MED437
KING SAUD UNIVERSITY

ANATOMY
Team 437

Hip, Knee & Ankle joints

Lecture 19

تحت المراجعة
غيداء آل مهمع
&
عبدالرحمن الحيسوني

Please check our Editing File.

هذا العمل لا يغني عن المصدر الأساسي للمذاكرة

{وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ}

ملاحظة: السلايدات كثيرة بس تراها سهلة مرة :)

Objectives

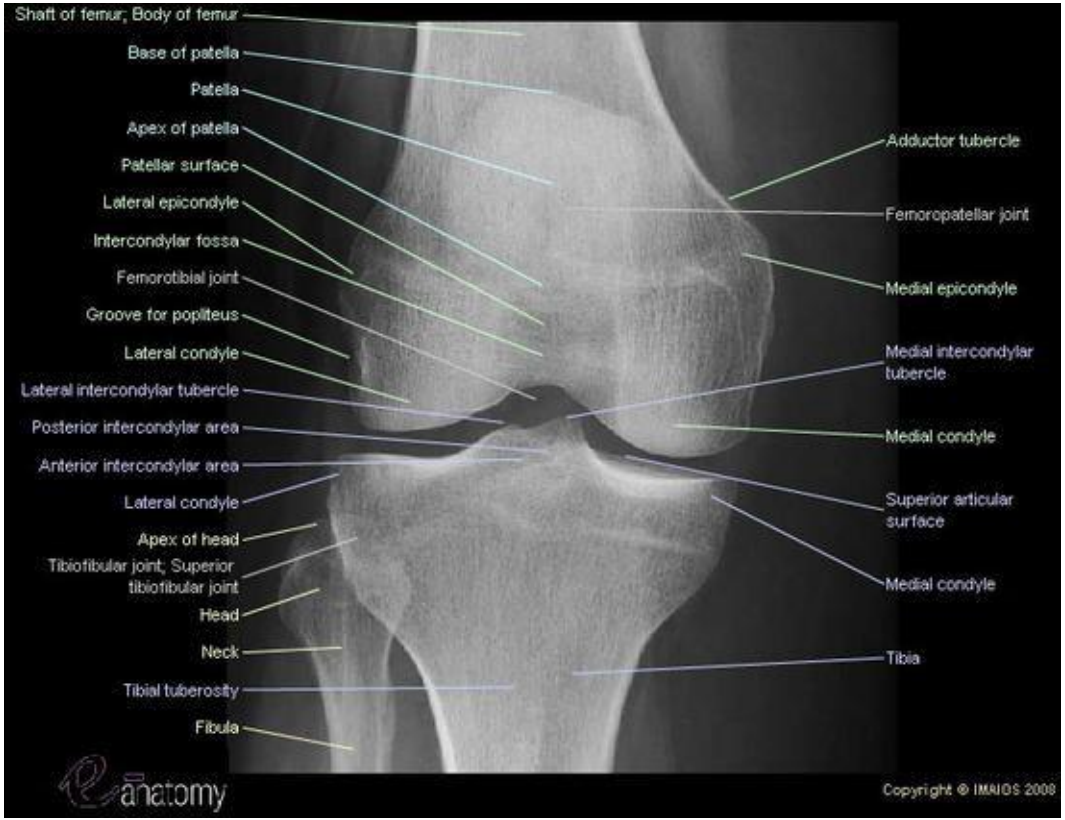
- List the **type & articular surfaces** of the hip, knee and ankle joints.
- Describe the **capsule and ligaments** of the hip, knee and ankle joints.
- Describe **movements** of hip, knee and ankle joints and list the muscles involved in these movements.
- List important **bursae** in relation to knee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

- **Text in BLUE was found only in the boys' slides**
- **Text in PINK was found only in the girls' slides**
- **Text in RED is considered important**
- **Text in GREY is considered extra notes**

Objectives (Knee Joint)

- List the **type & articular surfaces** of knee joint.
- List the **function** of knee joint.
- Describe the **capsule** of knee joint, its **extra- & intra -capsular ligaments**.
- List important **bursae** in relation to knee joint.
- Describe **movements** of knee joint.
- Describe the **stability** of knee joint.

