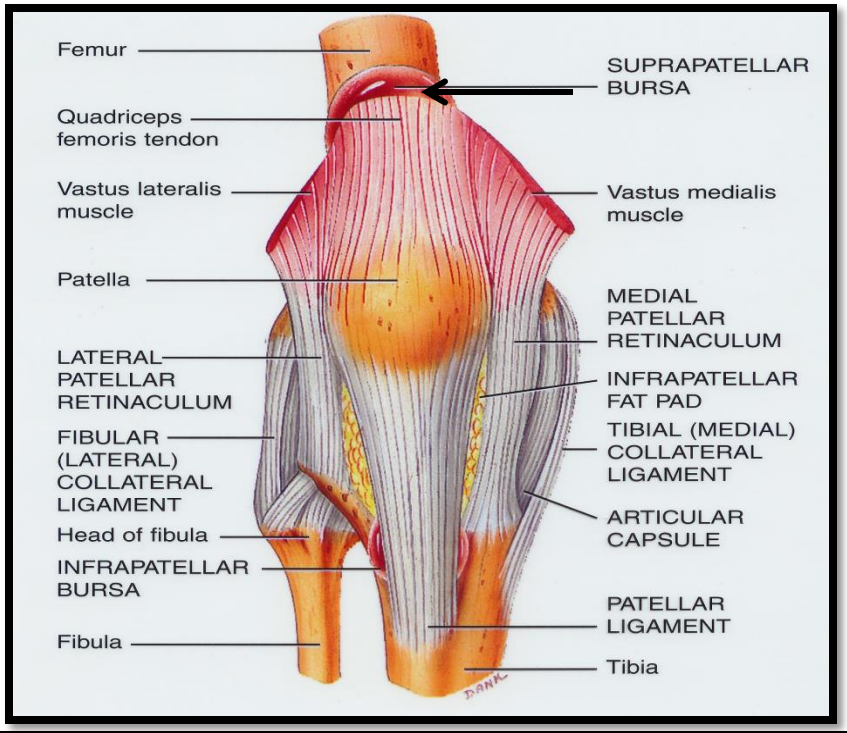
- Three bones.
- Three articulations.
- **Femoro-Tibial articulation**: between the 2 femoral condyles & upper surfaces of the 2 tibial condyles
- ***Type:*** ***synovial, modified hinge***
- **Femoro-Patellar articulation**: between posterior surface of patella & patellar surface of femur
- ***Type:*** ***synovial, plane.***

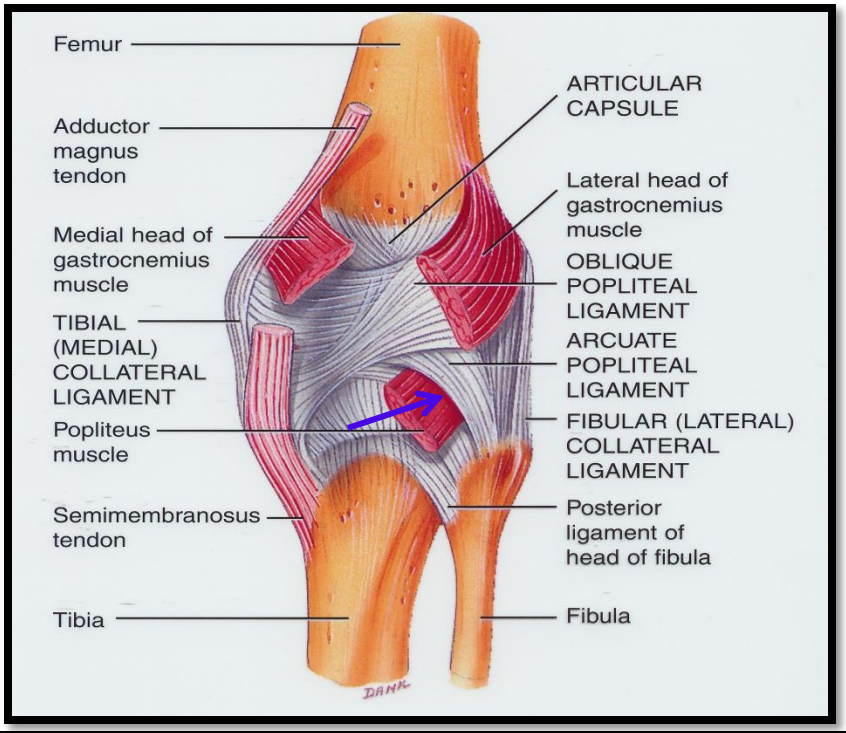


FUNCTIONS

- **1.** Weight bearing.
- **2.**Essential for daily activities: standing walking & climbing stairs.
- **3.**The main joint responsible for sports: running, jumping , kicking etc.

