

Knee and Ankle Joints

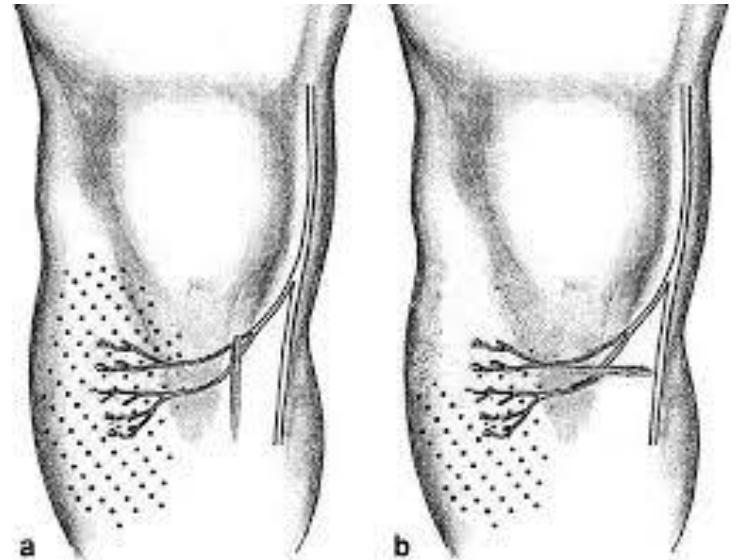
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Knee Joint (Introduction)

- The knee is the largest synovial joint in the body
- 3 Compartments...complex 'hinge' joint
- a fulcrum for the powerful extensor and flexor muscles

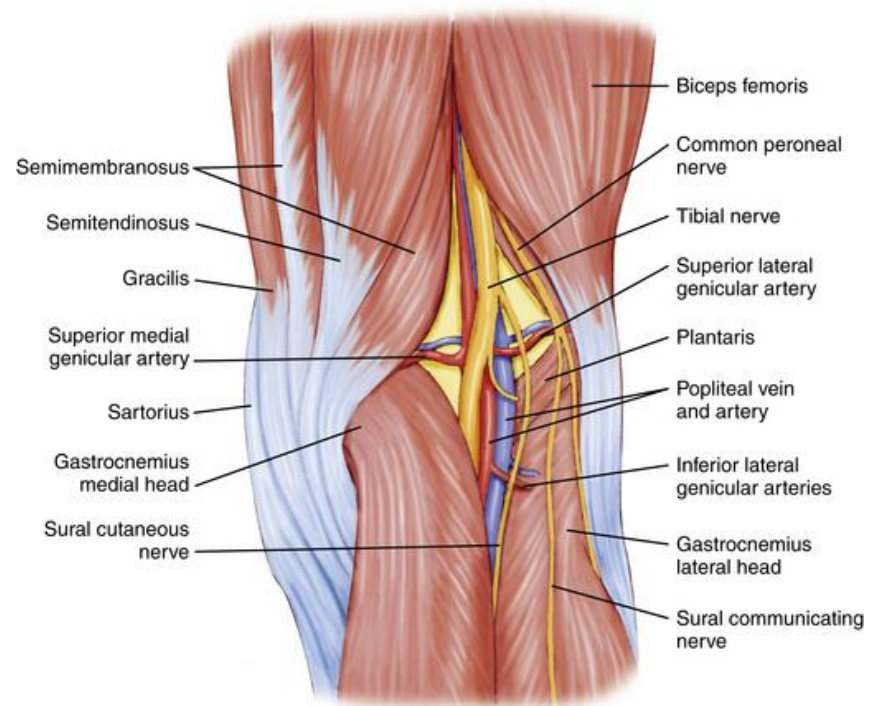
Skin

- **Cutaneous innervation:**
 - ***Infrapatellar branch of the saphenous nerve***
 - reaches the anterior aspect of the knee from the medial side.
 - invariably divided in the medial approach to the knee...numbness...neuro ma



SOFT TISSUE(Popliteal fossa)

- a narrow intermuscular space
- a diamond-shaped
- Boundaries:
 - biceps femoris
 - semimembranosus and the overlying semitendinosus
 - lateral head of gast. with the underlying plantaris
 - Medial head of gast.



- anterior boundary (or floor) of the fossa in proximodistal sequence:
 - by the popliteal surface of the femur,
 - the oblique popliteal ligament (overlying the posterior surface of the capsule of the knee joint),
 - the posterior aspect of the proximal tibia covered by popliteus and the fascia overlying popliteus
- roof of the fossa
 - popliteal fascia

Contents

- tibial nerve
- popliteal vein
- popliteal artery, a continuation of the femoral artery
- small saphenous vein
- common fibular nerve (also known as the common peroneal nerve)
- Popliteal lymph nodes

BONE

- FEMUR
- TIBIA
- FIBULA
- Patella

Joint

- PATELLOFEMORAL JOINT
- synovial joint
- on flexion the patellofemoral contact point moves proximally.
- The contact area also broadens to cope with the increasing stress that accompanies progressive flexion.

patellar tendon

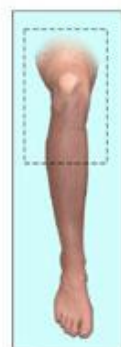
- the central band of the tendon of quadriceps femoris, and is continued distally from the patella to the tibial tuberosity
- 6 to 8 cm in length
- separated from the synovial membrane by a large infrapatellar fat pad and from the tibia by a bursa
- lies within its own well-defined sheath

TIBIOFEMORAL JOINT

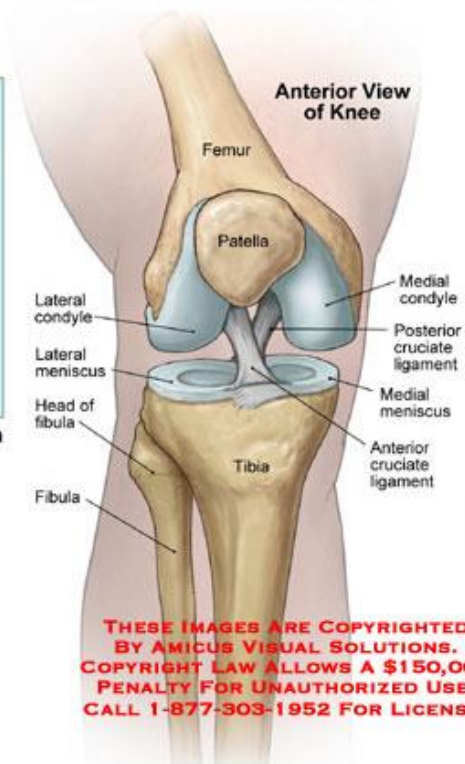
- a complex synovial joint
- Proximal tibial surface:
 - tibial plateau
 - slopes posteriorly and downwards relative to the long axis of the shaft
 - Medial and lateral articular surfaces (facets) for articulation with the corresponding femoral condyles



