

“Don’t be afraid to give up the good to go for the great.”

Musculoskeletal Block
ANATOMY
team 435



COLORCODES

- IMPORTANT NOTES
- EXTRA NOTES
- DEFINITION

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:

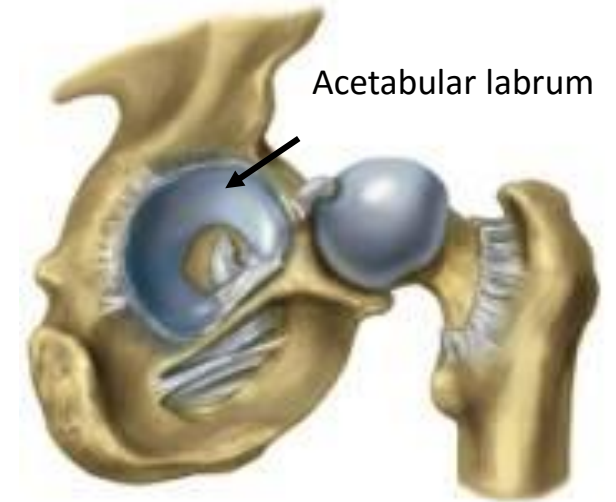
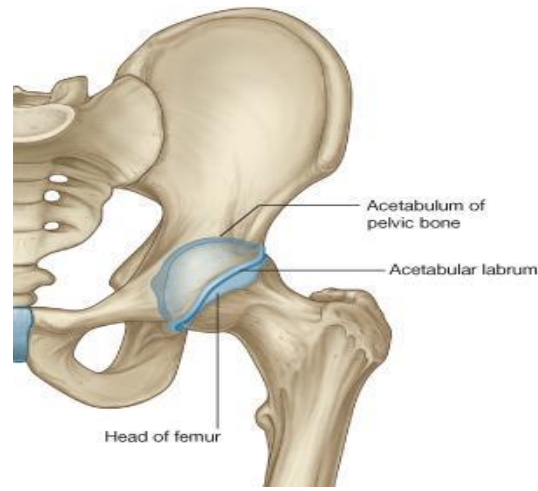
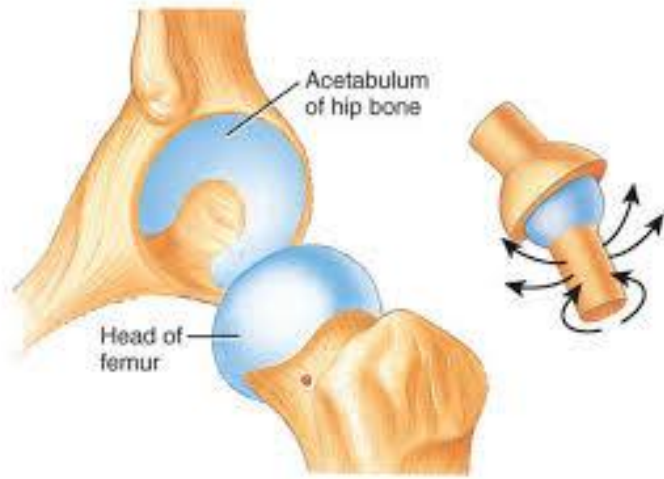
Synovial, Ball & Socket joint.
multiaxial

ARTICULAR SURFACES:

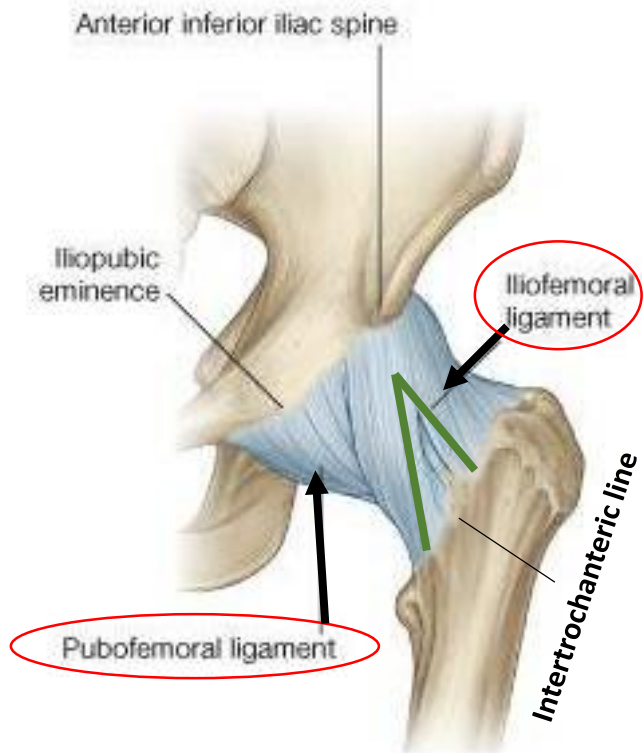
- Medially Acetabulum of hip (pelvic) bone
- laterally Head of femur

Acetabular labrum:

- **C-shaped** fibro-cartilaginous collar attached to margins of acetabulum,
increases its depth for better retaining of head of femur.



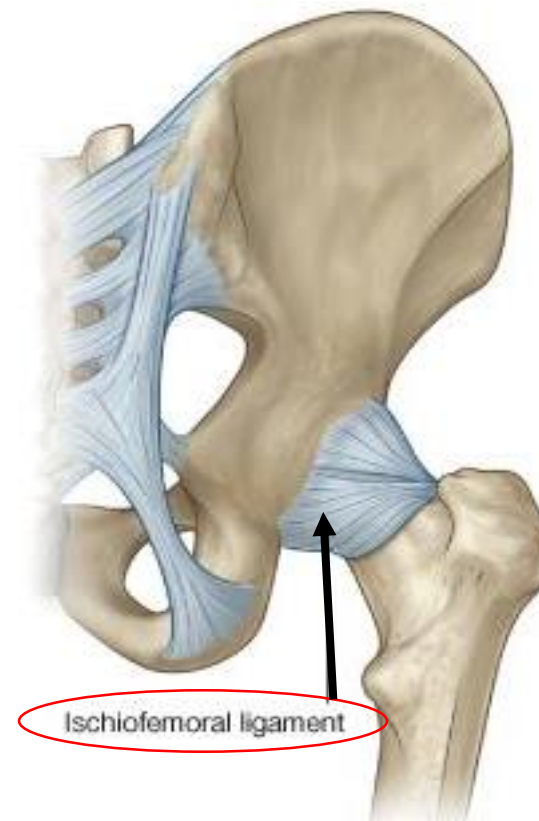
Ligaments: (3) Extracapsular



Iliofemoral ligament:

- Y-shaped (inverted Y)
- Located anterior to joint
- limits **extension**

Start from ilium (anterior inferior iliac spine) to intertrochanteric line of femur -prevent over extension of hip



Ischiofemoral ligament:

- Located posterior to joint
- limits **medial rotation**

Pubofemoral ligament:

