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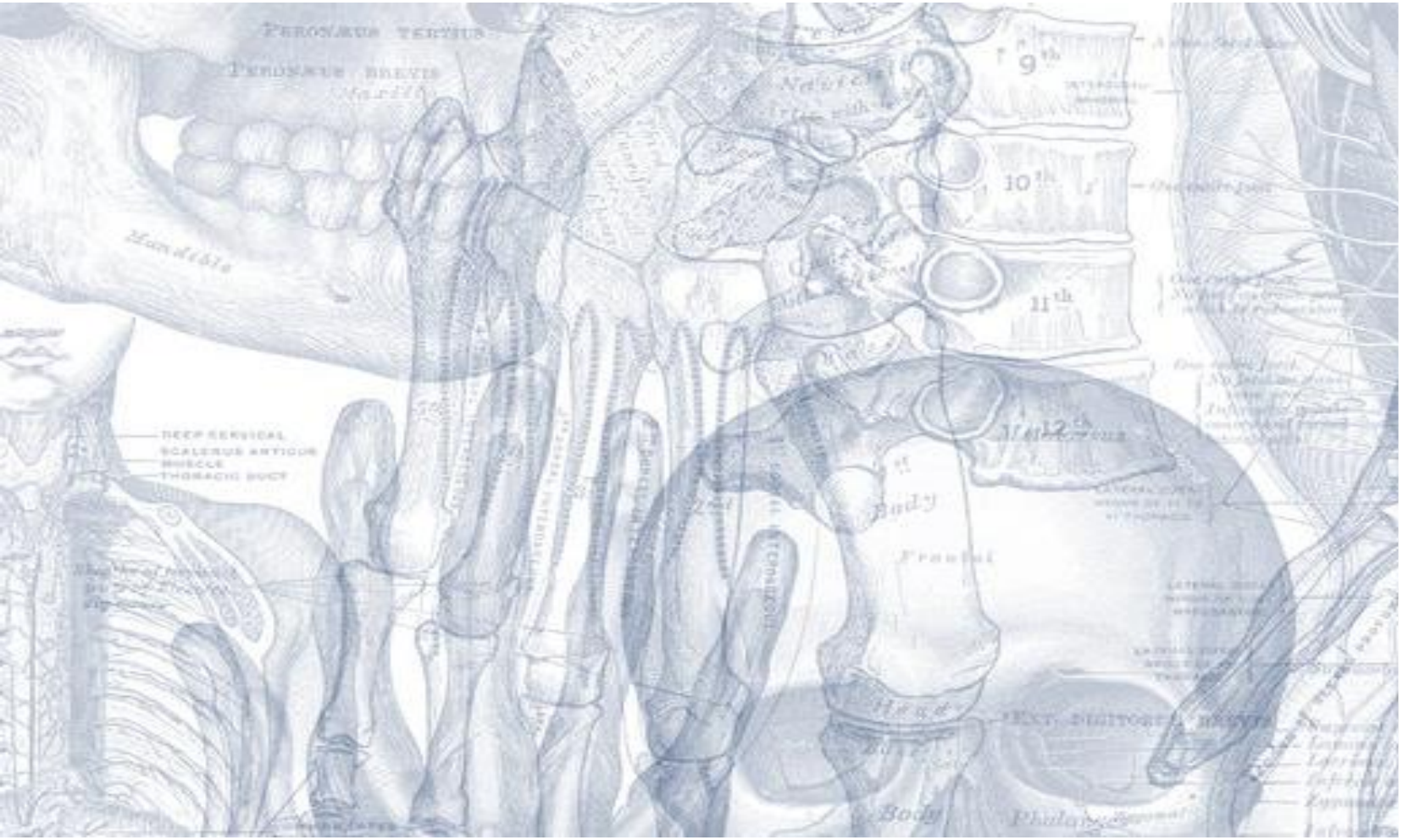


ANATOMY
TEAM 436

436
MEDICINE
KING SAUD UNIVERSITY

Revised by
شوق الأحمري & طراد الوكيل

Hip, Knee & Ankle Joints

By Biochemistry team

Biochemistry team 436

Editing File

Color Code

- **Important**
- **Doctors Notes**
- **Notes/Extra explanation**

Objectives:

- ✓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:

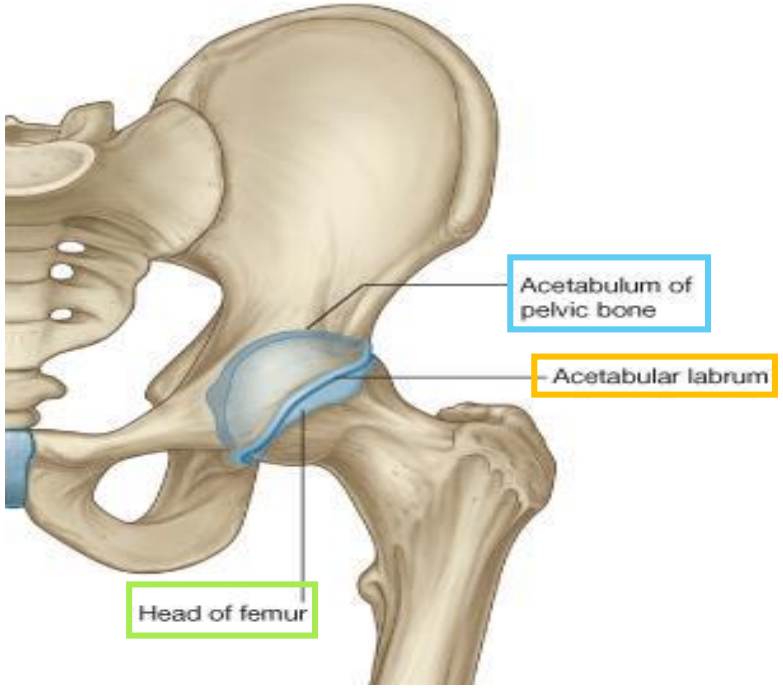
Synovial, Ball & Socket joint.

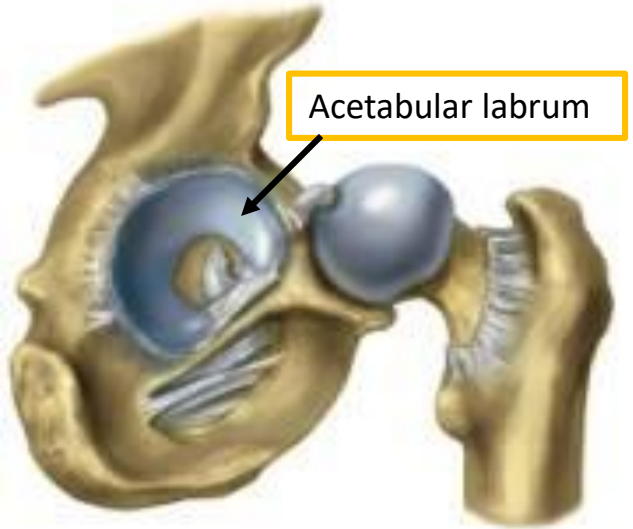
ARTICULAR SURFACES:

- Acetabulum of hip (pelvic) bone (socket)
- Head of femur (ball)

Acetabular Labrum:

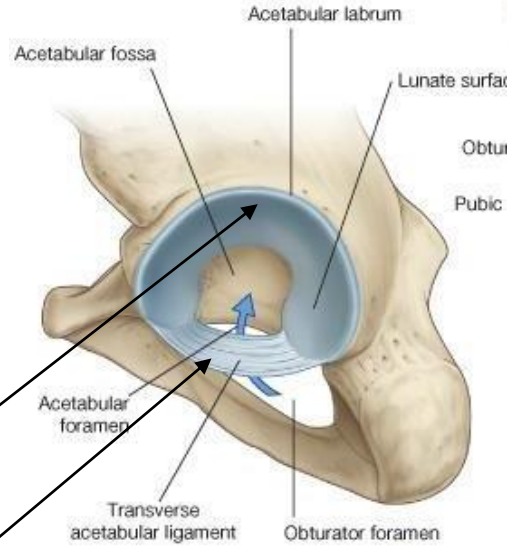
C-shaped fibrocartilaginous collar attached to margins of acetabulum, and increases its depth for better retaining of head of femur.