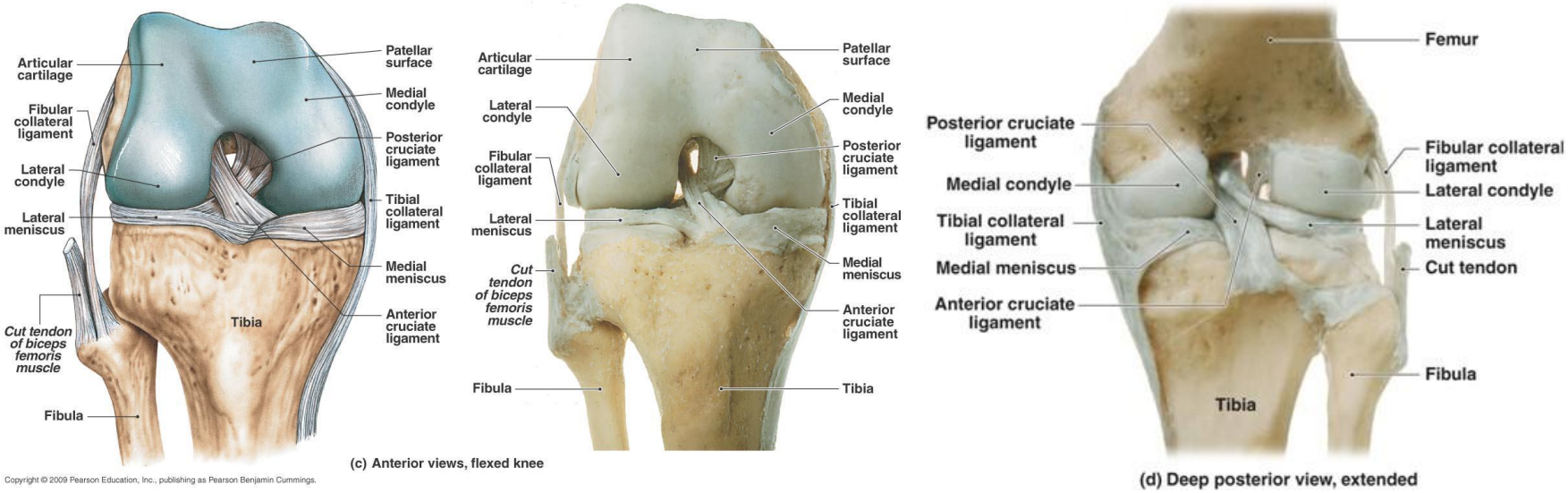
X-Ray Knee Structures (Identify)



Know the difference:

- The Condyle:
  - Is the articular surface, and it's smooth.
- The Epicondyle:
  - Is a tubercle above the Condyle.

Extra: Structures of the Knee



(c) Anterior views, flexed knee

(d) Deep posterior view, extended

Recall

Classes of Synovial Joints

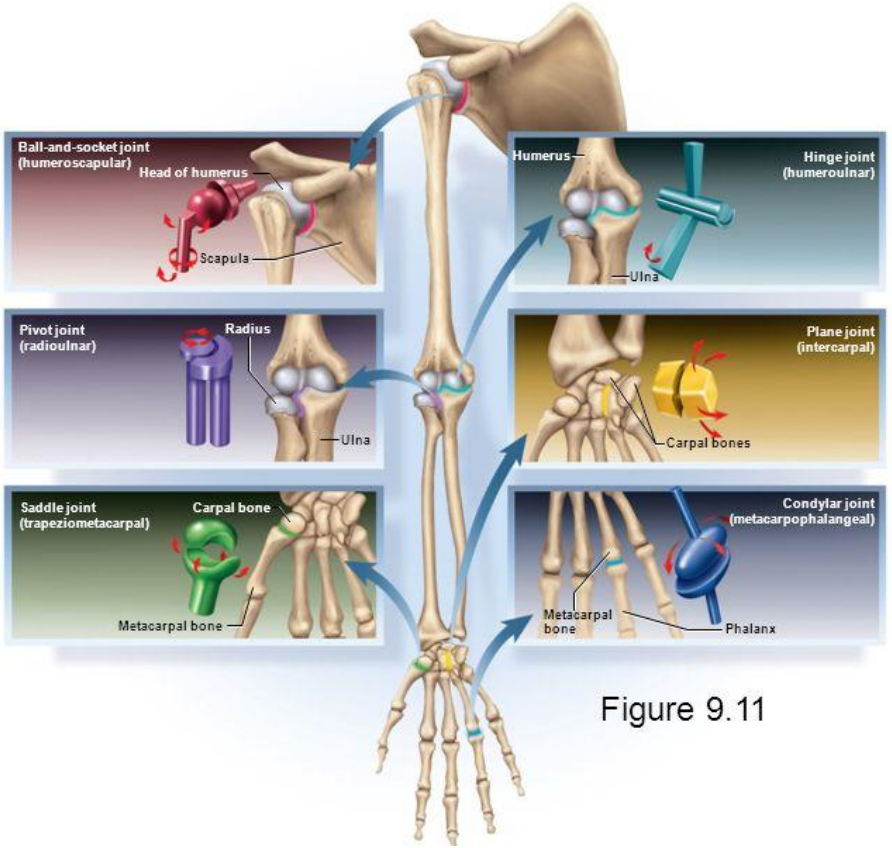


Figure 9.11

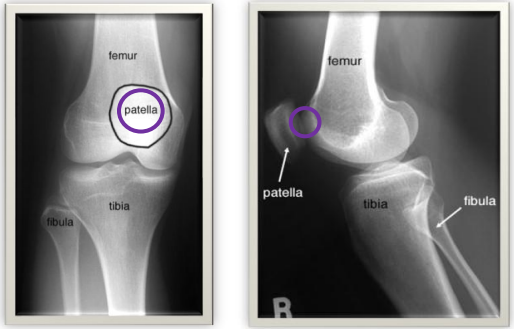
Knee Joint

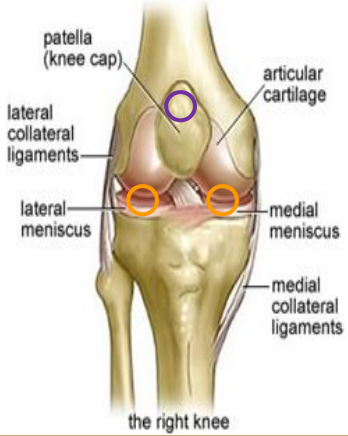
Types & Articular Surfaces

Knee joint is formed of:

- **Three bones:**
  - (Femur, Patella & Tibia)
- **Three articulations*:**
  - Two **Femoro-tibial articulations:**
    - 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***).