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

Prevent over abduction



(3) Intracapsular

Transverse acetabular ligament:

converts acetabular notch into foramen through which pass acetabular vessels

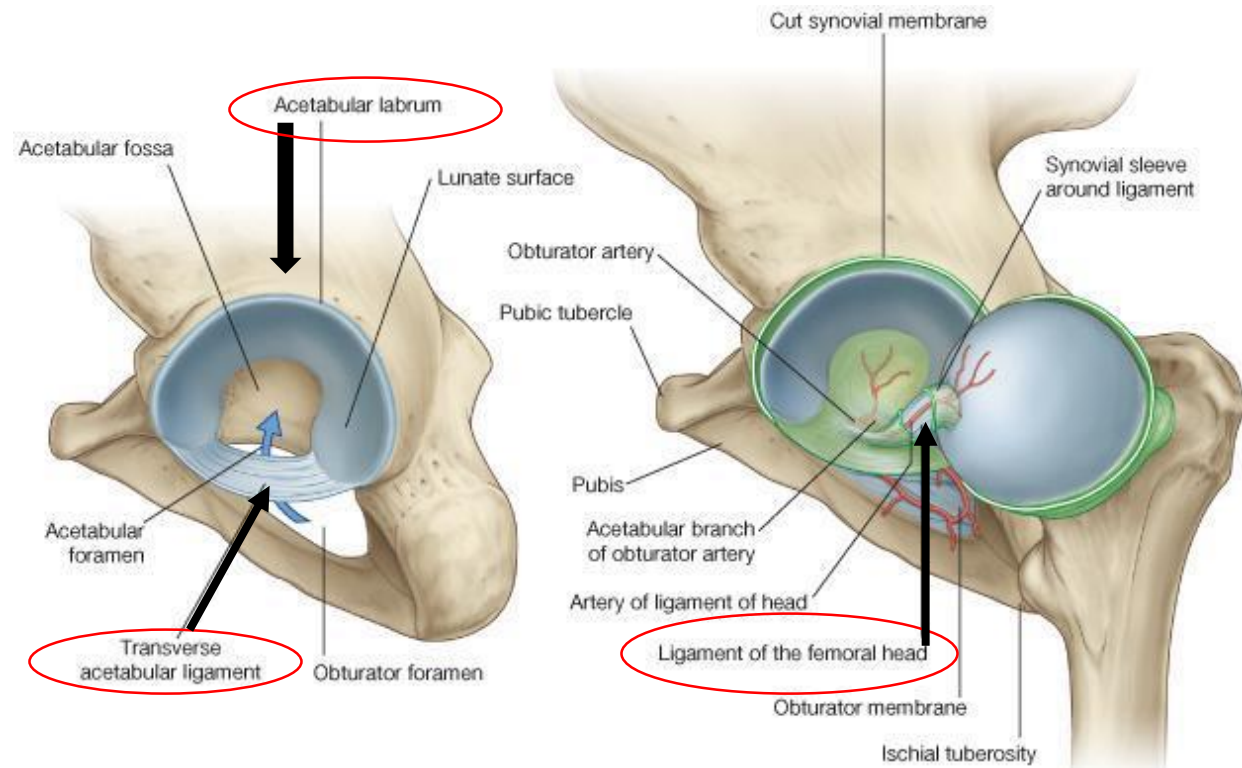
Ligament of femoral head:

carries vessels to head of femur

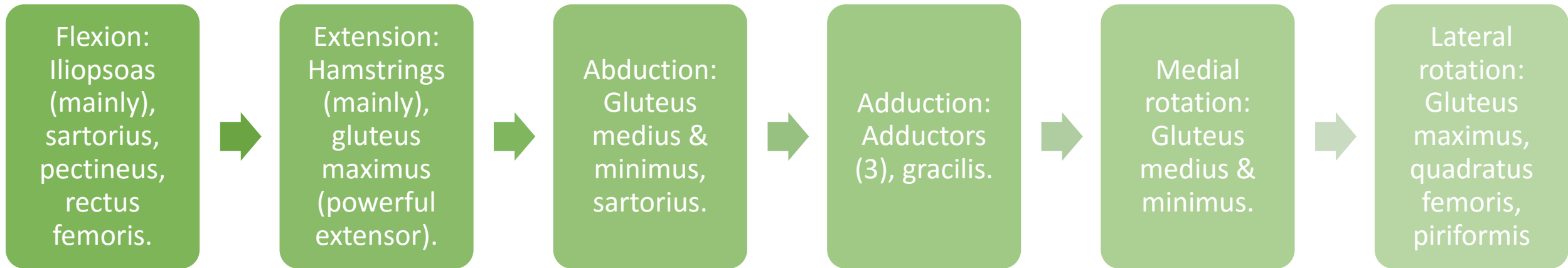
Legamentum teres (rounded)

Acetabular labrum

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



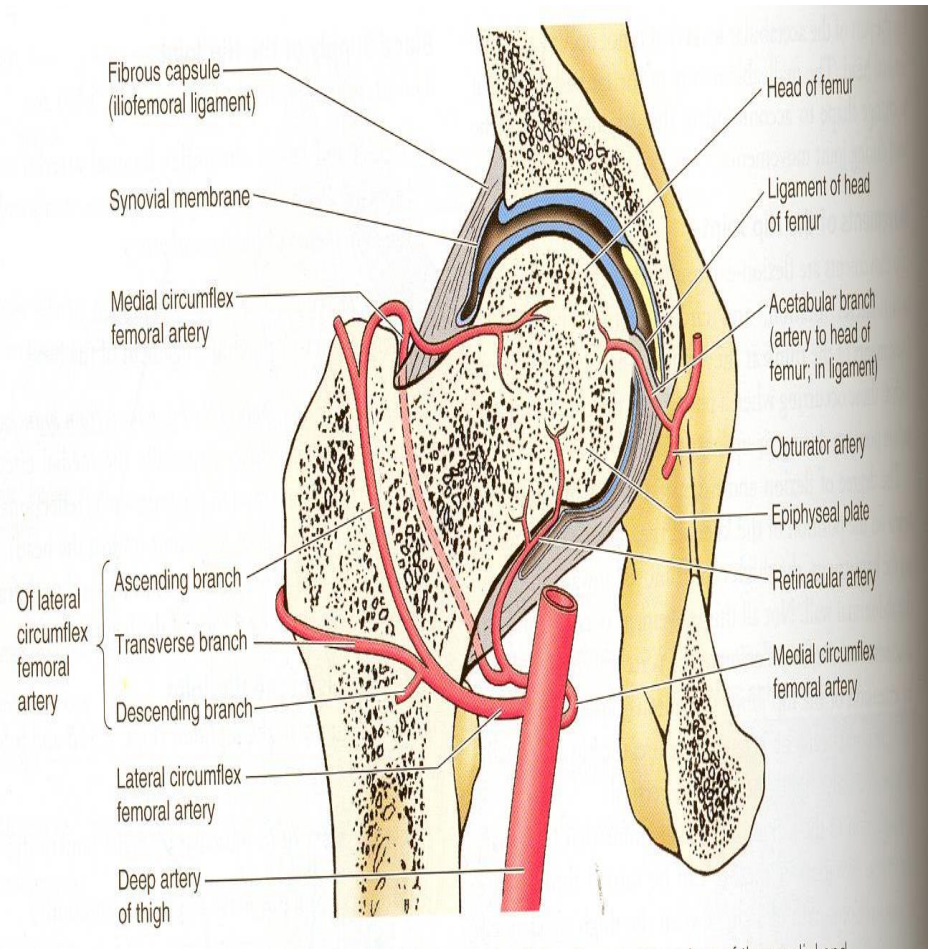
Movements



When do we use the hamstring? In the routine extension while standing
When do we use gluteus maximus? When we want it to stand and before it we were sitting (strong extensor against gravity)



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.

