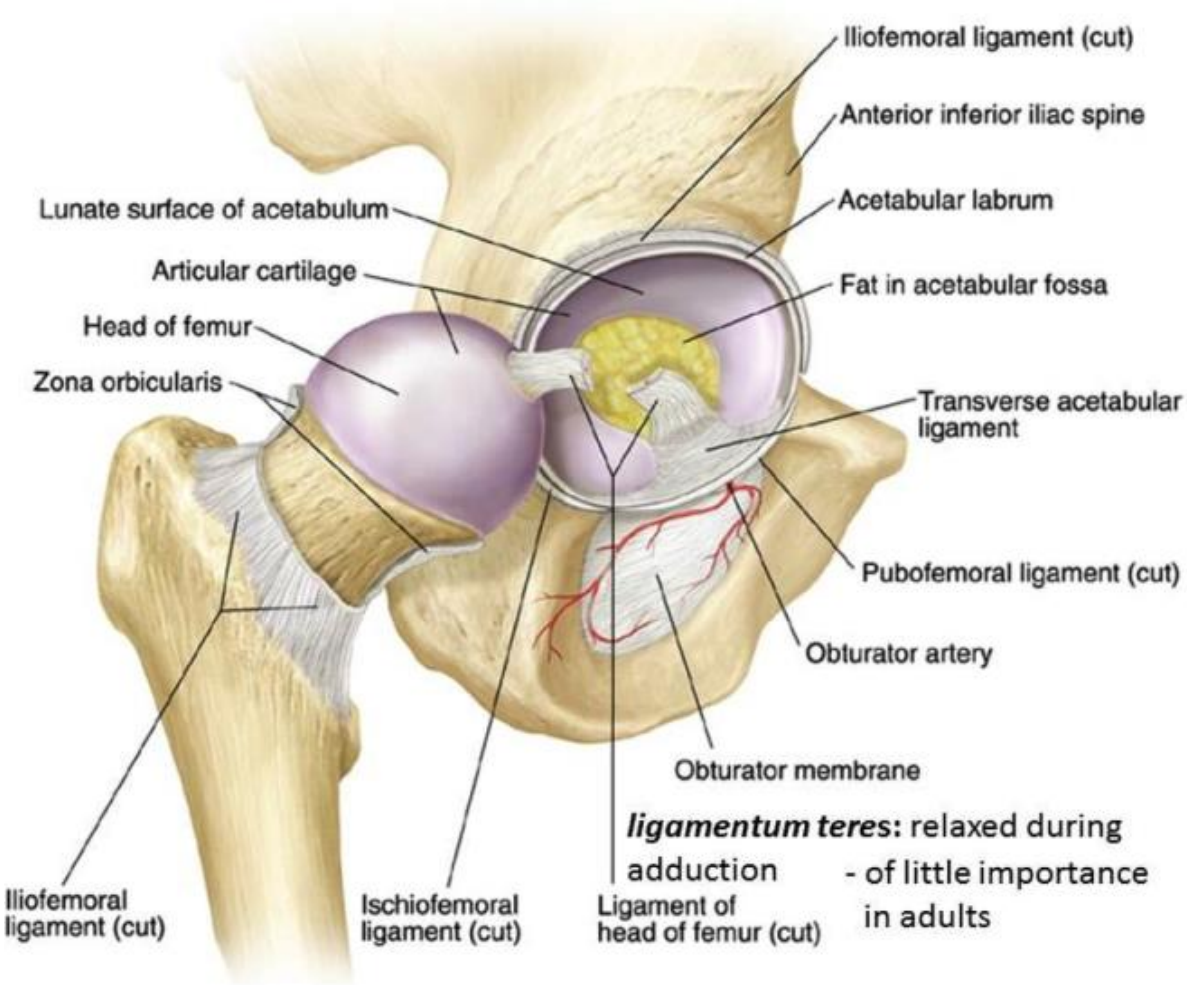
Hip joint

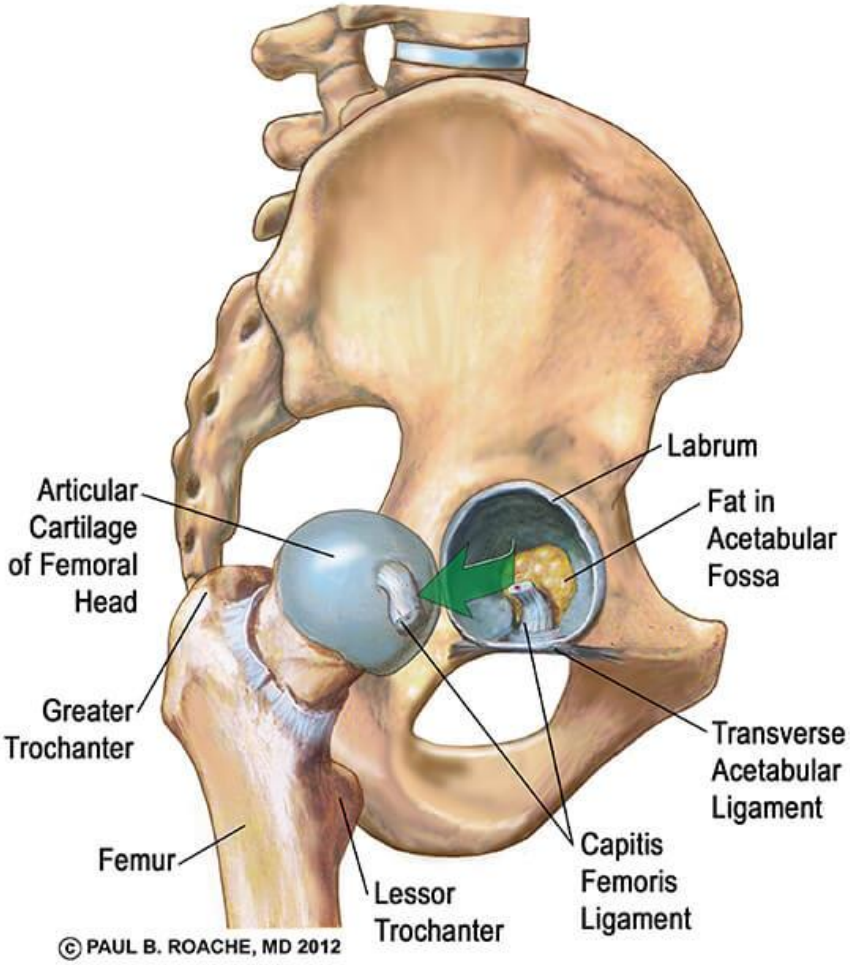
★ **Type**: synovial, polyaxial joint , **ball and socket variety**.

★ **Articulating bones**:

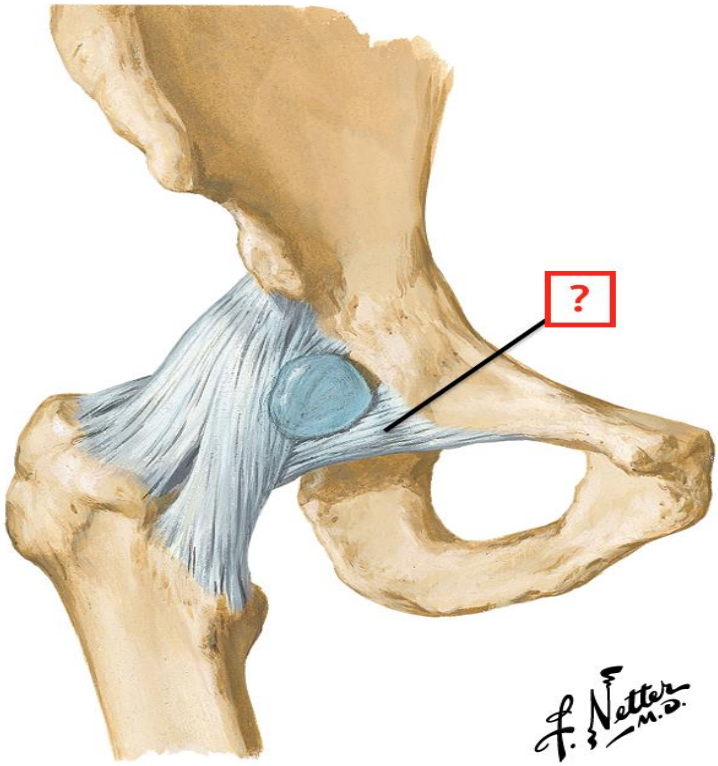
a- **Head of femur** : form 2/3 of a sphere (**ball**).

b- Horse-shoe **lunate articular surface** of the acetabulum of hip bone which becomes more deep by a fibrocartilagenous lip attached to the margin of the acetabulum called **labrum acetabulare** (**socket**).





Anterior view

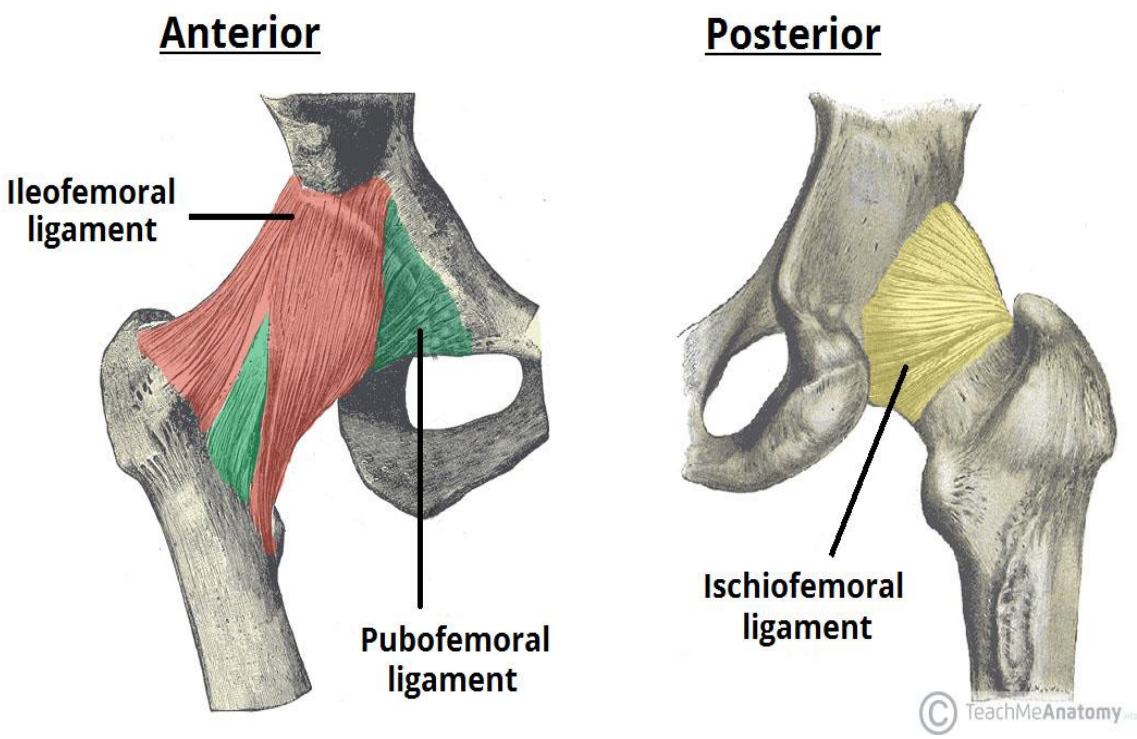


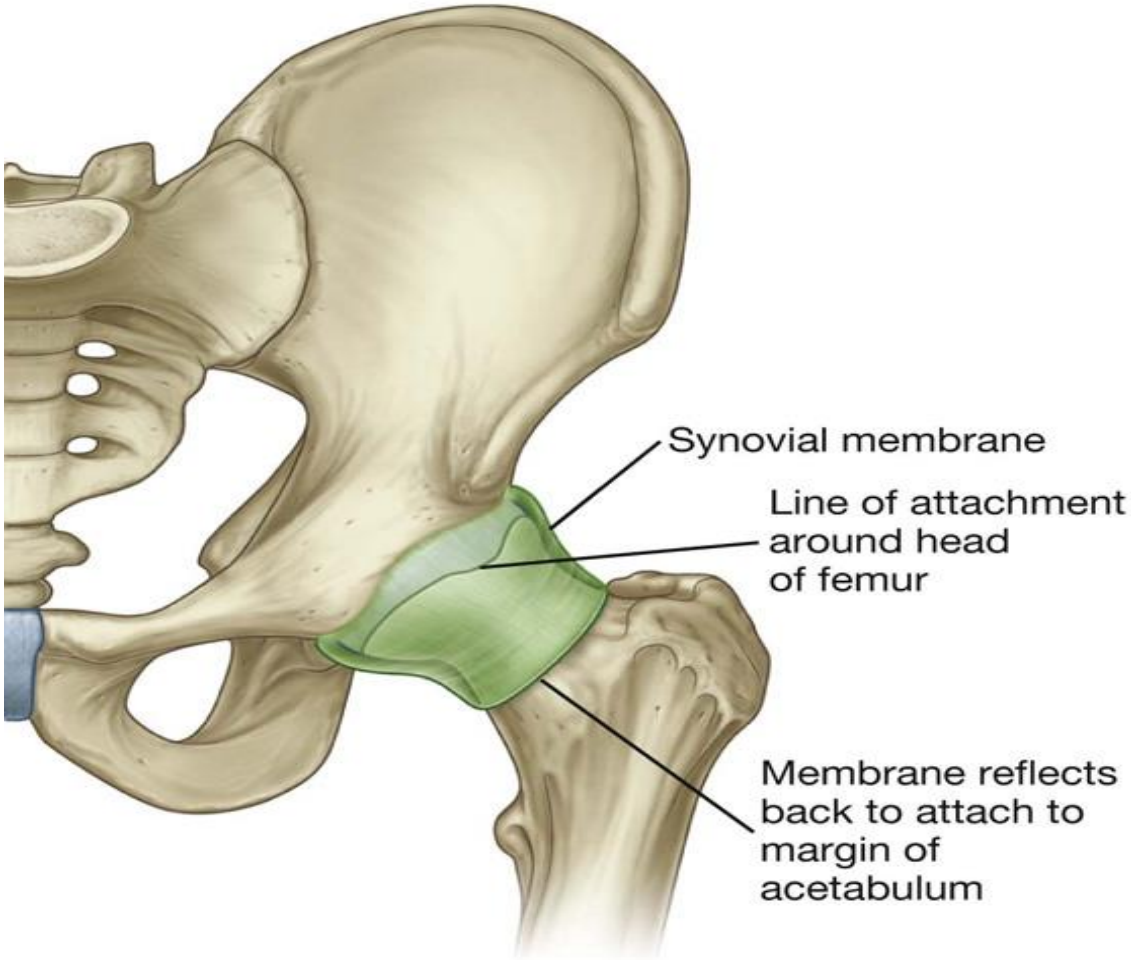
★ **Fibrous capsule**: a ***strong*** capsule surrounding the joint ***completely***. The capsule is thick except at its lower medial part which is frequently the site of dislocation of the head of femur.

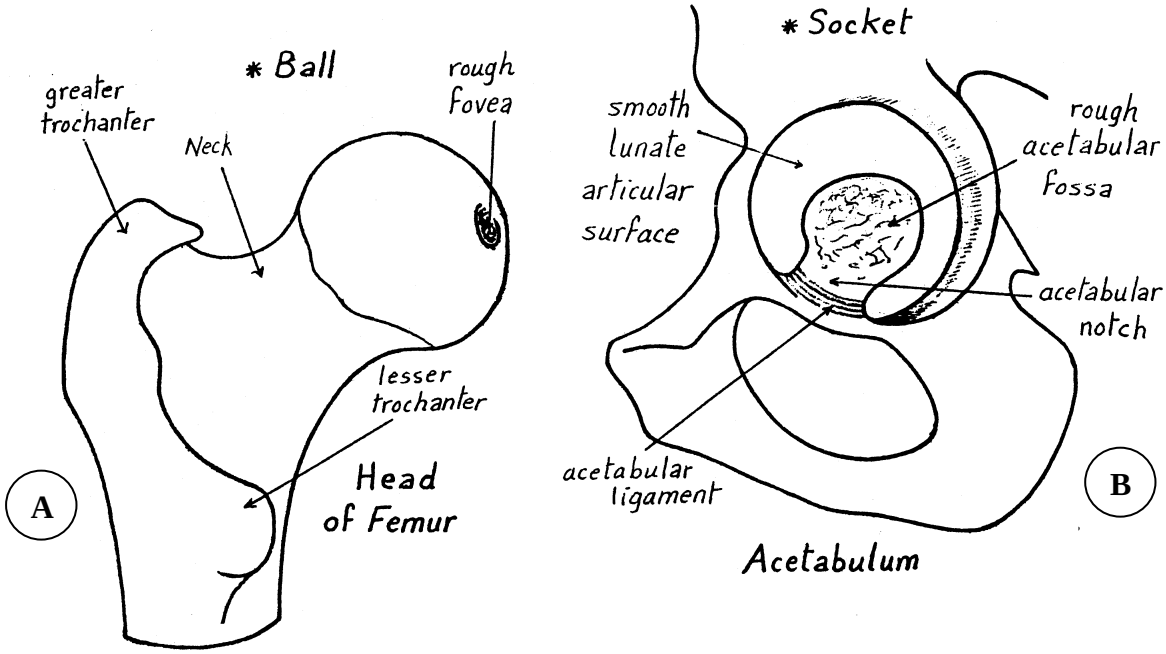
- **Attachments**:
  - **To hip bone:**
    - To the margins of acetabulum (**beyond labrum acetabulare**).
    - To the **transverse acetabular ligament**.
  - **To femur**:
    - **Anteriorly**: To the intertrochanteric line and upper borders of greater and lesser trochanters .
    - **Posteriorly** :To the middle of the back of neck of femur,.
    - Some fibres reflect from the capsule , called **retinacula** pass along the neck of femur towards its head. They carry blood supply to the head and neck of femur and also keep the segments of the fractured neck in position.
  - The anterior part of the capsule show opening between iliofemoral and pubofemoral ligaments through which the synovial membrane communicates with a bursa deep to psoas major.

★ **Synovial membrane:**

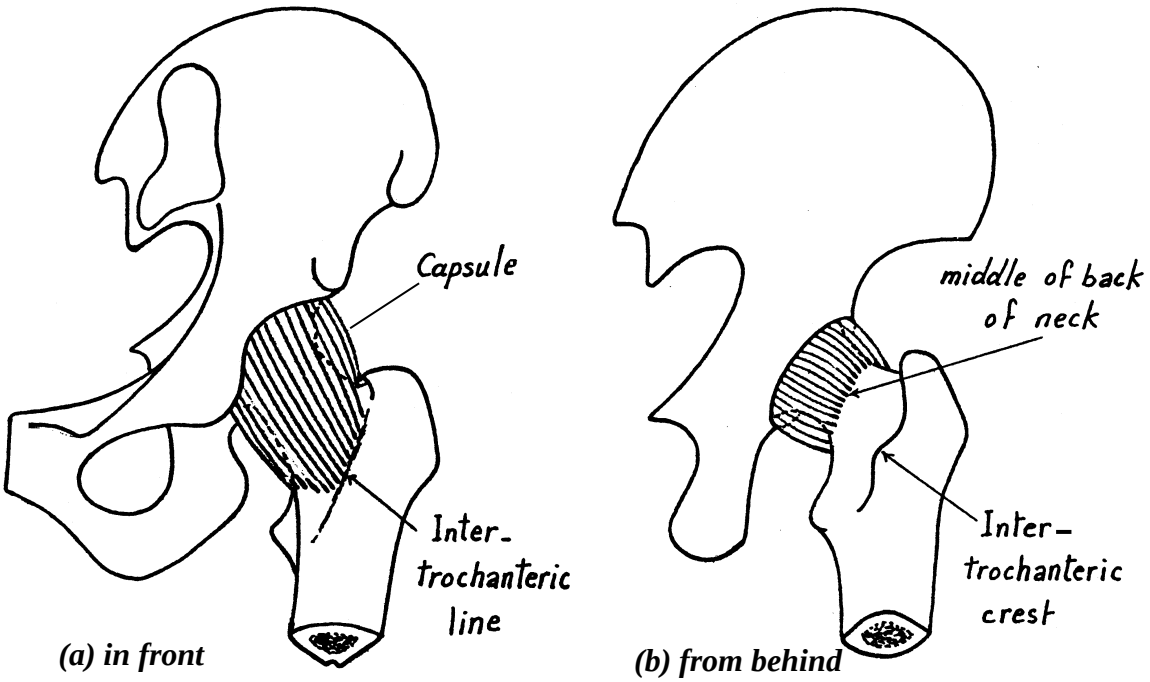
- It **lines** the inner surface of the fibrous capsule.
- It forms a **tubular sheath** for the ligamentum teres of the head of femur .
- It **covers** the intracapsular part of the **neck** of femur and **labrum** acetabulare but not cover the articular bony surfaces which are covered with hyaline cartilage instead.