Hip joint

Capsule

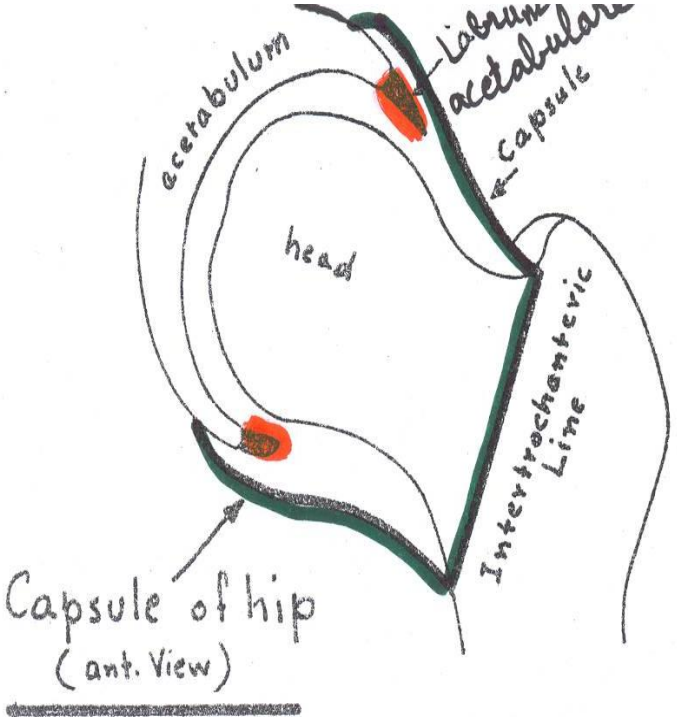


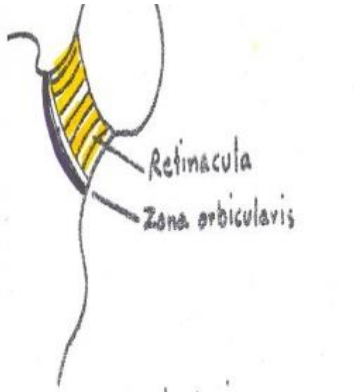
- **Attached Medially to hip bone** :
  1. Labrum acetabulare.
  2. Transverse acetabular ligament.
- **Posteriorly :**

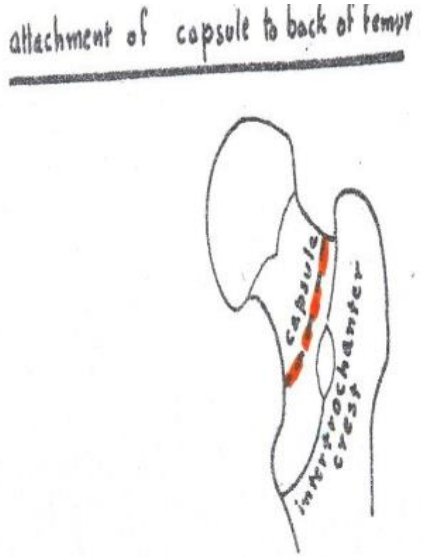
  Halfway along the posterior aspect of the neck. **(Part** of the neck lies **inside** the capsule and the other part is **outside** it).
- **Anteriorly** :

  the neck of the femur is **completely** inside the capsule

Basically the capsule covers the neck of the femur completely anteriorly but posteriorly it only covers half of it.







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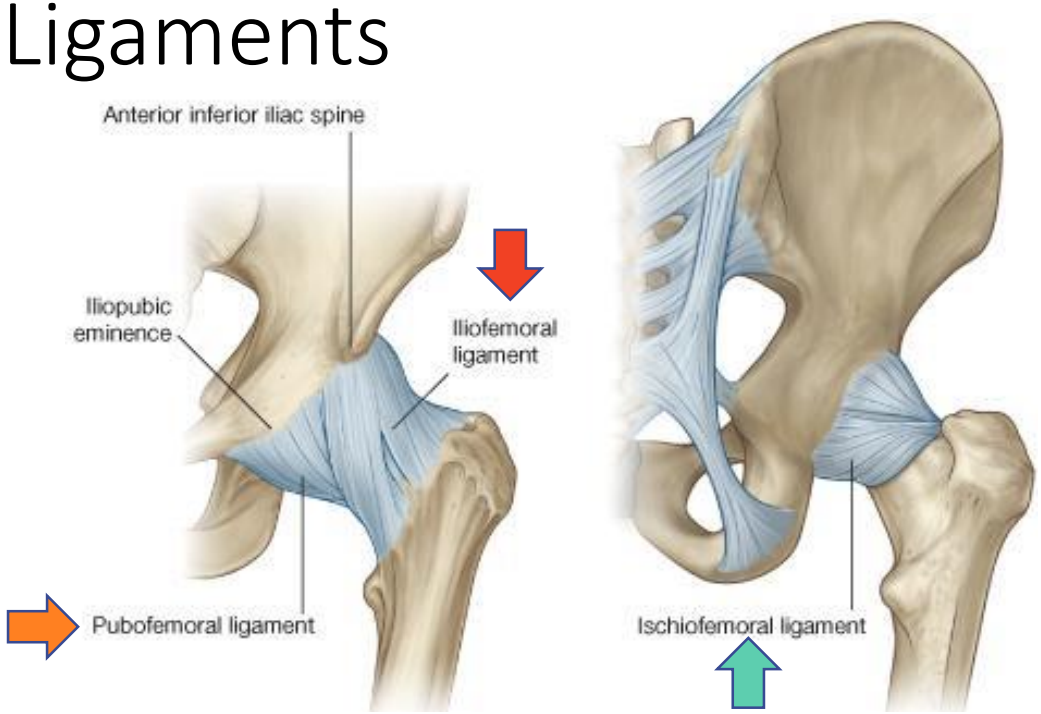
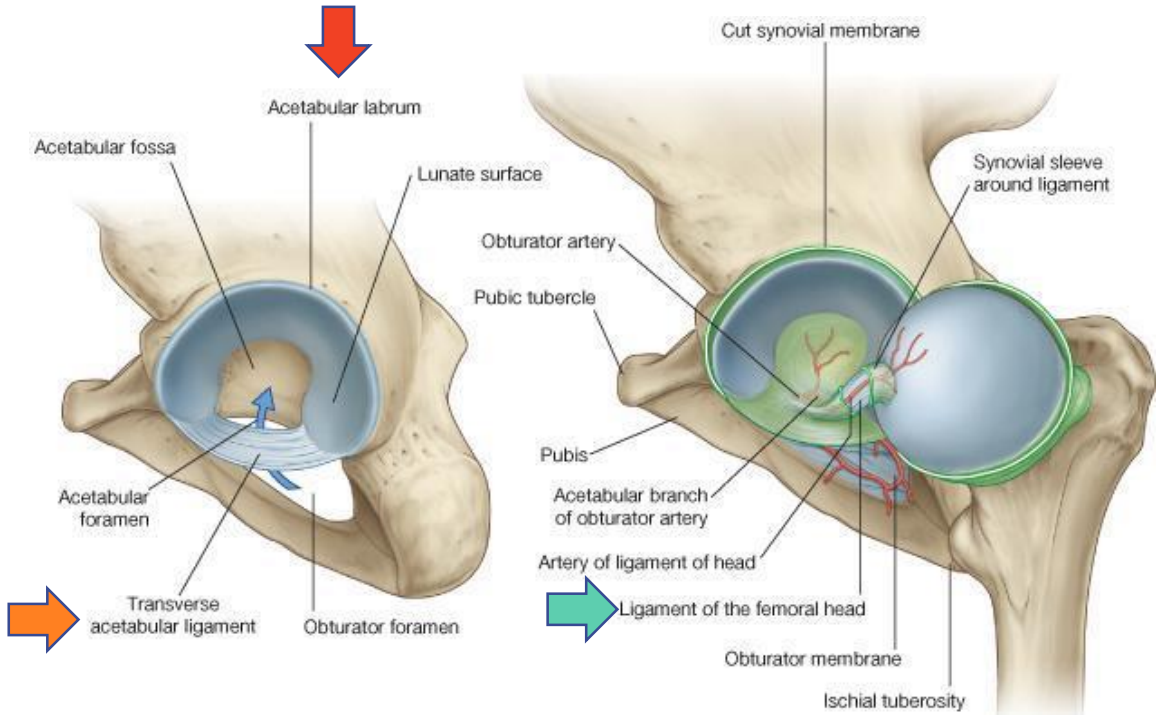
Hip joint

Ligaments





Extra-capsular (3)

➤ **Iliofemoral ligament:**

Y-shaped, anterior to joint, limits extension

➤ **Pubofemoral ligament:**

antero-inferior to joint, limits abduction & lateral rotation

➤ **Ischiofemoral ligament:**

posterior to joint, limits medial rotation

Intra-capsular (3)

➤ **Acetabular labrum:**

fibro-cartilaginous collar attached to margins of acetabulum to increase its depth for better retaining of head of femur.