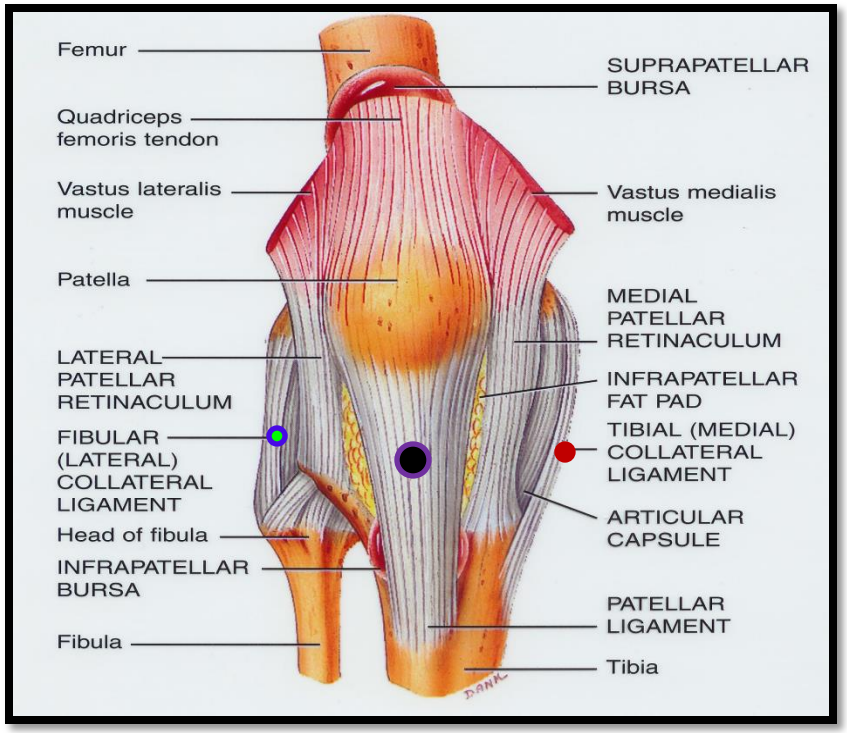
Capsule

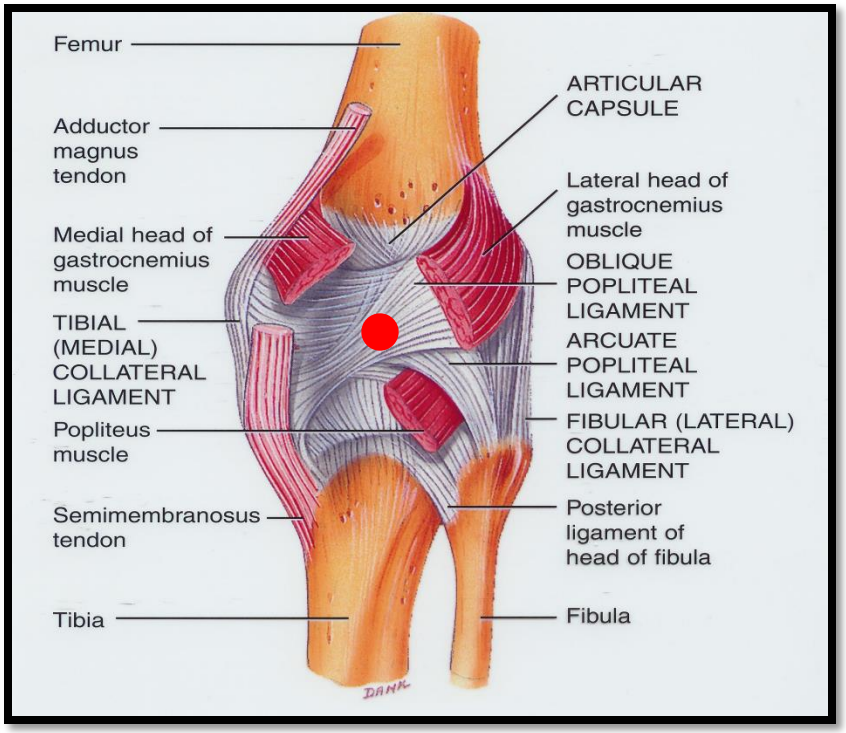




- Is **Deficient Anteriorly** & replaced by: *quadriceps femoris tendon, patella & ligamentum patellae.*
- **Possesses 2 openings**: one for popliteus tendon & one for communication with suprapatellar bursa.