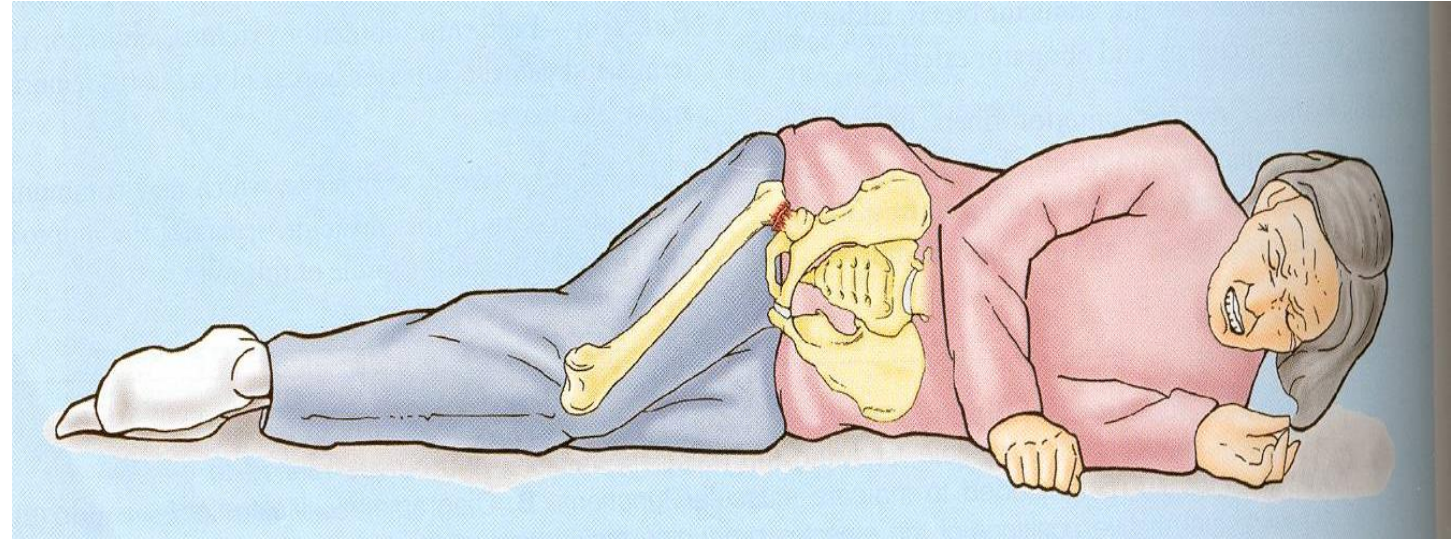
(2) Ligament of the head of the femur.

Fibres from the capsule attached to the neck of femur



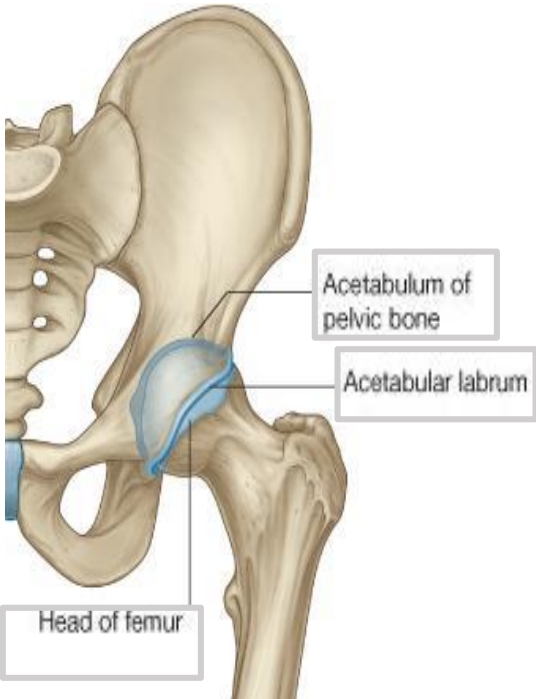
Damage of the retinacular fibers as in **fracture neck** of the femur can result in **Avascular necrosis** of the head of the femur.

-Fracture neck of the femur is common after age of (60) years especially in women because of **Osteoporosis**.



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

- 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.

كل اللي نحتاج نعرفه ان المفصل مستقر تماماً لعدة أسباب أولها إن رأس الفيمور يتناسب (بدقة) مع الاسيتايبولوم في الهيب و نقدر هنا نتذكر الشولدر جوينت كان غير مستقر لعكس هذا السبب تماماً إن رأس الهيومرس كان أكبر بكثير من القلنويد كافيتي في السكابيولا و لهذا التناسب الدقيق تفسيرات اللي هي الثلاثة المذكورة تحت أول نقطة ربما تكون موضع سؤال للسالك، الصورة في اليسار تساعدكم في فهمها، و بعد كذا السببين الأخيرين الأربطة و العضلات شيء سهل جداً

DISLOCATION OF HIP JOINT

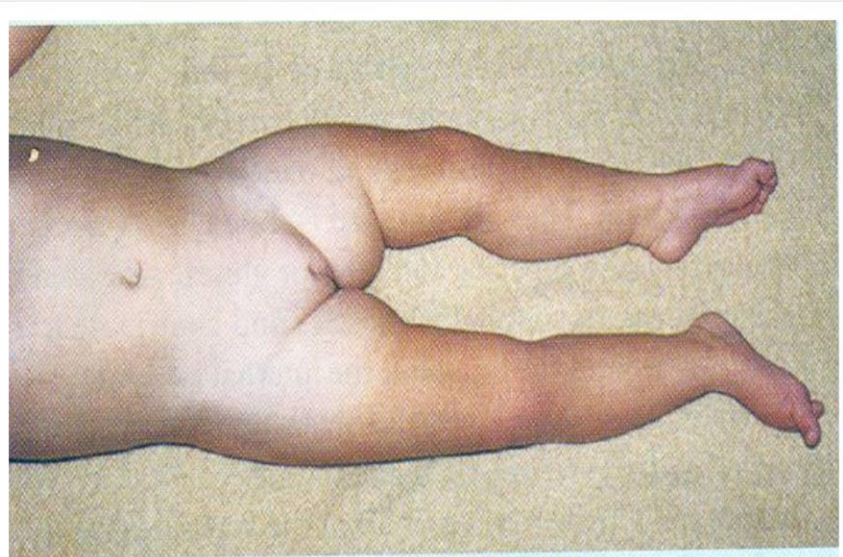
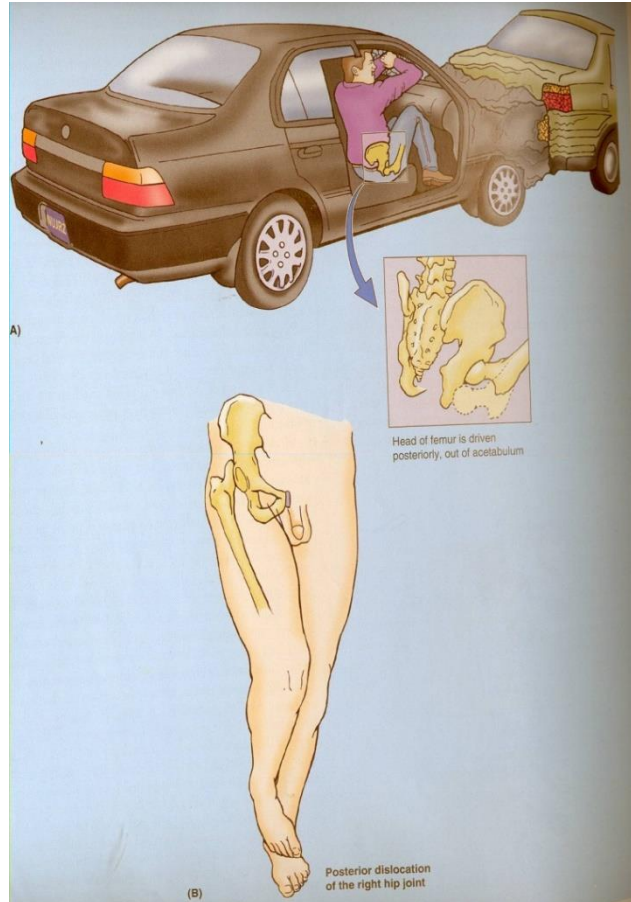


Figure 15.16 Congenital dislocation of left hip – note the extra skin creases in the upper thigh

CONGENITAL

- More common in girls and associated with inability to adduct the thigh. (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.