➤ **Transverse acetabular ligament:**

converts acetabular notch into foramen through which pass acetabular vessels

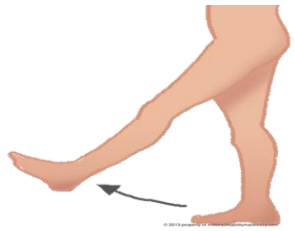
➤ **Ligament of femoral head:**

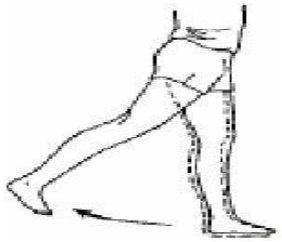
carries vessels to head of femur

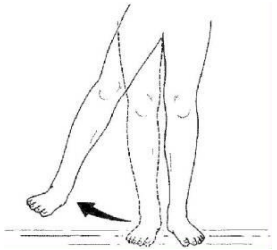
Hip joint

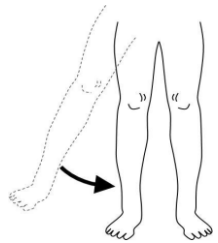
Movements

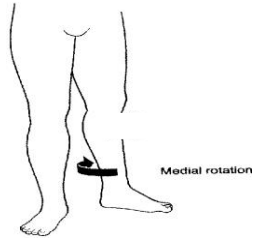
Flexion	Extension	Abduction	Adduction	Medial Rotation	Lateral Rotation
1-Iliopsoas (main flexor)	1-Hamstrings (main extensor)	1-Gluteus medius	1-Adductors	1-Gluteus medius	1-Gluteus maximus
2-Sartorius	2-Gluteus maximus (powerful extensor)	2-Gluteus minimus	2-Gracilis	2-Gluteus minimus	2-Quadratus femoris
3-Pectineus	----------	3-Sartorius	----------	----------	3-Piriformis
4-Rectus femoris	----------	----------	----------	----------	4,5-Obturator externus & internus

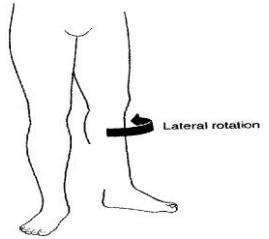












Hip joint

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 **Avascular 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**.

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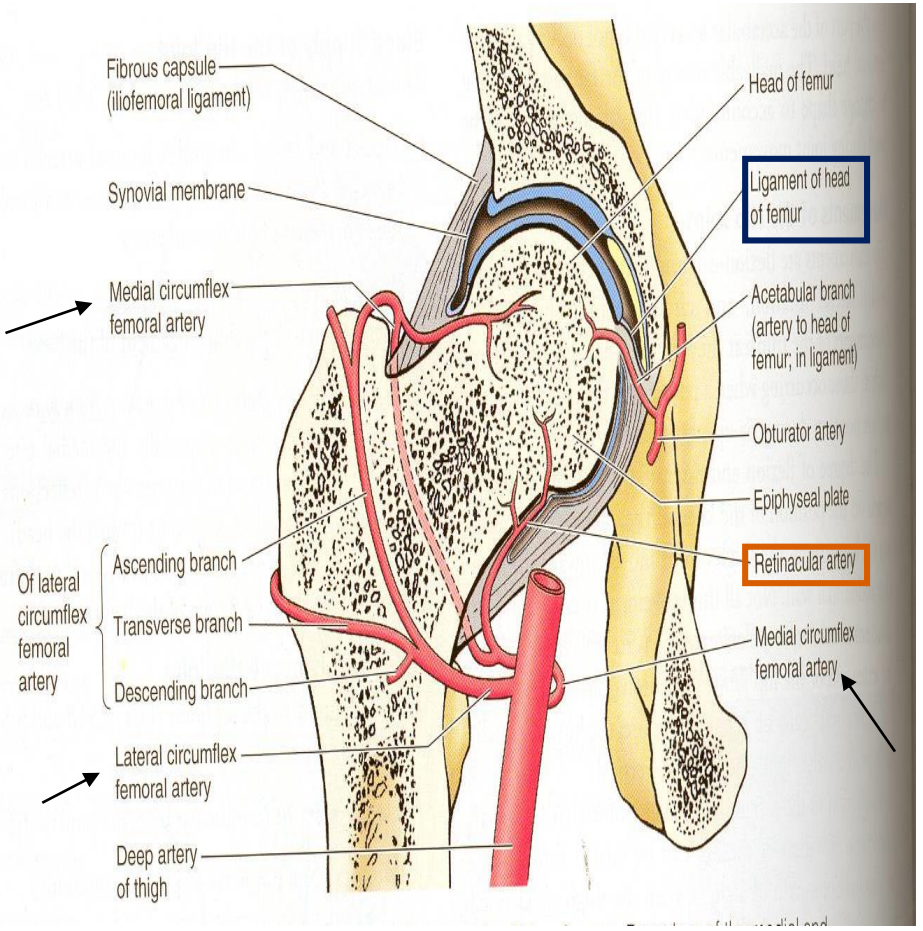
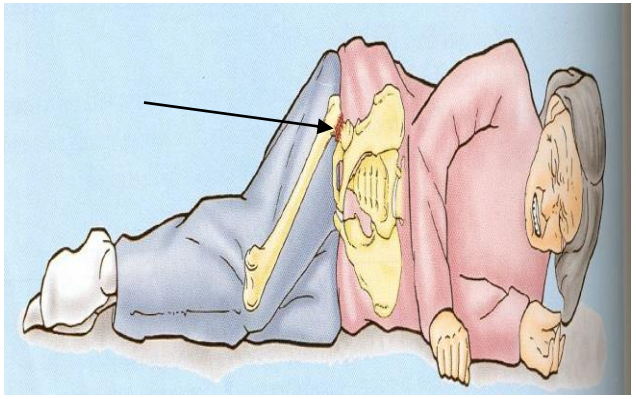




Hip joint

Stability

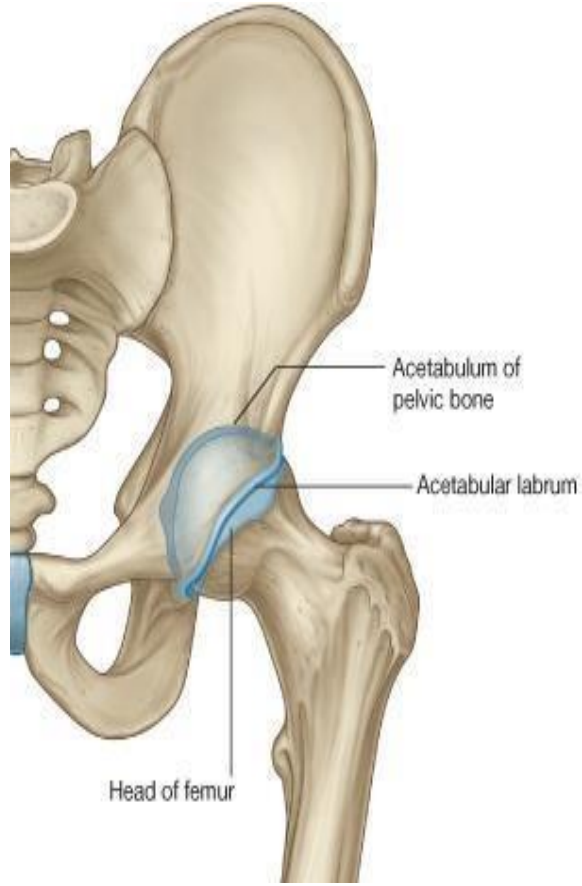
The hip joint is one of the most stable joints of the body because of :

(1) The Head of the femur fits very accurately in the acetabulum due to

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.

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Hip joint
Disloctaion

CONGENITAL

- More common in girls and associated with inability to adduct the thigh. (so the lower limb is abducted)
- 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.