Ligaments: (*4*) *Extracapsular*





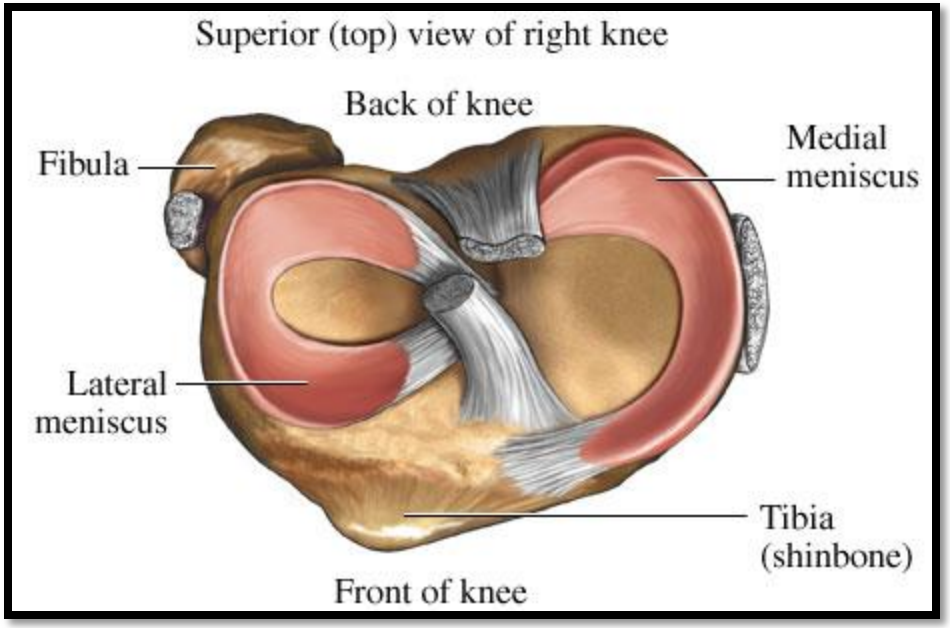
1. **Ligamentum patellae (patellar ligament)**: from patella to tibial tuberosity.
2. **Medial (tibial) collateral ligament:** from medial epicondyle of femur to upper part of medial surface of tibia (firmly attached to medial meniscus).
3. **Lateral (fibular) collateral ligament**: from lateral epicondyle of femur to head of fibula
4. **Oblique popliteal ligament:** extension of semimembranosus tendon.

INTRA Capsular Structures : Menisci

- They are 2 C-shaped plates of fibro-cartilage attached by anterior & posterior horns, to the articular surface of tibia.

FUNCTION:

- They deepen articular surfaces of tibial condyles.
- They serve as cushions between tibia & femur.



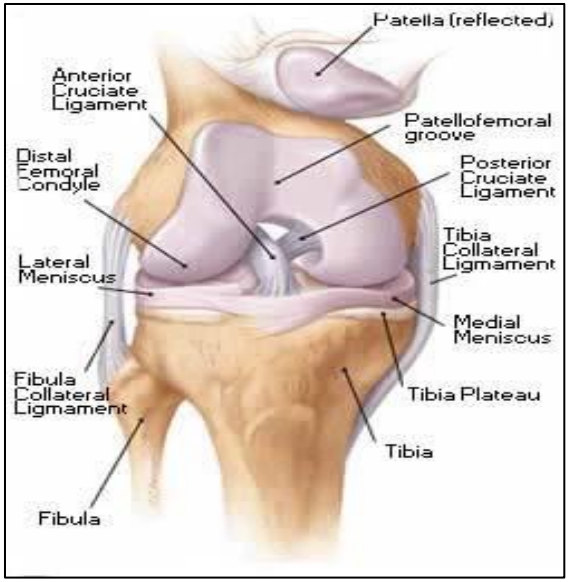
- **Lateral Meniscus:**
- **Small & Circular.**
- Its outer border is separated from lateral collateral ligament by popliteal tendon.

- **Medial Meniscus:**
- **Large & Oval.**
- Its outer border is (firmly attached to attached to the capsule & medial collateral ligament.

- ***medial meniscus is less mobile & more liable to be injured.***

CRUCIATE Ligaments

- Two in number, situated in the middle of the joint.
- They are called *Cruciate* because they cross each other
- Have received the names Anterior and Posterior, from the position of their attachments to the tibia.



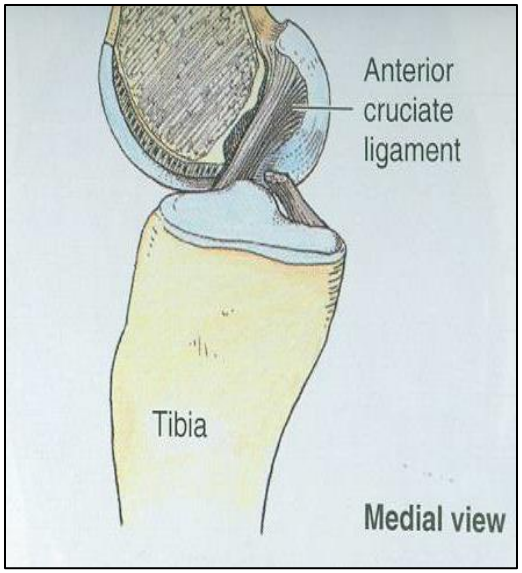
Anterior cruciate ligament:

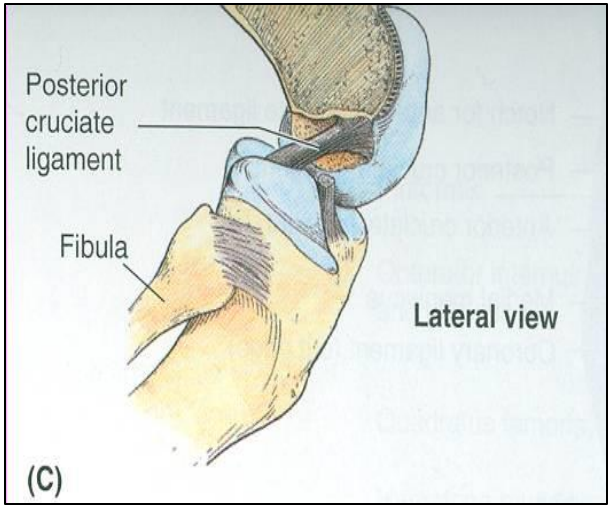
- Extends from anterior part of intercondylar area of tibia to posterior part of lateral condyle of femur.

Posterior cruciate ligament:

- Extends from posterior part of intercondylar area of tibia to anterior part of medial condyle of femur.

Functions of Cruciate Ligaments

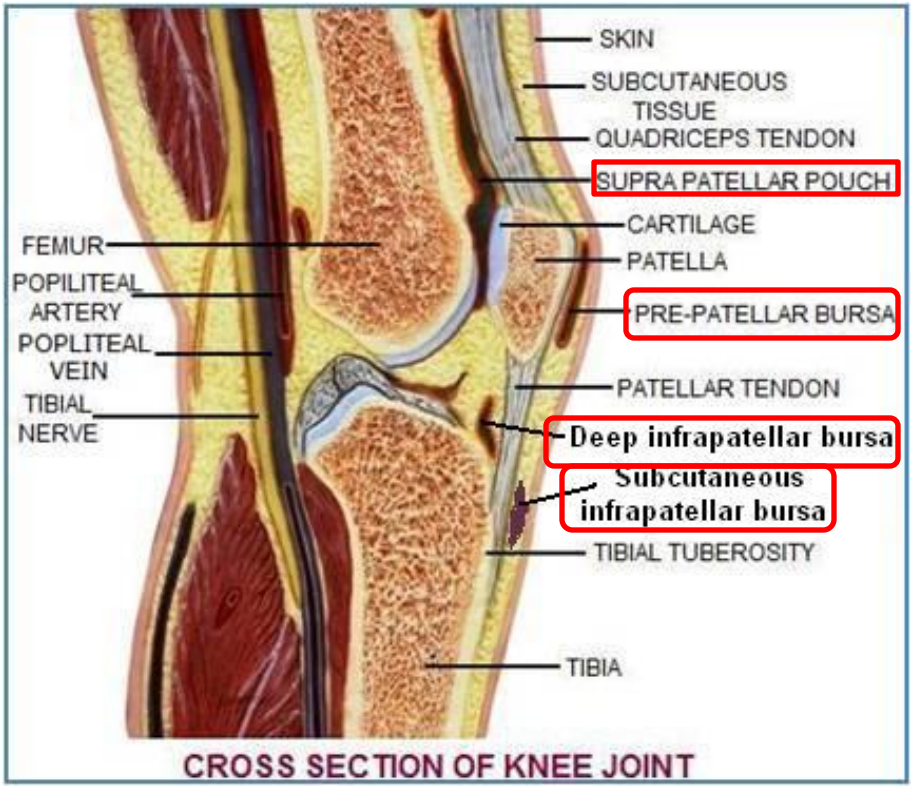




- Anterior ligament:
- Prevents **posterior** displacement of the femur on the tibia and the tibia from being pulled **anteriorly** when the knee joint is flexed.
- It is taught **in Hyper extension.**
- **Posterior ligament:**
- prevents **anterior** displacement of the femur on the tibia and the tibia from being pulled **posteriorly** when the knee joint is flexed.
- It is taught in **Hyper flexion.**

Bursae Related to Knee joint

- **Suprapatellar bursa:** between femur & quadriceps tendon, communicates with synovial membrane of knee joint **(Clinical importance?)**
- **Prepatellar bursa:** between patella & skin.
- **Deep infrapatellar bursa:** between tibia & ligamentum patella.
- **Subcutaneous infrapatellar bursa:** between tibial tuberosity & skin.
- **Popliteal bursa** between popliteus tendon & capsule, communicates with synovial membrane of knee joint.



MOVEMENTS

- **FLEXION:**

1. Mainly by hamstring muscles: biceps femoris , semitendinosus & semimembranosus.
2. Assisted by sartorius , gracilis & popliteus.

- **EXTENSION:**

Quadriceps femoris.