Anterior
Posterior
Ileofemoral ligament
Pubofemoral ligament
Ischiofemoral ligament
© TeachMeAnatomy


Synovial membrane
Line of attachment around head of femur
Membrane reflects back to attach to margin of acetabulum



Articulating bones of the hip joint



Attachments of the capsule of the hip joint

★ Ligaments of the hip joint:

- The capsule of the hip joint is strengthened by ***three extra-capsular ligaments.***

1) Ilio-femoral ligament:

- **Attachments:** it is an inverted **Y**-shaped ligament.
  - Its stem is attached to the **anterior inferior iliac spine**
  - Its 2 limbs are attached to the upper & lower ends of the **intertrochanteric line.**
- **Function:**
  - It is the **strongest** ligament of the hip joint which in forces the **anterior** aspect of its capsule (it is the second strongest ligaments in the body after interosseus sacroiliac ligament) .
  - It **limits over extension** of the joint and **prevents** the body from falling backwards (center of gravity of body weight lies behind hip joint).
  - It helps in **transmission of body** weight.

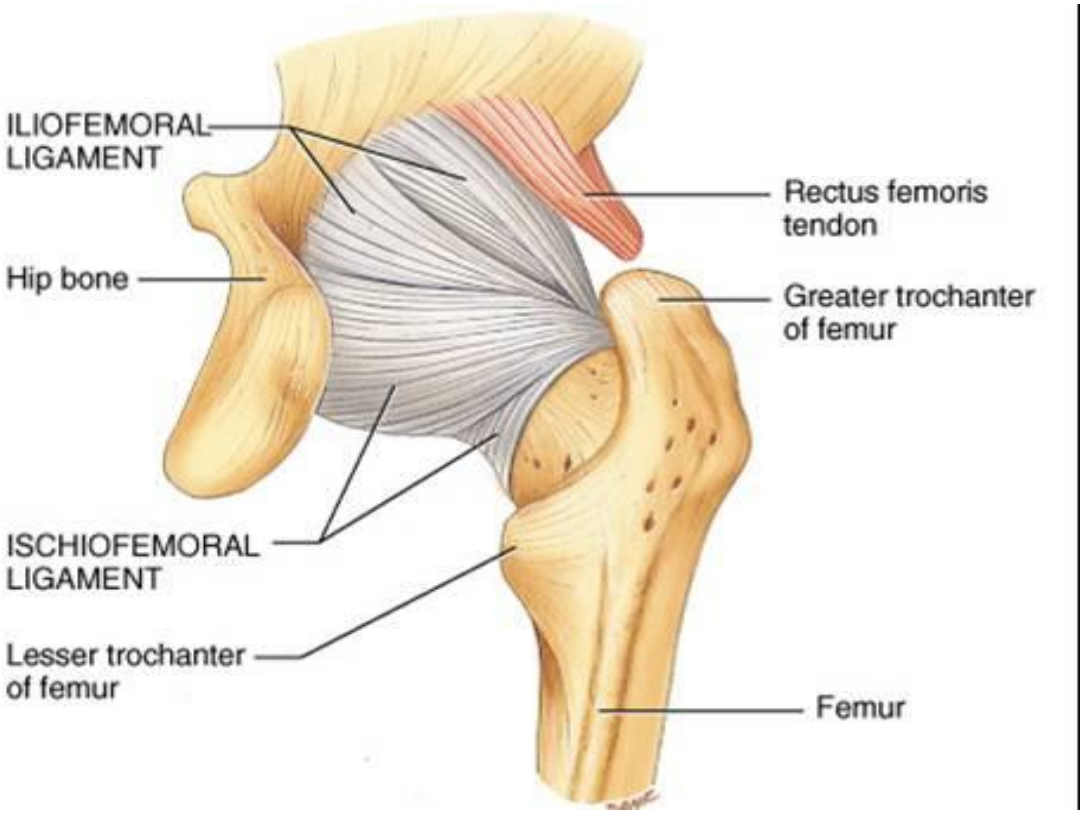
2) Pubo-femoral ligament:

- **Attachments:** a **triangular** ligament, attached to the **ilio-pubic eminence** of the hip bone and blended to the **medial part** of the capsule and lower part of intertrochanteric line.
- **Function:** it supports the **infero-medial** part of the capsule, and limits over **abduction** of the joint.

3) Ischio-femoral ligament: (weakest ligament of hip)

- **Attachments:**
  - It is attached to the ***ischium below the acetabulum*** and is blended to the ***back of the capsule***.
- **Function**:

- It supports the ***posterior part*** of the capsule and limits excessive ***medial rotation*** & adduction of the hip joint which predispose to posterior dislocation of hip joint .



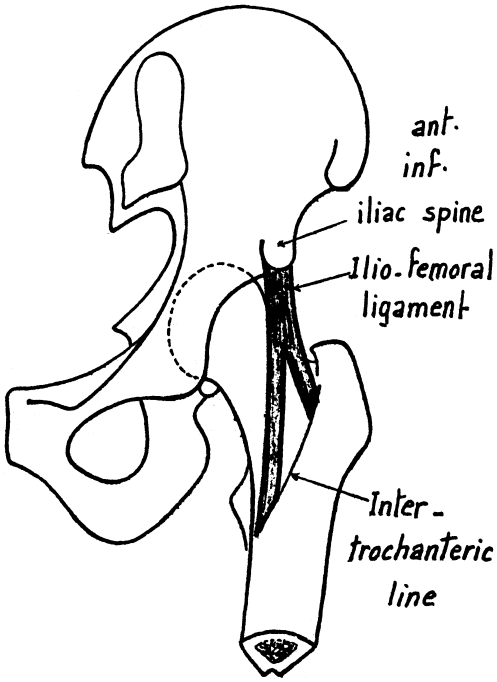
4) Transverse acetabular ligament :

- It is attached to the edge of the acetabular notch transforming it into a foramen which allows passage of nerves and vessels to the joint.

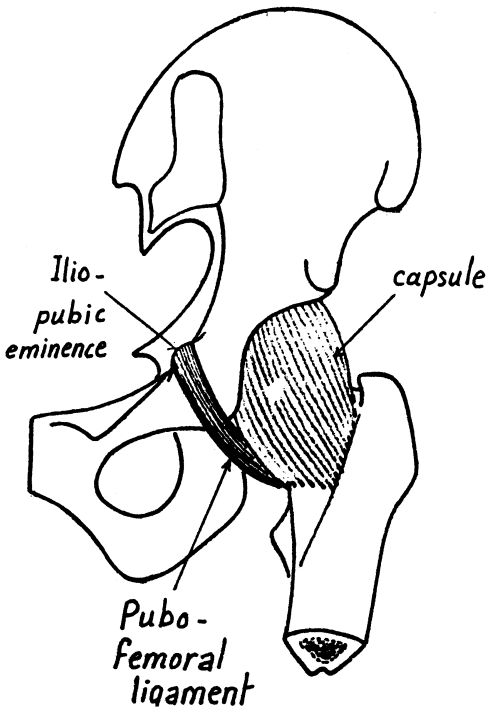
5)Ligament of the head of femur:(Ligamentum teres)

- **Attachments:**
  - A **weak triangular** band lying inside the cavity of the hip joint **surrounded by** a synovial sheath (so it is **intracapsular but extrasynovial).**
  - Its **apex** is attached to a **fovea** on the head of femur.
  - Its **base** is attached to both sides of **acetabular notch** and to the **transverse acetabular** ligament. (which bridges the acetabular notch).

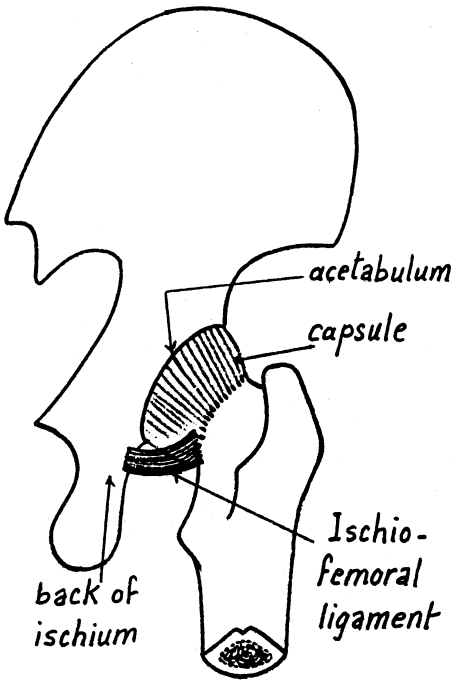
- **Function**:
  - It allows the passage of **minor arterial** supply to the head of femur.



(a) Ilio-femoral ligament

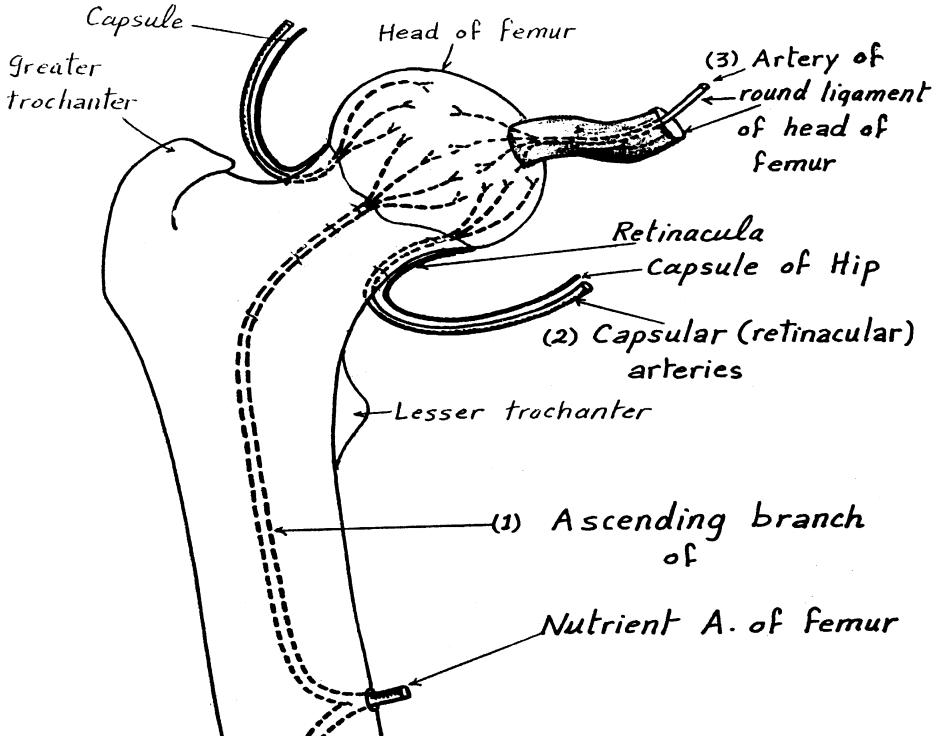


(b) Pubo-femoral



(c) Ischio-femoral ligament

Ligaments of the hip joint



Ligament and arterial supply of head of femur

★ **Blood supply of head of femur:**

1) Main blood supply :

- Ascending branch of the **nutrient artery**.
- **Retinacular blood supply** from ascending branches of medial and lateral circumflex femoral arteries.

2) **Minor blood supply** along the **ligament of head** of femur are acetabular branches of obturator and medial circumflex femoral arteries.

★ In **high neck fracture** , injury of the main arterial supply to the head leading to avascular necrosis of the head of femur while in **low neck fracture** the retinacular blood supply is preserved with necrosis of the head.

★ **Stability of the hip joint:** a **very stable** joint due to:

- **Bony factor**: the femoral head **fits well** in the deep socket of the acetabulum.
- **Ligamentous factor**: **strong** capsule and ligaments surround the joint (especially the **ilio-femoral** ligament).
- **Muscular factor:** strong muscles surround the joint.

★ **Movements of the hip joint and muscles acting on it**:

- **Flexion**:
  - **Mainly** by iliopsoas, **assisted** by sartorius , rectus femoris .
  - All adductors (except ischeal part of adductor magnus) assist in flexion from the position of full extension of the hip joint .
- **Extension**:
  - **Mainly** by gluteus maximus (Powerful main extensor of flexed thigh as during rising from sitting position), **assisted** by hamstrings and ischial part of adductor magnus.
- **Adduction**: done **mainly** by the 3 adductors (longus , brevis and pubic part of adductor magnus), **assisted** by gracilis and pectineus.
- **Abduction**: done **mainly** by gluteus medius and minimus, **assisted** by tensor fasciae latae.
- **Medial rotation**: done **mainly** by anterior fibres gluteus medius and minimus **assisted** by tensor fasciae latae.
- **Lateral rotation**: done **mainly** by the 6 lateral rotators of the thigh , **assisted** by gluteus maximus and sartorius.
- **Circumduction**: a combination of flexion, abduction, extension and finally adduction movements.

★ **Main relations:**

- **Anterior: Iliopsoas** muscle separates **femoral nerve and vessels** from the front of the capsule of the hip joint.

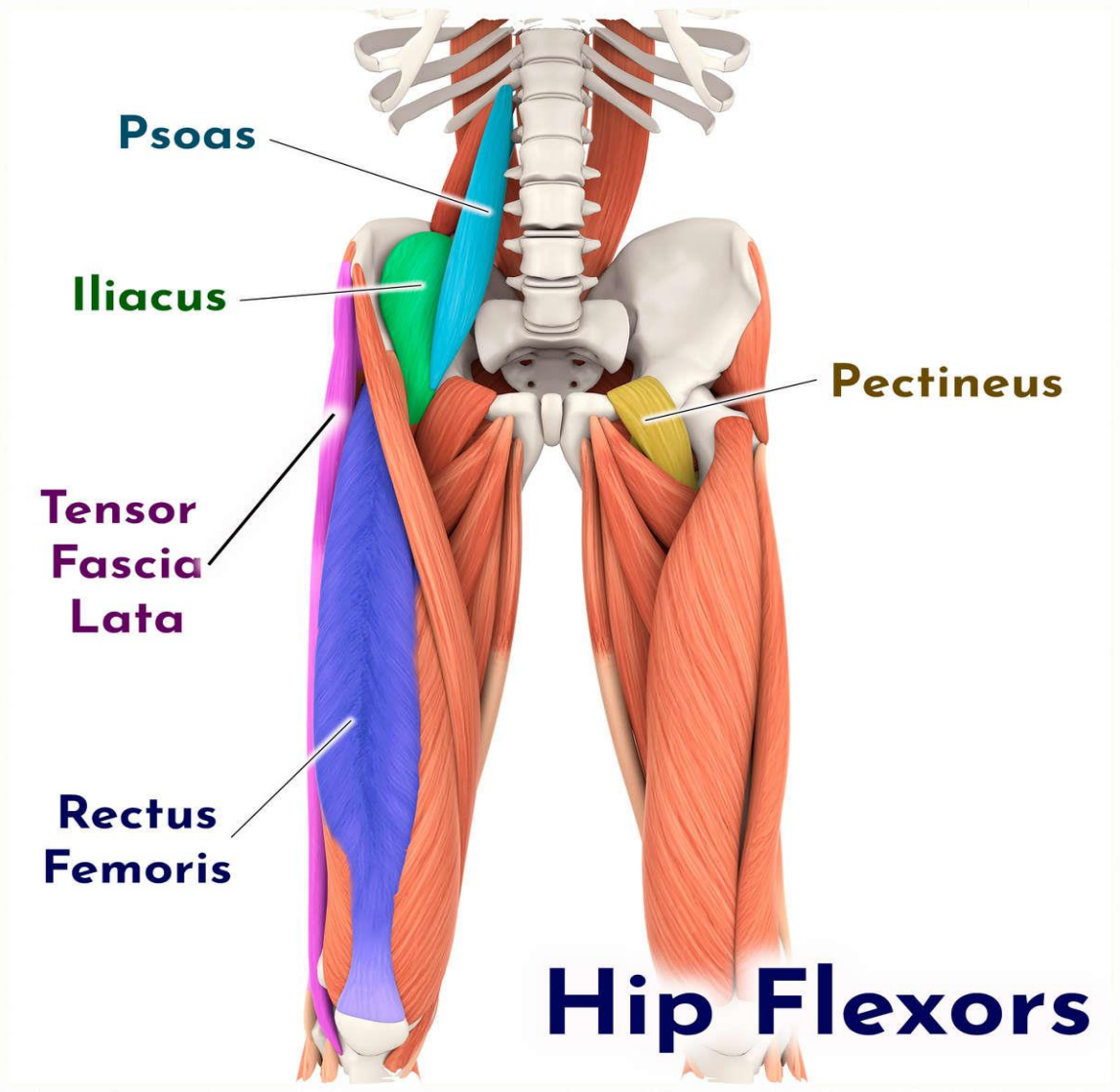
- **Posterior :** The **sciatic nerve** is separated from the back of the capsule of hip joint by **obturator internus and quadratus femoris**.

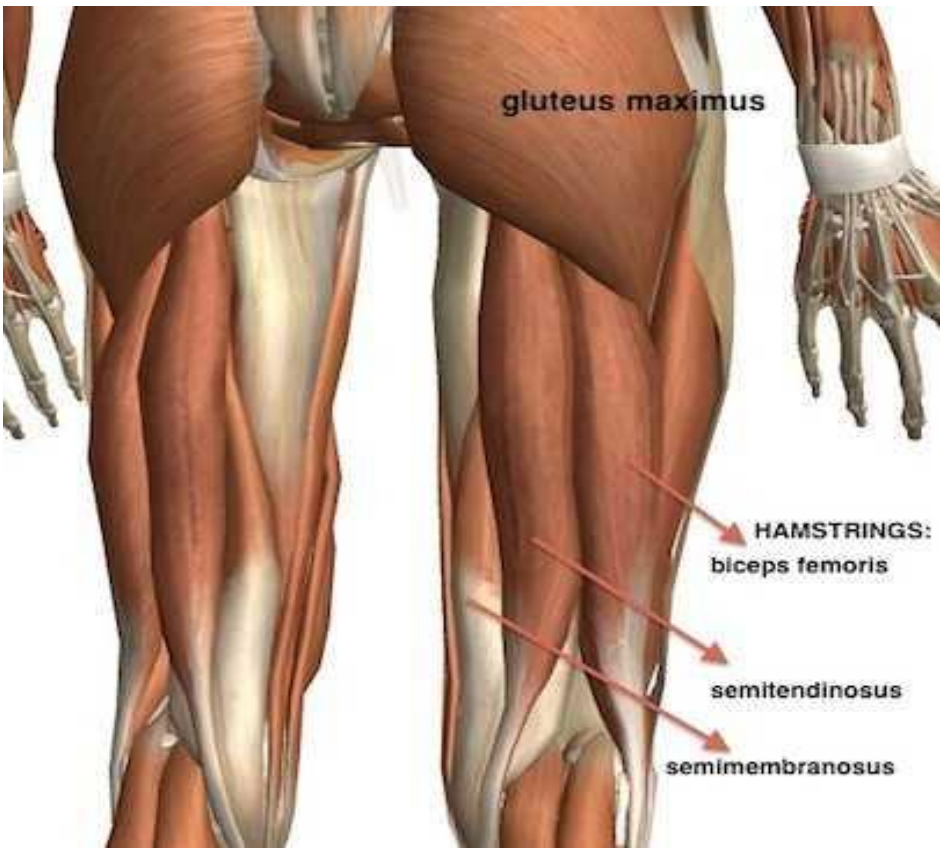
★ **Nerve supply of hip joint**: by branches from femoral, obturator , sciatic and nerve to quadratus femoris muscle.