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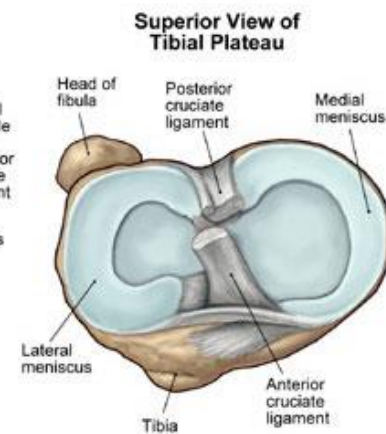


Orientation



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Right Knee Anatomy

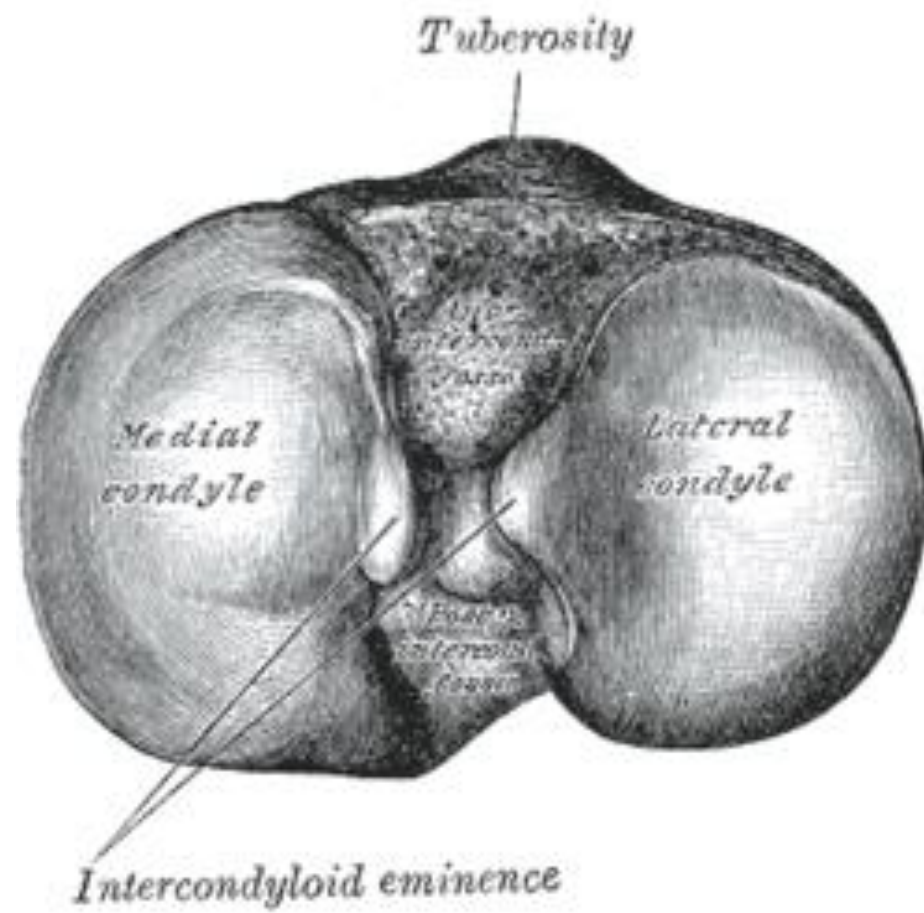


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- The medial articular surface is oval (long axis anteroposterior), concave and longer
- The lateral articular surface is more circular ,convex

Intercondylar area

- The rough-surfaced area between the condylar articular surfaces is narrowest centrally where there is an intercondylar eminence,
- the edges of which project slightly proximally as the lateral and medial intercondylar tubercles.



Femoral surface

- The femoral condyles, bearing articular cartilage, are almost wholly convex
- Tibiofemoral congruence is improved by the menisci...concavity

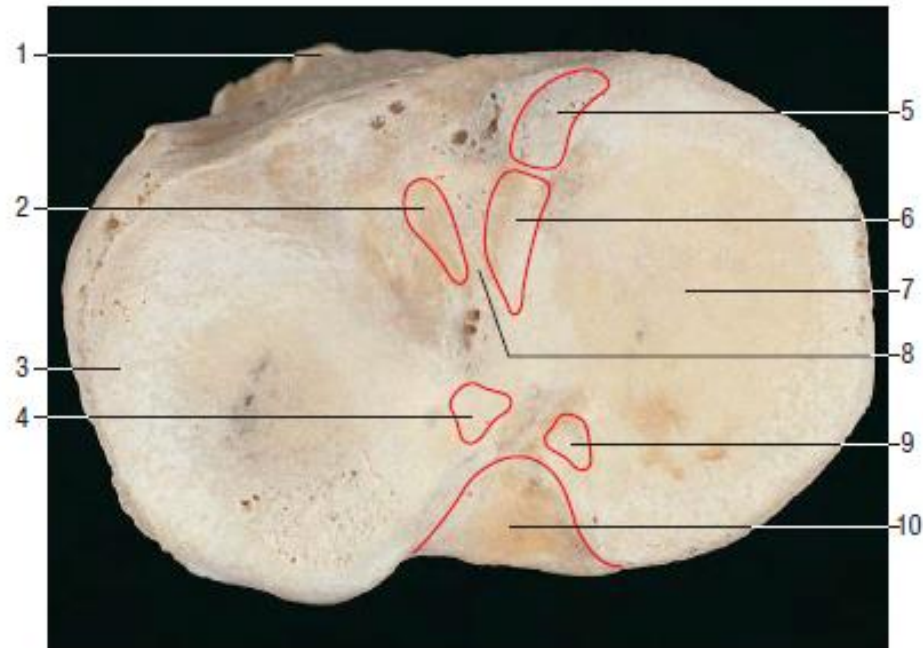


Fig. 82.7 The left tibial plateau. 1. Tibial tuberosity. 2. Attachment of anterior horn, lateral meniscus. 3. Lateral condyle. 4. Attachment of posterior horn, lateral meniscus. 5. Attachment of anterior horn, medial meniscus. 6. Attachment of anterior cruciate ligament. 7. Medial condyle. 8. Intercondylar eminence. 9. Attachment of posterior horn, medial meniscus. 10. Attachment of posterior cruciate ligament.