- **ACTIVE ROTATION (PERFORMED WHEN KNEE IS FLEXED):**

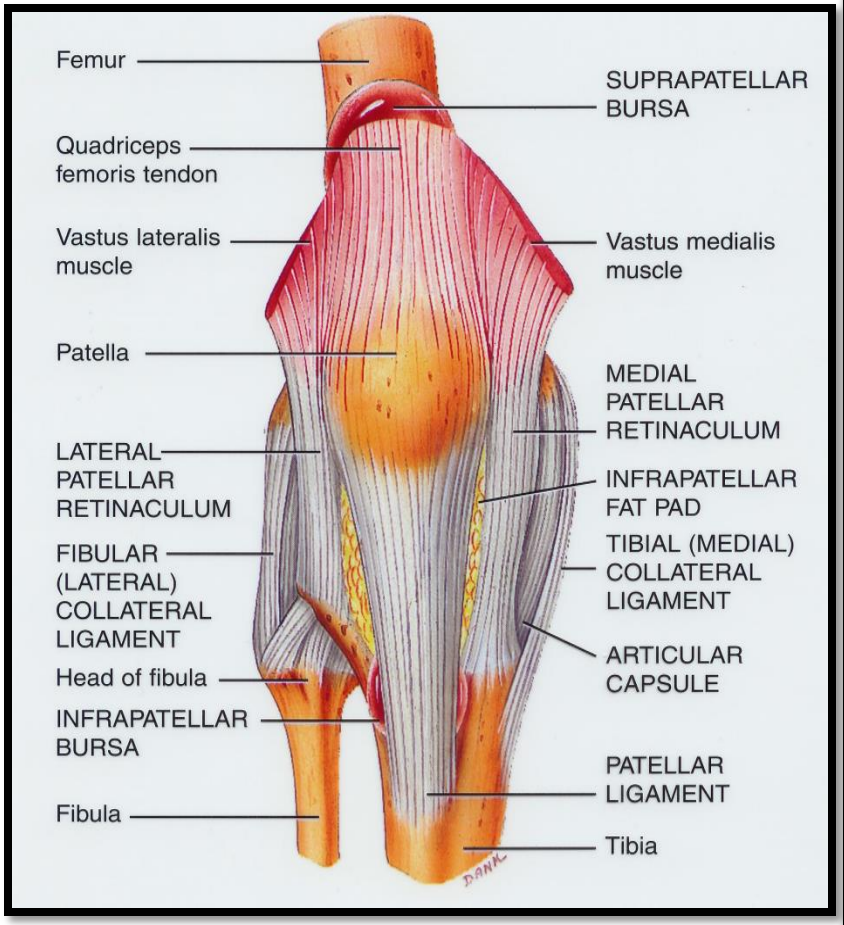
A) MEDIAL ROTATION:

1. Mainly by semitendinosus & semimembranosus.
2. Assisted by sartorius & gracilis.

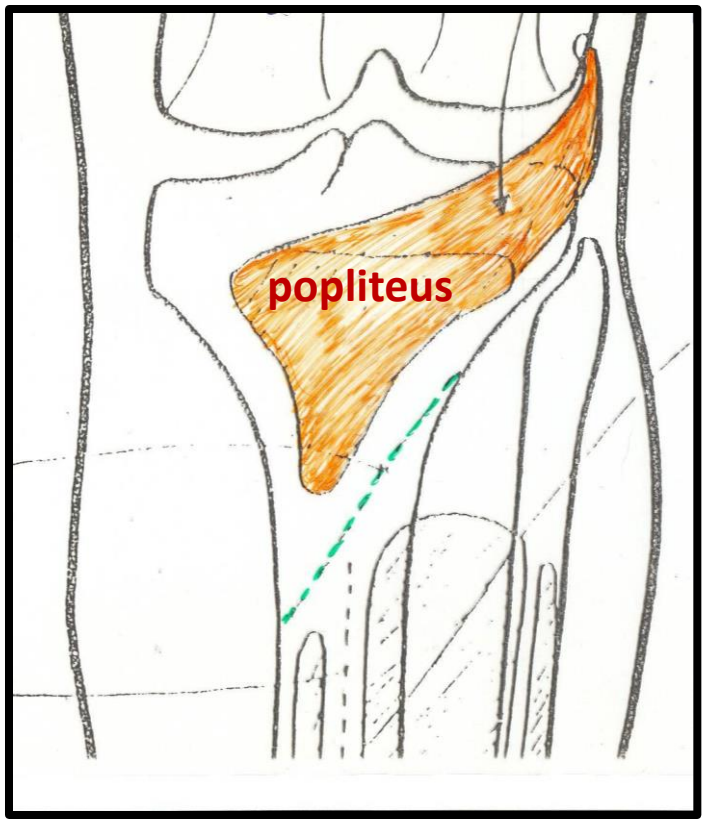
B) LATERAL ROTATION:

Biceps femoris.