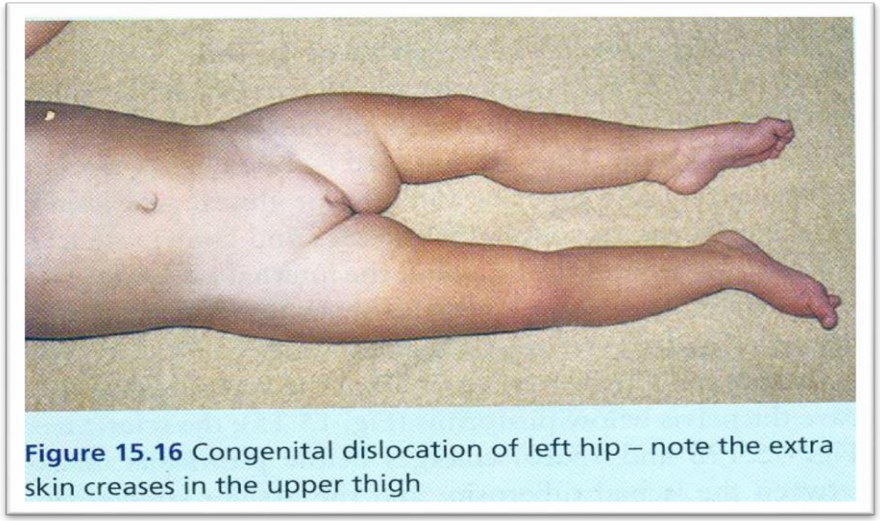
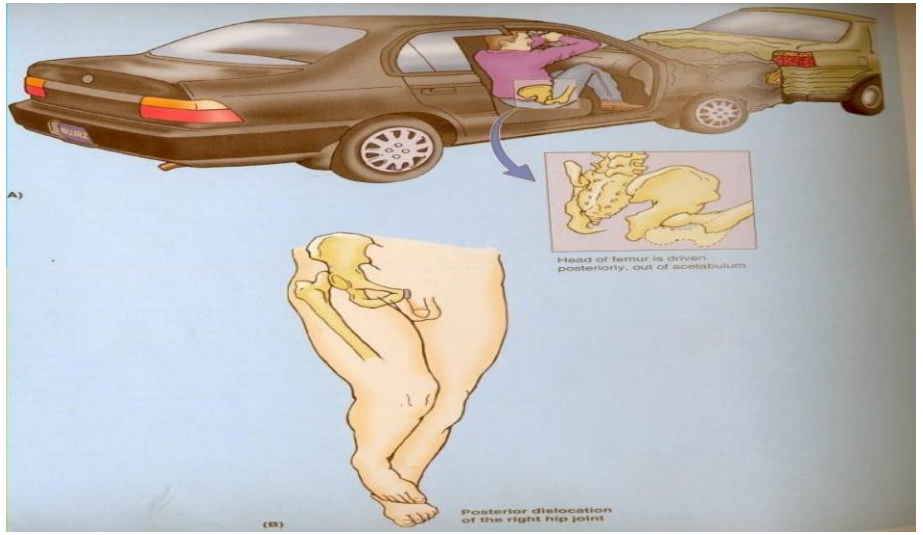


Figure 15.16 Congenital dislocation of left hip – note the extra skin creases in the upper thigh

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.



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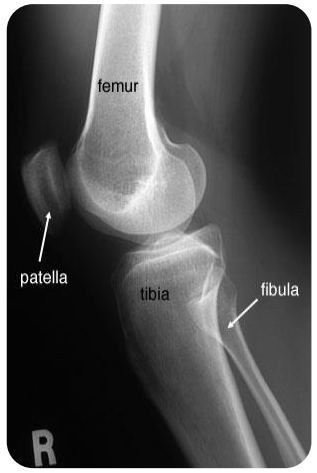
Knee joint



Three bones:
-Femur
-Tibia
-Patella

FUNCTIONS:

1. Weight bearing.

2. Essential for daily activities: standing walking & climbing stairs.

3. The main joint responsible for sports: running, jumping , kicking etc.

Three articulations:

-(**2**)**Femro-tibial articulation**: between the 2 femoral condyles & upper surfaces of the 2 tibial condyles .
Type: synovial, modified hinge

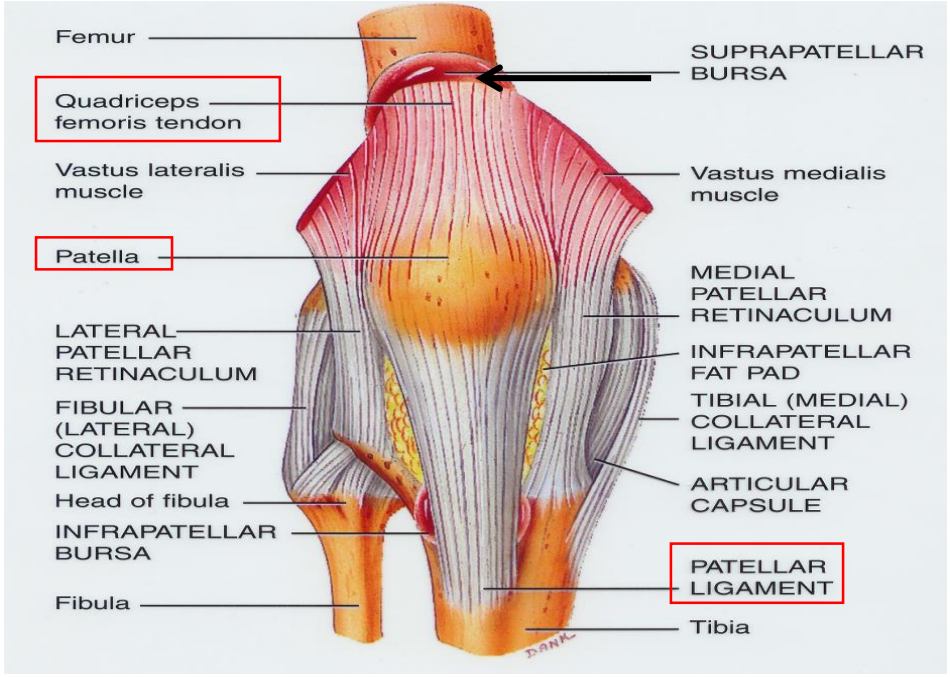
-Femoro-Patellar articulation: between posterior surface of patella & patellar surface of femur.
Type: synovial, plane

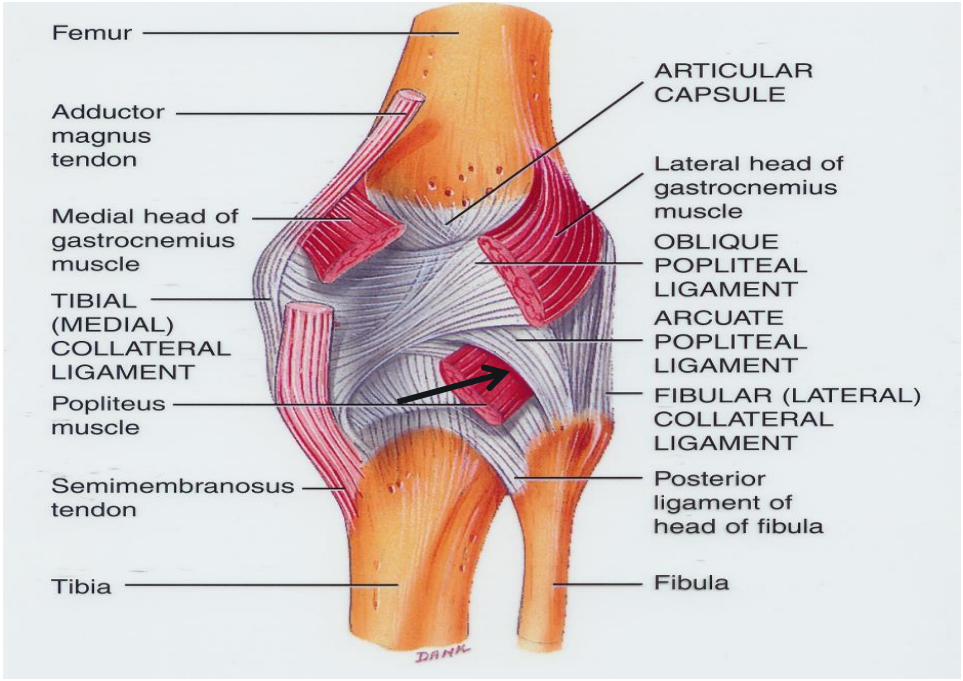
Knee joint
Capsule

The capsule is deficient anteriorly and replaced by:
-Quadriceps femoris tendon.
-Patella.
-Ligamentum patellae .

Possesses 2 openings:

1. for popliteus tendon.
2. for communication with suprapatellar bursa .





Knee joint

Ligaments

Extracapsular ligaments (4)

Ligamentum patellae (patellar ligament):
from patella to tibial tuberosity.

Medial (tibial) collateral ligament:
from medial epicondyle of femur to upper part of medial surface of tibia (firmly attached to medial meniscus).