DISLOCATION OF HIP JOINT



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

Knee joint is formed of:

Three bones

Three articulations



Femoro-Tibial articulation: (2 joints)

between the 2 femoral condyles & upper surfaces of the 2 tibial condyles

Type: synovial, modified hinge

Femoro-Patellar articulation: (1 joint)

between posterior surface of patella & patellar surface of femur

Type: synovial, plane (no axis)

FUNCTIONS:

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



Capsule

خاصية تميزه عن المفاصل الأخرى

- knee joint's capsule is **Deficient Anteriorly**

- the capsule is replaced by 3 structures:

1- **quadriceps femoris tendon.**

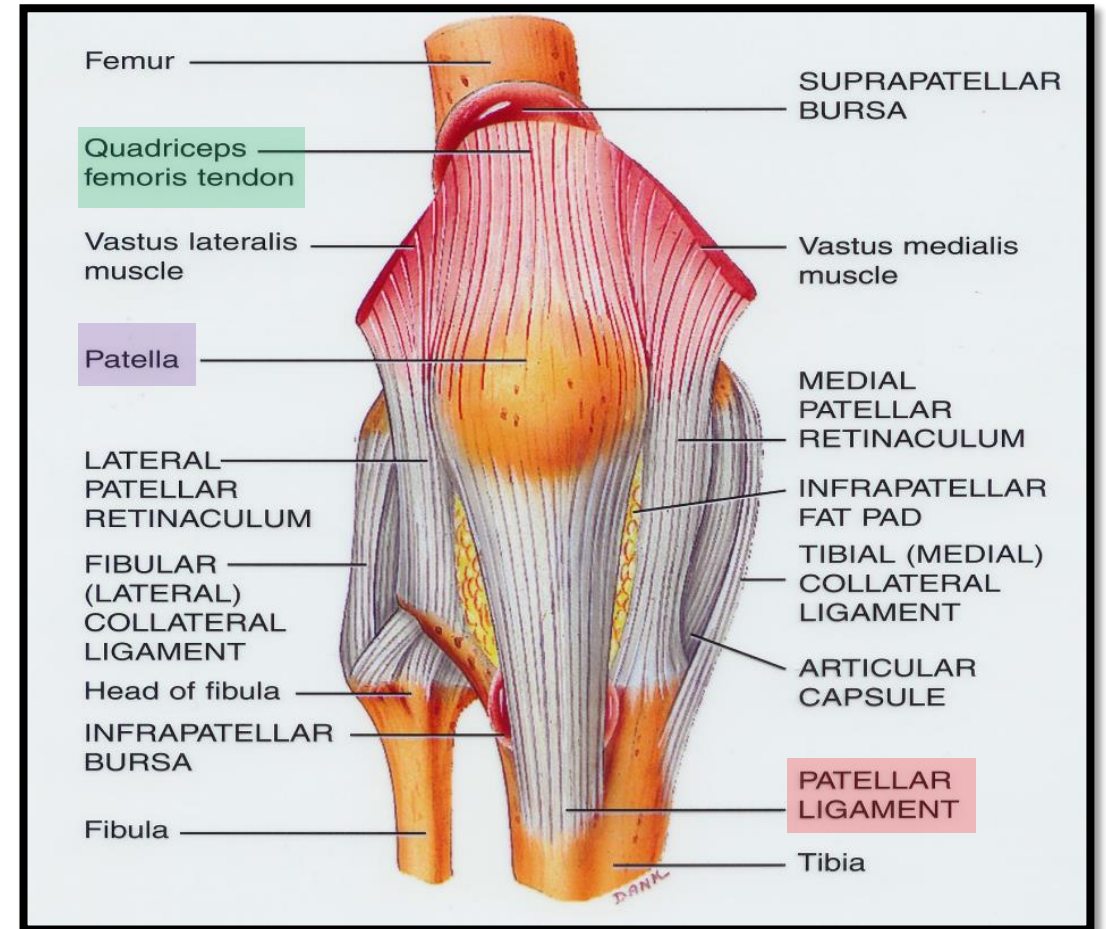
2- **patella.**

3- **ligamentum patellae.**

- It Possesses 2 openings:

one for popliteus tendon

one for communication with suprapatellar bursa.



Extracapsular ligaments

Related structures to knee joint :

Intra-capsular Structures:

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).

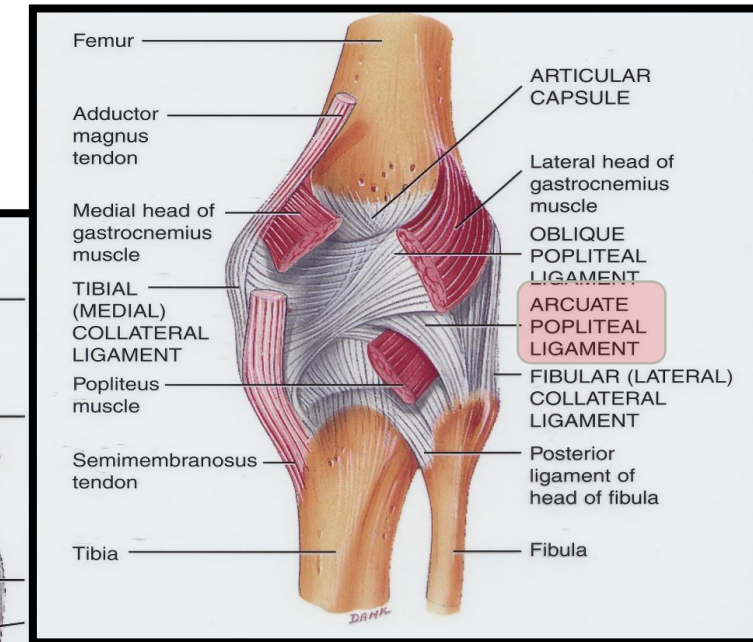
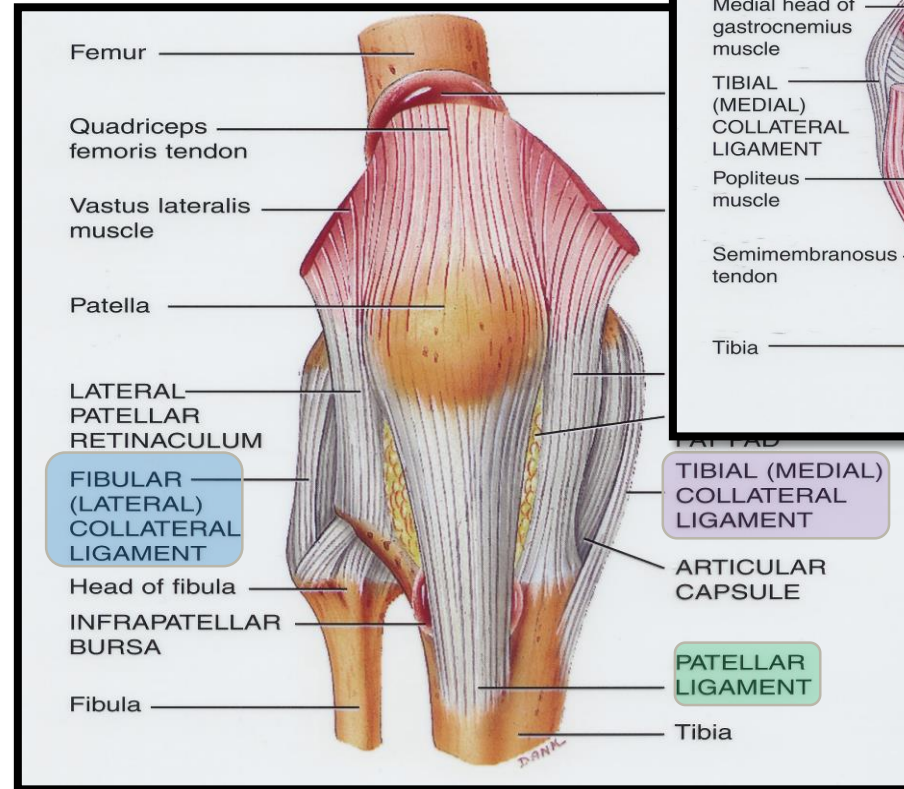
Tibia is located medially, so it goes with the medial epicondyle of femur