Menisci

- crescentic, intracapsular, fibrocartilaginous laminae
- widen and deepen the tibial articular surfaces
- Vascularity...capsular vs articular
- Tears ...avascular zone

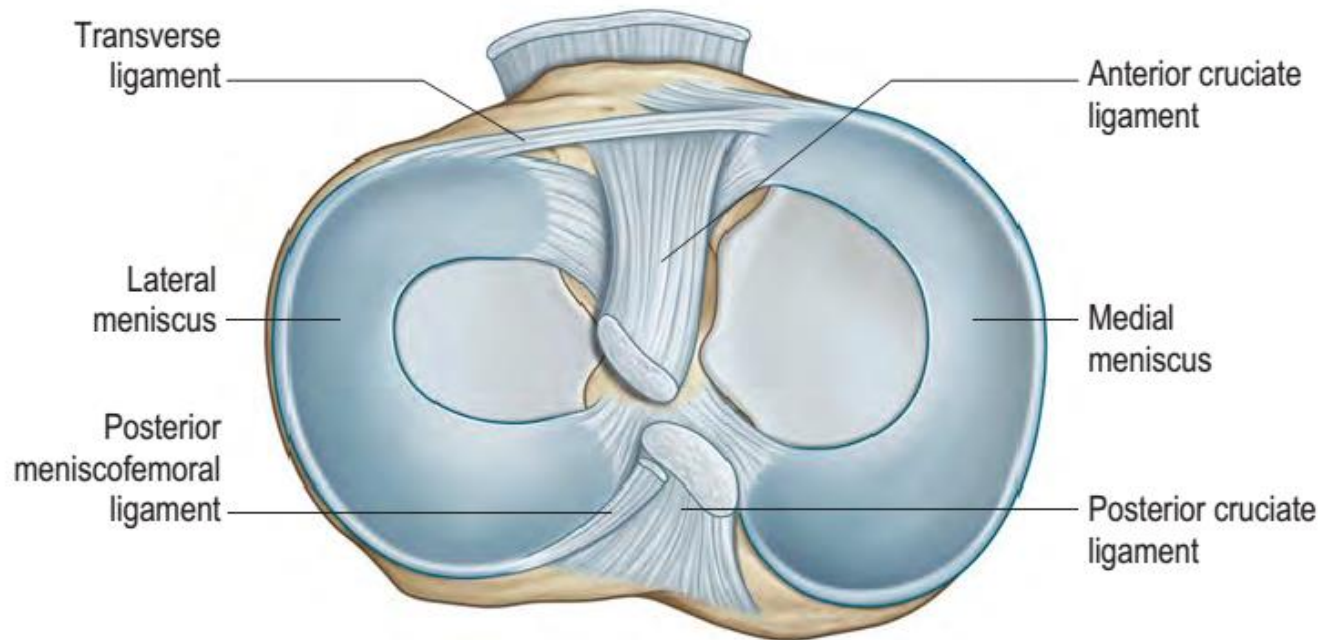


Fig. 82.9 Superior aspect of the left tibia, showing the menisci and the attachments of the cruciate ligaments. (From Drake, Vogl, Mitchell, Tibbitts and Richardson 2008.)

Medial meniscus

- broader posteriorly
- Semicircle
- peripheral border is attached to the fibrous capsule and the deep surface of the medial collateral ligament
- The tibial attachment of the meniscus is known as the 'coronary ligament'
- More injury

Lateral meniscus

- approximately four-fifths of a circle
- covers a larger area than the medial meniscus
- grooved posterolaterally by the tendon of popliteus, which separates it from the fibular collateral ligament
- The meniscus has no peripheral bony attachment in the region of popliteus...hiatus

Discoid lateral meniscus

- in up to 5% of the population
- often bilaterally
- meniscus is simply a wider form of the normal lateral meniscus.
- a biconcave disc and totally covers the lateral tibial plateau
- Asymptomatic....‘clunking knee’



Normal



Incomplete



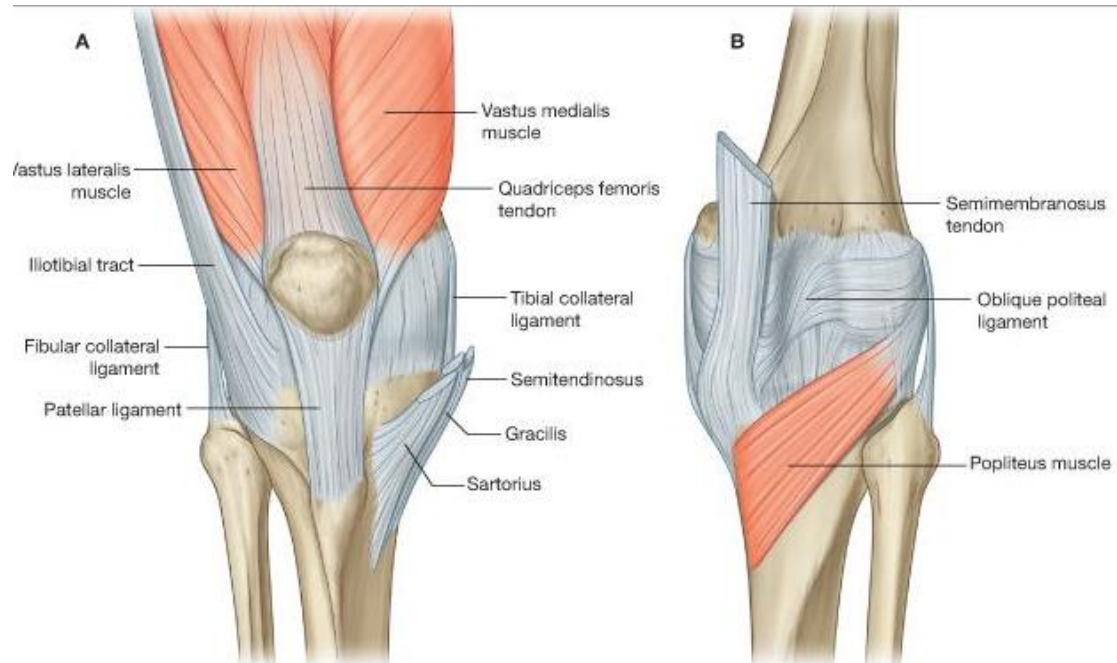
Complete

Soft tissues

- Recent advances in knee ligament surgery have contributed to a better understanding of the anatomy of the medial and lateral soft tissues of the knee.

Capsule and retinacula

- The capsule is a fibrous membrane of variable thickness
- Anteriorly it is replaced by the patellar tendon
- Elsewhere it lies deep to expansions from vasti medialis and lateralis, separated from them by a plane of vascularized loose connective tissue



- Posteriorly the capsule contains vertical fibres that arise from the articular margins of the femoral condyles and intercondylar notch and from the proximal tibia.
- The fibres mainly pass downwards and somewhat medially.
- The oblique popliteal ligament is a well-defined thickening across the posteromedial aspect of the capsule, and is essentially an extension from the tendon of insertion of semimembranosus.