Tibia is located medially, so it goes with the medial epicondyle of femur

Lateral (fibular) collateral ligament:
From lateral epicondyle of femur to head of fibula (separated from lateral meniscus by popliteus tendon).

fibula is located laterally, so it goes with the lateral epicondyle of femur

Oblique popliteal ligament:
extension of semimembranosus tendon

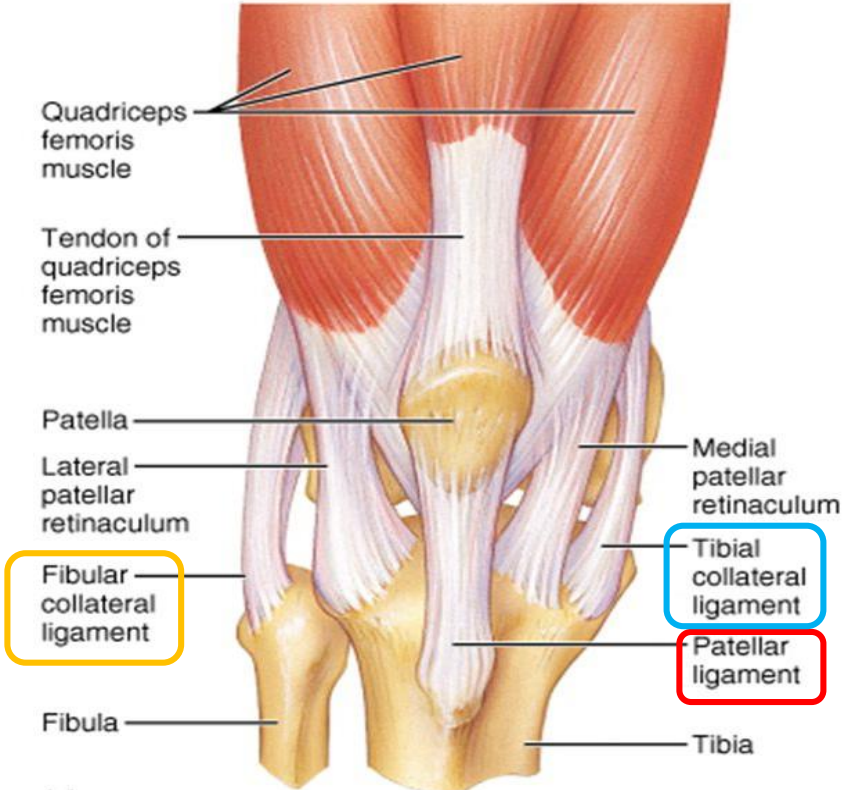
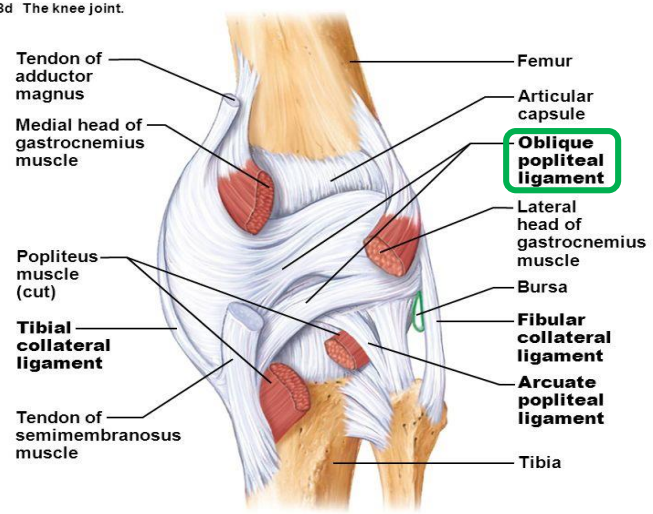


Figure 8.8d The knee joint.



(d) Posterior view of the joint capsule, including ligaments

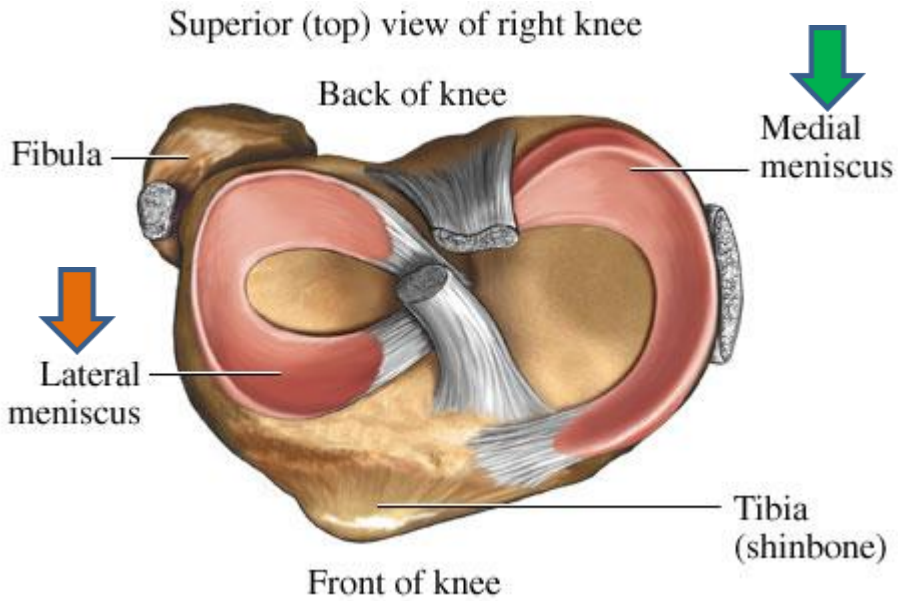
Knee joint

Ligaments

Intra-capsular Ligaments

MENISCI

They are 2 C-shaped plates of fibro-cartilage.
The **medial** meniscus is large & oval.
The **lateral** meniscus is small & circular



ATTACHMENTS:

- Each meniscus is attached by anterior & posterior horns into upper/articular surface of tibia.
- The outer surface of medial meniscus is also attached to capsule & medial collateral ligament: **medial meniscus is less mobile & more liable to be injured.**

FUNCTIONS

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

Knee joint

Ligaments

Intra-capsular Ligaments

ANTERIOR & POSTERIOR CRUCIATE LIGAMENTS

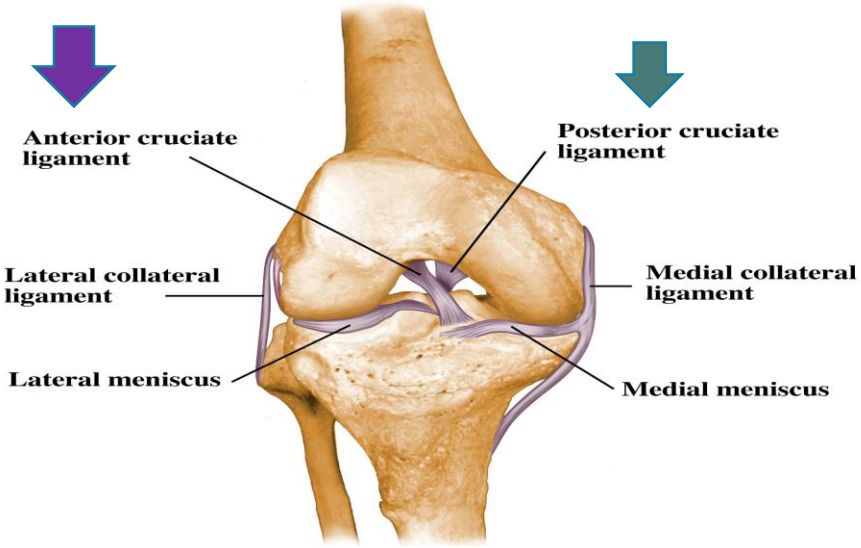
- Two in number, situated in the middle of the joint.
- They are called *Cruciate* because they cross each other
- Have received the names Anterior and Posterior, from the position of their attachments to the tibia.

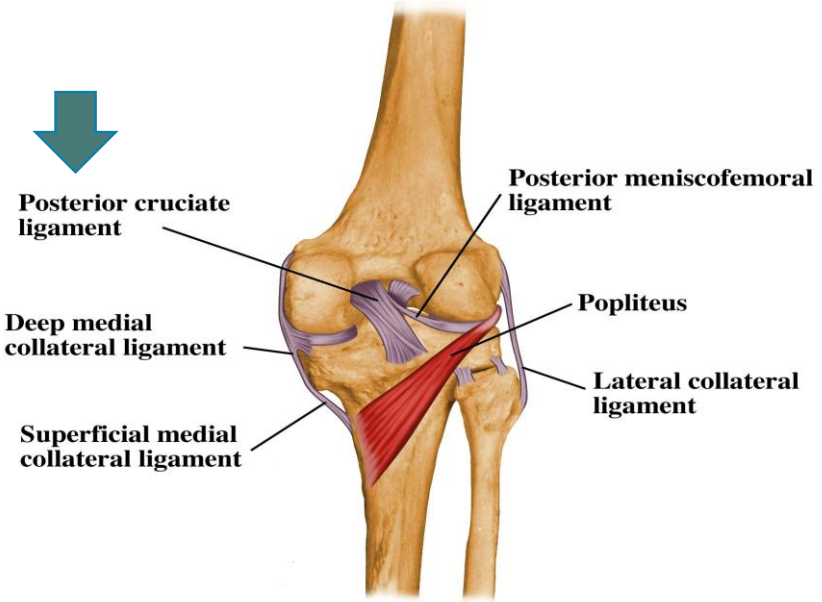
ATTACHMENTS:

- **Anterior cruciate** from anterior part of intercondylar area of tibia to posterior part of lateral condyle of femur.
- **Posterior cruciate:** from posterior part of intercondylar area of tibia to anterior part of medial condyle of femur.