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**.

The Dr. said that it is very important to know that “the Oblique popliteal ligament is an extension of **semimembranosus tendon**”



Extracapsular ligaments

Related structures to knee joint :

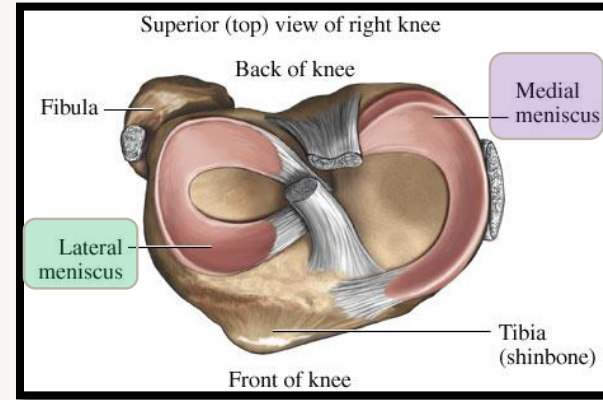
Intra-capsular Structures:

-what are they?

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



Types:

Medial Meniscus:

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

Lateral Meniscus:

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

Important: medial meniscus is less mobile (more stable) & more liable to be injured.

Menisci

CRUCIATE Ligaments

الميدان منسكس تكون مرتبطة بالـ «ميدان ليقامنت» وهذا مايجعلها مستقرة ويجعل حركتها صعبة ، وبما أن حركتها صعبة فعند حدوث إصابة لا تستطيع أن تتحرك (تهرب) حتى تتجنب الإصابة ، بينما الـ «لايترال ليقامنت» تستطيع التحرك والهرب وذلك لعدم ارتباطها بأي تركيب ، ولهذا السبب معظم الإصابة تصيب الميدان ولا تصيب اللاترال .

Extracapsular ligaments

Related structures to knee joint :

Intra-capsular Structures:

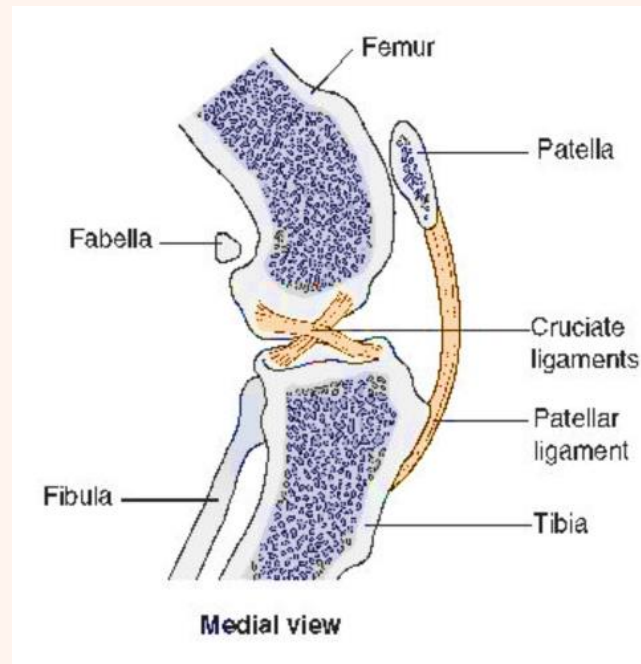
- what are they?

Two in number, situated in the middle of the joint.

- They are called :Cruciate because they cross each other.

- How did they receive the names Anterior and Posterior?

from the position of their attachments to the **tibia** (not to the femur).



Menisci

CRUCIATE Ligaments



Extracapsular ligaments

Related structures to knee joint :

Intra-capsular Structures:

Types of cruciate Ligament:

Anterior cruciate ligament	Posterior cruciate ligament
From: the anterior part of intercondylar area of tibia	From: the posterior part of intercondylar area of tibia
To: the posterior part of lateral condyle of femur .	To: the anterior part of medial condyle of femur
Function: it Prevents: - The posterior displacement of the femur on the tibia. - the tibia from being pulled anteriorly when the knee joint is extended.	Function: it Prevents: - The anterior displacement of the femur on the tibia. - the tibia from being pulled posteriorly when the knee joint is flexed.
It is taught in Hyper extension	It is taught in Hyper flexion
- تمنع التثبيت من تقدمها إلى الأمام، وتمنع الفيمر من الرجوع إلى الخلف.	- تمنع التثبيت من الرجوع إلى الخلف، وتمنع الفيمر من التقدم إلى الأمام.

Menisci

CRUCIATE Ligaments



Bursae Related to Knee joint

Suprapatellar bursa:

- between femur & quadriceps tendon.
- communicates with synovial membrane of knee joint.

Deep infrapatellar bursa:

- between tibia & ligamentum patella.

Popliteal bursa:

- between popliteus tendon & capsule.
- communicates with synovial membrane of knee joint.