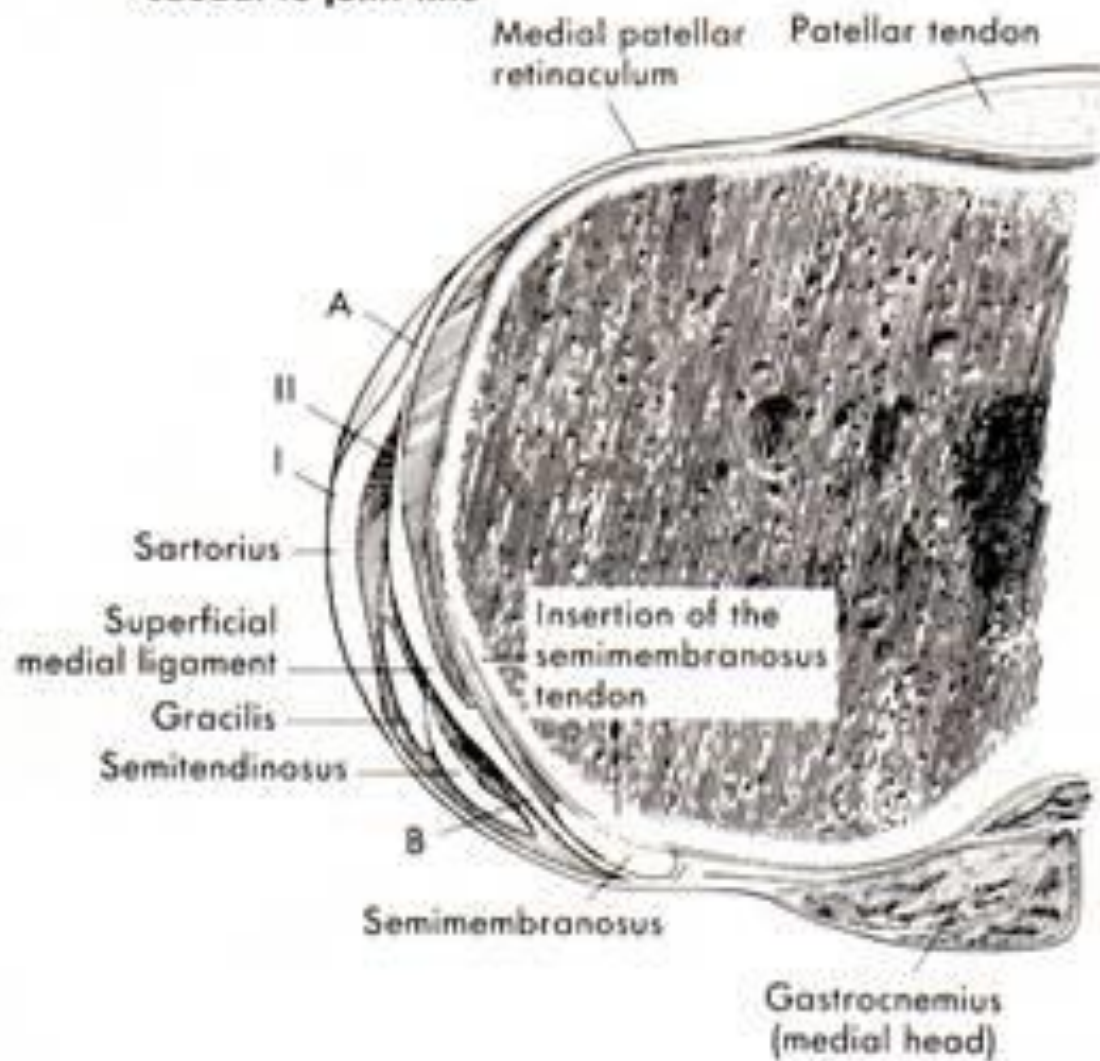
Medial soft tissues

- arranged in three layers
- Layer 1 is the most superficial and is the deep fascia that invests sartorius. The saphenous nerve and its infrapatellar branch are superficial to the fascia.
- Layer 2 is the plane of the superficial medial collateral ligament, which means that the tendons of gracilis and semitendinosus lie between layers 1 and 2.

- The superficial medial collateral ligament has vertical and oblique portions.
- Vertical contains vertically orientated fibres that pass from the medial epicondyle of the femur to a large insertion on the medial surface of the proximal end of the tibial shaft
- The posteriorly placed oblique fibres run posteroinferiorly from the medial epicondyle of the femur to blend with the underlying layer 3 (capsule), effectively to insert on the posteromedial tibial articular margin and posterior horn of the medial meniscus. This area is reinforced by a part of the insertion of semimembranosus