INACTIVE (DEPENDANT) ROTATION

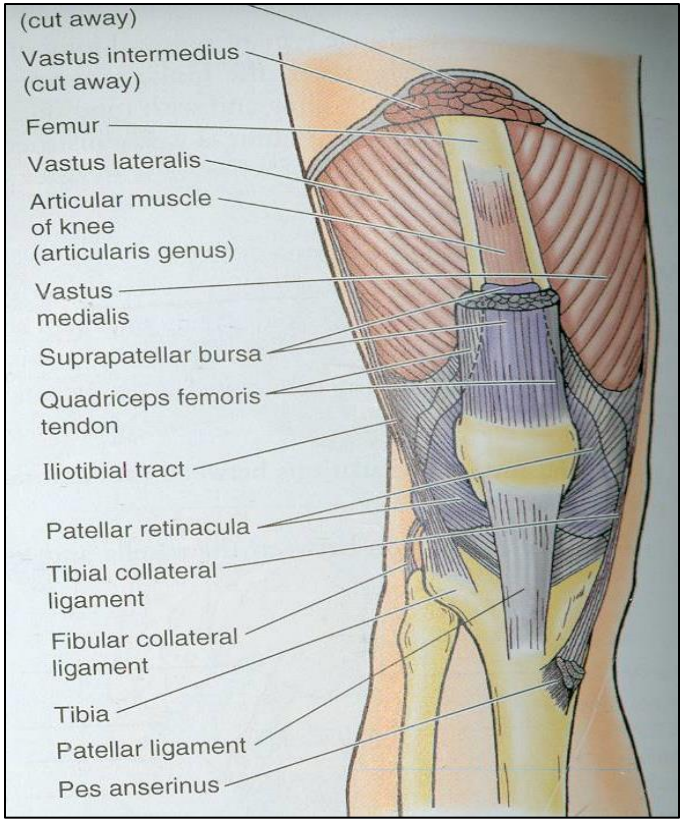


- **A) LOCKING OF KNEE:**
- The joint assumes the position of **full extension**.
- It becomes a rigid structure.
- The menisci are compressed between the tibial and femoral condyles.
- **Results mainly by tension of anterior cruciate ligament.**
- Tightening of all the major ligaments.
- The femur is **medially** rotated on the tibia (**Lateral rotation of tibia**).



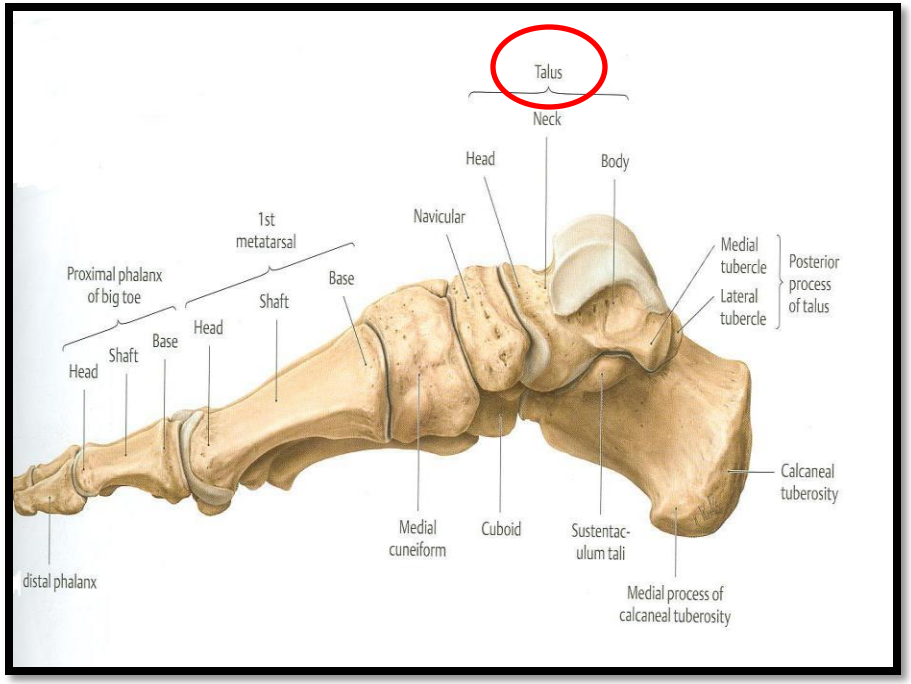
- **B) UNLOCKING OF KNEE:**
- **Medial rotation of tibia (**Lateral rotation of femur)**, at the beginning of flexion**
- **Performed by Popliteus to relax ligaments & allow easy flexion.**