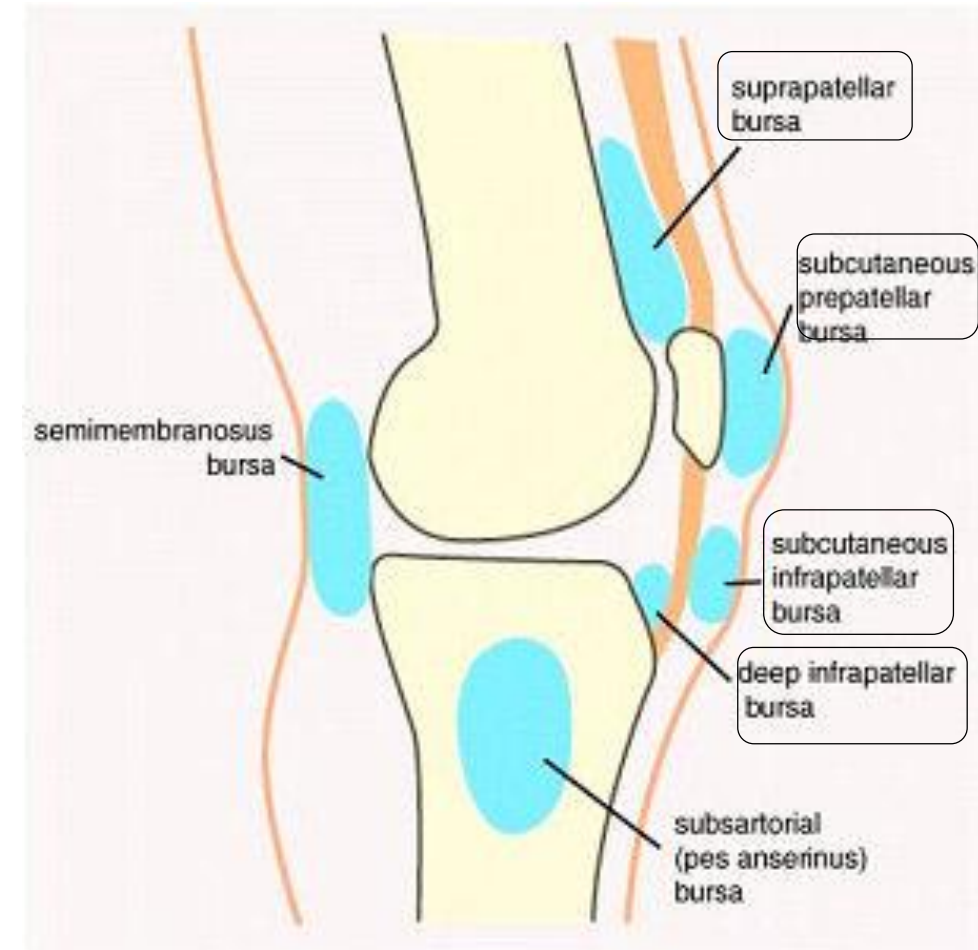
Prepatellar bursa:

- between patella & skin.

It's also called House- made bursa

Subcutaneous infrapatellar bursa:

- between tibial tuberosity & skin.



Swelling or infection in the cavity will cause swelling in the bursa and vice versa

Flexion:

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

Extension:

Quadriceps femoris.

Movements

Active rotation (performed when knee is flexed):

A) Medial rotation:

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

Active rotation (performed when knee is flexed):

B) Lateral rotation:

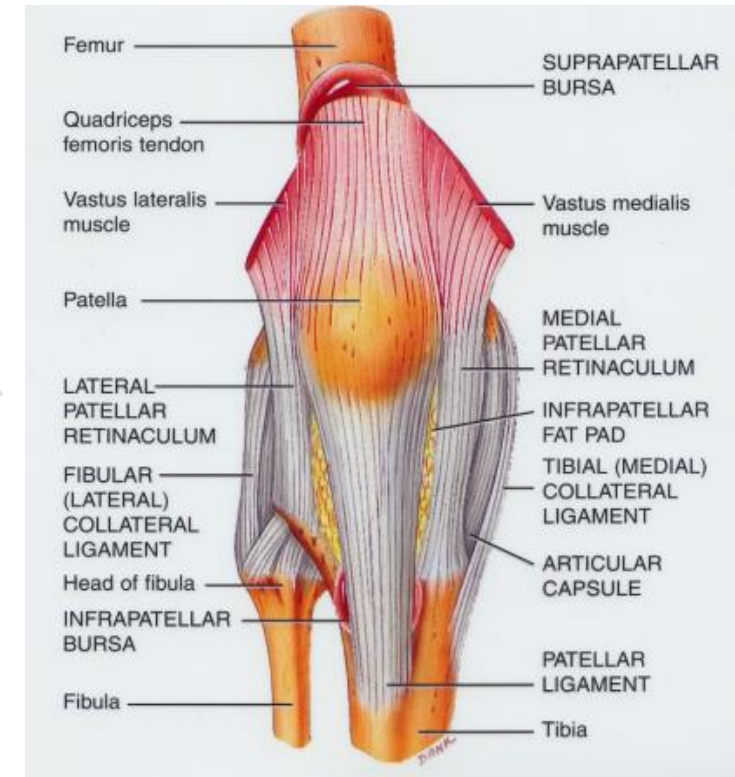
Biceps femoris



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).



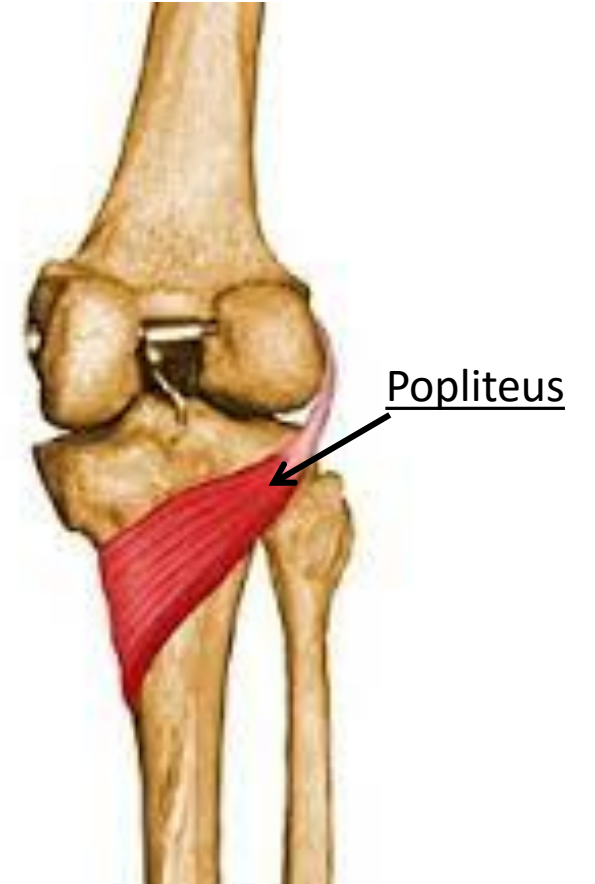
Inactive (Dependent) Rotation

Unlocking Of Knee

Before flexion

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

In the case of medial meniscus injury → the meniscus will stay trapped between tibia and femur → joint is rigid (locked) even if popliteus works (joint is permanently locked so he can't run)