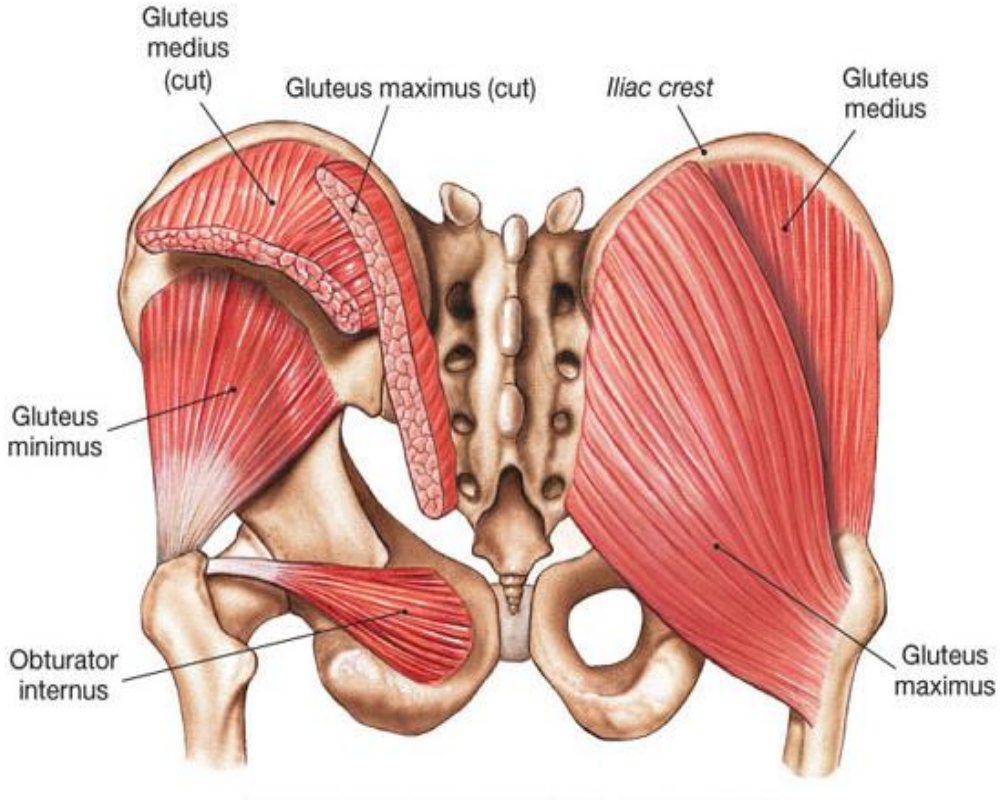
★**Arterial supply of hip joint**: From gluteal, medial & lateral circumflex femoral and obturator arteries.

★ **Applied anatomy**:

- **Pain from the hip joint may be felt at the knee region:**
  - This is due to the rich nerve supply of the hip joint from the femoral , obturator and sciatic nerves which also supply the knee joint.So, referred pain at the knee may be of hip origin.




gluteus maximus
HAMSTRINGS:
biceps femoris
semitendinosus
semimembranosus


Gluteus medius (cut)
Gluteus maximus (cut)
Iliac crest
Gluteus medius
Gluteus minimus
Obturator internus
Gluteus maximus

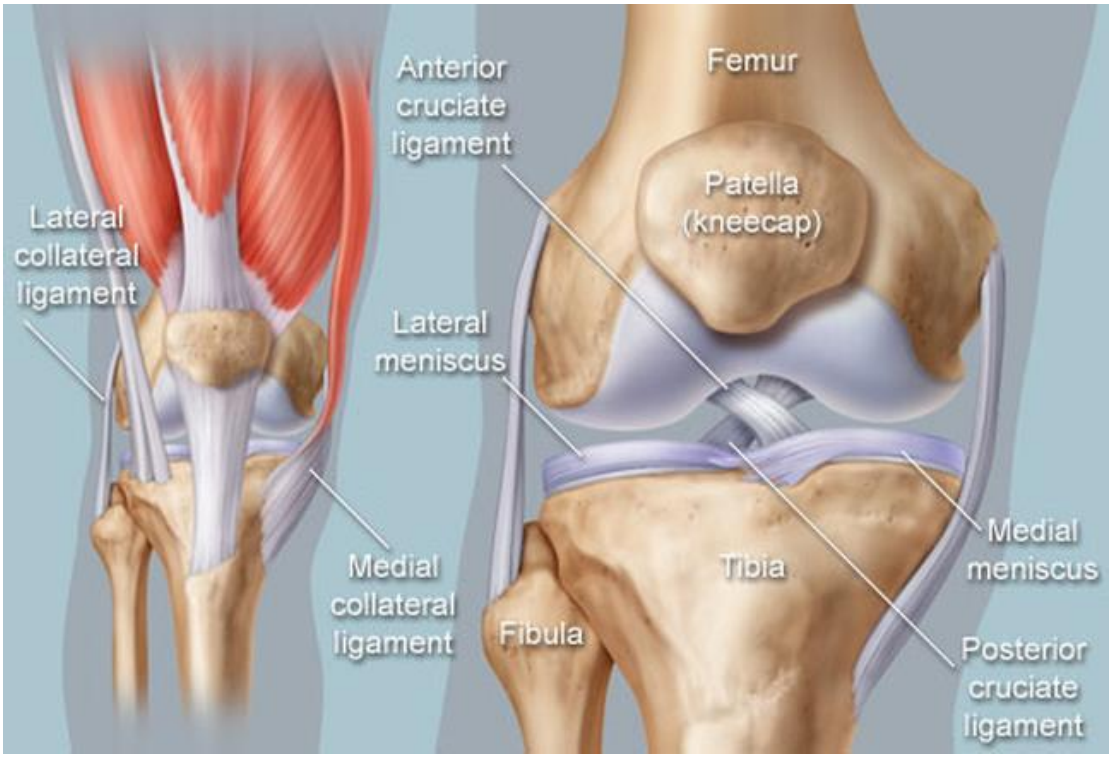
Knee Joint

★ **Type**: Synovial joint , biaxial of **condylar variety** (or also considered as **modified hinge** as it allows some medial and lateral rotation added to flexion and extension).

★ **Articulating surfaces**:

- Articular surfaces of **2 condyles of femur**
- Upper articular surface of the **2 condyles of tibia**
- Articular surface on the **back of patella**.

⁕ **N.B:** The **fibula has no role** in formation of knee joint .

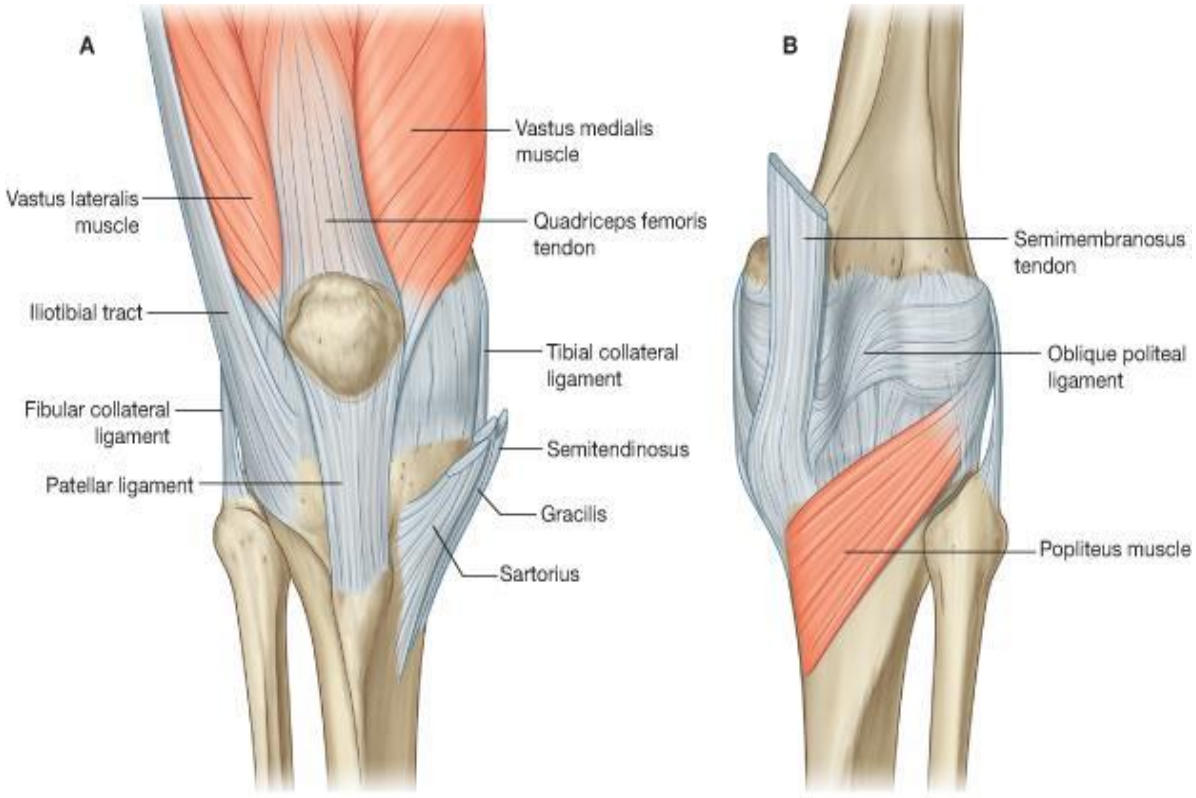


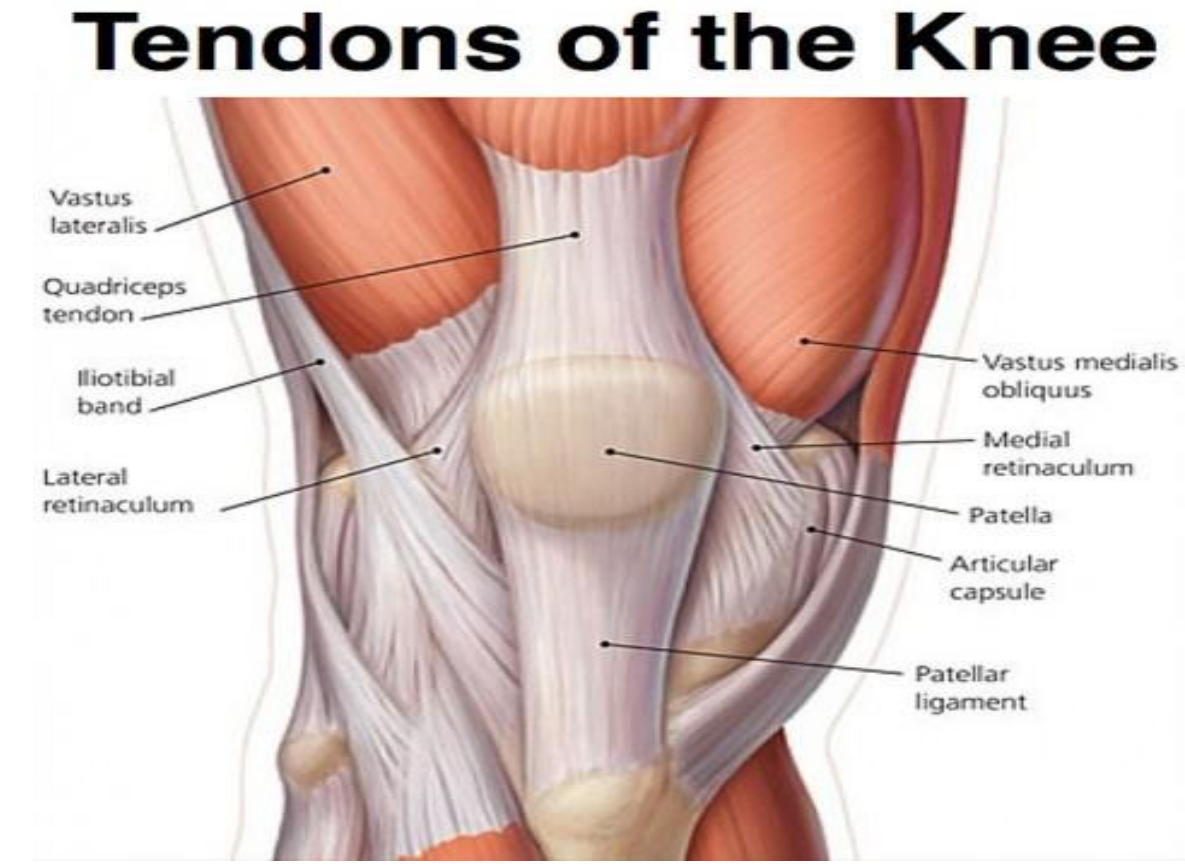
★ **Fibrous capsule**:

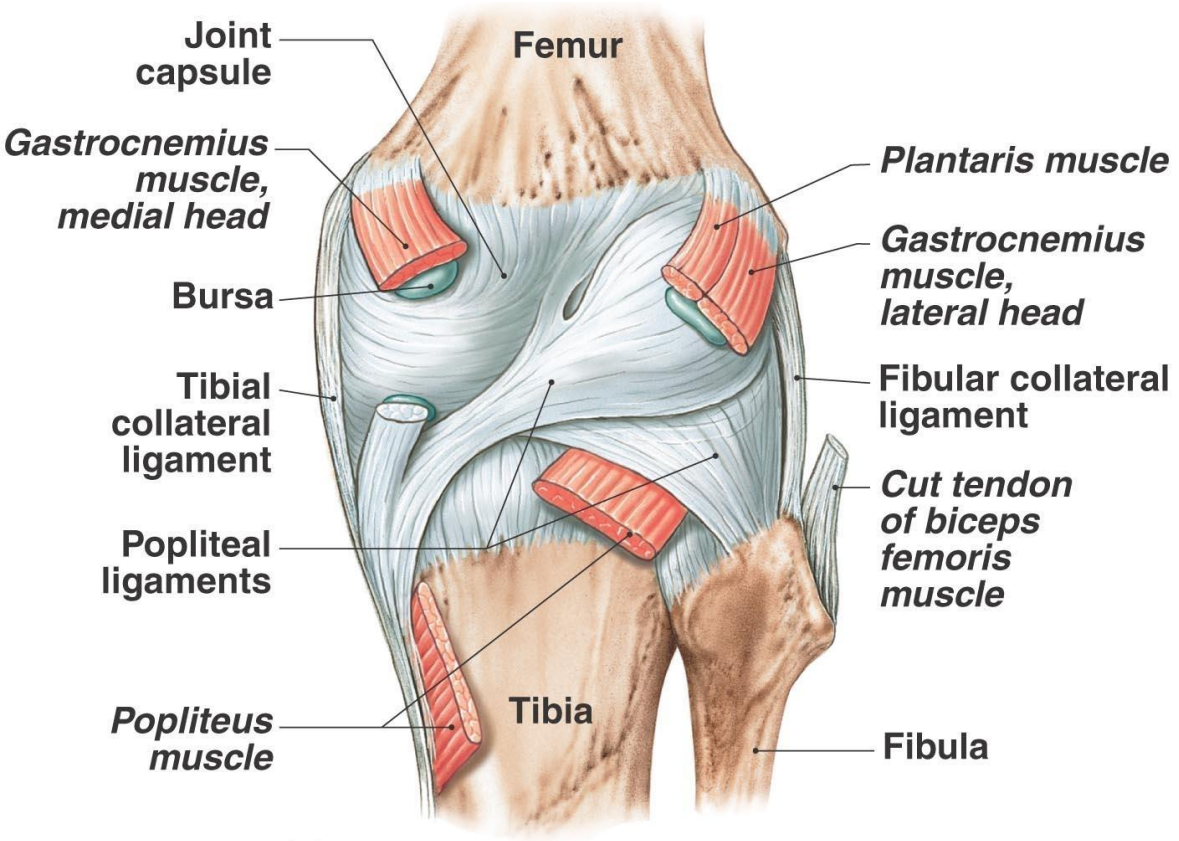
- **Attachments**:
  - **In general** the capsule is attached to the margins of the articular surfaces (except anterior) and on either sides of the tibial tuberosity.

- **Anteriorly** the capsule is thus **completely absent** where it is **replaced** by the lower part of the tendon of quadriceps femoris muscle, patella and patellar ligament.
- **Posteriorly:** the capsule is **perforated** by the **tendon** of popliteus muscle which is thus **intracapsular.**
- **Lateraly:** the capsule is attached **just above the groove for popliteus** muscles with the **2 femoral epicondyles are extracapsular.**

- **The capsule is strengthened** by expansions from the surrounding muscles as follows:
  - Lateral and medial **patellar retinacula** ,are expansions from vastus lateralis and medialis respectively, which are attached to the lateral and medial margins of patella and patellar ligament.
  - **Iliotibial** tract.
  - **Semimembranosus** .



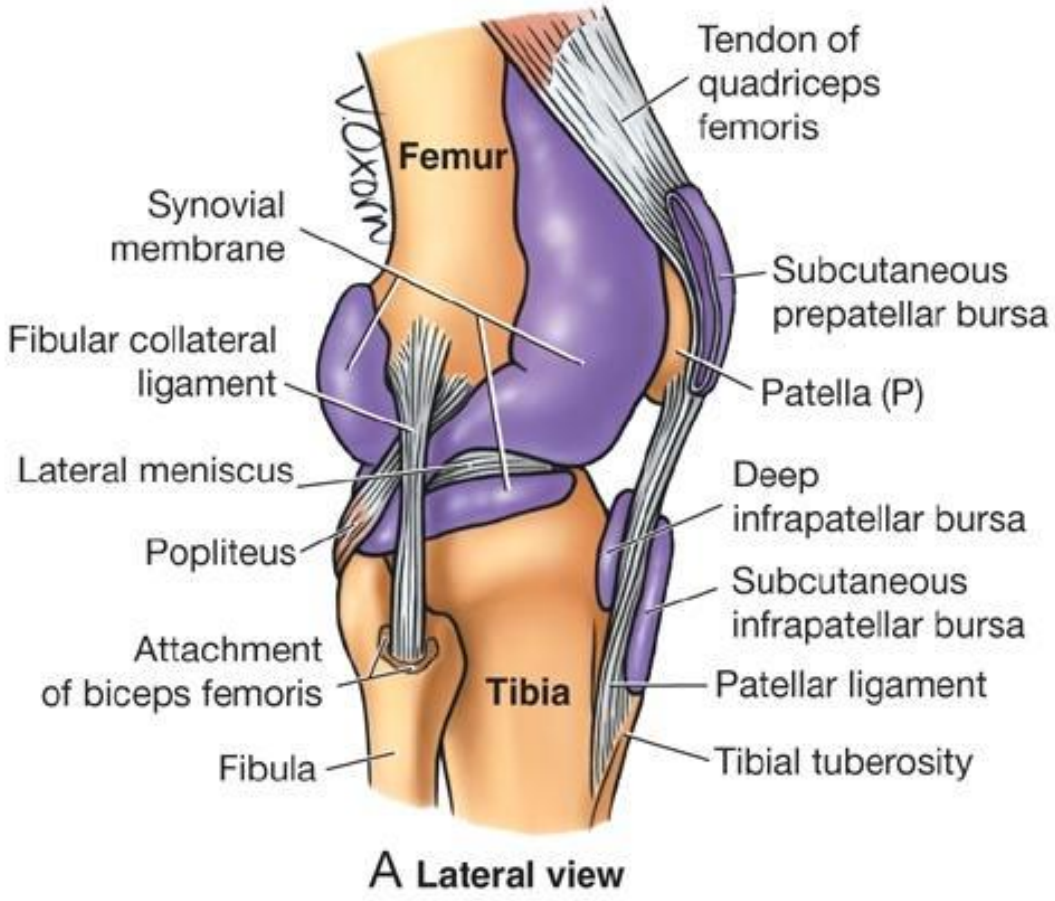




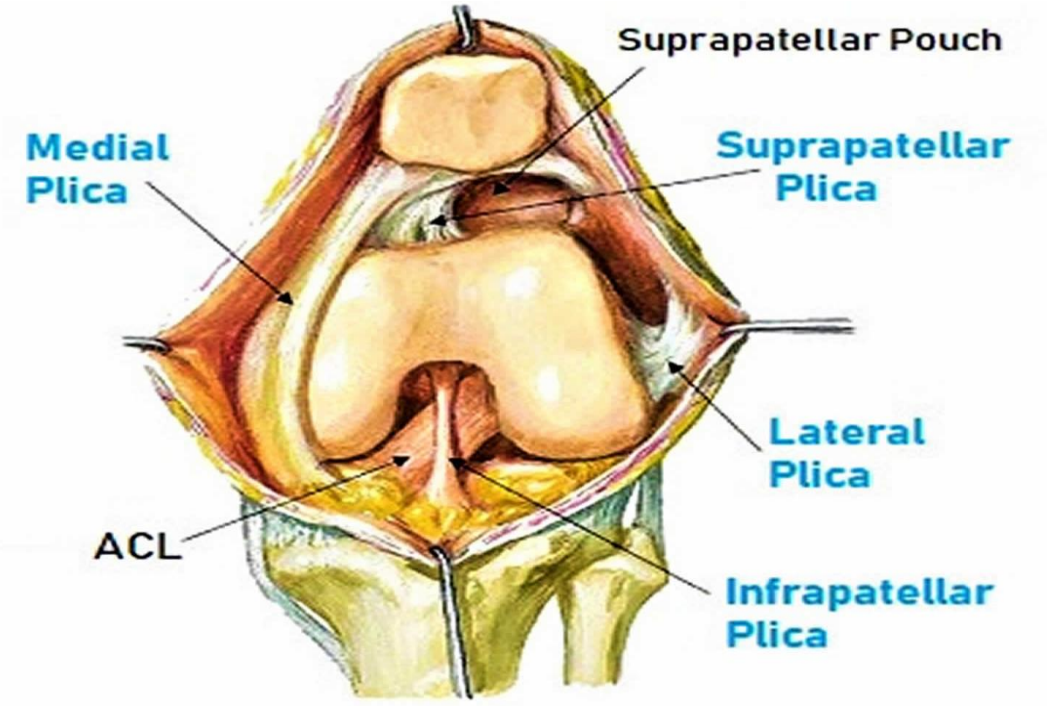
(a) Posterior view, superficial layer

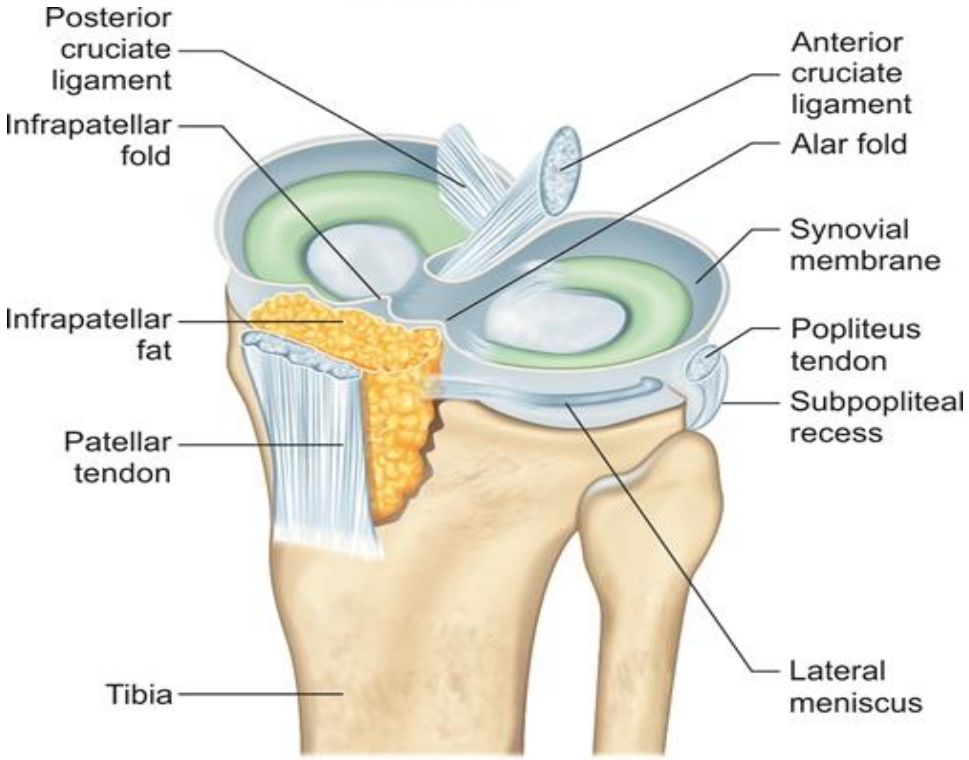
★ **Synovial membrane:**

- **It lines** the fibrous capsule and **cover** all the intra-articular structures (like the 2 cruciate ligaments)) **except** the bony articular surfaces.
- There is a pouch of synovial membrane extending upwards deep to the tendon of quadriceps femoris called **suprapatellar bursa.**
- The **tendon of popliteus** muscle lies inside the fibrous capsule and surrounded the synovial membrane (i.e.it is **intracapsular but extrasynovial).**
- **Infrapatellar synovial fold** extends from the back of patellar ligament to the front of the intercondylar notch of femur.
- **The sides of infrapatellar synovial fold** extends laterally to from alar folds.
- **Below infrapatellar synovial fold** there is infrapatellar pad of fat.