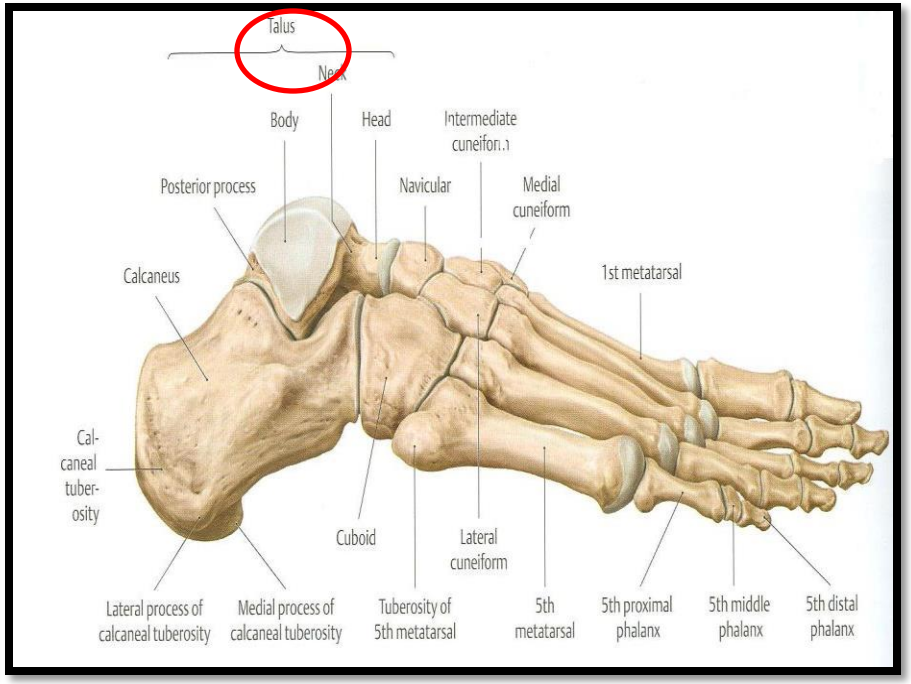
STABILITY OF THE JOINT



- **1. Muscles :**
- **QUADRICEPS** particularly the inferior fibers of the **Vasti** lateralis and medialis.
- Many sport injuries can be preventable through appropriate training and conditioning of the muscle.
- 2**. Ligaments :**
- The knee joint can function well following a ligamentous strain if the quadriceps is intact.

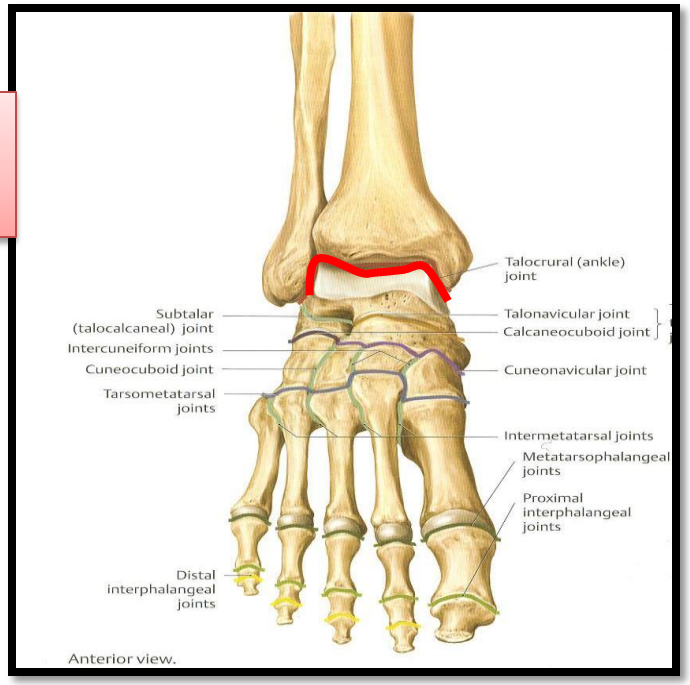
Skeleton of Foot

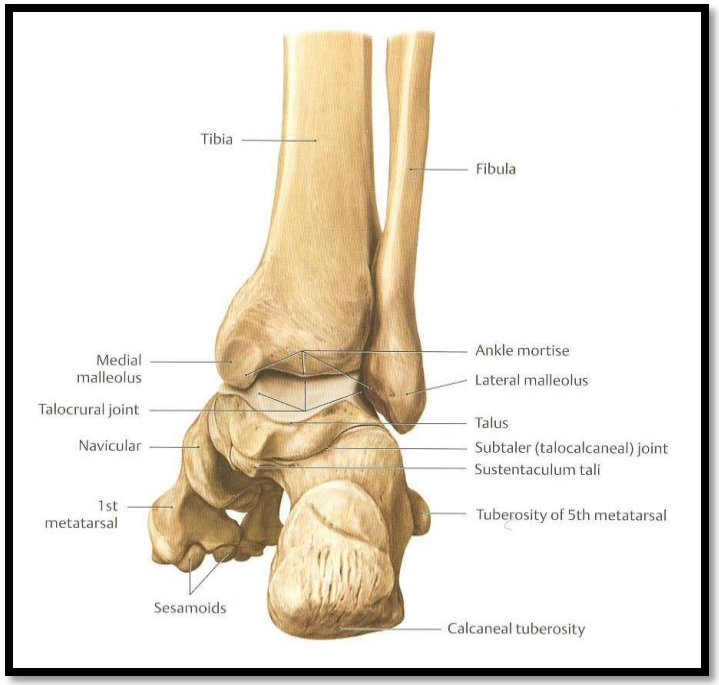




ANKLE JOINT

TYPE: synovial, hinge joint.