*First articulations does an action, the other articulation does a separate action.
A normal hinge joint can only do Flexion & Extension, but since the knee joint can also do some degree of rotation is considered as a **modified hinge joint.
***gliding





Function

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

This was in girls' slides only

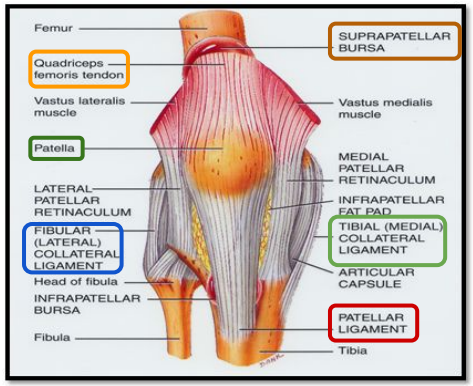
Capsule

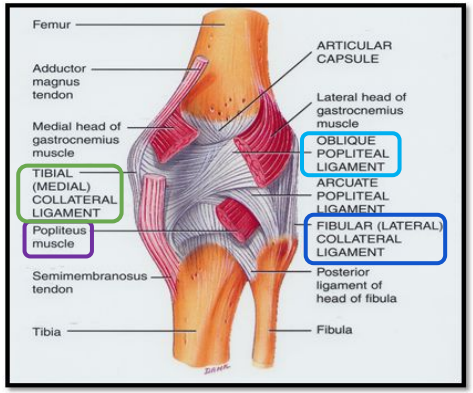
& the 4 EXTRA-CAPSULAR LIGAMENTS

- **Is deficient anteriorly & is replaced by:**
  - **Quadriceps femoris tendon.**
  - **Patella.**
  - **Ligamentum patellae**(Patellar ligament)**.**
- **Possesses 2 openings** (Posteriorly):
  - One for **Popliteus tendon***
  - One for Communication with **Suprapatellar bursa****.

*From the popliteus muscle.

**Opens in the joint cavity through an opening in the posterior part of the capsule.





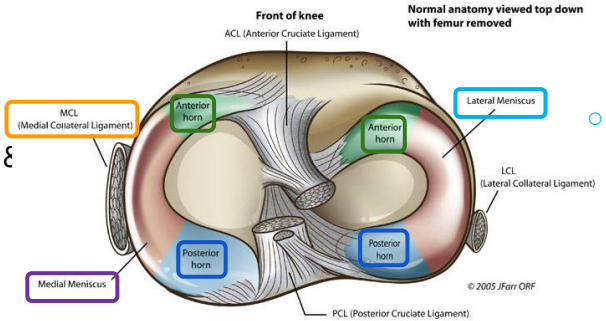
- **Ligamentum patellae (patellar ligament):**
  - From patella to tibial tuberosity.
- **Medial (tibial) collateral ligament:**
  - From medial epicondyle of femur to upper part of medial surface of tibia (firmly attached to medial meniscus).
- **Lateral (fibular) collateral ligament:**
  - From lateral epicondyle of femur to head of fibula (separated from lateral meniscus by popliteus tendon).
- **Oblique popliteal* ligament:**
  - Extension of semimembranosus tendon.

*Careful: it has **nothing** to do with Popliteal muscle.

INTRA-CAPSULAR STRUCTURES (LIGAMENTS)

Menisci

- **ATTACHMENTS:**
  - Each meniscus is attached by:
    - **Anterior** & **Posterior** horns* into upper surface of tibia.
- **FUNCTIONS:**
  - Deepen articular surfaces of tibial condyles.
  - Serve as cushions** between tibia & femur.



- **They are two C-shaped plates of fibro-cartilage:**
  - **Medial Meniscus:**
    - Large & Oval.
    - Its outer border is firmly attached to:
      - **Capsule**.
      - **Medial collateral ligament.**
  - **Lateral Meniscus:**
    - Small & Circular.
    - Its outer border is separated from lateral collateral ligament by popliteal tendon.

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

*The two ends of each meniscus are called: Horns.