FUNCTIONS:

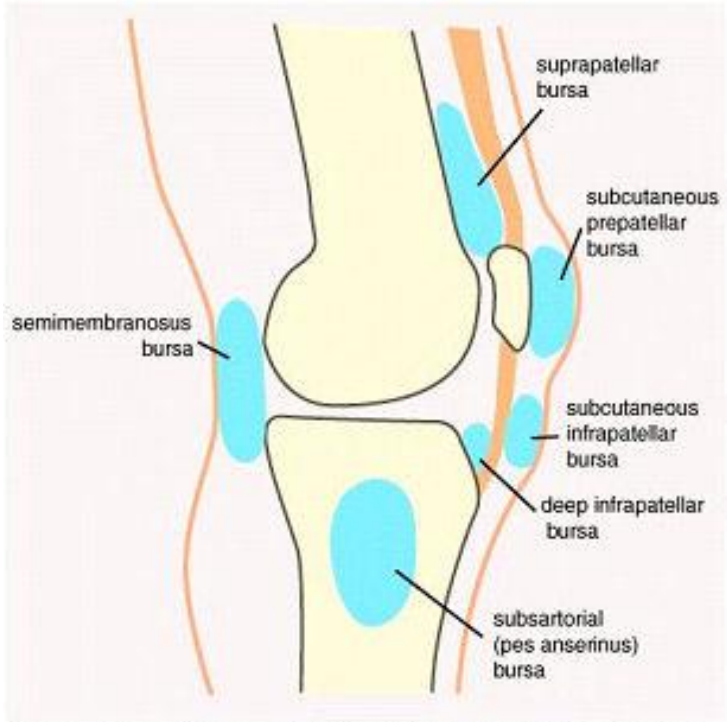
- **Anterior cruciate**: prevents posterior displacement of the femur on the tibia and the tibia from being pulled **anteriorly** when the knee joint is extended. It is taught **in Hyper extension.**
- **Posterior cruciate:** prevents anterior displacement of the femur on the tibia and the tibia from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





Knee joint

Bursae



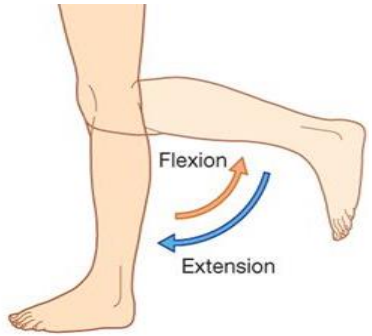
Interactive Knee 1.1 © 2000 Primal Pictures Ltd.

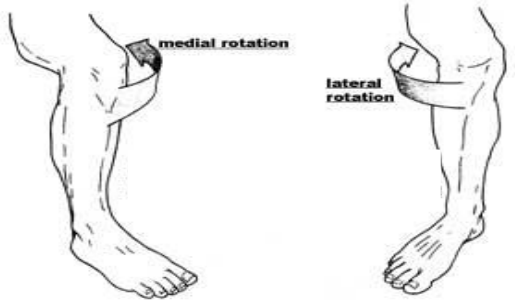
Suprapatellar bursa	Deep infrapatellar bursa	Popliteal bursa	Prepatellar bursa	Subcutaneous infrapatellar bursa
-between femur & quadriceps tendon. <u>communicates</u> with synovial membrane of knee joint. **Clinical importance?**	-between tibia & ligamentum patella.	-between popliteus tendon & capsule.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

Knee joint
Movements

*A normal hinge joint can only do flexion and extension but since the knee joint can also do some degree of rotation it is considered as a **modified** hinge joint

Flexion	**Extension**	**Active rotation (performed when knee is flexed)***	
		A) Medial rotation:	B) Lateral rotation:
1. Mainly by hamstring muscles: biceps femoris , semitendinosus & semimembranosus. 2. Assisted by Sartorius , gracilis & popliteus.	Quadriceps femoris.	1. Mainly by semitendinosus & semimembranosus. 2. Assisted by Sartorius & gracilis.	Biceps femoris





Knee joint
Movements

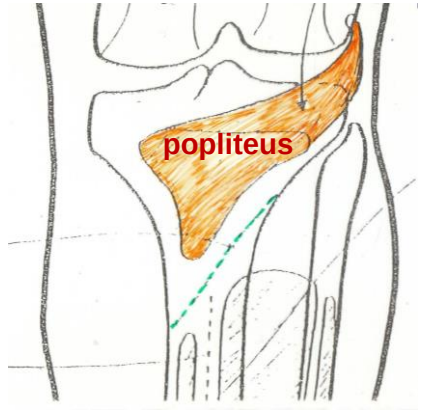
Inactive (Dependent) Rotation

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)**.

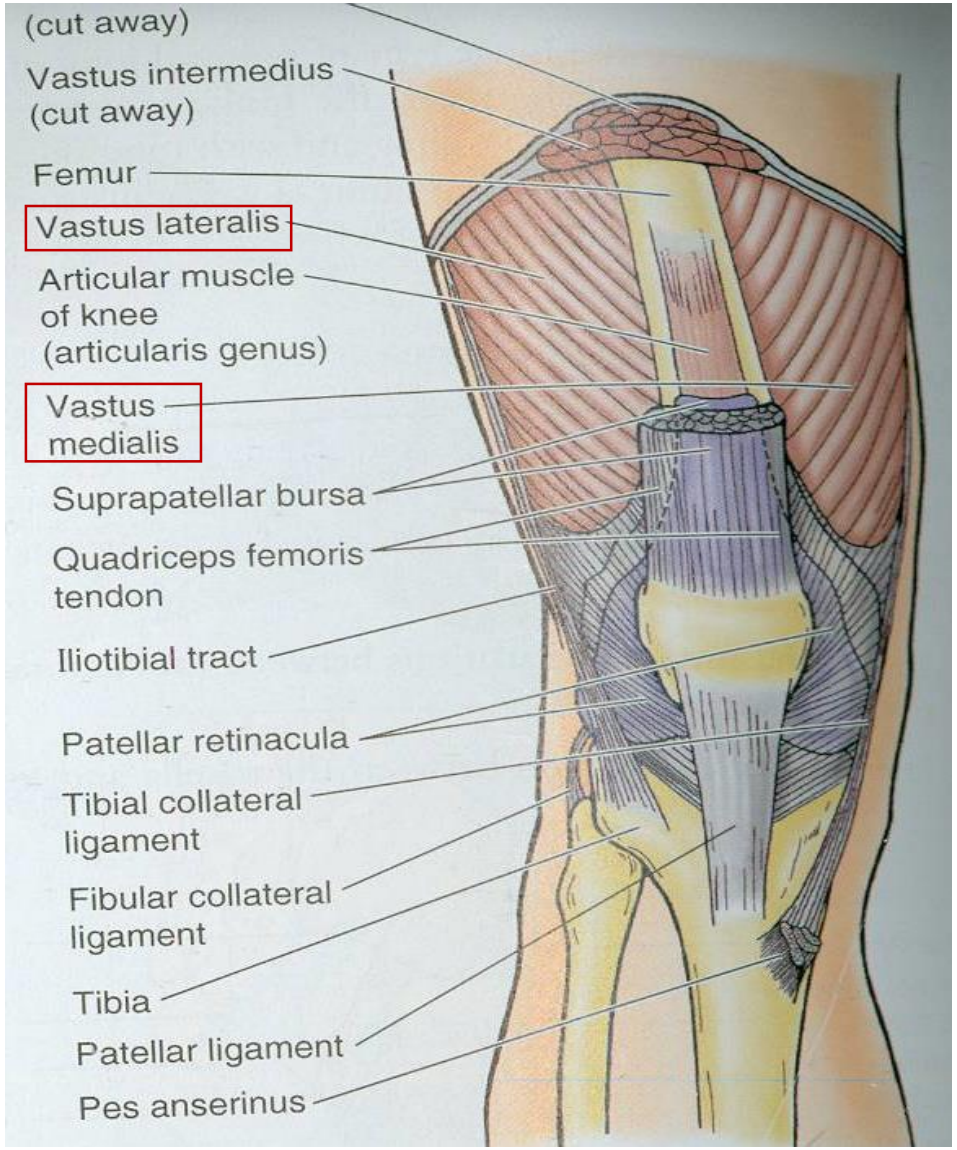
Unlocking Of Knee

- Medial rotation of tibia (lateral rotation of femur) , at the beginning of flexion.
- Performed by **popliteus** to relax ligaments & allow easy flexion.