ARTICULAR SURFACES:

UPPER:

A socket formed by: Lateral malleolus, the lower end of tibia & medial malleolus.

LOWER:

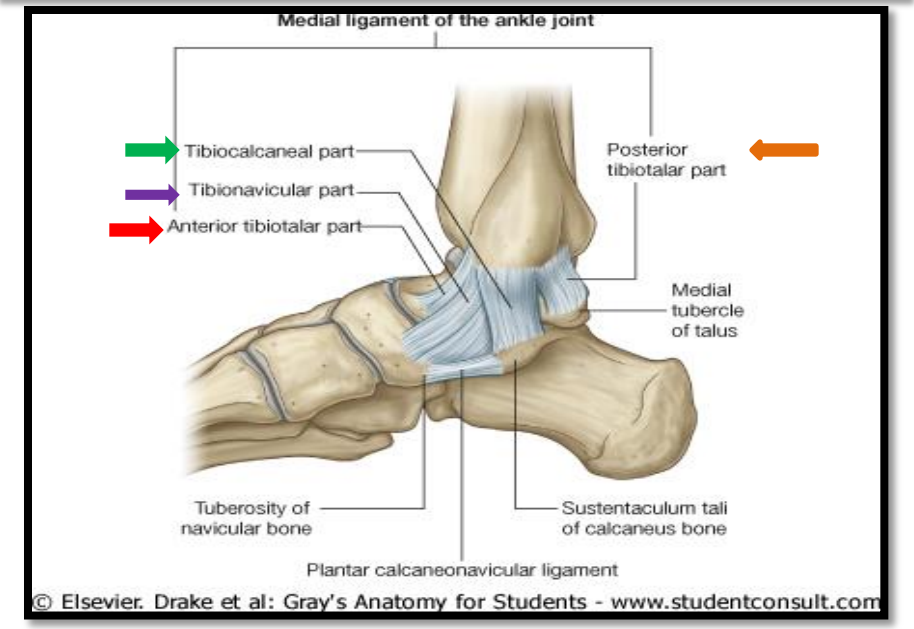
Body of talus.

Ligaments

MEDIAL (DELTOID) LIGAMENT:

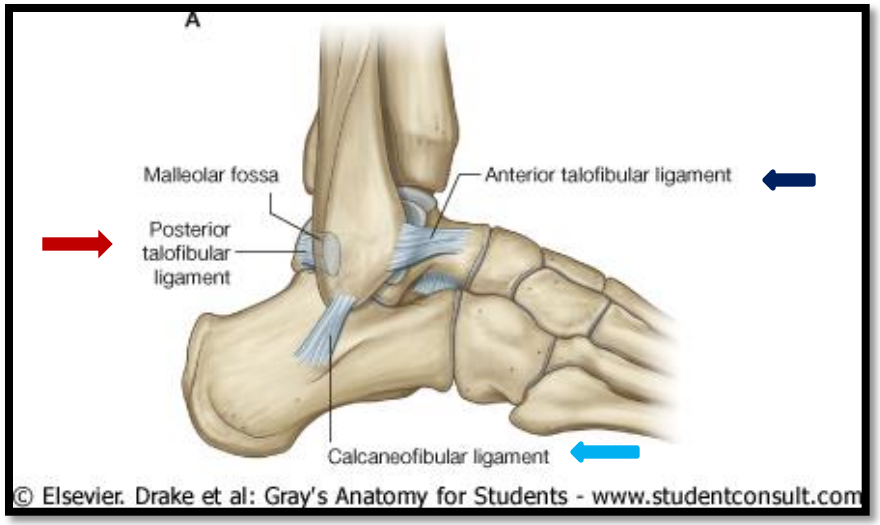
- A strong triangular ligament.
- Apex: attached to medial malleolus.
- Base: subdivided into 4 parts:

1. Anterior tibiotalar part.
2. Tibionavicular part.
3. Tibiocalcaneal part.
4. Posterior tibiotalar part.



LATERAL LIGAMENT:

- Composed of 3 separate ligaments
- Anterior talofibular ligament.
- Calcaneofibular ligament.
- Posterior talofibular ligament.



Movements

DORSIFLEXION:

- Performed by muscles of anterior compartment of leg *(tibialis anterior, extensor hallucis longus, extensor digitorum longus & peroneus tertius).*

PLANTERFLEXION:

- Initiated by soleus.
- Maintained by gastrocnemius.
- Assisted by other muscles in posterior compartment of leg *(tibialis posterior, flexor digitorum longus & flexor hallucis longus)* + muscles of lateral compartment of leg *(peroneus longus & peroneus brevis).*

- **INVERSION & EVERSION MOVEMENTS** occur *on the talo-calcaneo-navicular (subtalar) joint (Not on ankle joint).*

Nerve Supply of all JOINTS

HILTON'S LAW:

"The joint is supplied by branches from nerves supplying muscles acting on it".


BEST LUCK