A Lateral view





★ **Ligaments of the knee joint:**

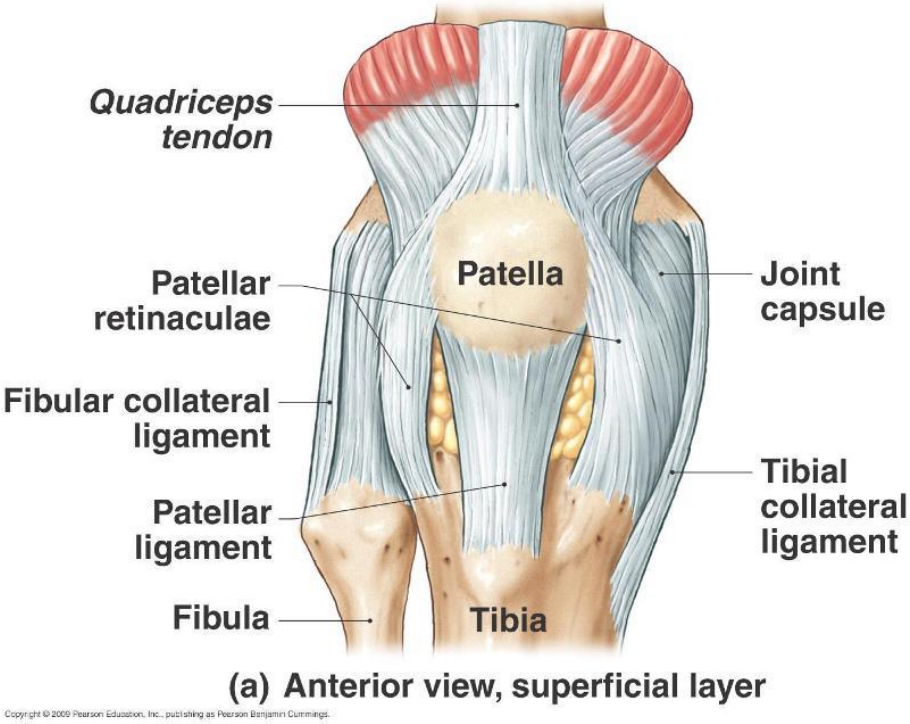
I) **Four extra-capsular ligaments: (outside the capsule)**

- **One anterior , one posterior , one medial and one lateral**

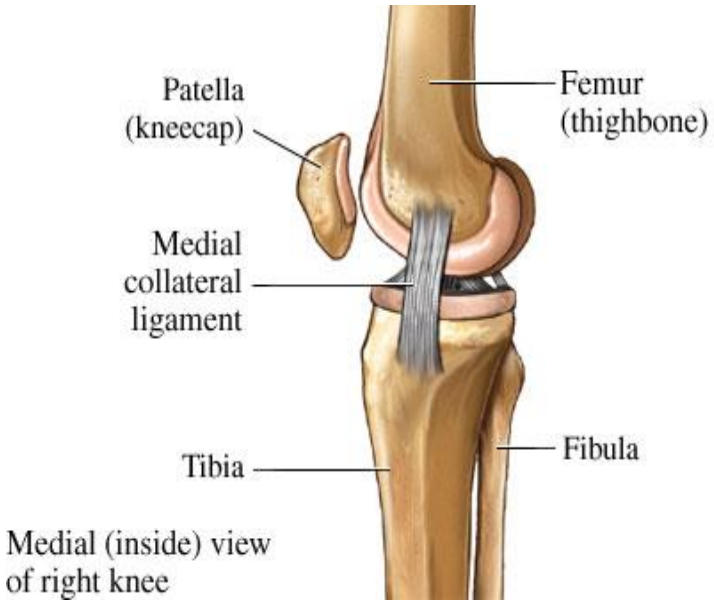
1) Patellar ligament: (Ligamentum patellae) (anterior).

➢ It is the downward **continuation** of the quadriceps femoris tendon.

- It extends from the apex of **patella** to the **tibial tuberosity**.
- It **replaces** part of **anterior part of** the capsule of knee joint.



2) Fibular (lateral) collateral ligament	3) Tibial (medial) collateral ligament
▪ It is cord like	▪ It is flattened triangular band
▪ Above it is attached to the **lateral epicondyle** of the femur .	▪ Above it is attached to the **medial epicondyle of femur** .
▪ Below it is attached to the **head of fibula**.	▪ Below it is attached to the **upper part of medial surface of tibia** .
▪ It **inforces** the lateral part of the capsule.	▪ It **inforces** the medial part of the capsule.
▪ It is **related to** biceps tendon superficially and popliteus tendon deeply.	▪ **It is deep to** the tendons of sartorius, gracilis and semitendinosus muscles (S.G.S.).
▪ It is not adherent to the capsule and lateral meniscus because the tendon of **popliteus** muscle **separates** them.	▪ It is firmly **attached to the capsule and medial meniscus.**
▪ It prevents adduction of leg.	▪ It prevents abduction the leg



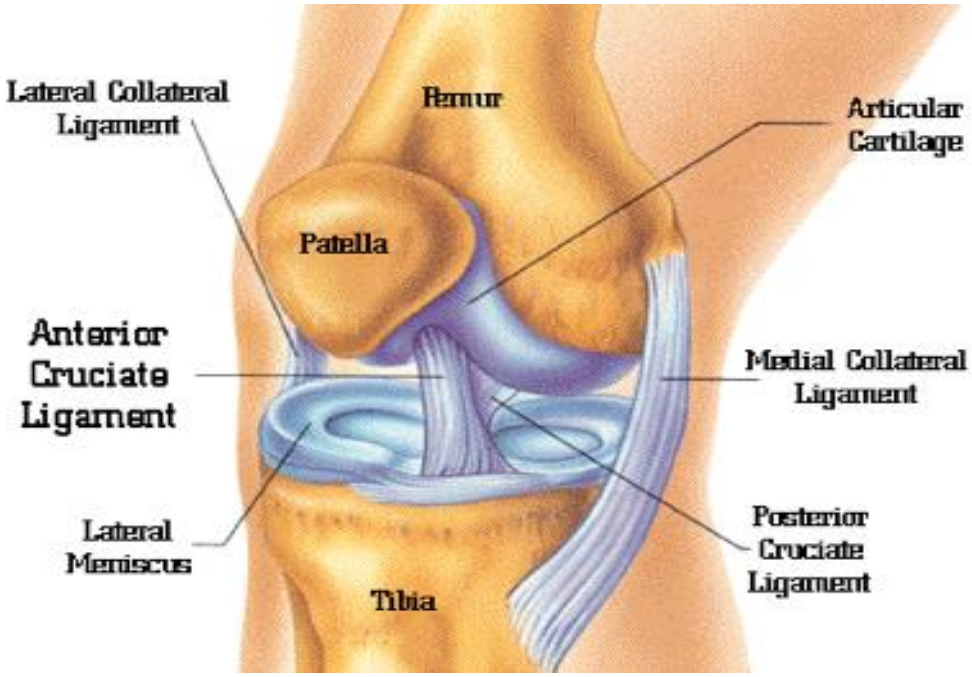
4) **Oblique popliteal ligament**: (posterior)
   - It is an **extension** from the tendon of insertion of **semimembranosus** muscle.
   - It extends from back of medial condyle of tibia ,**upwards and laterally** ,towards the back of lateral condyle of the femur **inforcing** the posterior aspect of the capsule
   - It **prevents hyperextension**.

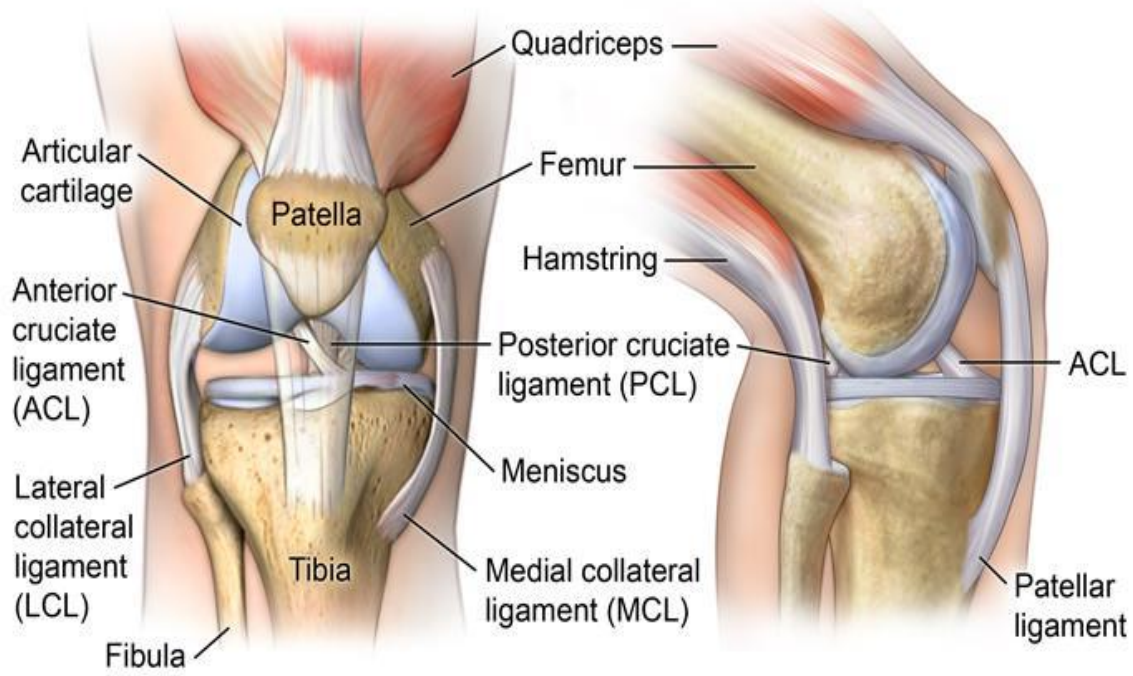
II) Three intracapsular ligaments:(inside the capsule)

1- **Anterior cruciate** ligament.

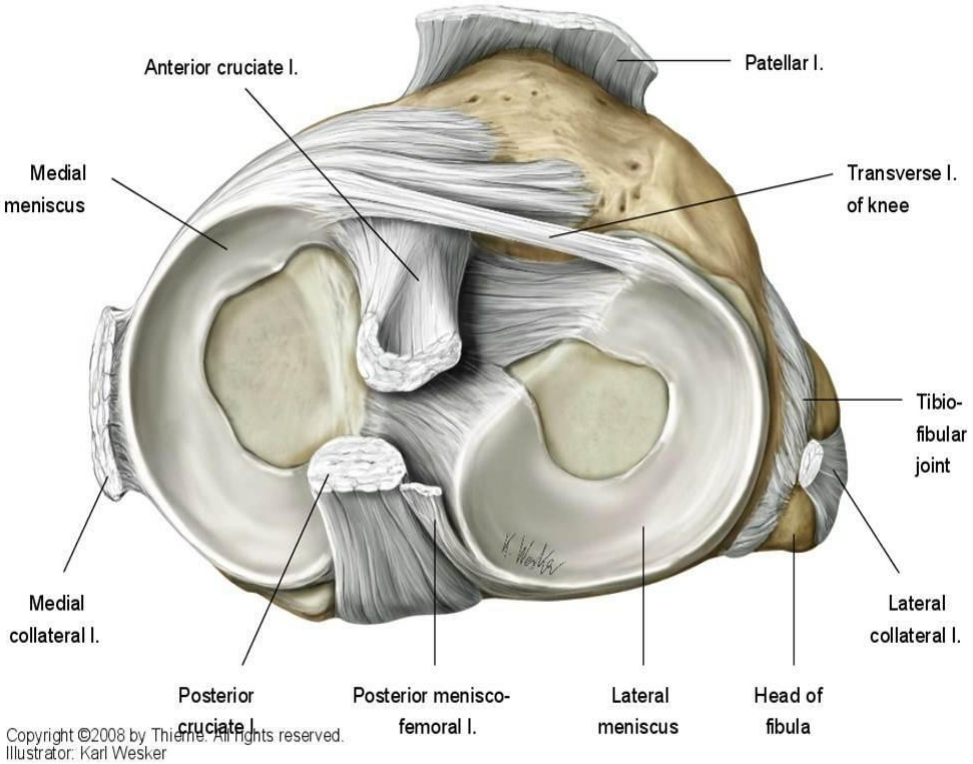
2- **Posterior cruciate** ligament.

3-**Transverse ligament of the knee**: which connects the 2 anterior horns of the 2 menisci (has no bony attachment).





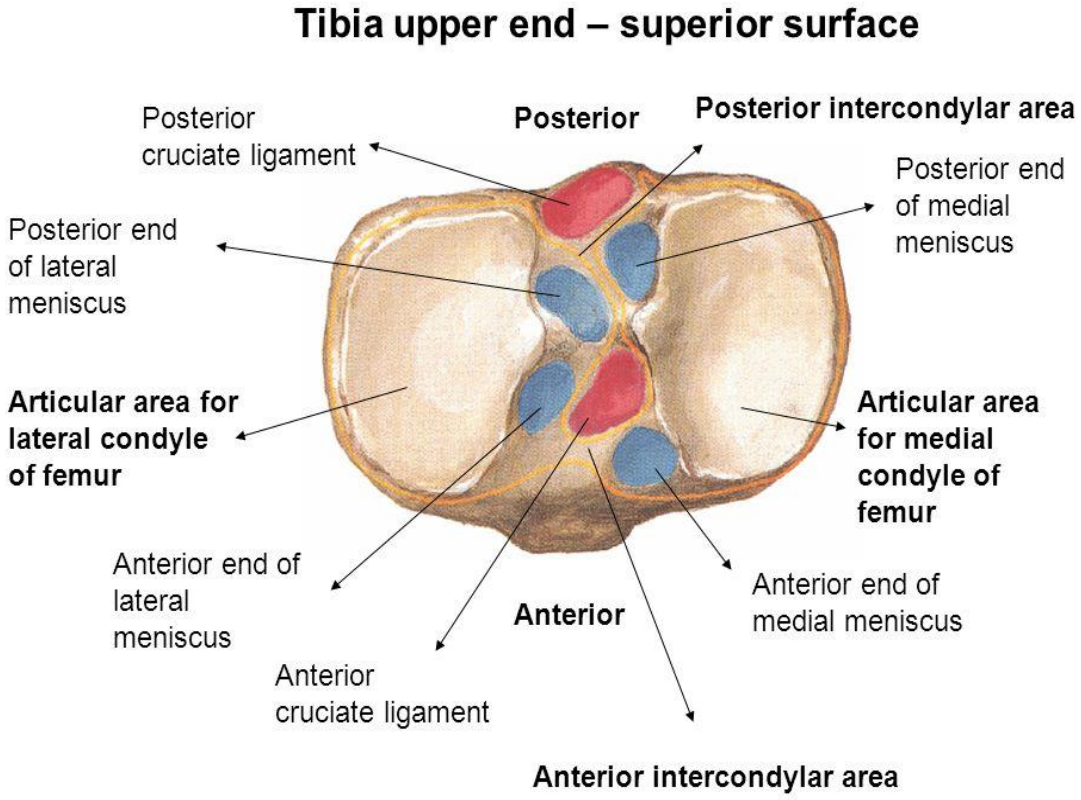
Knee anatomy

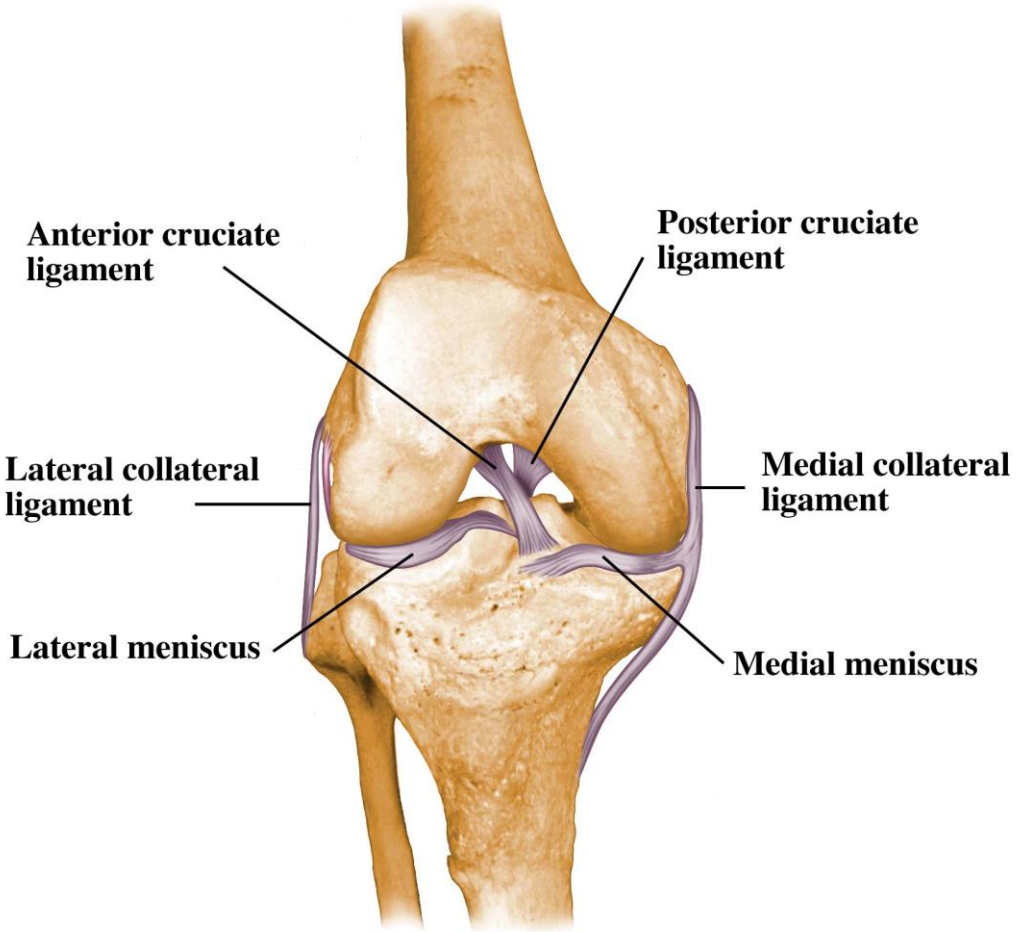


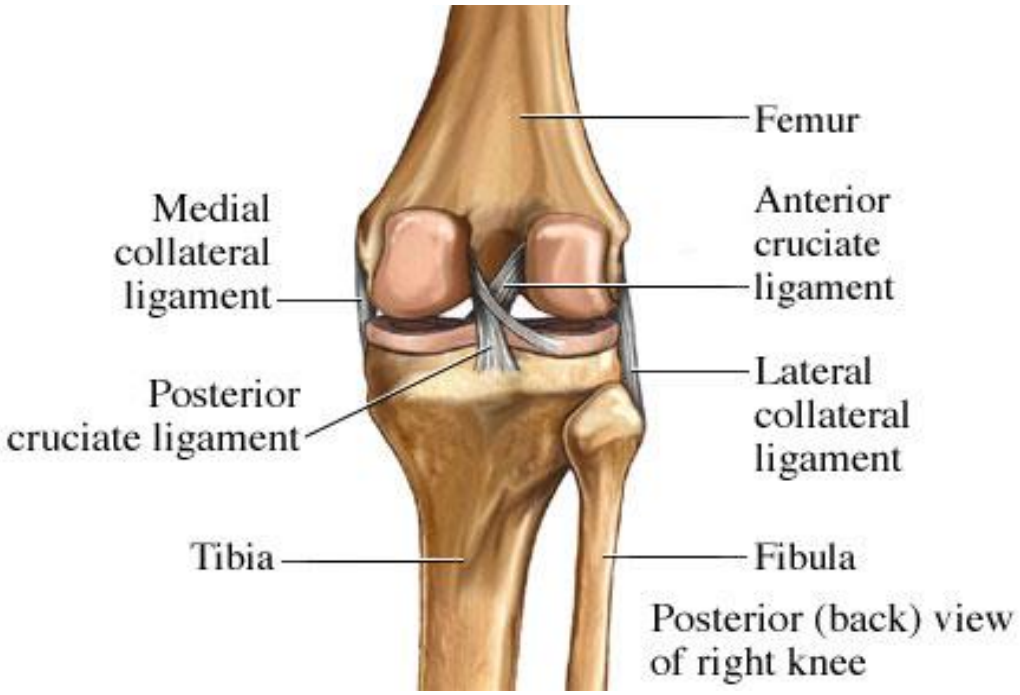
1) Cruciate Ligaments:

- **Two strong ligaments** (anterior and posterior) present **inside** the knee joint.
- They **cross each other** in the form of the letter **X.**

a) Anterior cruciate ligament	b) Posterior cruciate ligament
▪ It attaches below to the **anterior intercondylar area** of tibia (between the anterior horns of the 2 menisci) to	▪ It attaches below to the **posterior intercondylar** area of tibia (**posterior** to the posterior horns of the 2 menisci)
▪ It attaches above to the posterior part of medial surface of the **lateral condyle** of femur.	▪ It attaches above to the anterior part of lateral surface of the **medial condyle** of femur.
➢ It is stretched on **extension** of the knee so it **prevents** hyperextension & **anterior dislocation** of the tibia during extension.	• It is stretched on **flexion** of the knee, so it prevents **posterior dislocation** of the tibia during flexion.




Anterior cruciate ligament
Posterior cruciate ligament
Lateral collateral ligament
Medial collateral ligament
Lateral meniscus
Medial meniscus


Femur
Medial collateral ligament
Anterior cruciate ligament
Posterior cruciate ligament
Lateral collateral ligament
Tibia
Fibula
Posterior (back) view of right knee

★ Intracapsular structures of the knee joint:

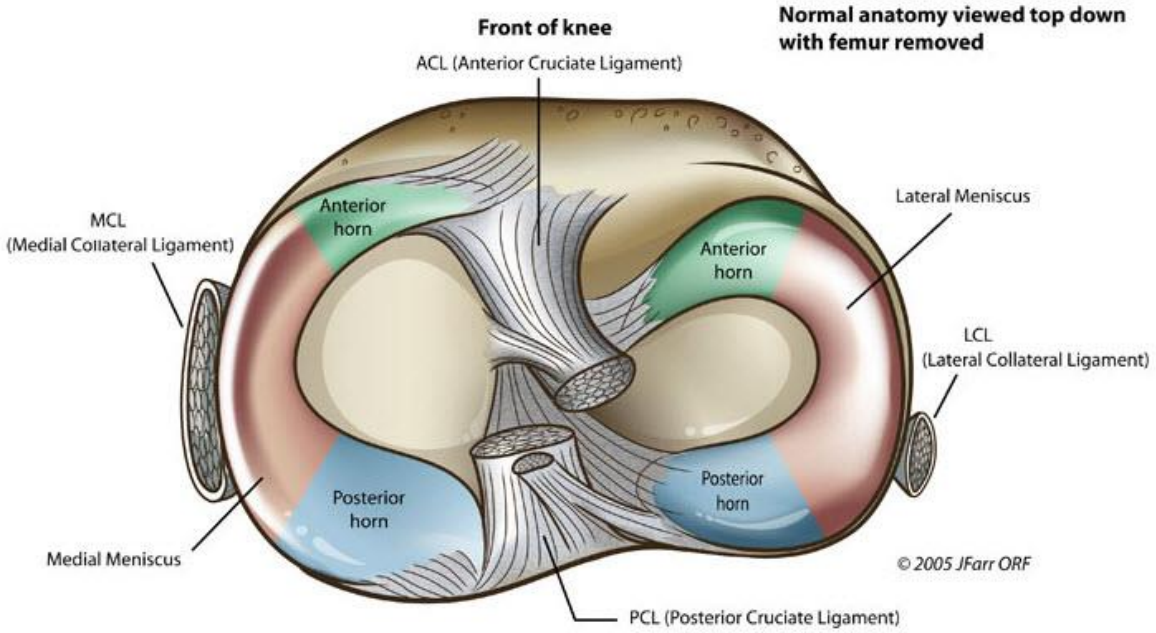
1. **Two menisci** (semilunar cartilages).
2. **Two cruciate** ligaments.
3. **Transverse ligament** of the knee
4. Tendon of origin of **popliteus** which perforates the back of the capsule to leave the knee joint, accompanied by its synovial sheath.
5. Infra-patellar **pad of fat.**
6. **Supra-patellar bursa**.

★ Semilunar Cartilages : (Menisci)

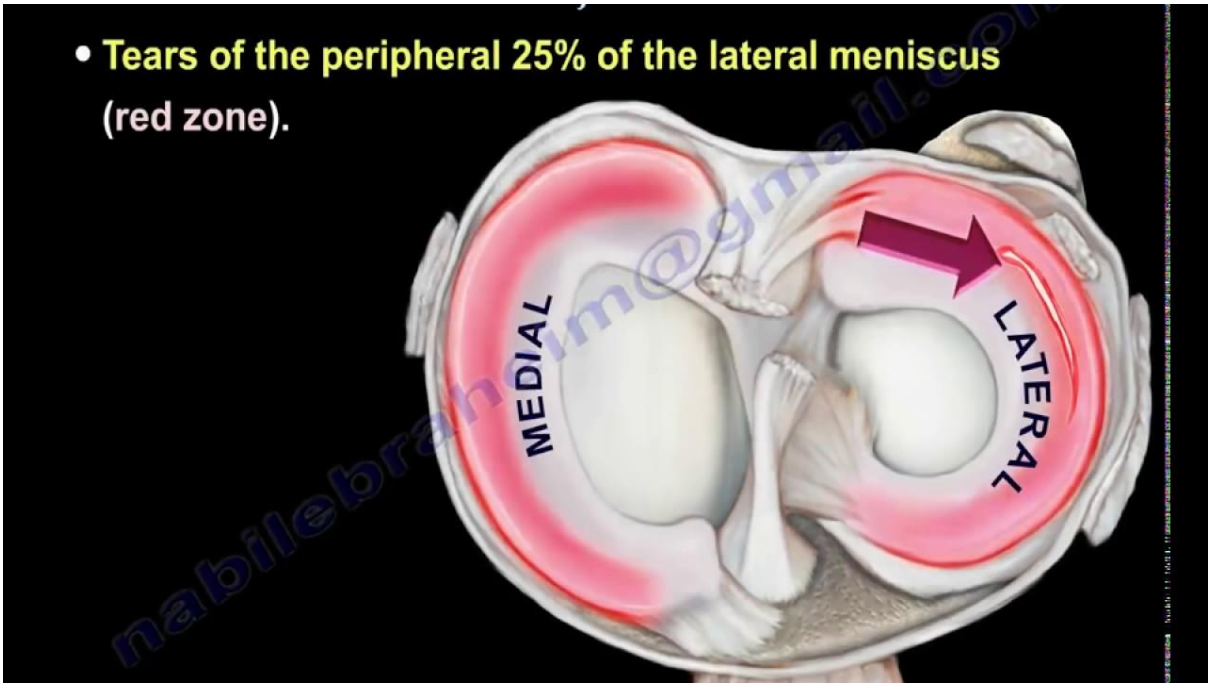
- The meniscus is a **curved plate of fibrocartilage** which lies on the **upper surface** of the 2 condyles of tibia.
- Each meniscus has outer **thick** and inner thin border.
- Each meniscus is **attached** by 2 horns to the **intercondylar area** of the tibia.
- **Functions :**
  - The menisci act as **shock absorbers**.
  - **They increases the concavity** of the articular surface of condyles of tibia .

1) Medial Meniscus	2) Lateral Meniscus
▪ **Larger**	▪ **Smaller**
▪ **C-shaped.**	▪ Nearly **circular**
▪ **The anterior horn**: is attached to the ***most anterior*** part of the anterior intercondylar area of tibia (in front of the anterior cruciate ligament).	▪ **Anterior horn is** attached to the anterior intercondylar area of tibia just **in front of the lateral intercondylar tubercle .**
▪ **The posterior horn:** is attached to the posterior part of the intercondylar area (behind the posterior horn of the lateral meniscus and in front of the	▪ **Posterior horn is** attached to the posterior intercondylar area of tibia just **behind the lateral intercondylar tubercle.**

posterior cruciate ligament).	
▪ It is less mobile as it is **attached to the capsule and tibial collateral** ligament. So, it is **more liable to be injured** .	▪ It is **more mobile and less liable to injury** because it is separated from the capsule and the fibular collateral ligament by the tendon of popliteus muscle.



Menisci of the knee joint (superior view)



★ Bursae around the knee joint: (10 in number)

I)Bursae on the anterior aspect of the joint:

1- **Supra-patellar bursa**: between tendon of quadriceps femoris and front of lower end of femur.

2- **Infra-patellar bursa**:

a) Subcutaneous infra-patellar bursa: between skin and tuberosity of tibia.

b) Deep infra-patellar bursa: between patellar ligament and front of upper end of tibia.

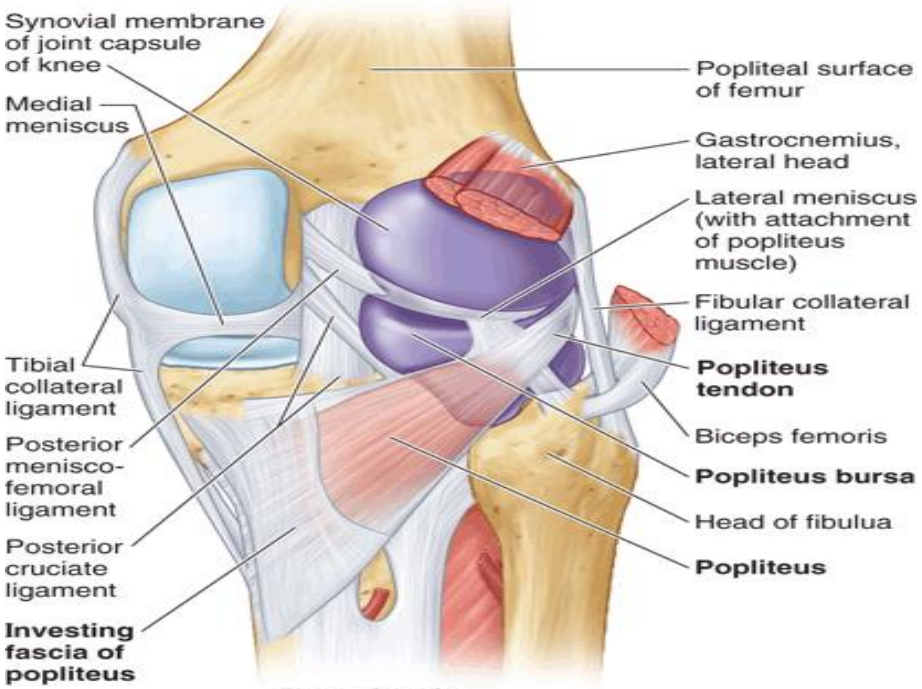
3- **Subcutaneous pre-patellar** bursa: between skin and patella.

II) Bursae on the medial aspect of the joint:

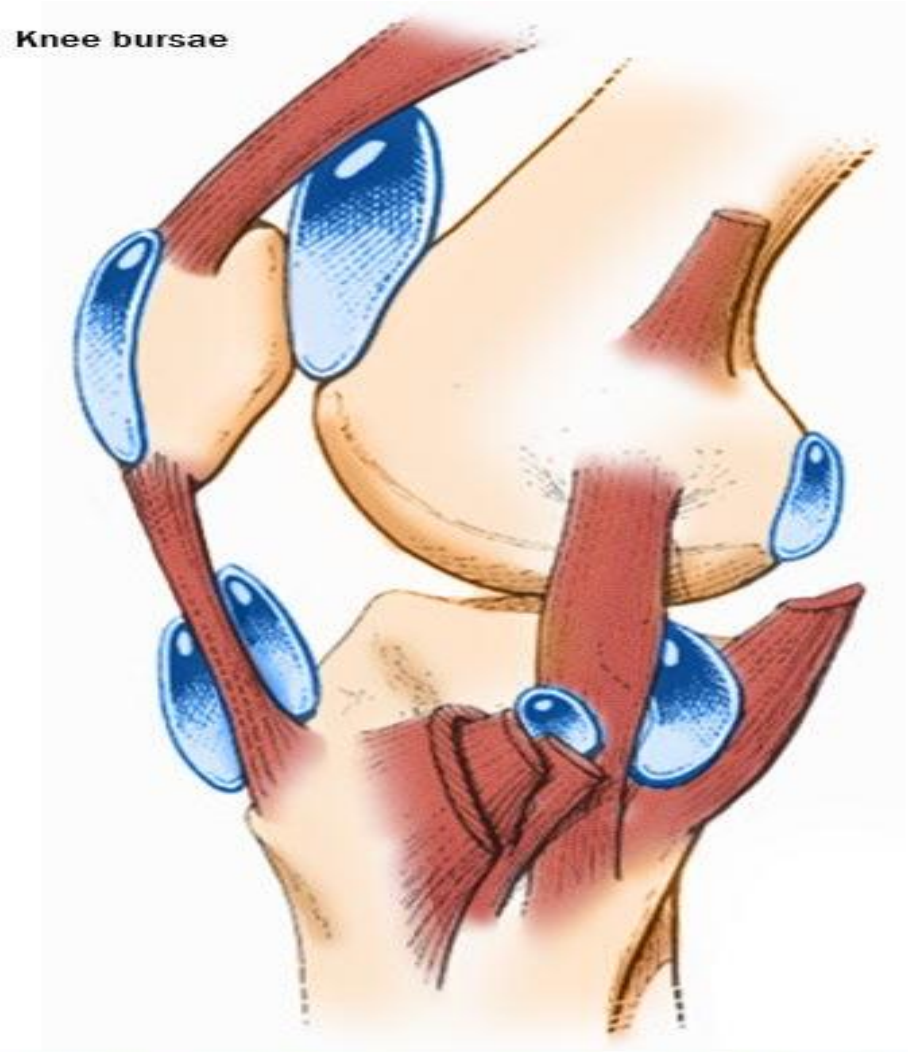
1. Between **medial head of gastrocnemius** and back of capsule of the knee joint.
2. Between insertion of **semimembranosus** and back of capsule of the knee joint.
3. Between tendons of **(S.G.S)** and capsule of the joint.

III) Bursae on the lateral aspect of the joint:

1. Between the **lateral head of gastrocnemius** and the capsule of the joint.
2. Between the **tendon of biceps** and the fibular collateral ligament.
3. Between the **tendon of popliteus** and the lateral condyle of femur.



Posterior view



★Movements of the Knee Joint:

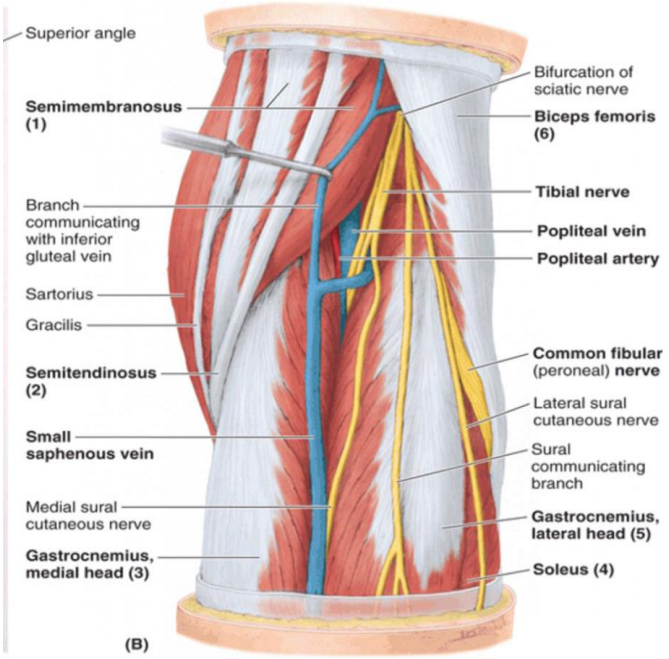
a) **Flexion**: done **mainly by the 3 hamstrings**, assisted by popliteus, sartorius , gracilis and gastocnemius .

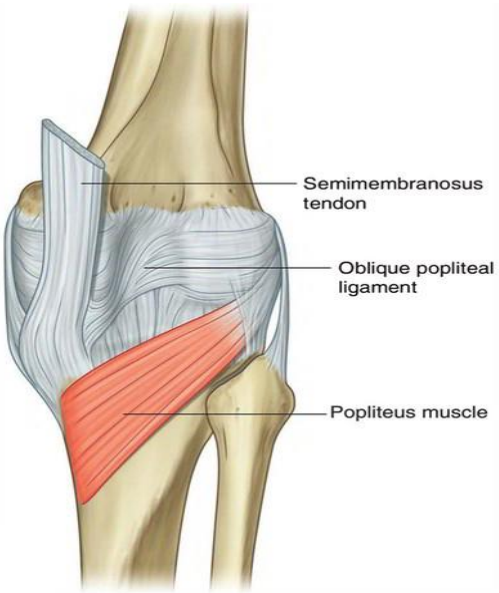
b) **Extension**: done by **quadriceps femoris only.**

c) **Rotation:** Slight degree of rotation can also occur at the knee which is of 2 types:

1) Voluntary active rotation occurs in the semiflexed knee :

- **Lateral rotation:** done by **biceps** femoris **only**.
- **Medial rotation:** done **mainly by popliteus**, assisted by sartorius, gracilis, semitendinosus (S.G.S) and semimembranosus. (i.e muscles inserted in upper part of tibia)





2) Involuntary obligatory rotation: It occurs during end of extension (locking) and beginning of flexion (unlocking):

⁕ Locking and unlocking of the knee joint:

	Locking	Unlocking
Mechanism:	• It occurs at the last 15° of extension to make the knee mechanically rigid stable structure to support body weight transmission : ➢ With the foot on the ground: Medial rotation of femur ➢ With the foot off the ground: Lateral rotation of tibia.	• It occurs at first 15° of flexion . • Popliteus lateraly rotates femur or medially rotate the tibia leading to loosening of ligaments of the knee and hamstring can flex the knee.
Ligaments tense during movement	• Anterior cruciate ligament . • All extracapsular ligaments of knee joint. • Iliotibial tract .	
Muscles involved	• Biceps femoris. • Gluteus maximus and tensor fascia lata through iliotibial tract.	• Popliteus .

★ Nerve supply of the knee joint:

- Three genicular nerves from **tibial** nerve.
- Three genicular nerves from **common fibular** nerve.
- From **femoral , obturator** nerves (as the hip joint); that is why diseases of the hip joint may lead to pain referred to the knee joint.