- layer 3 is the capsule of the knee joint

Transaxial plane
caudal to joint line

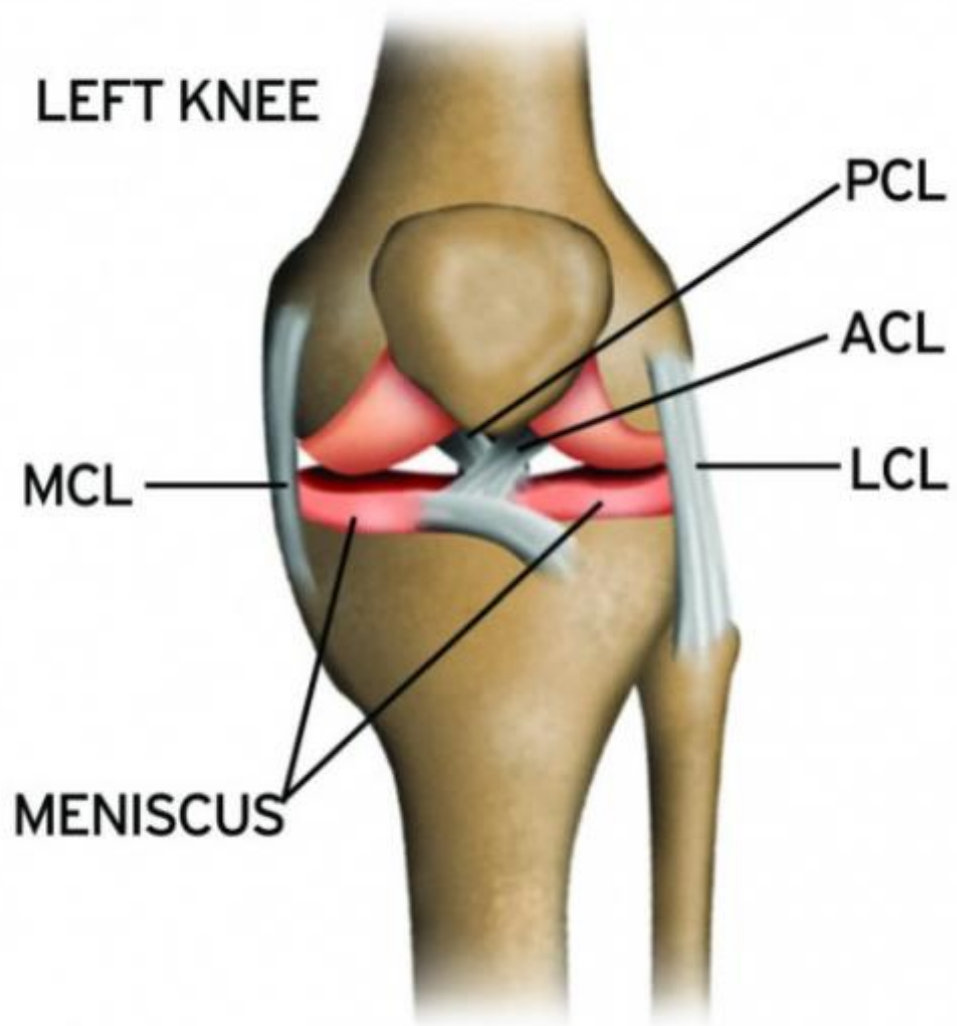


Lateral soft tissues

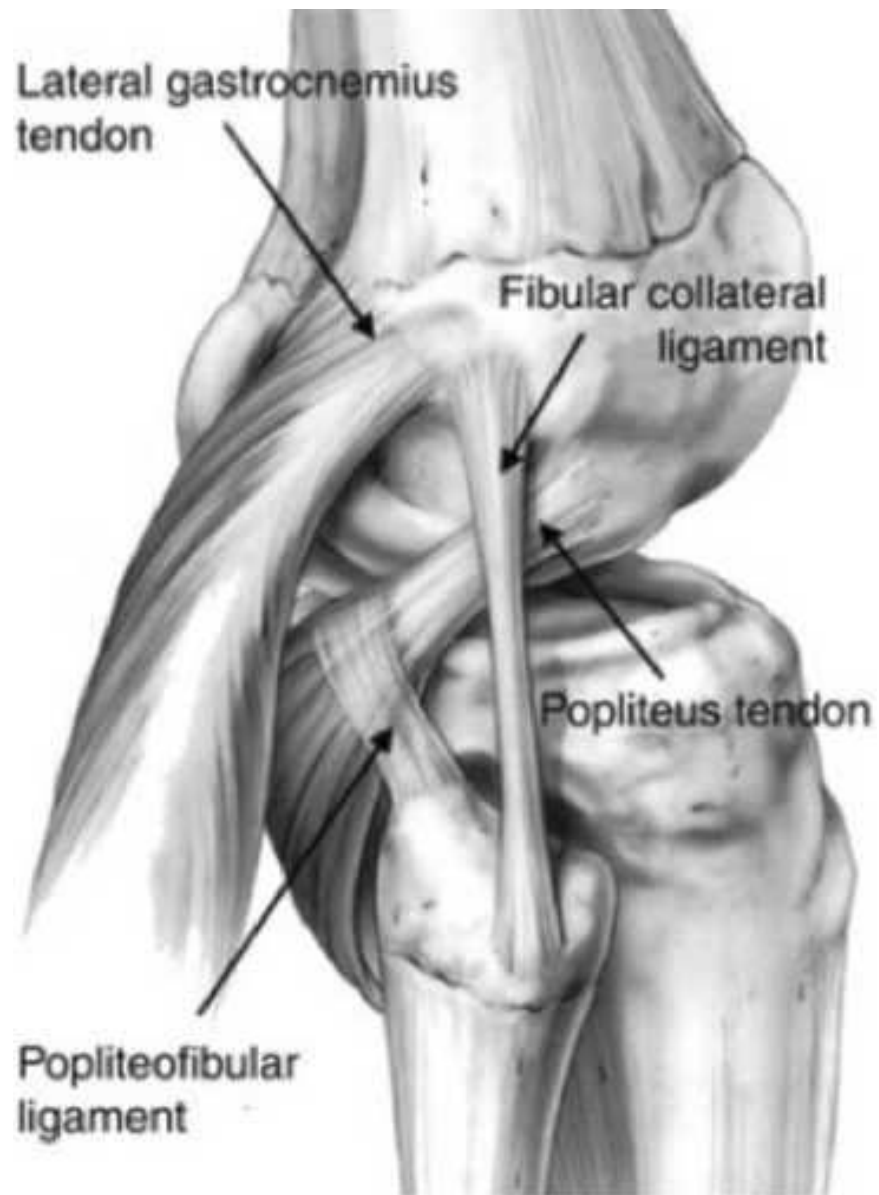
- Three layers
- Most superficial is the lateral patellar retinaculum.
- The middle layer consists of the lateral collateral ligament, popliteofibular ligament, fabellofibular ligament and arcuate ligament.
- The deep layer is the lateral part of the capsule.

LCL

- cord-like structure
- The lateral collateral ligament arises from the lateral epicondyle of the femur posterior to the popliteus insertion and inserts to the fibular head



- The single most important stabilizer of the posterolateral knee is the popliteofibular ligament.
- It passes from the popliteus tendon at a level just below the joint line, posteriorly, laterally and inferiorly, to the fibular head



Ligaments

(cruciate ligaments)

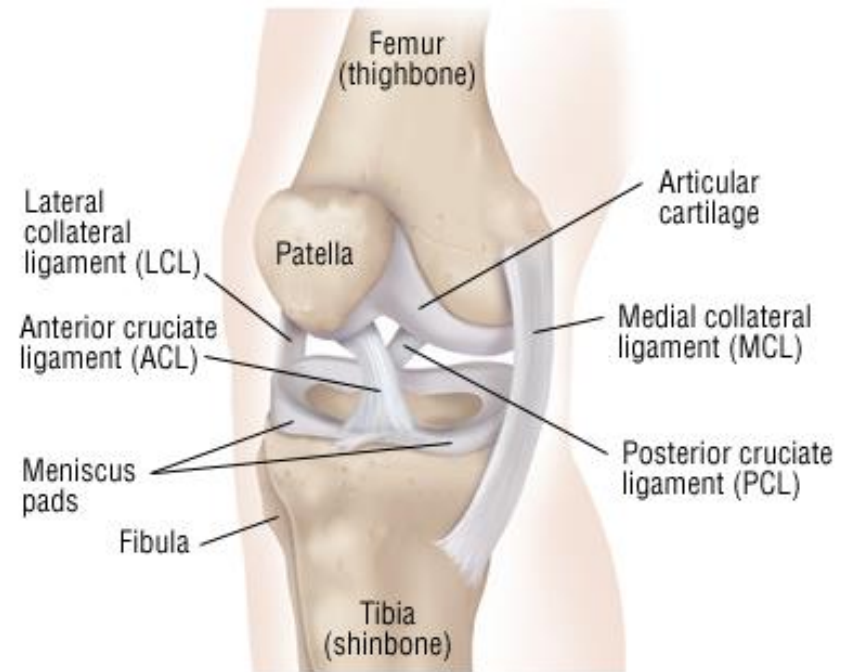
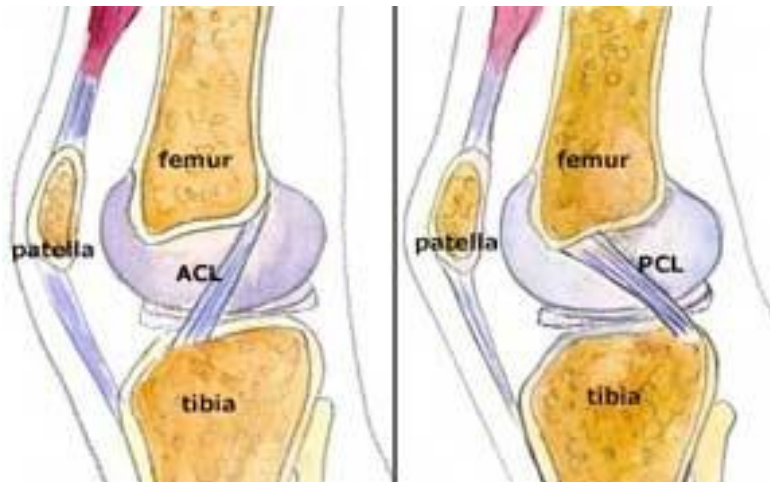
- so named because they cross each other
- named anterior and posterior with reference to their tibial attachments