**Cushion: وسادة, to absorb shocks

***Why? Because it's larger and attached to medial ligament (which is more susceptible to injury).

INTRA-CAPSULAR STRUCTURES (LIGAMENTS)

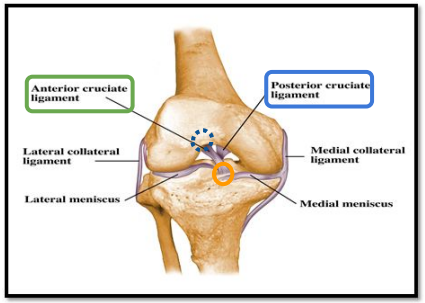
ANTERIOR & POSTERIOR CRUCIATE LIGAMENTS

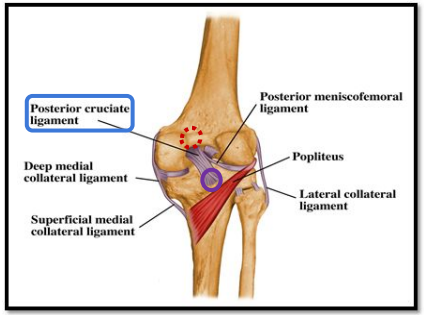
- **Two in number**, situated in the middle of the joint.^
- They are called Cruciate because they cross each other.^
- Have received the names **Anterior and Posterior**, from the position of their attachments to the tibia.^

- **ATTACHMENTS:**

- **Anterior Cruciate ligament:**
  - Extends from anterior part of intercondylar area of tibia to posterior part of lateral condyle of femur.
- **Posterior Cruciate Ligament:**
  - Extends from posterior part of intercondylar area of tibia to anterior part of medial condyle of femur.

(ACL): Start Anterior then goes: Upward, Laterally, Backward.
(PCL): Start Posterior then goes: Upward, Medially, Forward.





- **Most common injuries:**
- ACL.
- Medial Meniscus.
- Tibial Collateral Ligament.

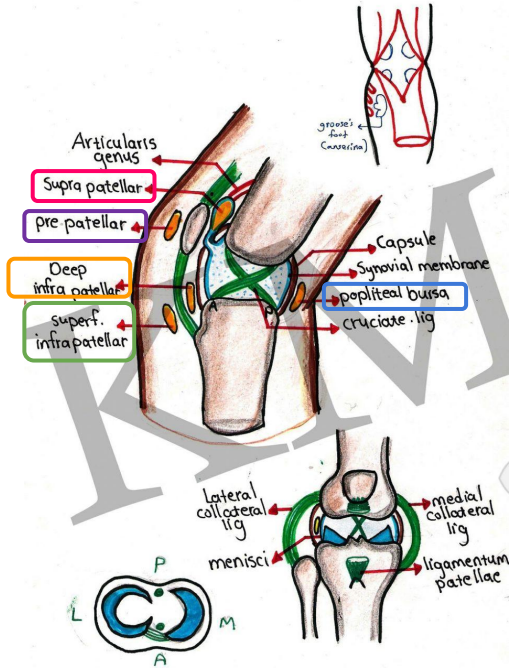
- **FUNCTIONS:**

- **Anterior Cruciate Ligament:**
  - Prevents:
    - Posterior displacement of femur on the tibia.
    - The tibia from being pulled anteriorly when the knee joint is extended.^
    - It's taught in **Hyper extension.^**
- **Posterior Cruciate Ligament:**
  - Prevents:
    - Anterior displacement of femur on tibia.
    - the tibia from being pulled posteriorly when the knee joint is flexed.^
    - It's taught in **Hyper flexion.^**

^was in girls' slides only^

Knee joint: Bursae

- **Suprapatellar bursa:**
  - Between:
    - Femur.
    - Quadriceps tendon.
  - Communicates with synovial (membrane) (cavity) of knee joint.
  - Has a clinical importance*.
- **Prepatellar bursa**:**
  - Between:
    - Patella.
    - Skin.
- **Deep Infrapatellar bursa:**
  - Between:
    - Tibia.
    - Ligamentum patella.
- **Subcutaneous infrapatellar bursa:**
  - Between:
    - Tibial tuberosity.
    - Skin.
- **Popliteal bursa:**
  - Between:
    - Popliteus tendon.
    - Capsule.
  - Communicates with synovial (membrane) (cavity) of knee joint.*



*If there's an inflammation/infection it will be transferred between the joint and this bursa.

**Another name: Housemaid Bursa. Because when housemaid sit on the floor while cleaning she presses on this bursa.

Knee joint: Movements

<table>
<tr><td></td><td colspan="4">Movements of Lower Limbs Joints</td></tr>
<tr><td></td><td colspan="4">Knee Joint</td></tr>
<tr><td>Flexion</td><td colspan="2">(Assisted By):
Sartorius
Gracilis
Popliteus</td><td colspan="2">(Mainly):
Hamstring Muscles:
- Biceps Femoris
- Semitendinosus.
- Semimembranosus.</td></tr>
<tr><td>Extension</td><td colspan="4">Quadriceps Femoris</td></tr>
<tr><td rowspan="2">Medial Rotation</td><td colspan="2">Active Rotation
(When the Knee Is Flexed)</td><td colspan="2">Inactive Rotation
(Independent)</td></tr>
<tr><td>(Mainly):
Semitendinosus
Semimembranosus</td><td>(Assisted By):
Sartorius
Gracilis</td><td rowspan="2">(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).</td><td rowspan="2">(Unlocking of Knee):
- Medial rotation of tibia (Lateral rotation of femur), at the beginning of flexion.
- Performed by <u>Popliteus</u> to relax ligaments & allow easy flexion.</td></tr>
<tr><td>Lateral Rotation</td><td colspan="2">Biceps Femoris</td></tr>
</table>