★ **Arterial supply of the knee joint:** from the anastomosis around the knee joint.

★ Clinical points related to the knee joint:

- **Genu valgus**: (Knock knee)
  - Usually congenital or rarely traumatic with rupture of medial collateral ligament of the knee .
  - There is abduction deformity of the leg.

- **Genu varus** : (Bow leg)
  - Usually congenital or rarely traumatic with rupture of lateral collateral ligament .
  - There is adduction deformity of the leg.
- **Genu recurvatum** is hyperextension deformity of the knee joint.

Tibio-fibular Joints

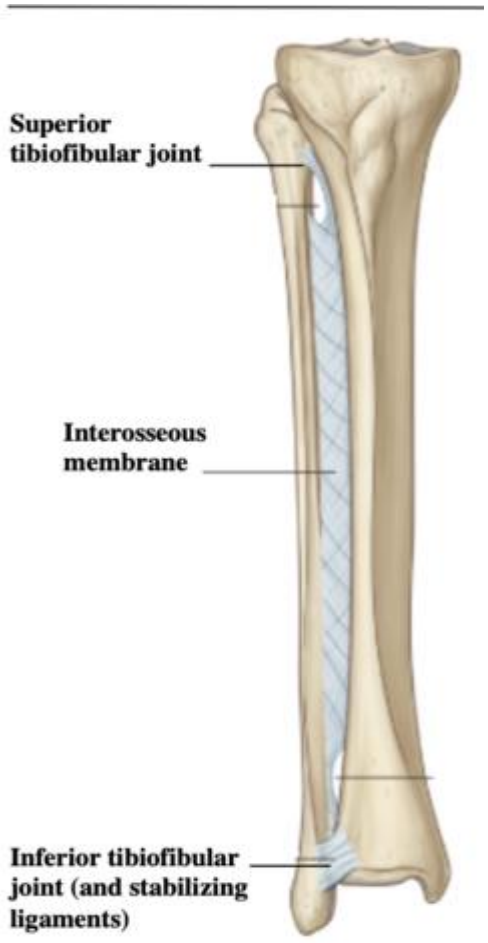
1) Superior tibio-fibular joint:

- A ***synovial*** joint of ***plane*** variety, between head of fibula and a rounded facet on the inferior surface of the lateral condyle of tibia.

2) Middle tibio- fibular joint : (**interosseus membrane**)

- A fibrous membrane extending between **interosseus borders** of tibia and fibula.
- It is **tense**, so **not allowing movements** between tibia and fibula.
- Its fibres run obliquely **downwards and laterally** from tibia to fibula.
- It is **perforated**: -
  a) In its **upper part**: by the **anterior tibial** vessels.
  b) In its **lower part**: by the **perforating branch of the fibular** artery.

3) Inferior tibio-fibular joint:
a **fibrous** joint **(syndesmosis)** between the medial surface of the lower end of fibula and the fibular notch of tibia.

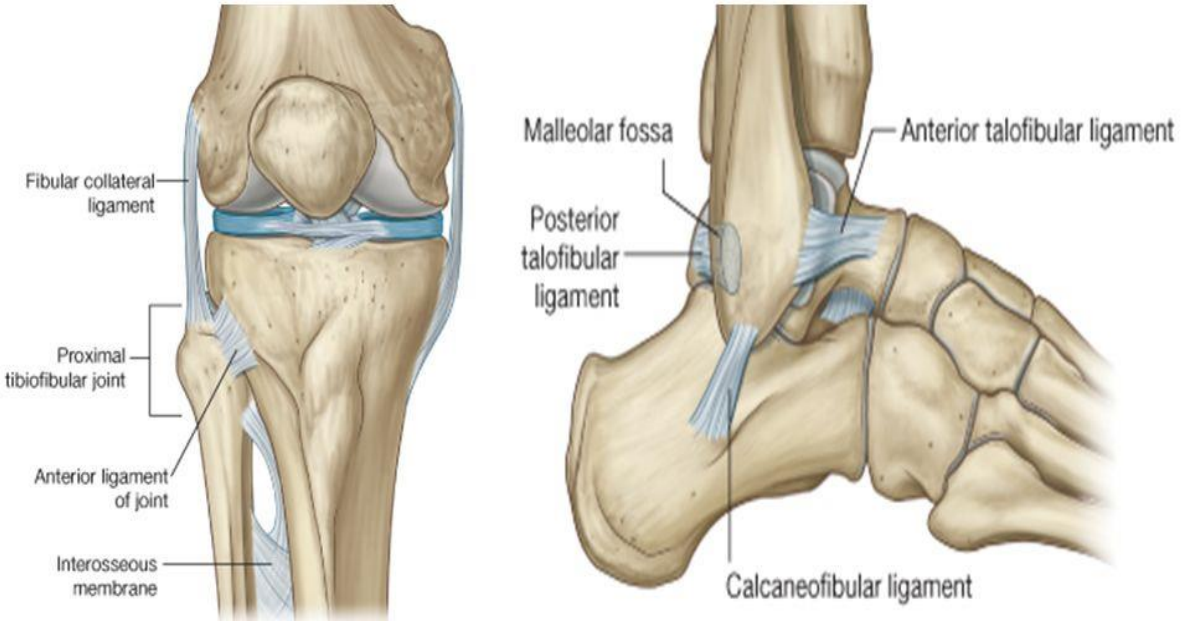


TIBIOFIBULAR JOINTS

(Superior) Tibiofibular joint

Syndesmosis (inferior tibiofibular) joint

In addition, an interosseous membrane joins the shafts of the two bones.



The Ankle Joint

★ **Type and variety:** synovial, uniaxial joint of **hinge** variety.

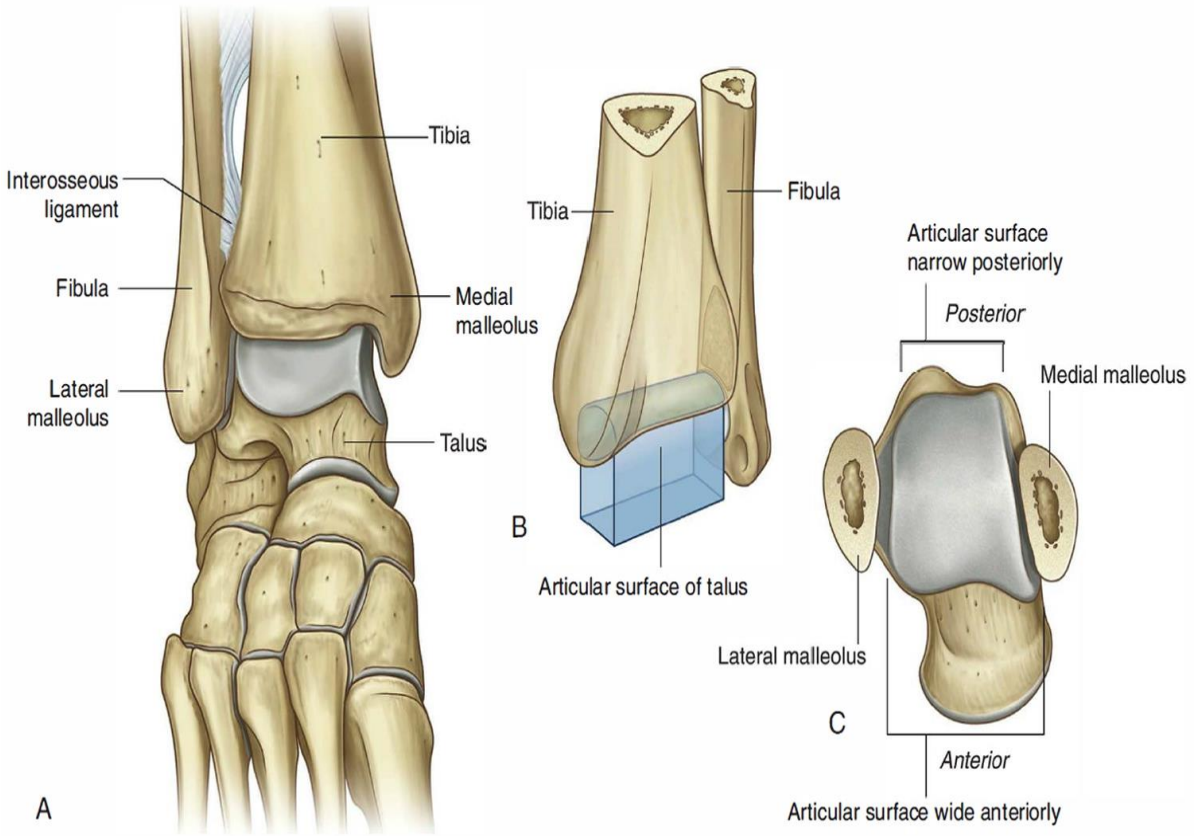
★ **Articulating surfaces**:

- **Above**: Inferior articular surface of lower end of tibia.
- **Medially**: articular surface of medial malleolus.
- **Laterally** : articular surface of lateral malleolus of fibula.
- **Below** : articular surfaces of trochlea of talus.

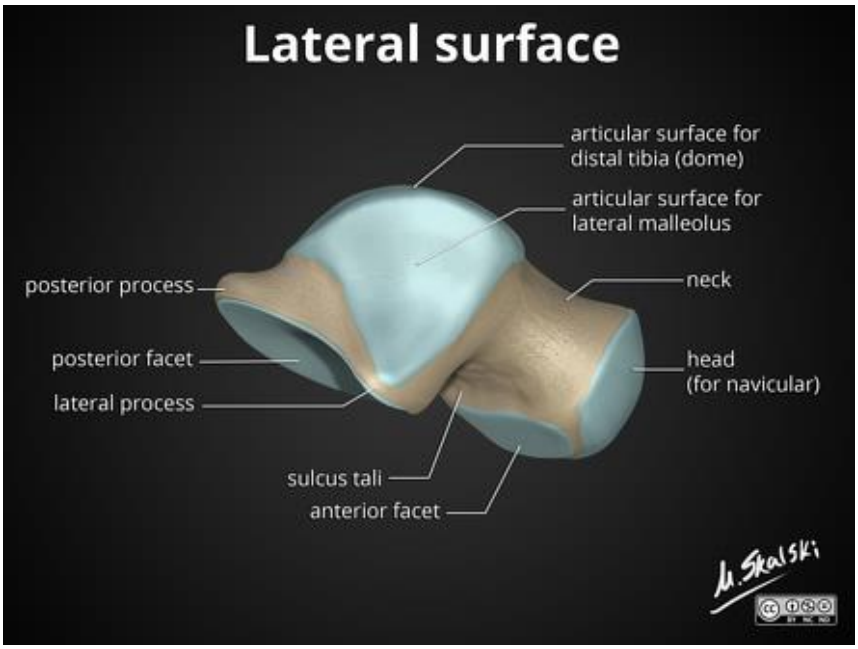
★ **Fibrous capsule:**

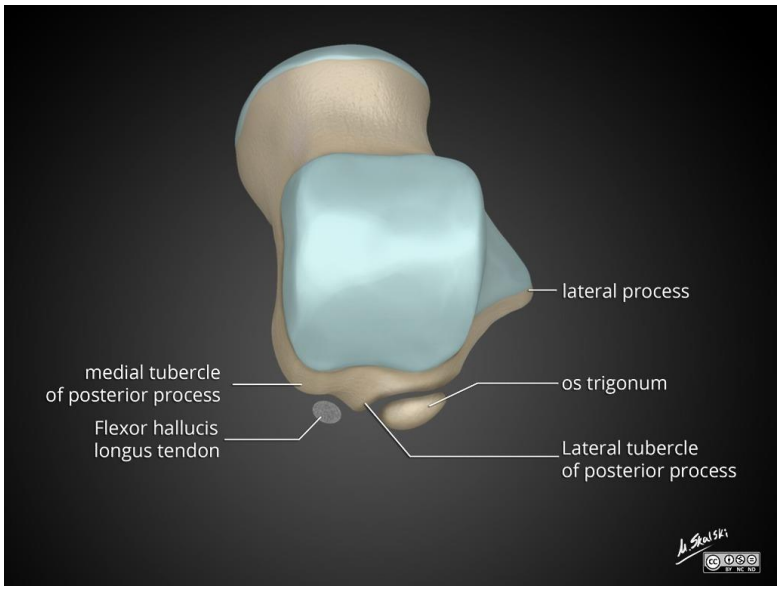
- It is attached to the **margins** of the articulating surfaces.
- It is **weak** both anteriorly and posteriorly **but thickened** on both sides due to the presence of **2 strong collateral ligaments** (medial and lateral ligaments of ankle).

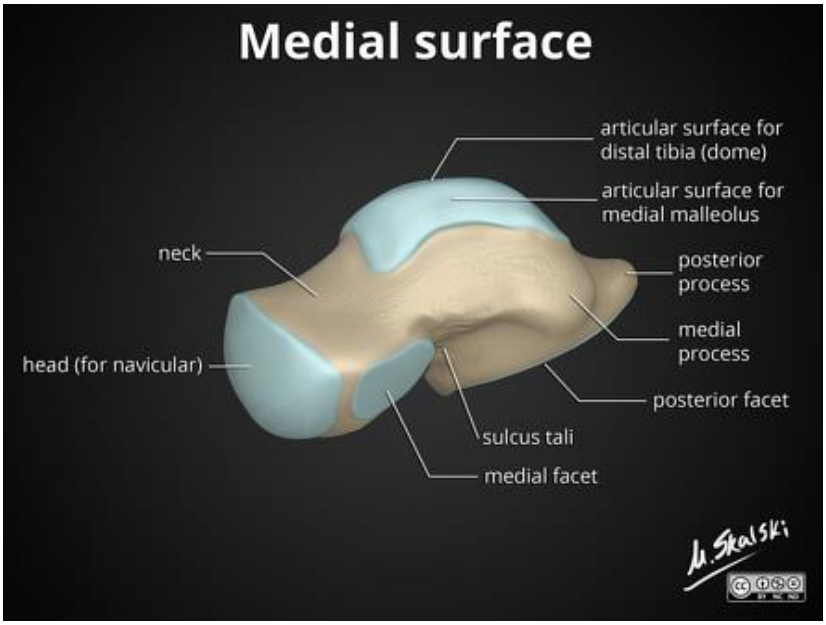
★ **Synovial membrane:** lines the fibrous capsule and covers the intra-articular structures (as the neck of talus) except articular surfaces.



Articulating surfaces of ankle



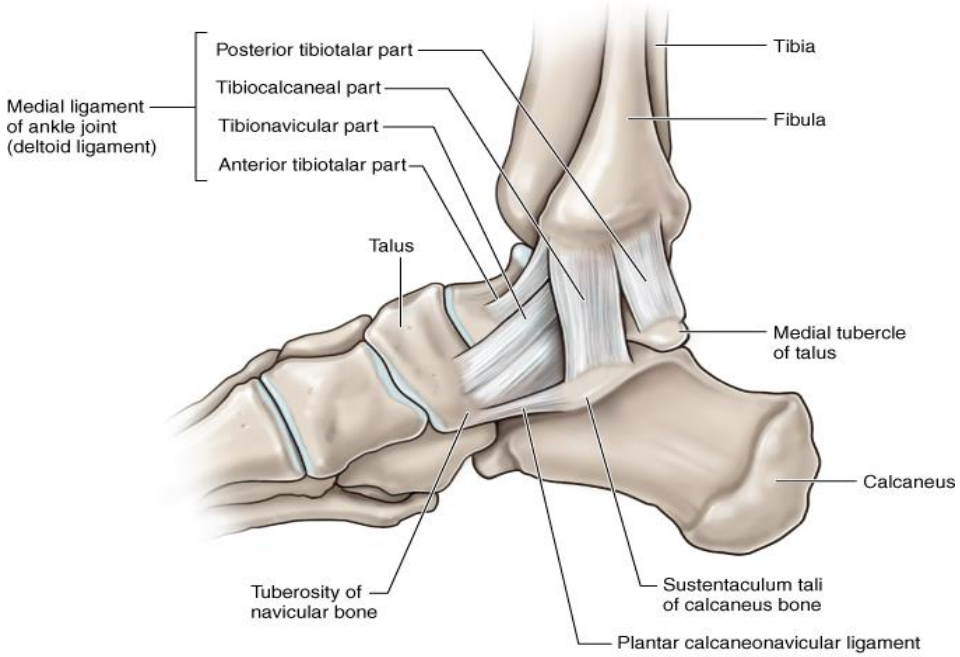




★ **Ligaments of ankle joint:**

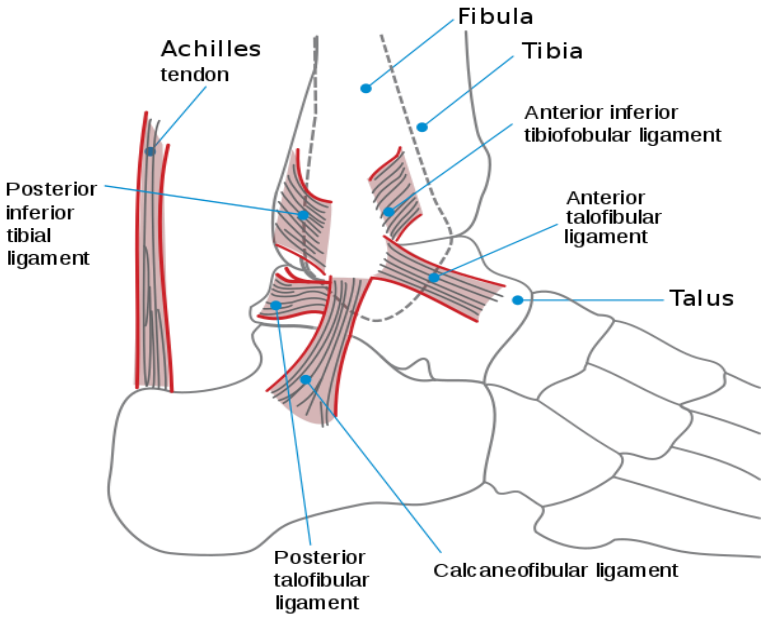
1) Medial ligament of ankle: **(deltoid ligament**):

- It is **triangular** in shape.
- It is attached by its **apex** (above) to the tip of the medial malleolus.
- It is attached by its **base** (below) to the tuberosity of navicular bone, spring ligament, neck of talus, sustentaculum tali and medial tubercle of talus.
- It is the third strongest ligament in human body.



Source: Dutton M: *Dutton's Orthopaedic Examination, Evaluation, and Intervention*, 3rd Edition: www.accessphysiotherapy.com

2) **Lateral ligament of ankle:** formed of **3 separate bands radiating** from lateral malleolus of fibula.
   a- **Anterior talo-fibular ligament**: it extends **horizontally** forwards from lateral malleolus to talus.
   b- **Posterior talo-fibular ligament**: (the strongest of them): it extends **horizontall**y backwards from malleolar fossa of fibula to talus.
   c- **Calcaneo-fibular ligament**: it is a **vertical** middle band which extends from the lateral malleolus to the lateral surface of calcaneus.
3) **Posterior tibiofibular ligament:**
   - It extends from the upper part of malleolar fossa to the medial malleolus.



★ **Movements of the ankle joint:**

a) **Plantar flexion (flexion)**: (moving the foot downwards):

- Produced **mainly by: gastrocnemius and soleus** and assisted by the deep calf muscles (tibialis posterior, flexor hallucis longus and flexor digitorum longus).

b) **Dorsiflexion (Extension)**: (moving the foot upwards with the heel on the ground)

- Produced by: muscles of **anterior compartment** of leg (tibialis anterior, extensor digitorum longus, extensor hallucis longus and peroneus tertius).

★ **Nerve supply of the ankle joint:** branches from deep fibular and tibial nerves.

★ **Arterial supply of the ankle joint:** from the anastomosis around the ankle (around medial and lateral malleoli).

★ **Applied anatomy**:

1- **Sprain** (microscopic tear in the ligaments) of ankle joint: occurs due to :

- Excessive inversion of foot leading to damage of the lateral ligaments.

- Excessive eversion of foot leading to damage of the deltoid ligament.