Knee joint
Stability

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



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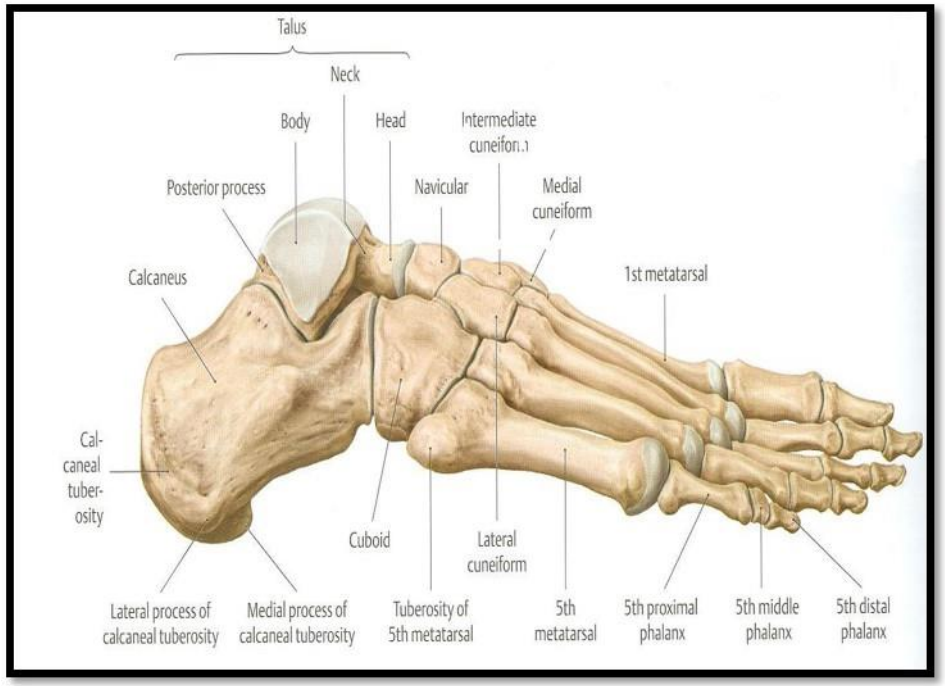
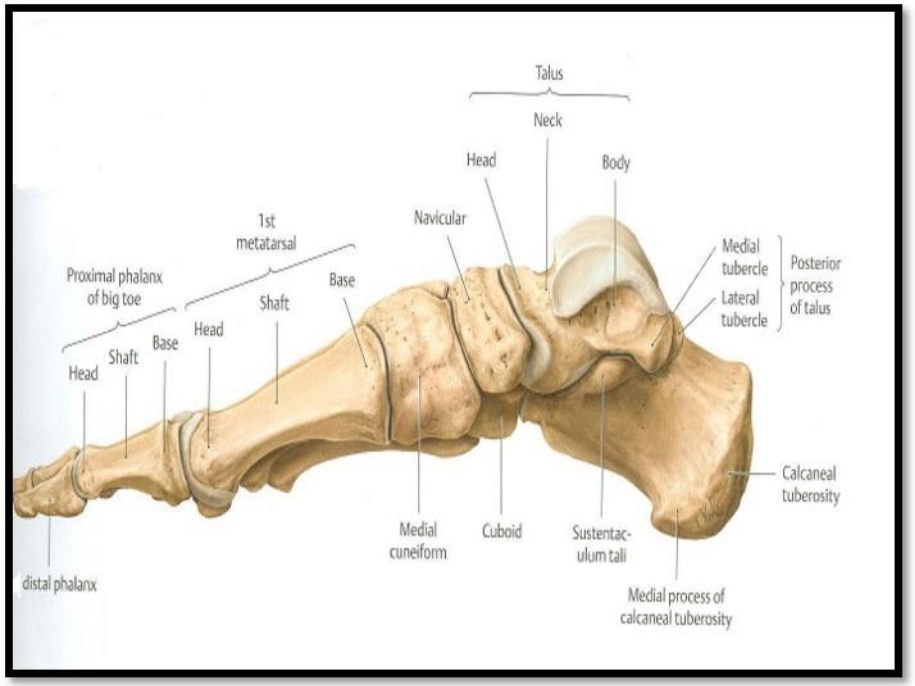
Skeleton of foot





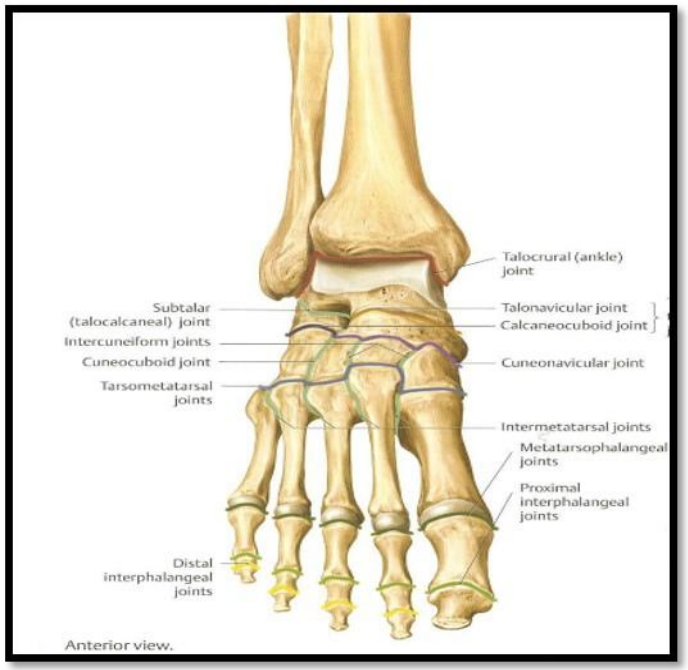
- Tarsals: Calcaneus-talus-navicular-cuboid-three cuneiform bones
- Metatarsals:1st to 5th medial to lateral metatarsal
- Phalanges: each toe has 3 phalanges except big toe has 2

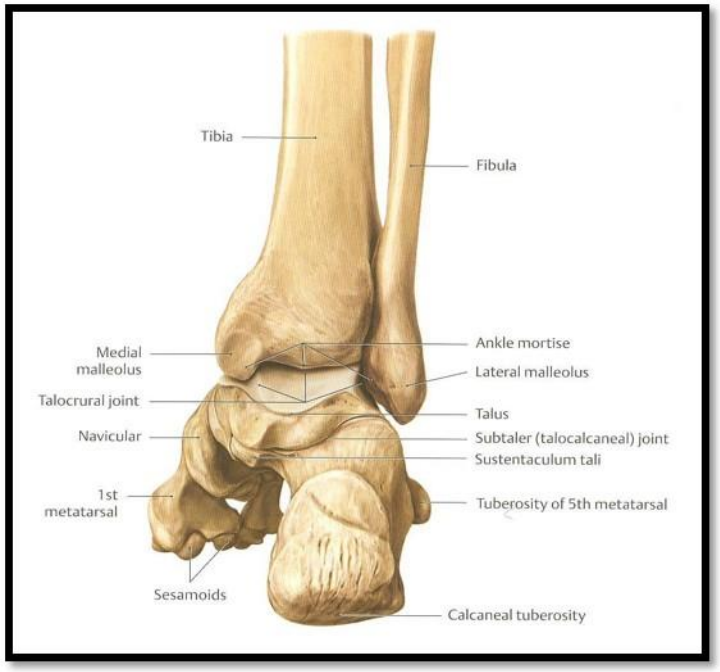
Ankle joint

- **TYPE**:
  It is a synovial, hinge joint.

- **ARTICULAR SURFACES:**
  1. UPPER:
  A socket formed by: the lower end of tibia, medial malleolus & lateral malleolus.
  2. LOWER:
  Body of talus.

Hinge joint :
A hinge joint is a bone joint in which the articular surfaces are molded to each other in such a manner as to permit motion only in one plane.
So the movement will only be flexion + extension