This Slide was in girls' slides only

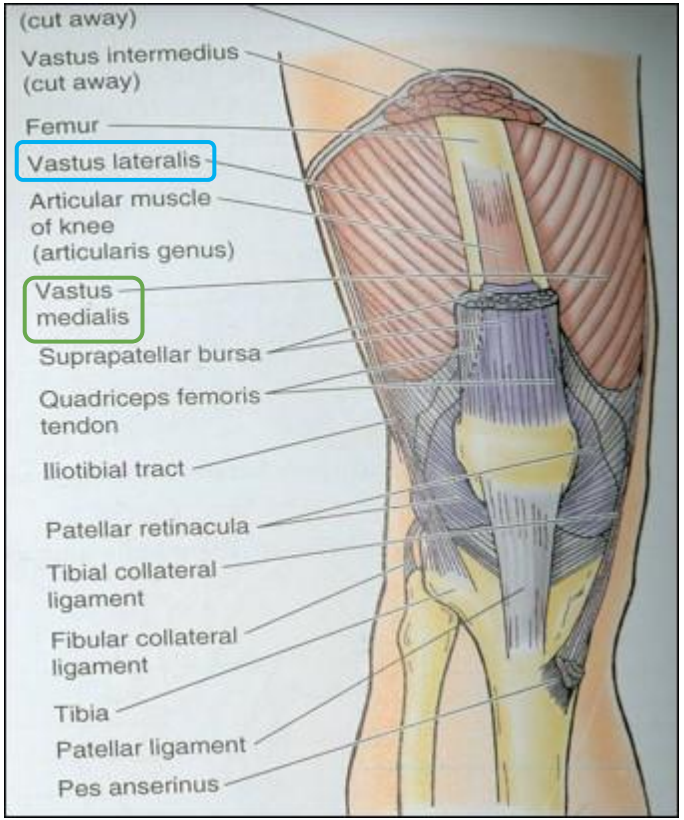
STABILITY OF THE JOINT

Maintained by*:

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

*the shape of the Bones has no role here.

**Muscles are the most important stabilizer.

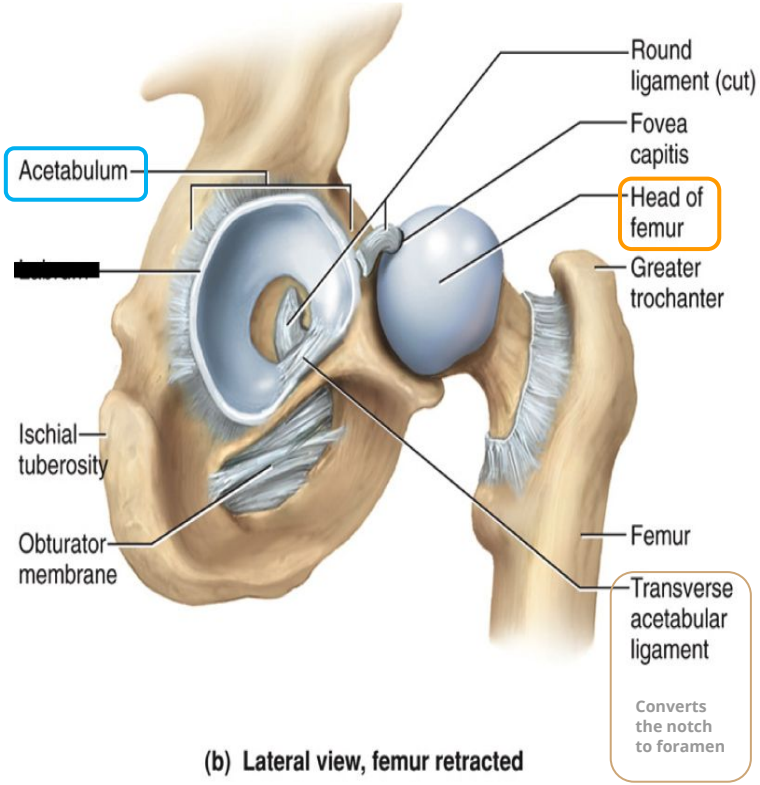


Objectives (Hip Joint)

- List the **type & articular** surfaces of hip joint.
- Describe the **ligaments** of hip joints.
- Describe the **capsule** of hip joint.
- Describe **movements** of hip joint.
- Describe the **blood supply** of hip joint.
- Describe the **avascular necrosis** & **how may it occur**.
- Describe the **stability** of hip joint.
- Mention the **types of dislocation**, and **describe** each one of it.

Hip Joint

Hip Joint		
TYPE	ARTICULAR SURFACES	Acetabular labrum
synovial, ball & socket joint (Polyaxial)	(socket) • Acetabulum of hip(pelvic) bone • Head of femur (ball)	C-shaped fibro-cartilaginous collar attached to margins of acetabulum, increases its depth for better retaining of head of femur.