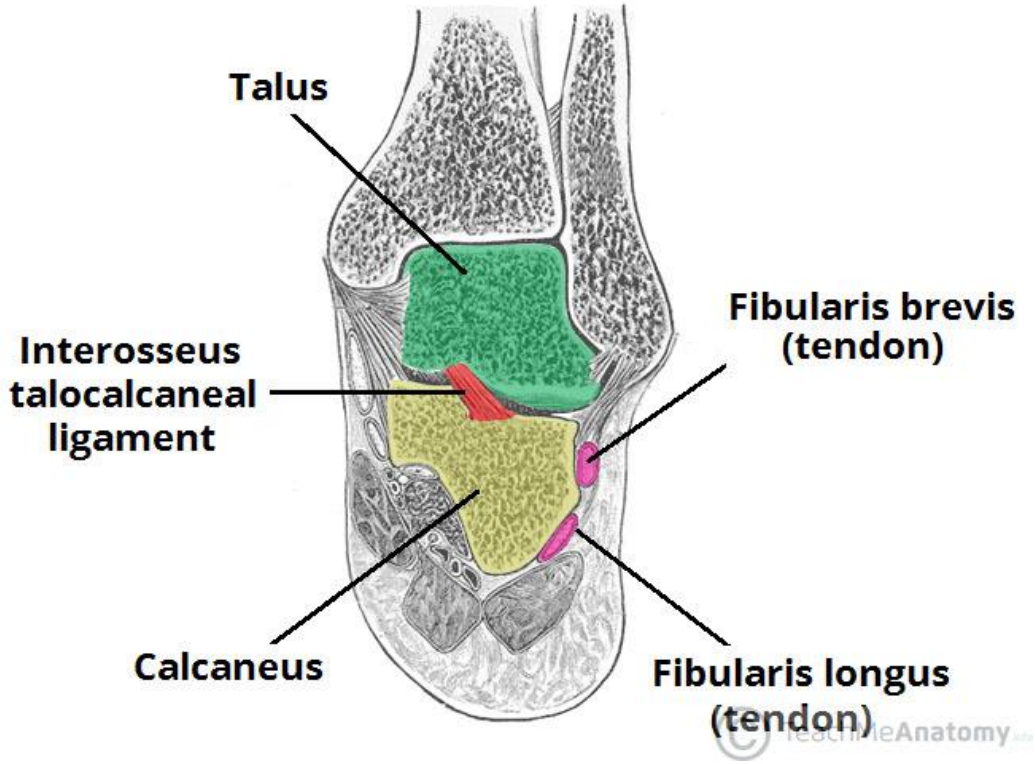
2- **Ankle fractures** :

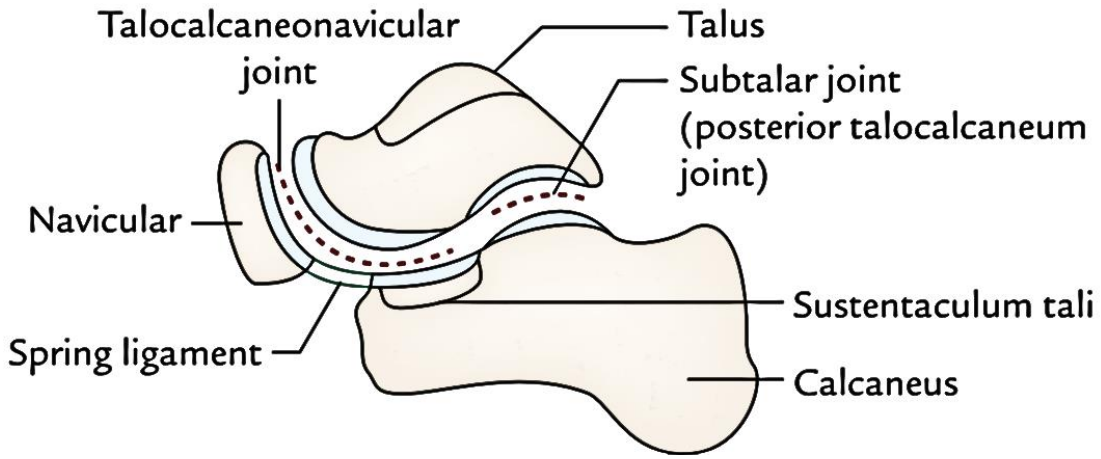
- Affect one or more of the three malleoli with affection of deltoid or lateral ligaments of the ankle.

Joints of the foot

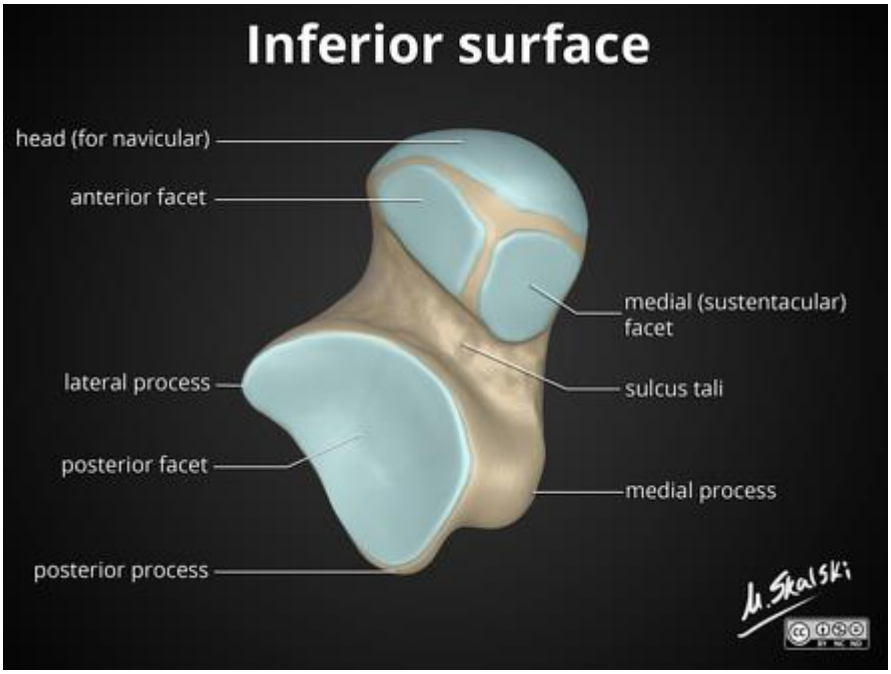
1) Subtalar (talo-calcanean) joint:

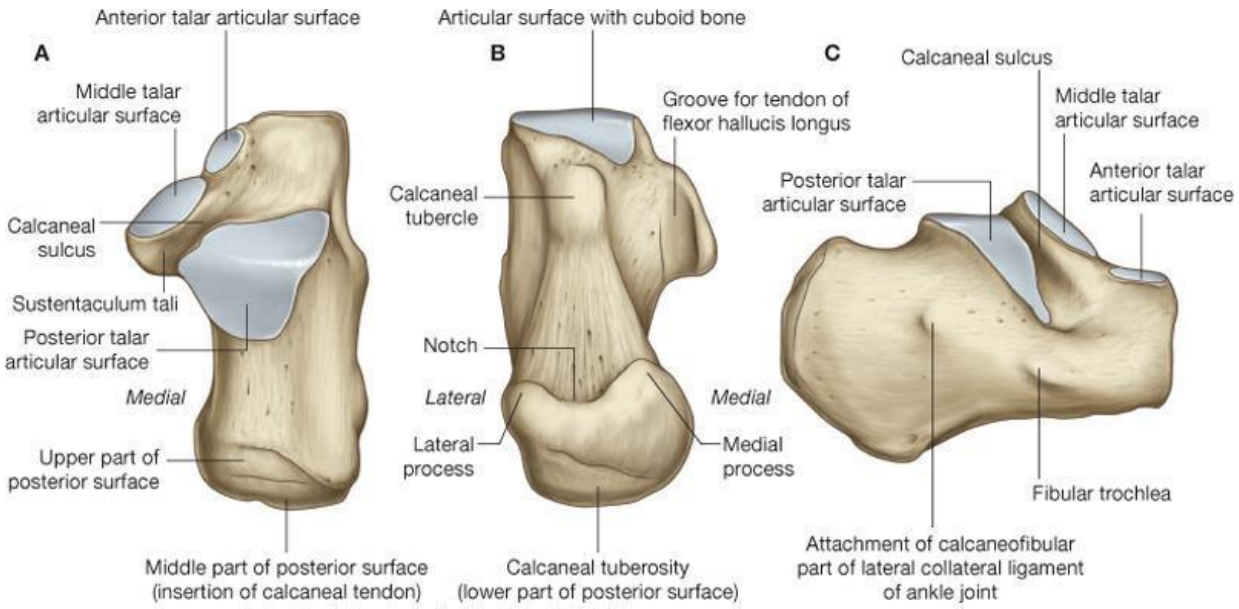
- **Type**: synovial joint.
- **Variety**: ***plane*** (or gliding).
- **Articular surfaces**: between inferior surface of body of talus and upper surface of calcaneus.
- **Capsule**: attached to the margins of the articular surfaces.
- **Ligaments**: 3 **talo-calcanean ligaments** (lateral, medial and interosseus).
- **Movements**: the subtalar joint allows **inversion and eversion** of foot.

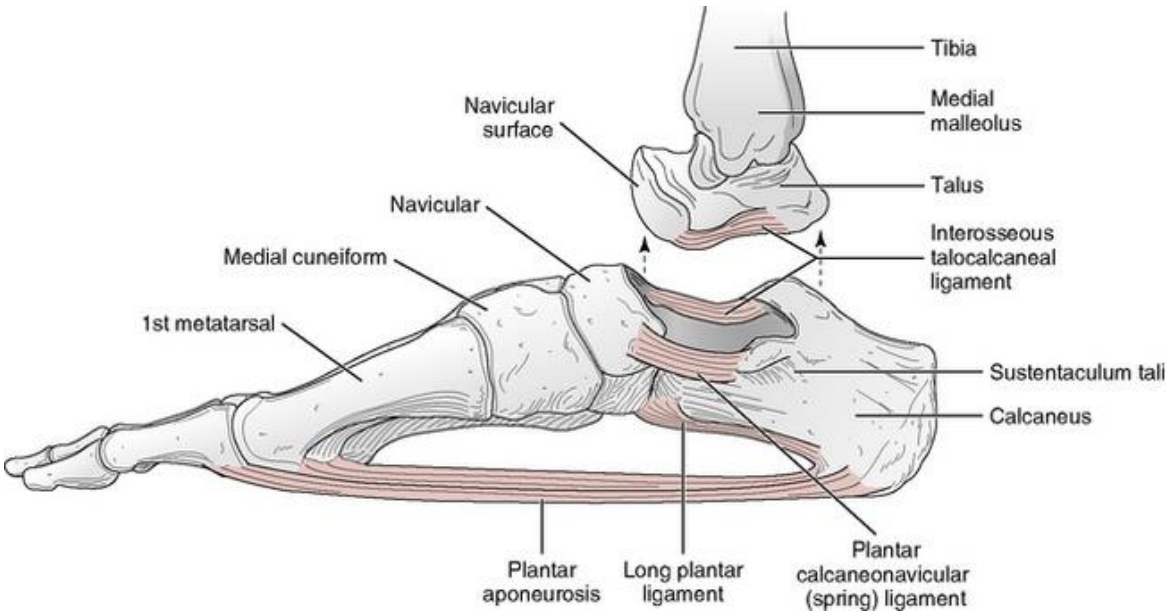


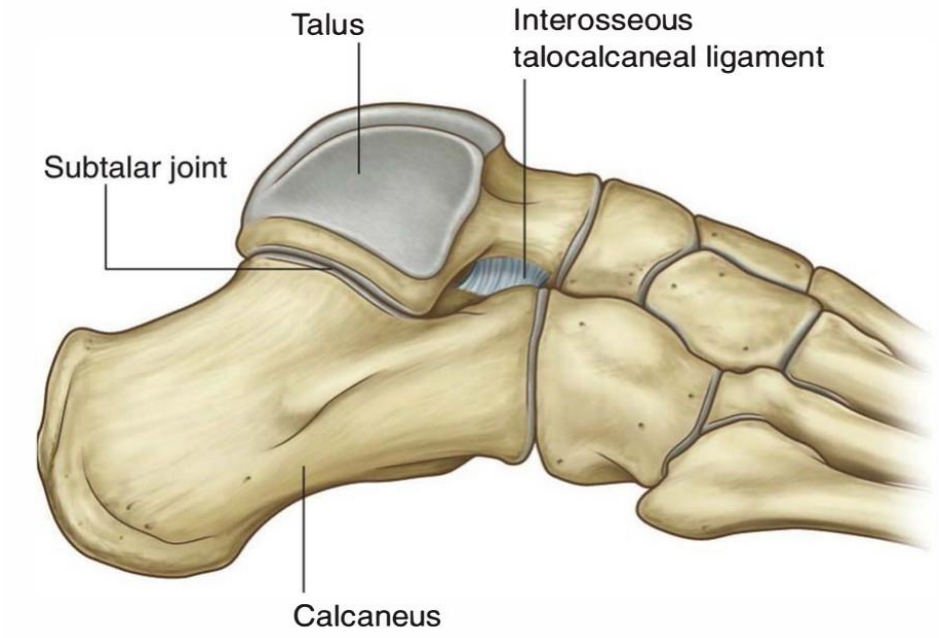


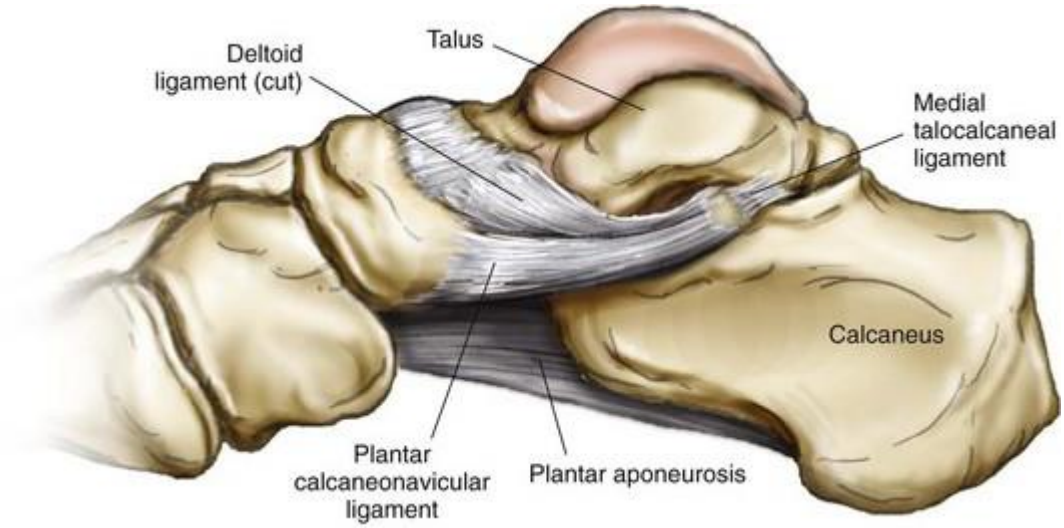
Subtalar & Talo-calcaneo-navicular joints

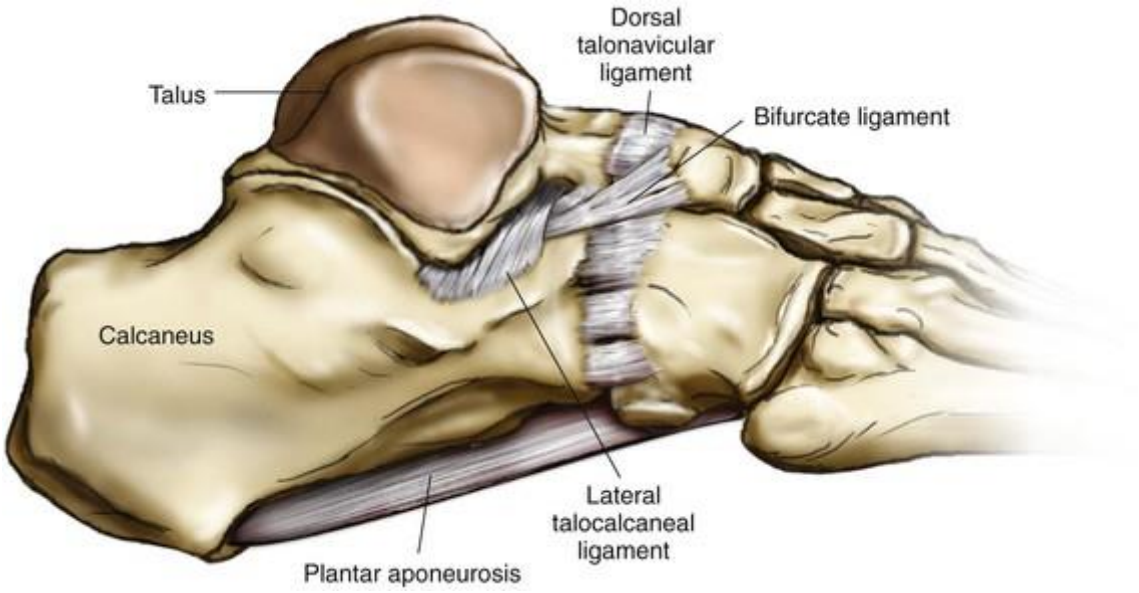

Inferior surface
head (for navicular)
anterior facet
medial (sustentacular) facet
lateral process
sulcus tali
posterior facet
medial process
posterior process
A. Skalski


A
Anterior talar articular surface
Middle talar articular surface
Calcaneal sulcus
Sustentaculum tali
Posterior talar articular surface
Medial
Upper part of posterior surface
Middle part of posterior surface (insertion of calcaneal tendon)
B
Articular surface with cuboid bone
Groove for tendon of flexor hallucis longus
Calcaneal tubercle
Notch
Lateral
Medial
Lateral process
Medial process
Calcaneal tuberosity (lower part of posterior surface)
C
Calcaneal sulcus
Middle talar articular surface
Anterior talar articular surface
Posterior talar articular surface
Fibular trochlea
Attachment of calcaneofibular part of lateral collateral ligament of ankle joint


Tibia
Medial malleolus
Navicular surface
Talus
Navicular
Interosseous talocalcaneal ligament
Medial cuneiform
1st metatarsal
Sustentaculum tali
Calcaneus
Plantar aponeurosis
Long plantar ligament
Plantar calcaneonavicular (spring) ligament

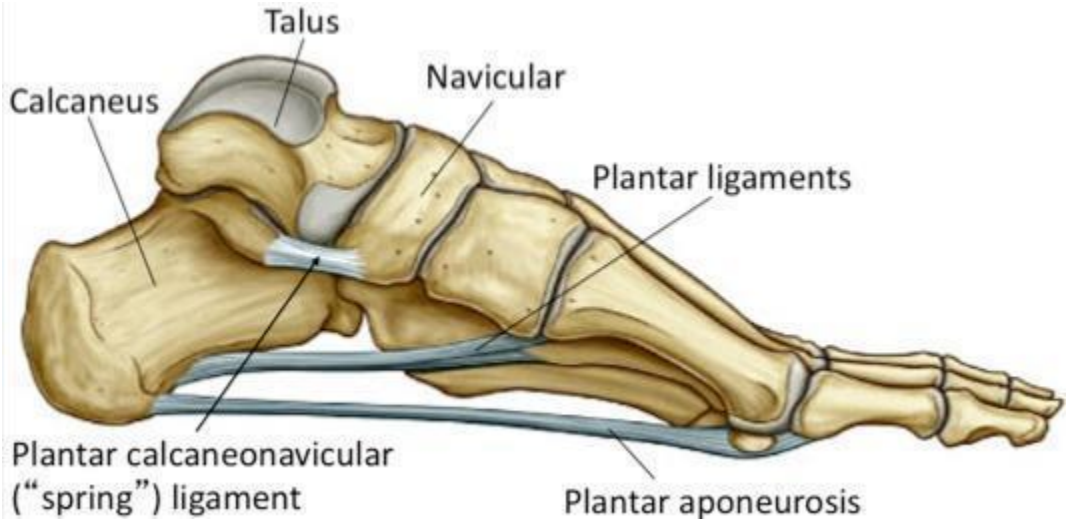

Talus
Interosseous talocalcaneal ligament
Subtalar joint
Calcaneus

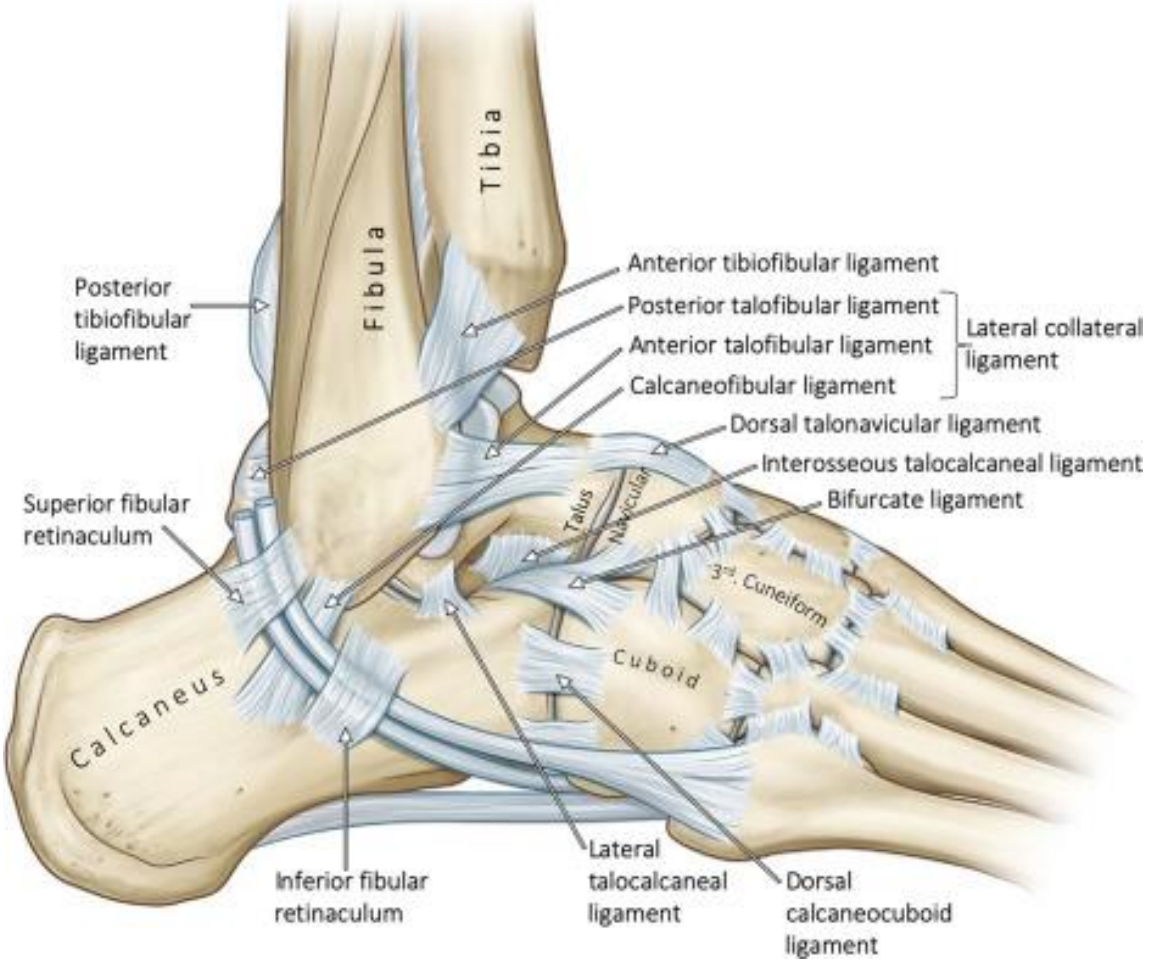

Deltoid ligament (cut)
Talus
Medial talocalcaneal ligament
Calcaneus
Plantar calcaneonavicular ligament
Plantar aponeurosis