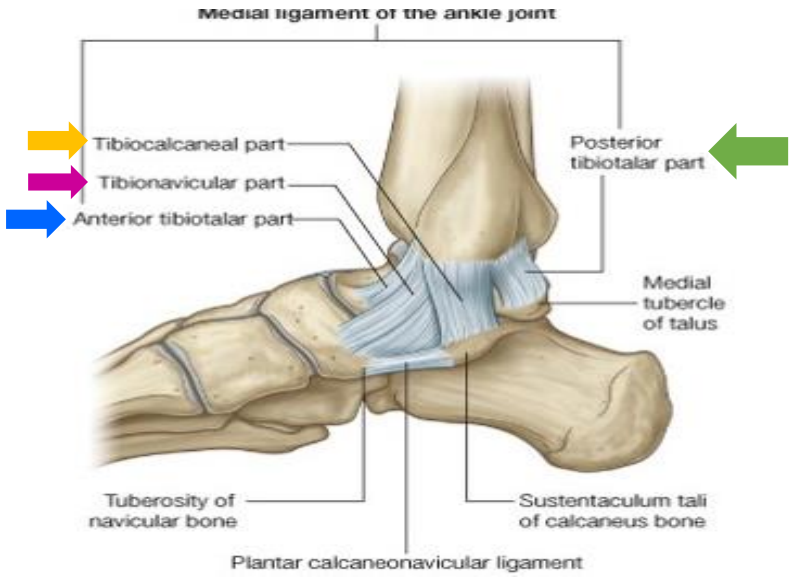


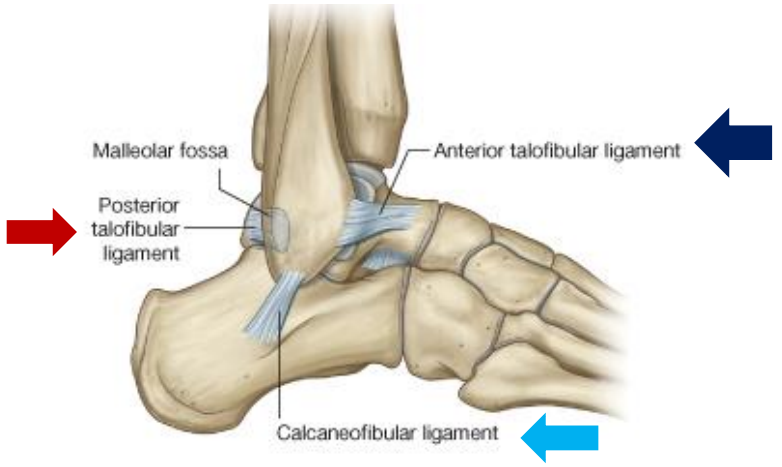


Ankle joint

Ligaments

* As a hinge joint, medial and lateral ligaments are important (for flexion and extension)





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 (WHY?).

- Anterior talofibular ligament.
- Calcaneofibular ligament.
- Posterior talofibular ligament.

Ankle joint
Movements

DORSIFLEXION:

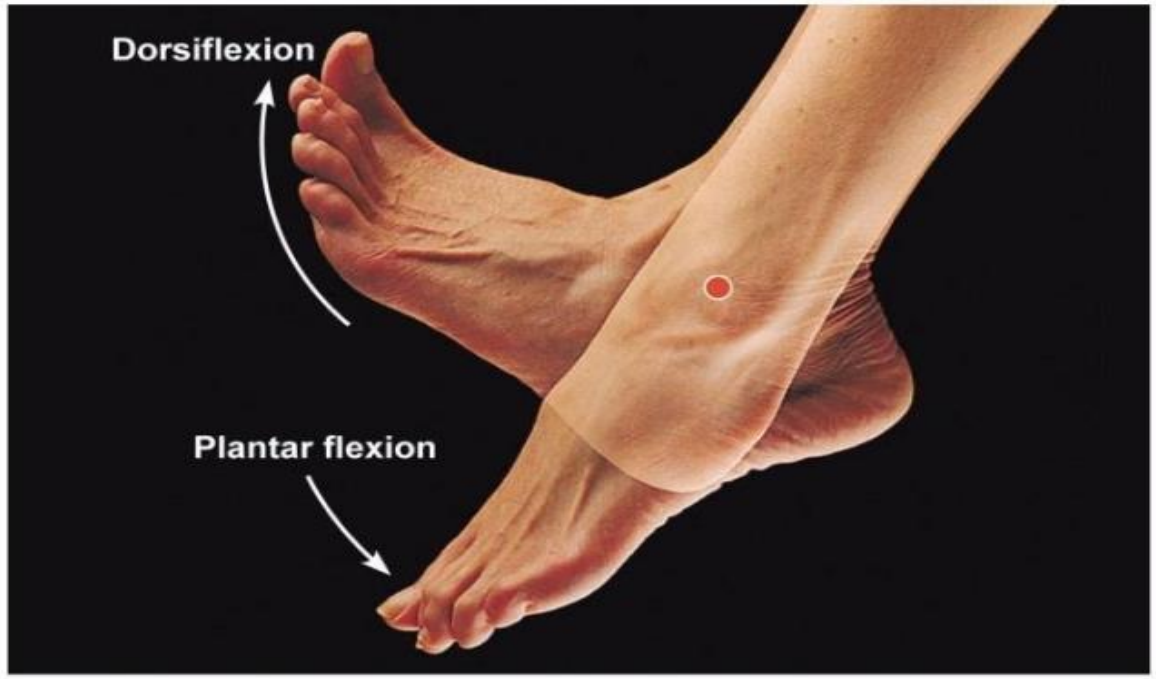
Performed by muscles of anterior compartment of leg:

1-tibialis anterior.

2-extensor hallucis longus.

3-extensor digitorum longus

4-peroneus tertius .



N.B.

INVERSION & EVERSION MOVEMENTS occur at the talo-calcaneo-navicular joint. Or simply subtalar joint

NOT ON ANKLE

PLANTERFLEXION:

Initiated by soleus

Maintained by gastrocnemius,

Assisted by other muscles in **posterior** compartment of leg:

1- tibialis posterior.

2-flexor digitorum longus .

3- flexor hallucis longus .

+ muscles of **lateral** compartment of leg :

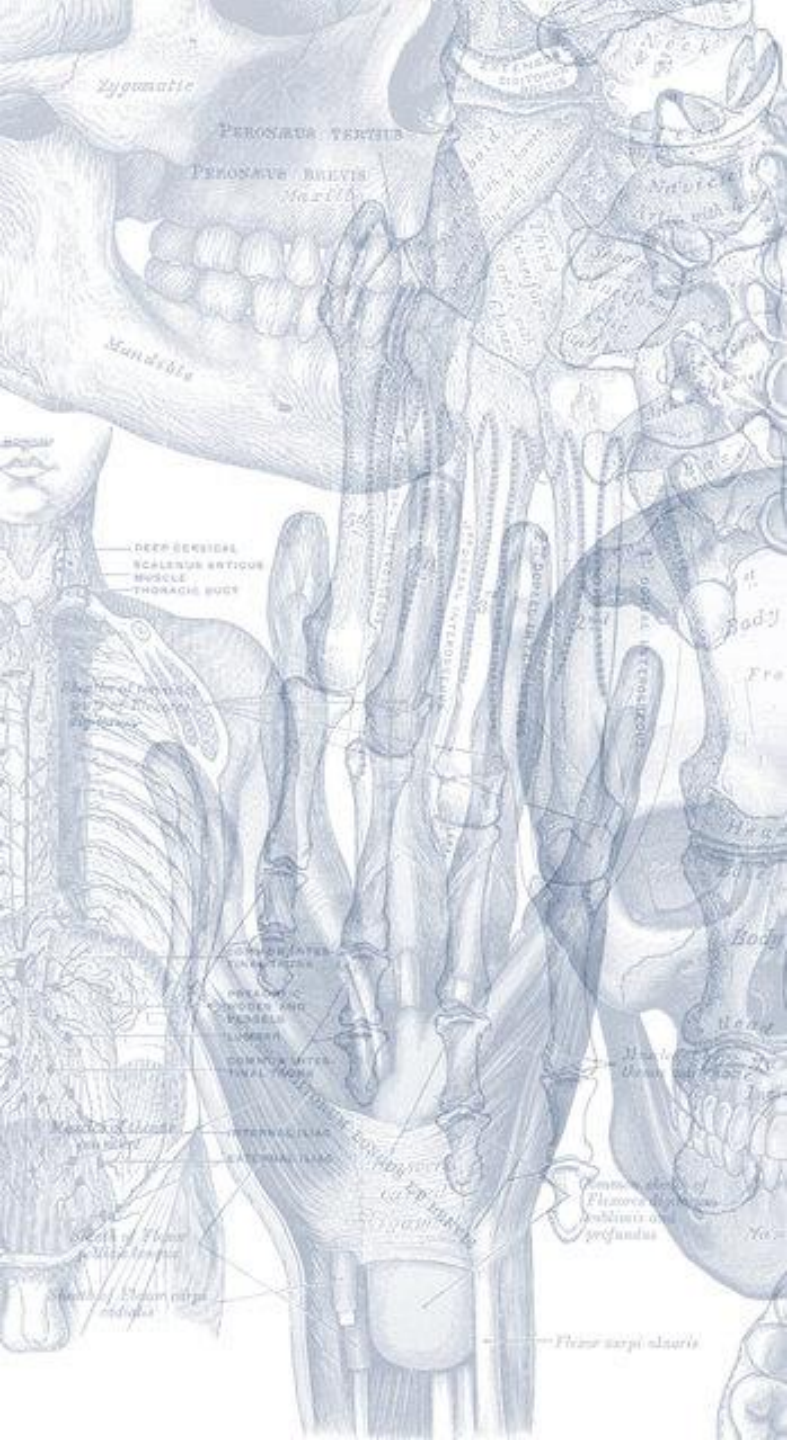
1-peroneus Longus .

2-peroneus brevis .

Nerve supply of all JOINTS

HILTON'S LAW:

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



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