(b) Lateral view, femur retracted

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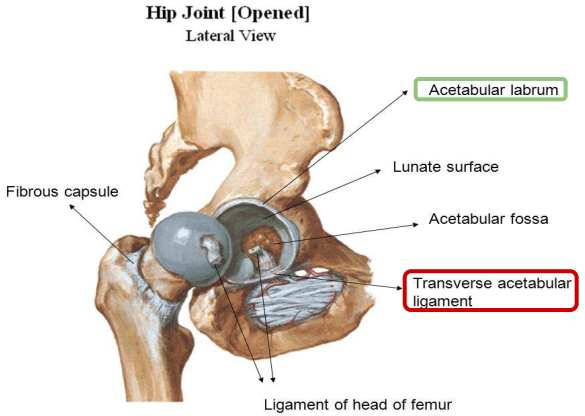
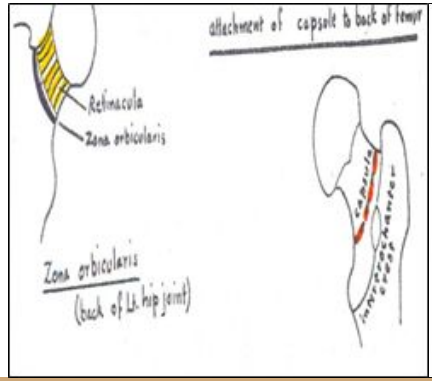
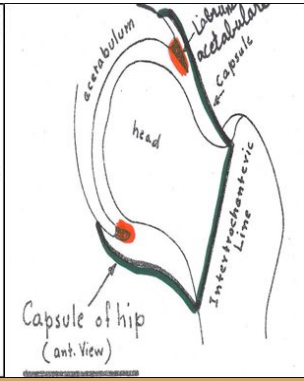
Capsule

Capsule	Medially	Attached 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

Neck of Femur is:
- Fully Covered Anteriorly.
- Only Upper Part Covered Posteriorly.







Ligaments of Hip Joint

3 EXTRACAPSULAR:

- **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.

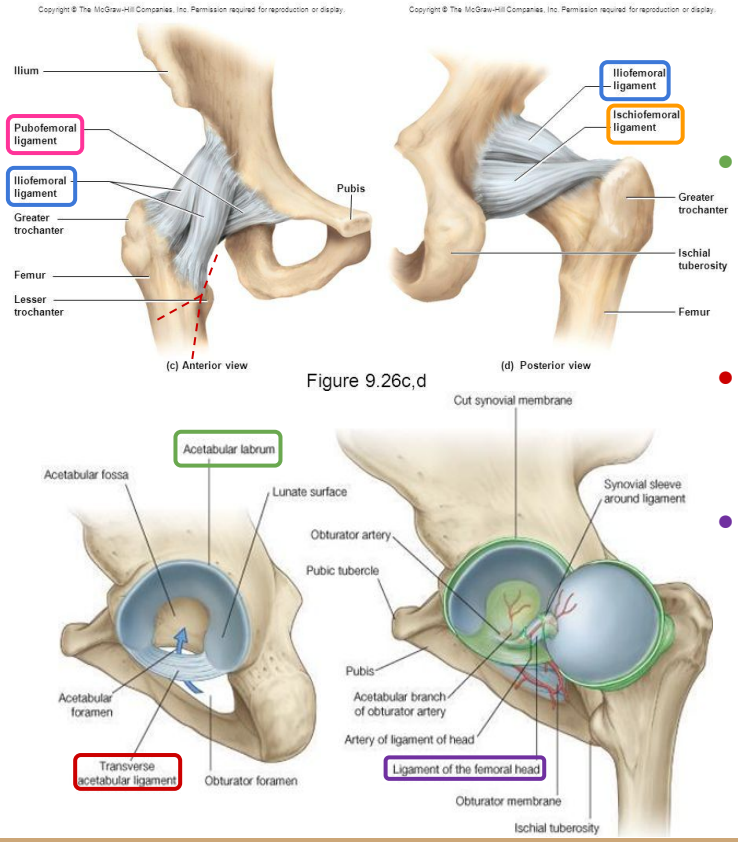
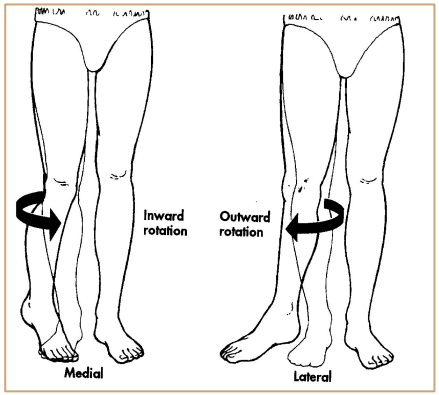


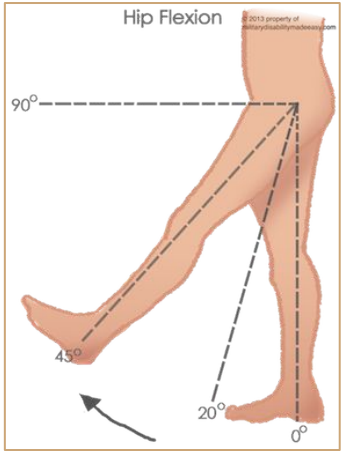
Figure 9.26c,d

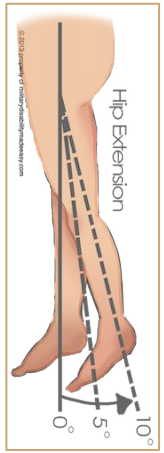
3 INTRACAPSULAR:

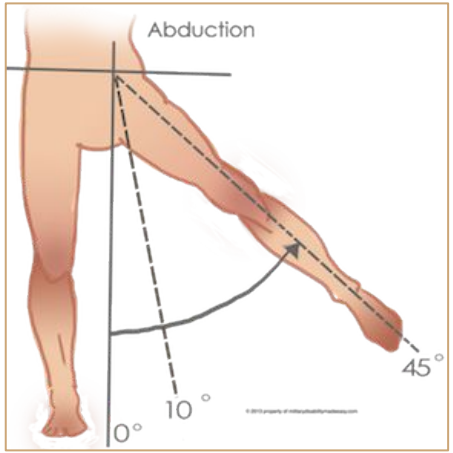
- **Acetabular labrum:**
  - Fibro-cartilaginous collar* attached to margins of acetabulum to increase its depth for better retaining of head of femur.
- **Transverse acetabular ligament:**
  - Converts acetabular notch into foramen through which pass acetabular vessels.
- **Ligament of femoral head:**
  - Carries vessels to head of femur.

Movements of Hip Joint







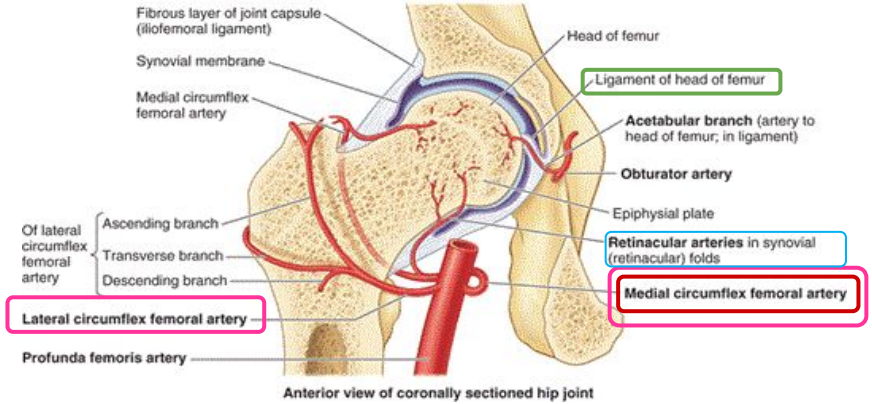


	Movements of Lower Limbs Joints
	Hip Joint
Flexion	Iliopsoas (Main Flexor) Pectineus Rectus Femoris Sartorius
Extension	Hamstrings (Mainly) (while standing) Gluteus Maximus (Powerful Extensor) (while doing activities like: Standing up)
Medial Rotation	Gluteus Medius Gluteus Minimus
Lateral Rotation	Gluteus Maximus Quadratus Femoris Piriformis Obturator Externus Obturator Internus
Adduction	Adductors Gracilis
Abduction	Gluteus Medius Gluteus Minimus Sartorius

This Slide was in girls' slides only

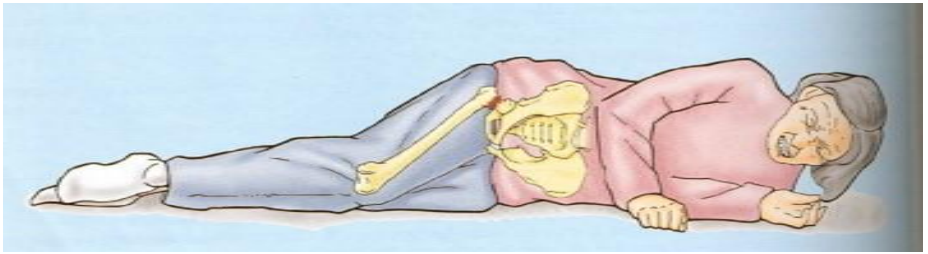
Blood Supply

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



Anterior view of coronally sectioned hip joint

- Damage of the <u>retinacular fibers</u> as in **fracture neck** of the femur can results in:
  - **Avascular* necrosis** of the head of the femur. (Because there won't be blood supply)
- Fracture neck of the femur is <u>common after age of (60) years</u> especially in women because of **Osteoporosis**.