Stability Of The Knee Joint

1. Muscles:

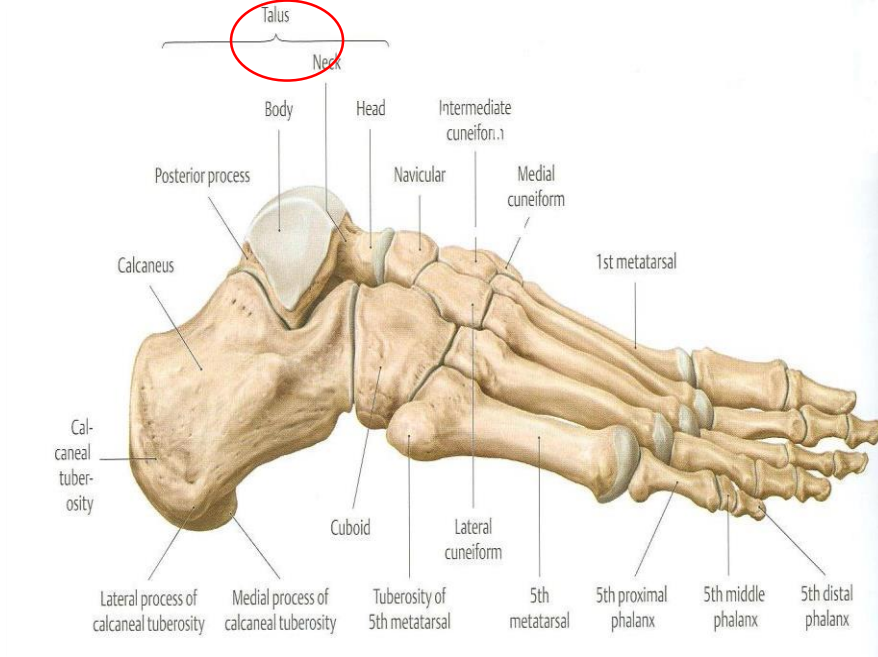
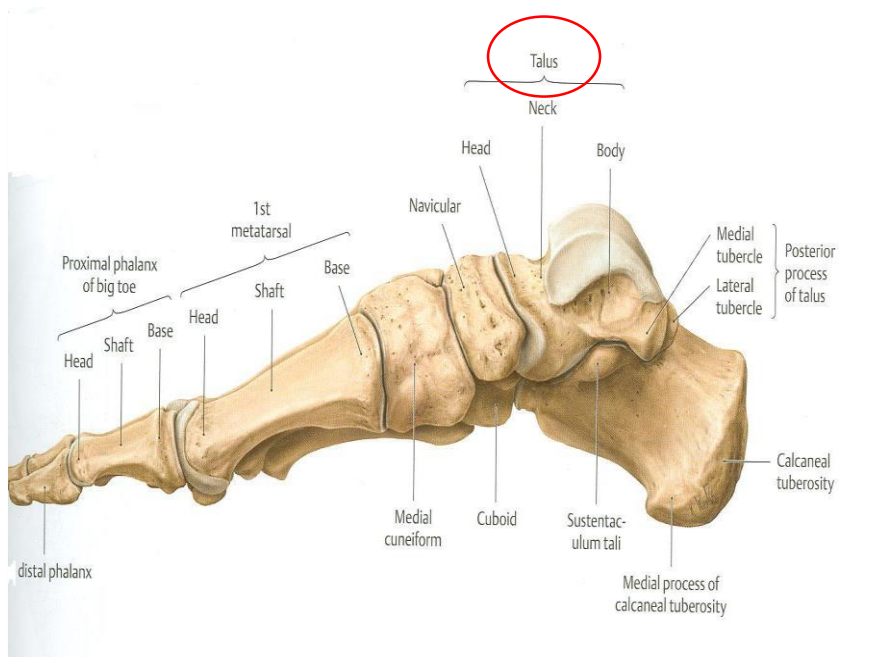
- Quadriceps particularly the inferior fibers of the Vasti lateralis and medialis.
- Many sport injuries can be preventable through appropriate training and conditioning of the muscle.

2. Ligaments:

- The knee joint can function well following a ligamentous strain if the quadriceps is intact.



Skeleton of Foot



ANKLE JOINT

synovial, hinge joint.
(Uniaxial, transverse)

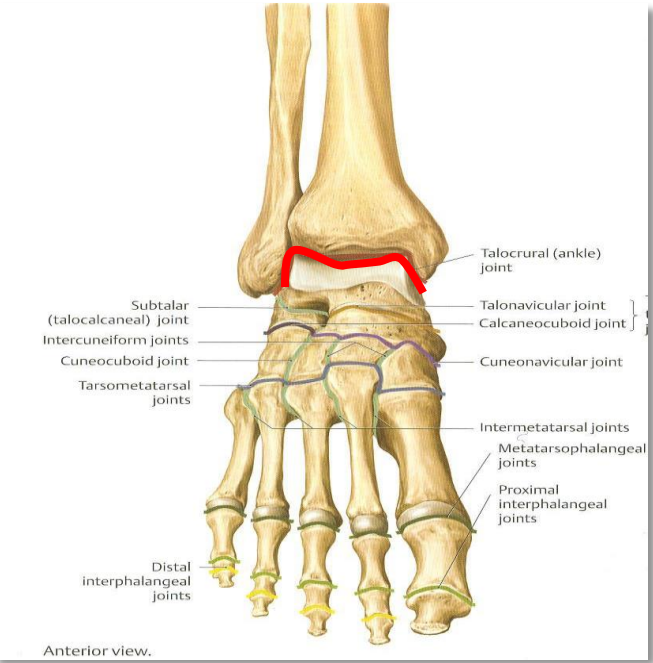
ARTICULAR SURFACES of ankle joint

UPPER: (superiorly)

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

LOWER: (inferiorly)

Body of talus.



Ligaments

Sprain in the lateral ligament is more liable

MEDIAL (DELTOID) LIGAMENT:

A strong triangular ligament.

Base: subdivided into 4 parts:

Apex: attached to medial malleolus.

Anterior tibiotalar part.

Tibionavicular part.

Tibiocalcaneal part.

Posterior tibiotalar part.

LATERAL LIGAMENT:

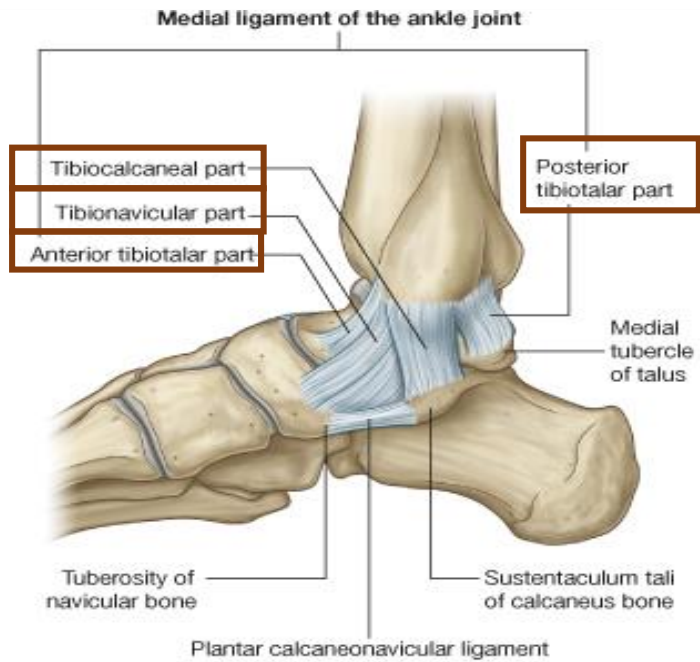
Composed of 3 separate ligaments

Anterior talofibular ligament.

Calcaneofibular ligament.

Posterior talofibular ligament.





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MEDIAL LIGAMENT



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LATERAL 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** (most important.)
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 'inferior to ankle) 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”.