Anterior cruciate ligament

- attached to the anterior intercondylar area of the tibia, just anterior and slightly lateral to the medial tibial eminence
- ascends posterolaterally, twisting on itself and fanning out to attach high on the posteromedial aspect of the lateral femoral condyle
- length and width...38 mm and 11 mm

Posterior cruciate ligament

- thicker and stronger
- 38 mm and 13 mm
- attached to the lateral surface of the medial femoral condyle and extends up onto the anterior part of the roof of the intercondylar notch and pass distally and posteriorly to a depression on the posterior tibia



Synovial membrane, plicae and fat pads

- The synovial membrane of the knee is the most extensive and complex in the body
- The synovial membrane lines the capsule and is attached to the margins of the articular surfaces

- On the front and above the joint, it forms a pouch which extends up beneath the quadriceps femoris muscle for three fingerbreadths above the patella, forming the **suprapatellar bursa**
- At the sides of the joint the synovial membrane descends from the femur and lines the capsule as far as the menisci, whose surfaces have no synovial covering

Bursae Related to the Knee Joint

- Anterior Bursae
 - The **suprapatellar bursa** lies beneath the quadriceps muscle and communicates with the joint cavity
 - The **prepatellar bursa** lies in the subcutaneous tissue between the skin and the front of the lower half of the patella and the upper part of the ligamentum patellae
 - The **superficial infrapatellar bursa** lies in the subcutaneous tissue between the skin and the front of the lower part of the ligamentum patellae
 - The **deep infrapatellar bursa** lies between the ligamentum patellae and the tibia

KNEE JOINT BURSTITIS



- Posterior Bursae:
- The **popliteal bursa** is found in association with the tendon of the popliteus and communicates with the joint cavity.
- The **semimembranosus bursa** is found related to the insertion of the semimembranosus muscle(between the medial head of the gastrocnemius and the medial femoral condyle and the semimembranosus tendon) and may communicate with the joint cavity.

Movements

- flex, extend, and rotate
- As the knee joint assumes the position of full extension, medial rotation of the femur results in a twisting and tightening of all the major ligaments of the joint, and the knee becomes a mechanically rigid structure
- Unlocking or untwisting process is accomplished by the popliteus muscle, which laterally rotates the femur on the tibia during flexion

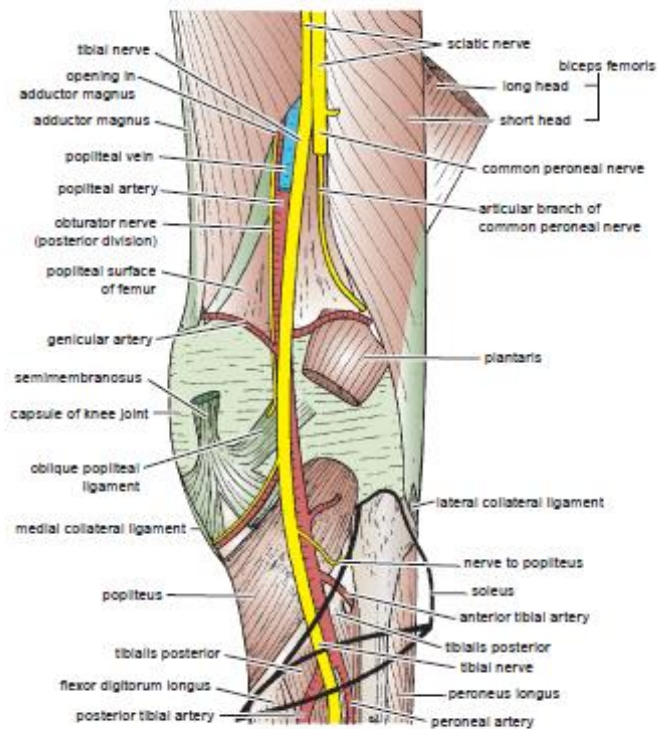


FIGURE 10.42 Deep structures in the right popliteal fossa. The proximal end of the soleus muscle is shown in o

- At right angle, a considerable range of rotation is possible.
- In the flexed position, the tibia can also be moved passively forward and backward on the femur

- Flexion

- The biceps femoris, semitendinosus, and semimembranosus muscles, assisted by the gracilis, sartorius, and popliteus muscles.

- Extension

- The quadriceps femoris

- Medial Rotation

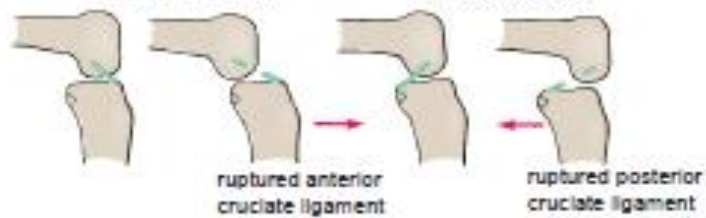
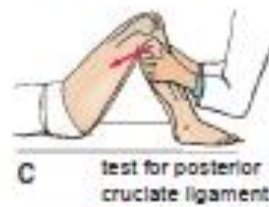
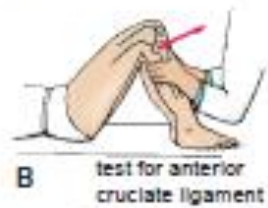
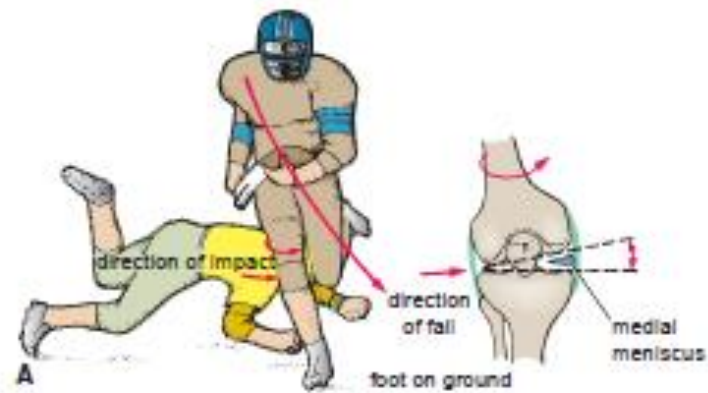
- The sartorius, gracilis, and semitendinosus