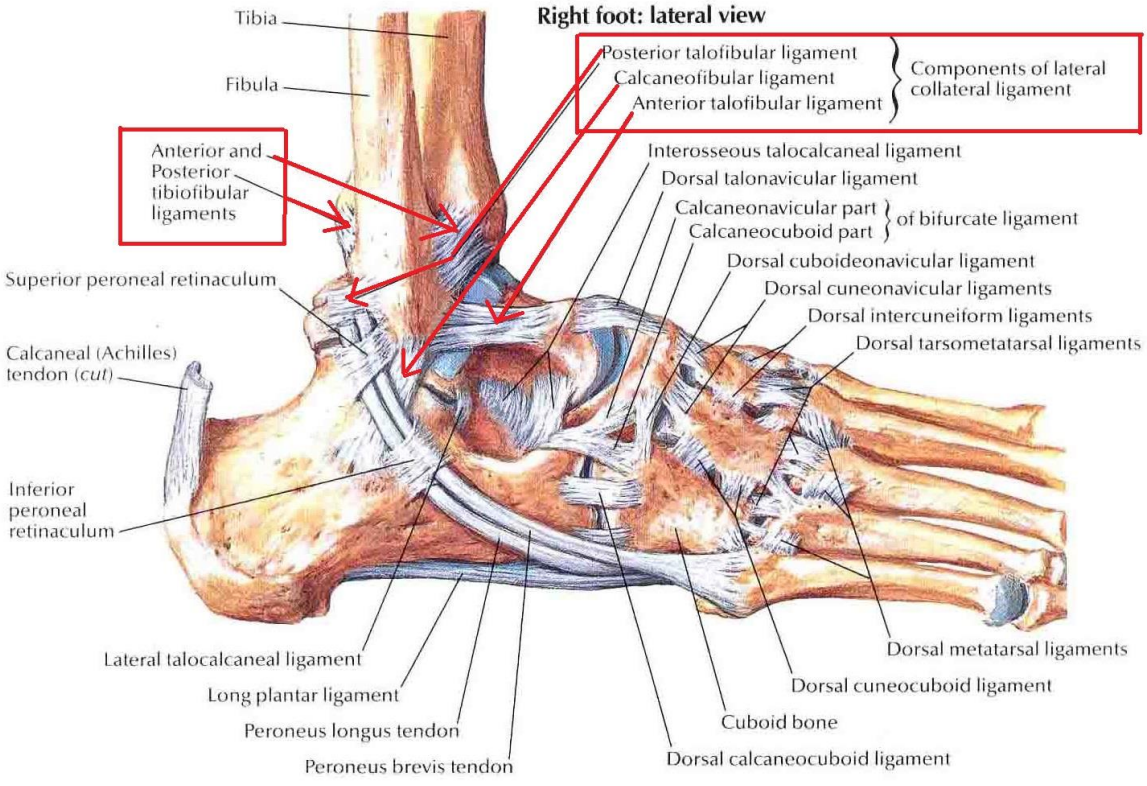

Dorsal talonavicular ligament
Talus
Bifurcate ligament
Calcaneus
Lateral talocalcaneal ligament
Plantar aponeurosis

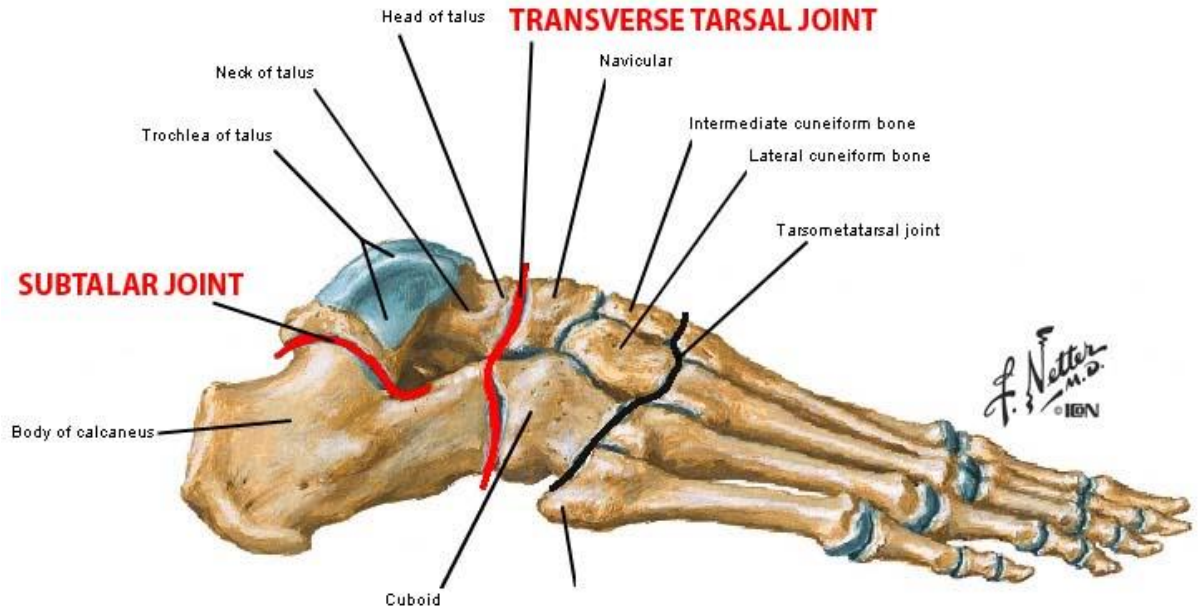
2)Talo-calcaneo-navicular joint:

- **Type:** synovial joint.
- **Variety**: **complex ball and socket**.
- **Articular surfaces**: between **head of talus** (a ball) which articulates with (a socket) formed by **sustentaculum tali** of **calcaneus** and **navicular** bones with the **spring ligament** between them.
- **Ligaments:**
  - a) **Spring (plantar calcaneo-navicular) ligament**: it extends between **the sustentaculum tali** of calcaneus to the **tuberosity & plantar surface of navicular** bone on the plantar surface of foot.
  - b) **Dorsal Calcaneo-navicular ligament**: it forms the **medial limb** of the **bifurcate** ligament of the calcaneo-cuboid joint.
  - c) **Dorsal talo-navicular ligament**: connects the **neck of talus to the navicular** bone .
- **Movements :** this joint allows **inversion and eversion** of foot.




Tibia
Fibula
Posterior tibiofibular ligament
Anterior tibiofibular ligament
Posterior talofibular ligament
Anterior talofibular ligament
Calcaneofibular ligament
Lateral collateral ligament
Dorsal talonavicular ligament
Interosseous talocalcaneal ligament
Bifurcate ligament
Superior fibular retinaculum
Talus
Navicular
3rd Cuneiform
Cuboid
Calcaneus
Inferior fibular retinaculum
Lateral talocalcaneal ligament
Dorsal calcaneocuboid ligament


Right foot: lateral view
Tibia
Fibula
Posterior talofibular ligament
Calcaneofibular ligament
Anterior talofibular ligament
Components of lateral collateral ligament
Anterior and Posterior tibiofibular ligaments
Interosseous talocalcaneal ligament
Dorsal talonavicular ligament
Calcaneonavicular part
Calcaneocuboid part
of bifurcate ligament
Dorsal cuboideonavicular ligament
Dorsal cuneonavicular ligaments
Dorsal intercuneiform ligaments
Dorsal tarsometatarsal ligaments
Superior peroneal retinaculum
Calcaneal (Achilles) tendon (cut)
Inferior peroneal retinaculum
Lateral talocalcaneal ligament
Long plantar ligament
Peroneus longus tendon
Peroneus brevis tendon
Dorsal metatarsal ligaments
Dorsal cuneocuboid ligament
Cuboid bone
Dorsal calcaneocuboid ligament



4) Calcaneo-cuboid joint:

- **Type**: synovial joint , biaxial joint of ***saddle*** variety.
- **Articular surfaces**: **anterior end of calcaneus** articulates with **posterior surface of cuboid** bone.
- **Ligaments:**
  - **a) Bifurcate ligament**: (see later)
  - **b) Long and short plantar ligaments**: (see later)

5) Cunonavicular joint

6) Tarsometatarsal joints

7) Intertarsal joints .

8) Metatarsophalangel joints.

9) Interphalangeal joints

Important Ligaments of the Foot

1) Spring ligament: **(plantar calcaneo-navicular ligament)**

- It **extends between** the sustentaculum tali of calcaneus to the tuberosity & plantar surface of navicular bone on the plantar surface of foot.
- It is attached to the **deltoid ligament** (medial ligament of ankle).
- It is so called as it acts as a **spring below the head of talus**.
- It is also called plantar calcaneo-navicular ligament as it lies on the medial side of the plantar surface of foot.
- It is **supported** from below by the tendon of **tibialis posterior muscle.**
- It **support head of talus** from below , play an important role in transmission of **body weight** & maintain the **medial longitudinal arch** so weakness of this ligament results in **flat foot**.

2) Bifurcate ligament: it is a **Y-shaped** ligament which lies on the **dorsal surface of foot**. It is formed of a stem and 2 limbs:

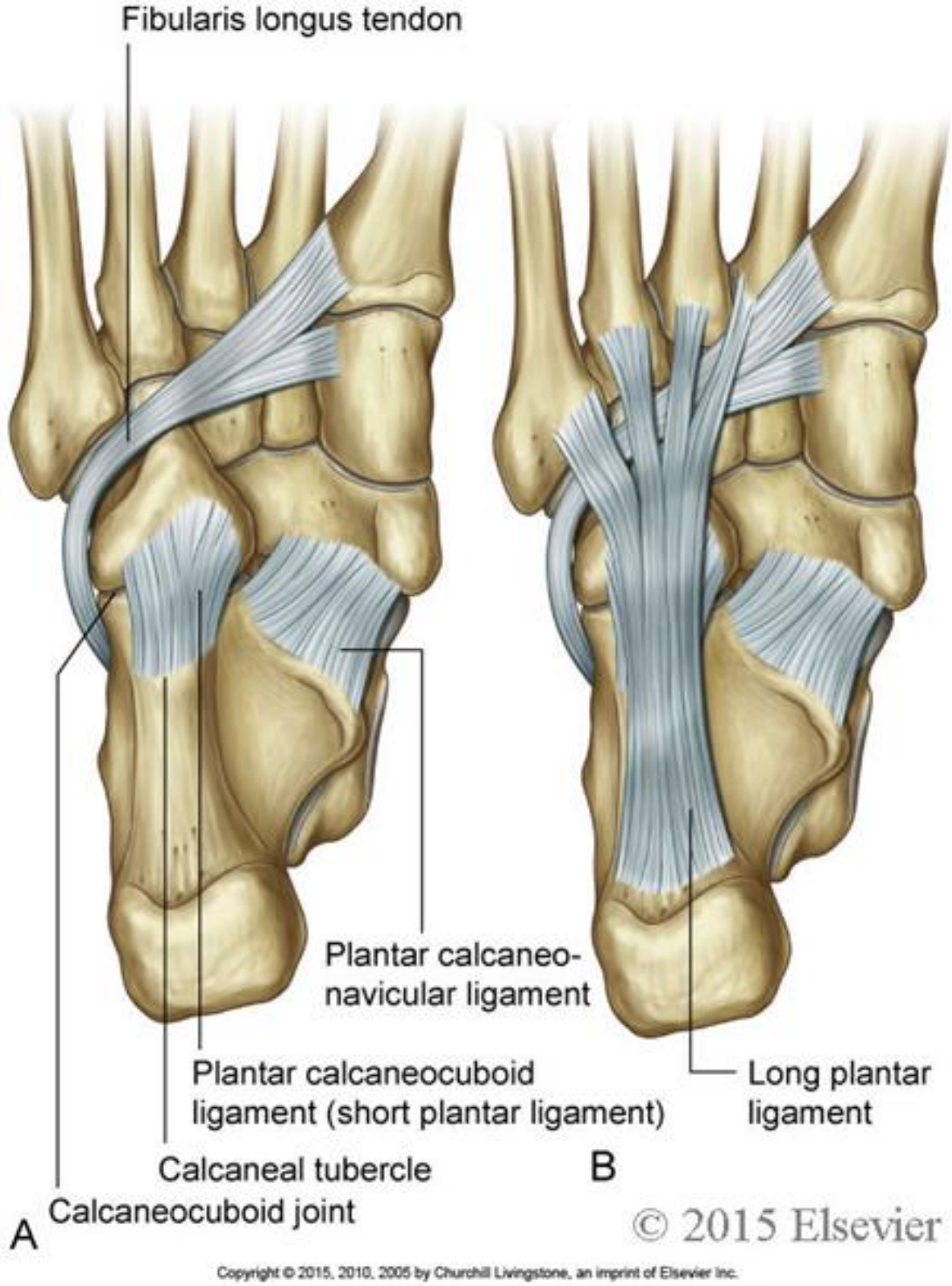
- The **stem** is attached to the **upper surface of calcaneus**.
- The **2 limbs** are made of 2 ligaments:
  - **Dorsal calcaneo-cuboid ligament:** attached to the ***medial side of cuboid bone.***
  - **Dorsal calcaneo-navicular ligament**: attached to the ***lateral side of navicular bone.***

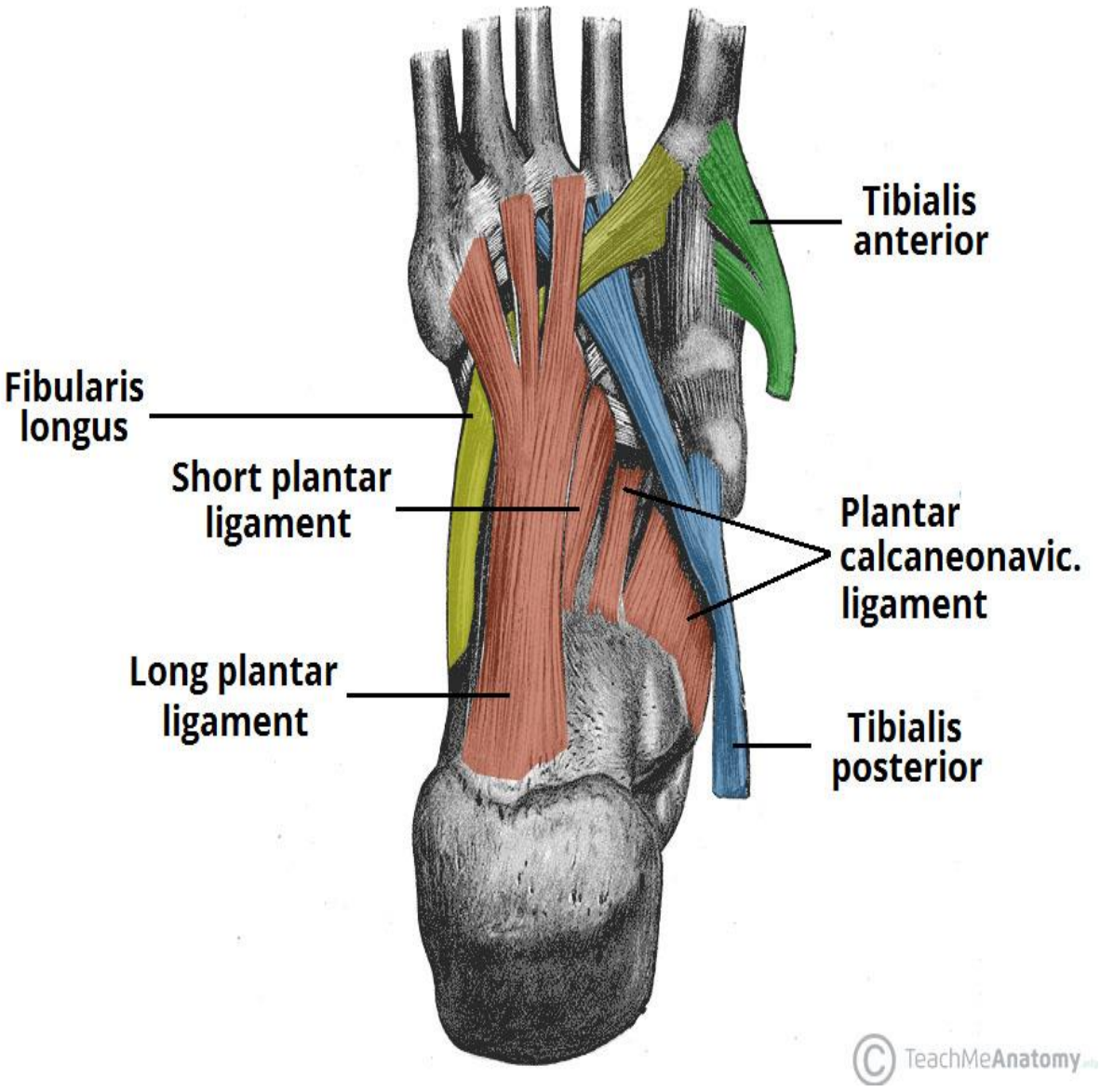
3)Long plantar ligament: lies on the **lateral side of sole** of foot.

- It **extends** from the plantar surface of **calcaneus** to the bases of lateral 3 **metatarsal** bones.
- It supports the **lateral longitudinal arch** of foot.
- With the cuboid bone, it forms a **tunnel for** the tendon of **fibularis longus** muscle.

4) Short plantar ligament (or plantar calcaneo-cuboid):

- It lies on plantar surface of **lateral side of sole of foot** (immediately **deep to** long plantar ligament).
- It stretches **between** the anterior calcaneal tubercle and the plantar surface of the cuboid bone.
- It supports the **lateral longitudinal arch** of foot.




Tibialis anterior
Fibularis longus
Short plantar ligament
Plantar calcaneonavic. ligament
Long plantar ligament
Tibialis posterior
© TeachMeAnatomy

Inversion and Eversion of Foot

- **In inversion**: the sole turns medially (to inside).
- **In eversion**: the sole turns laterally (to outside).
- **These movements take place at the intertarsal joints**:
  1- Subtalar joint.
  2- Talo-calcaneo-navicular joint.
- The range of these movements is increased by the gliding action that occur at the transverse tarsal (mid-tarsal) joint.
- **Mechanism:** the talus is fixed (by the 2 malleoli) while the calcaneus , navicular bones and spring ligament swing around it carrying the other bones of the foot with them.
- **Muscles acting in**:

Inversion	Eversion
Tibialis anterior	**Fibularis** longus
Tibialis posterior	**Fibularis** brevis
	Fibularis tertius

★ **N.B**.: These movements are <u>not done</u> by the ankle joint.