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	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
	Intracapsular	Transverse acetabular ligament	Converts acetabular notch → foramen "acetabular vessels pass through it"
		Ligament of femoral head	carries vessels to head of femur
		Acetabular labrum	-
Movements		<ul style="list-style-type: none"> • <u>Flexion</u>: Iliopsoas (mainly), sartorius, pectineus, rectus femoris. • <u>Extension</u>: Hamstrings (mainly), gluteus maximus (powerful extensor). • <u>Abduction</u>: Gluteus medius & minimus, sartorius. • <u>Adduction</u>: Adductors, gracilis. • <u>Medial rotation</u>: Gluteus medius & minimus. • <u>Lateral rotation</u>: Gluteus maximus, quadratus femoris, piriformis, obturator externus & internus 	

Hip joint

Blood supply		<p>Mainly from branches of the circumflex femoral arteries especially the <u>medial</u>. The blood passes to the joint through :</p> <p>(1) Retinacular fibers of the neck. (2) Ligament of the head of the femur.</p>
Damage of the retinacular fibers		<ul style="list-style-type: none"> • happens in: fracture <u>neck</u> of the femur. • results in: a vascular necrosis of the <u>head</u> of the femur. • common after age of (60) years especially in women <u>because of osteoporosis</u>.
Stability		<p>it is one of the most stable joints of the body because of :</p> <ul style="list-style-type: none"> • The Head of the femur fits very accurately in the acetabulum due: <ol style="list-style-type: none"> 1. Deep acetabulum "its depth is increased by the labrum acetabular". 2. The labrum acetabulare forms a firm grip on the head of the femur. 3. The atmospheric pressure resists separation. • The three strong <u>Extrinsic ligaments</u>. • The surrounding strong <u>Muscles</u>.
Dislocation	Congenital	<ul style="list-style-type: none"> • More common in girls and associated with inability to adduct the thigh • The upper lip of the acetabulum fails to develop adequately. • head of the femur rides up out of the acetabulum onto the gluteal surface of the ileum.
	Traumatic	<ul style="list-style-type: none"> • 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

Function	<ol style="list-style-type: none"> 1. Weight bearing. 2. Essential for daily activities: standing walking & climbing stairs. 3. The main joint responsible for sports: running, jumping , kicking etc 			
Formed of	Three bones	Femur – tibia – patella		
	Three articulations	2 Femoro-Tibial articulation	Between femoral condyles + tibial condyles “on each side”	<ul style="list-style-type: none"> * synovial * modified hinge
		1 Femoro-Patellar articulation	between posterior surface of patella + patellar surface of femur	<ul style="list-style-type: none"> * synovial * plane
Capsule	<ul style="list-style-type: none"> • <u>Deficient Anteriorly & replaced by:</u> quadriceps femoris tendon, patella & ligamentum patellae. • <u>Possesses 2 openings:</u> one for popliteus tendon & one for communication with suprapatellar bursa. 			
Movement	<ul style="list-style-type: none"> • <u>flexion:</u> Mainly by (hamstring muscles, biceps femoris, semitendinosus & semimembranosus). Assisted by (sartorius , gracilis & popliteus) • <u>Extension:</u> Quadriceps femoris. • <u>Active rotation (performed when knee is flexed):</u> <ol style="list-style-type: none"> 1. <u>Medial rotation:</u> Mainly by (semitendinosus & semimembranosus). Assisted by (sartorius & gracilis). 2. <u>Lateral rotation:</u> by Biceps femoris 			

Knee joint

Extracapsular structures	Ligamentum patellae		from patella to tibial tuberosity		
	Medial (tibial) collateral ligament		from medial epicondyle of femur to medial meniscus		
	Lateral (fibular) collateral ligament		from lateral epicondyle of femur to head of fibula		
	Oblique popliteal ligament		extension of semimembranosus tendon		
Intracapsular structures	Menisci <ul style="list-style-type: none"> • 2 C-shaped plates of fibro-cartilage • They deepen articular surfaces • 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 the capsule & medial collateral ligament. It less mobile & more liable to be injured		
	Cruciate Ligaments <ul style="list-style-type: none"> • 2 ligaments in the middle of the joint • Cruciate because they cross each other • Named according to the position of their attachments to the tibia. 	ACL	Extends from anterior part of intercondylar area of tibia to posterior part of <u>lateral</u> condyle of femur	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 <u>Hyper-extension</u>	
		PCL	Extends from posterior part of intercondylar area of tibia to anterior part of <u>medial</u> condyle of femur	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 <u>Hyper-flexion</u>	

Knee joint

Bursae	Suprapatellar bursa	<ul style="list-style-type: none"> • between femur & quadriceps tendon • <u>communicates</u> with synovial membrane of knee joint
	Prepatellar bursa	<ul style="list-style-type: none"> • between patella & skin
	Deep infrapatellar bursa	<ul style="list-style-type: none"> • between tibia & ligamentum patella
	Subcutaneous infrapatellar bursa	<ul style="list-style-type: none"> • between tibial tuberosity & skin
	Popliteal bursa	<ul style="list-style-type: none"> • between popliteus tendon & capsule • <u>communicates</u> with synovial membrane of knee joint
Inactive (dependent) rotation	Locking of knee	<ul style="list-style-type: none"> • The joint assumes the position of full extension. • It becomes a rigid structure. • The menisci are compressed. • Results mainly by tension of anterior cruciate ligament. • Tightening of all the major ligaments. • <u>The femur is medially rotated on the tibia (Lateral rotation of tibia).</u>
	Unlocking of knee	<ul style="list-style-type: none"> • <u>Medial rotation of tibia (Lateral rotation of femur)</u>, at the beginning of flexion • Performed by <u>Popliteus</u> to relax ligaments & allow easy flexion

Knee joint

stability	<ol style="list-style-type: none"> <u>Muscles</u> : Quadriceps (the inferior fibers of the Vasti lateralis and medialis). Sport injuries can be preventable through appropriate training of the muscle. <u>Ligaments</u> : The knee joint can function well following a ligamentous strain if the quadriceps is intact.
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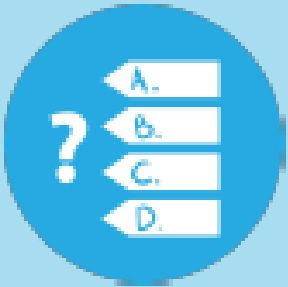
Ankle joint

Type	Synovial hinge joint	
Articular surfaces	<u>Upper</u> : socket formed by: lateral malleolus, the lower end of tibia & medial malleolus	
	<u>Lower</u> : body of talus	
Ligaments	<u>Medial (deltoid) ligament</u>	Apex → attached to medial malleolus. Base → subdivided into 4 parts: (Anterior tibiotalar part + Tibionavicular part + Tibiocalcaneal part + Posterior tibiotalar part)
	<u>Lateral ligament</u>	(Anterior talofibular ligament + Calcaneofibular ligament + Posterior talofibular ligament)
Movement	Dorsiflexion	Muscles of <u>anterior</u> compartment of leg
	Planterflexion	Initiated by soleus and aintained by gastrocnemius. Assisted by other muscles in <u>posterior&lateral</u> compartment of leg.
	Inversion & eversion	on the talo-calcaneo-navicular (subtalar) joint (Not on ankle joint)

HILTON'S law: "the joint is supplied by branches from nerves supplying muscles acting on it"



[Knee Ligaments.](#)



<https://www.onlineexambuilder.com/anatomy-last/exam-53235>

هذا العمل إجتهد من طلاب و طالبات
إن أصبنا فمن الله وإن أخطأنا فمن أنفسنا و من الشيطان

TEAM MEMBERS:

Shahad AlEnazi

Monirah Alsalouli

Sara Alenazy

Lamy Alsaghan

Nouf Alabdulkarim

Ola Alnuhayer

Johara Almalki

TEAM LEADERS:

Bodour Julaidan

Elham Alzahrani

Abdullah Alfuraih

- For questions and suggestions you can contact us on Anatomy435@gmail.com