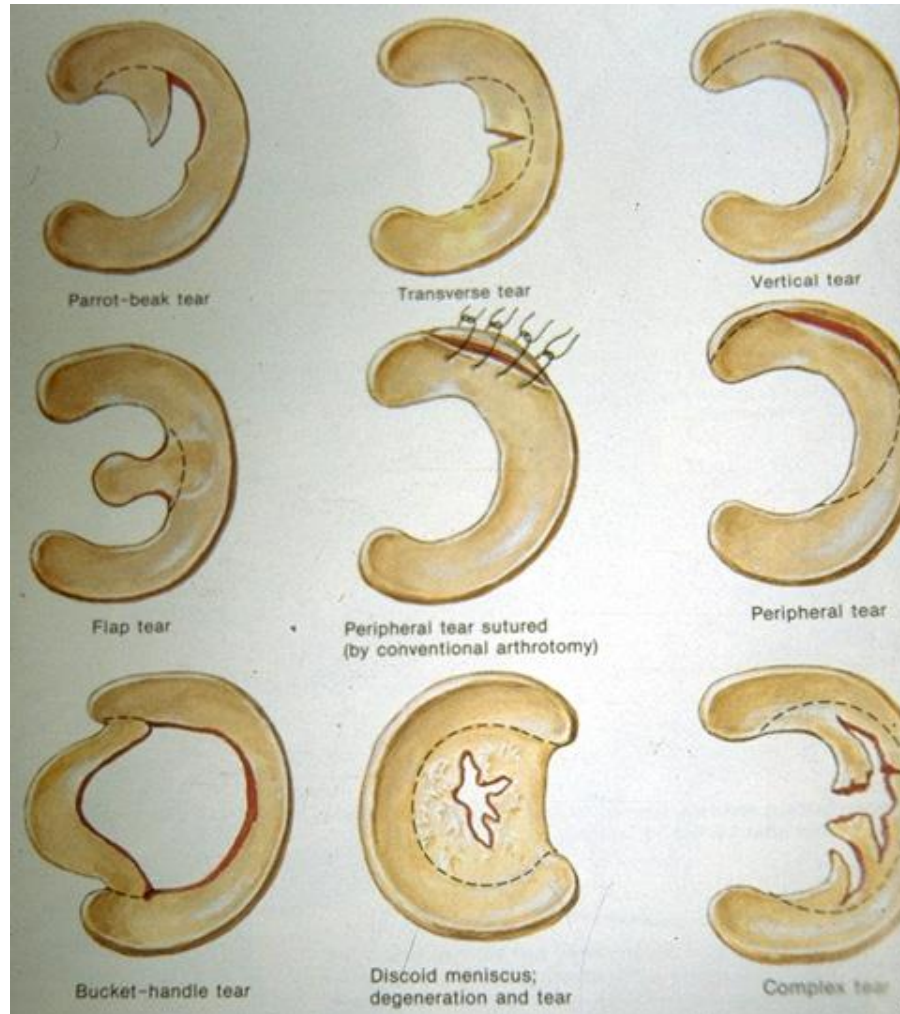
- Lateral Rotation

- The biceps femoris

CLINICAL

- The most important muscle group is the quadriceps femoris; provided that this is well developed, it is capable of stabilizing the knee in the presence of torn ligaments
- Bursitis
- MCL(tenderness) , LCL, ACL PCL injuries...hemarth...tests
- Meniscal injuries...locking
- Arthroscopy





Ankle joint

- The ankle joint consists of a deep socket formed by the lower ends of the tibia and fibula, into which is fitted the upper part of the body of the talus.
- The talus is able to move on a transverse axis in a hinge like manner.
- The shape of the bones and the strength of the ligaments and the surrounding tendons make this joint strong and stable.



ANKLE JOINT SPRAIN



Articulation

- Articulation is between the lower end of the tibia(the two malleoli) and the body of the talus
- The inferior transverse tibiofibular ligament, which runs between the lateral malleolus and the posterior border of the lower end of the tibia, deepens the socket into which the body of the talus fits snugly.
- The articular surfaces are covered with hyaline cartilage.



Type

- The ankle is a synovial hinge joint.
- The capsule encloses the joint and is attached to the bones near their articular margins

Ligaments

- The **medial, or deltoid, ligament** is strong and is attached by its apex to the tip of the medial malleolus
- Below, the deep fibers are attached to the nonarticular area on the medial surface of the body of the talus;
- the superficial fibers are attached to the medial side of the talus, the sustentaculum tali, the plantar calcaneonavicular ligament, and the tuberosity of the navicular bone.

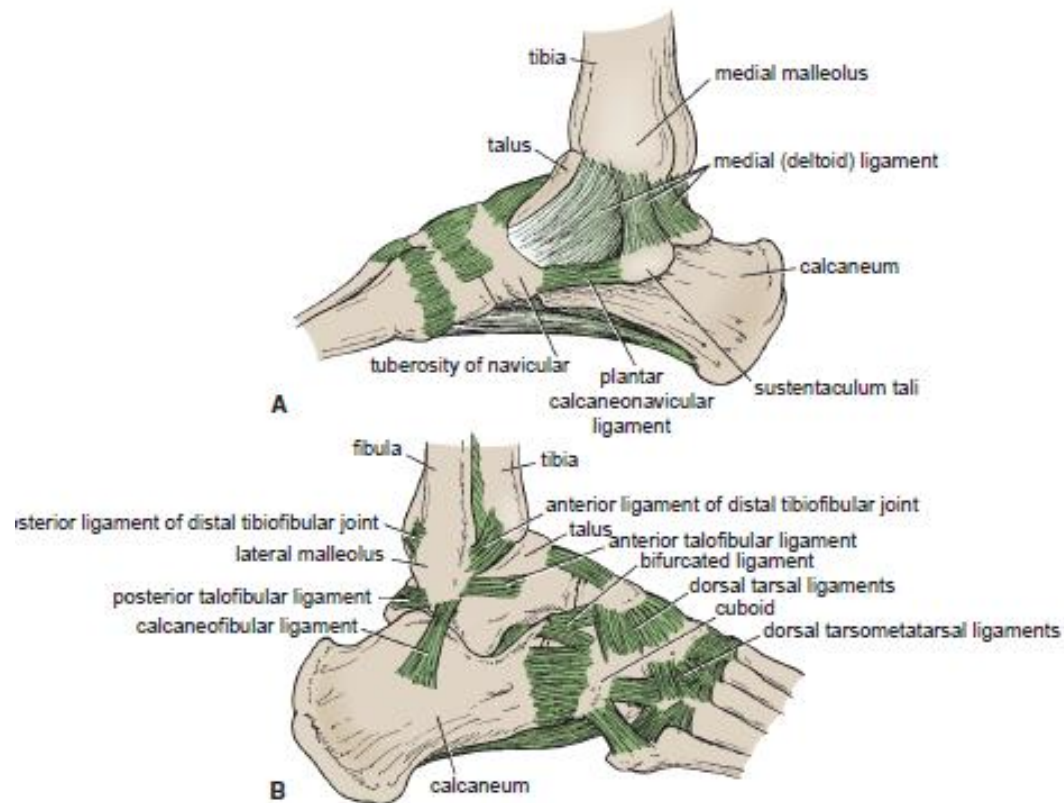


FIGURE 10.64 The right ankle joint as seen from the medial aspect (A) and the lateral aspect (B).

- The **lateral ligament** is weaker than the medial ligament and consists of three bands.
 - The **anterior talofibular ligament** runs from the lateral malleolus to the lateral surface of the talus.
 - The **calcaneofibular ligament** runs from the tip of the lateral malleolus downward and backward to the lateral surface of the calcaneum.
 - The **posterior talofibular ligament** runs from the lateral malleolus to the posterior tubercle of the talus.

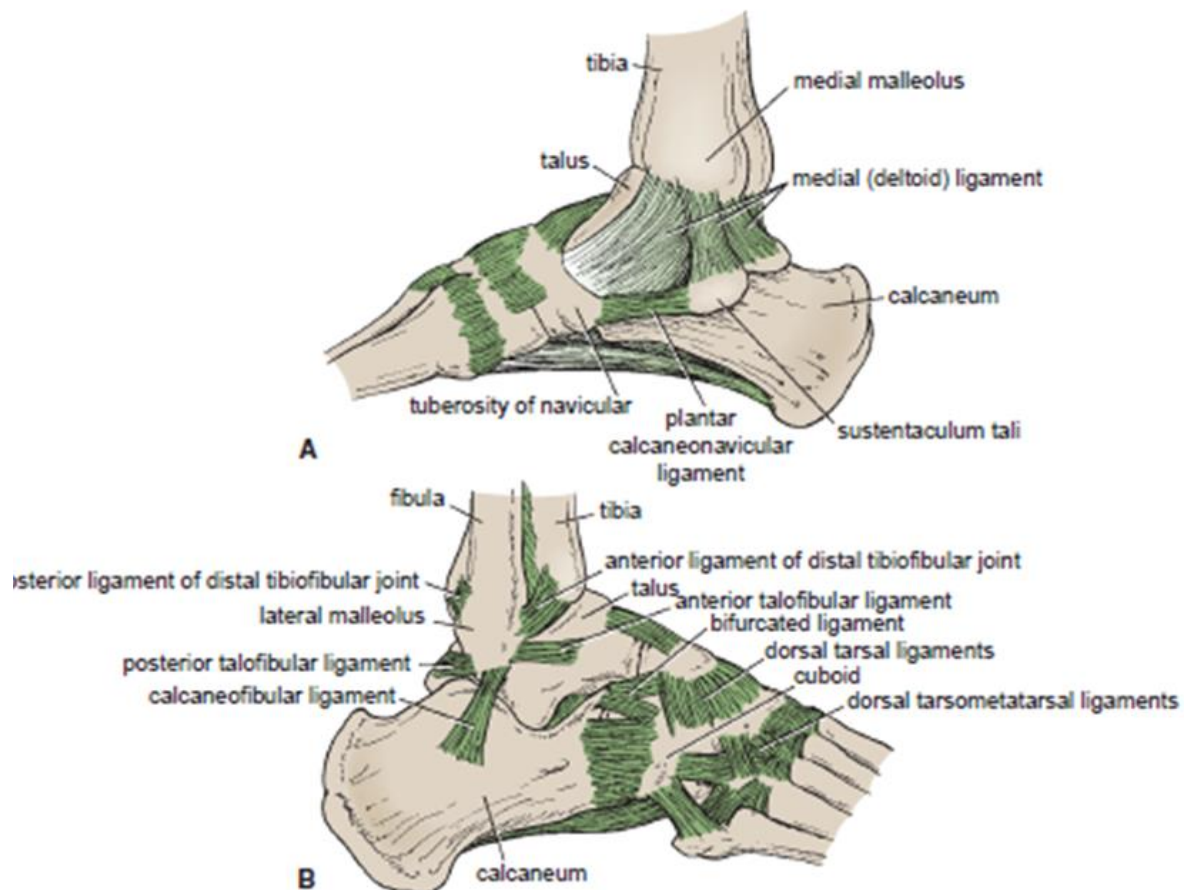


FIGURE 10.64 The right ankle joint as seen from the medial aspect (A) and the lateral aspect (B).

Movements

- **Dorsiflexion** is performed by the tibialis anterior, extensor hallucis longus, extensor digitorum longus, and peroneus tertius
- **Plantar flexion** is performed by the gastrocnemius, soleus, plantaris, peroneus longus, peroneus brevis, tibialis posterior, flexor digitorum longus, and flexor hallucis longus.

Important Relations

- **Anteriorly:** The tibialis anterior, the extensor hallucis longus, the anterior tibial vessels, the deep peroneal nerve, the extensor digitorum longus, and the peroneus tertius
- **Posteriorly:** The tendo calcaneus and plantaris
- **Posterolaterally (behind the lateral malleolus):** The peroneus longus and brevis
- **Posteromedially (behind the medial malleolus):** The tibialis posterior, the flexor digitorum longus, the posteriotibial vessels, the tibial nerve, and the flexor hallucis longus

CLINICAL

- **Acute Sprains of the “Lateral Ankle”**
 - caused by excessive inversion of the foot with plantar flexion of the ankle. The anterior talofibular ligament and the calcaneofibular ligament are partially torn, giving rise to great pain and local swelling.
- **Acute Sprains of the “Medial Ankle”**
 - less common
 - a result of excessive eversion.
 - results in the ligament pulling off the tip of the medial malleolus.

Fracture Dislocations of the Ankle Joint

- Common
- Caused by forced external rotation and overeversion of the foot
- talus is externally rotated forcibly against the lateral malleolus of the fibula...# lat and med.

Thank You