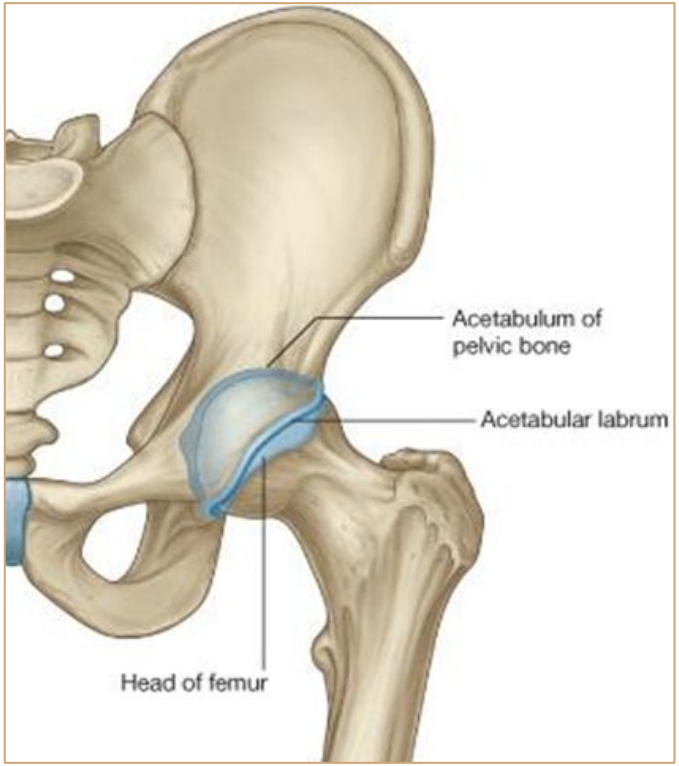


*Avascular necrosis (AVN):also called osteonecrosis or bone infarction, is death of bone tissue due to interruption of the blood supply.

This Slide was in girls' slides only

Stability of the Joint

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



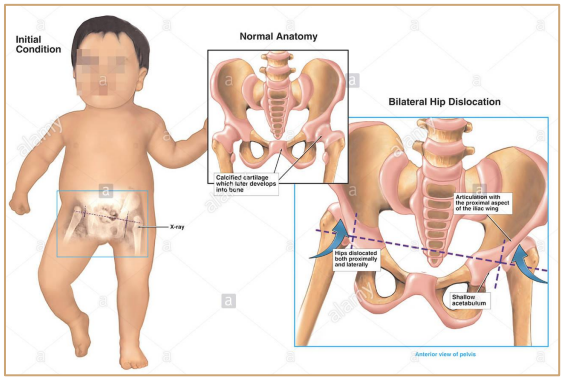
*Head of Femur is the most important factor in this joint, unlike the shoulder joint, it was the muscles surrounding the joint.

**
- Iliofemoral ligament.
- Pubofemoral ligament.
- Ischiofemoral ligament.

This Slide was in girls' slides only

Dislocation of Hip Joint

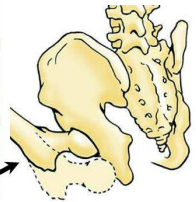
- **CONGENITAL:**
  - More common in girls and associated with **inability** to adduct the thigh.
  - The **upper lip of the acetabulum** fails to develop adequately.
  - The **head of the femur** rides up out of the acetabulum onto the gluteal surface of the ileum.



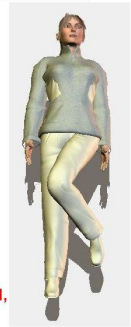
- **TRAUMATIC:**
  - It is common in motor vehicle accidents when the **thigh is flexed and adducted**.
  - The dislocated head is displaced **posteriorly** to lie on the posterior surface of the ileum.
  - In **posterior** dislocation the **sciatic nerve** (عرق النَّسا) is liable to be injured.

Femoral Head Dislocation (Posterior Hip Dislocation)

fotosearch.com/comp/LIF/LIF134/E501003.jpg



2006 Moore & Dalley *COA*



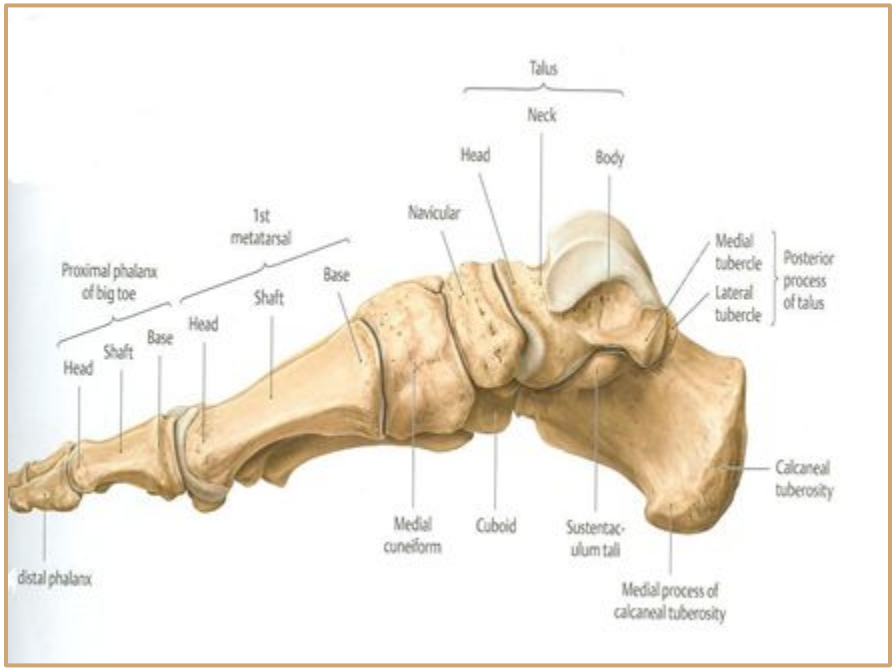
limb shortened, flexed, & medially rotated

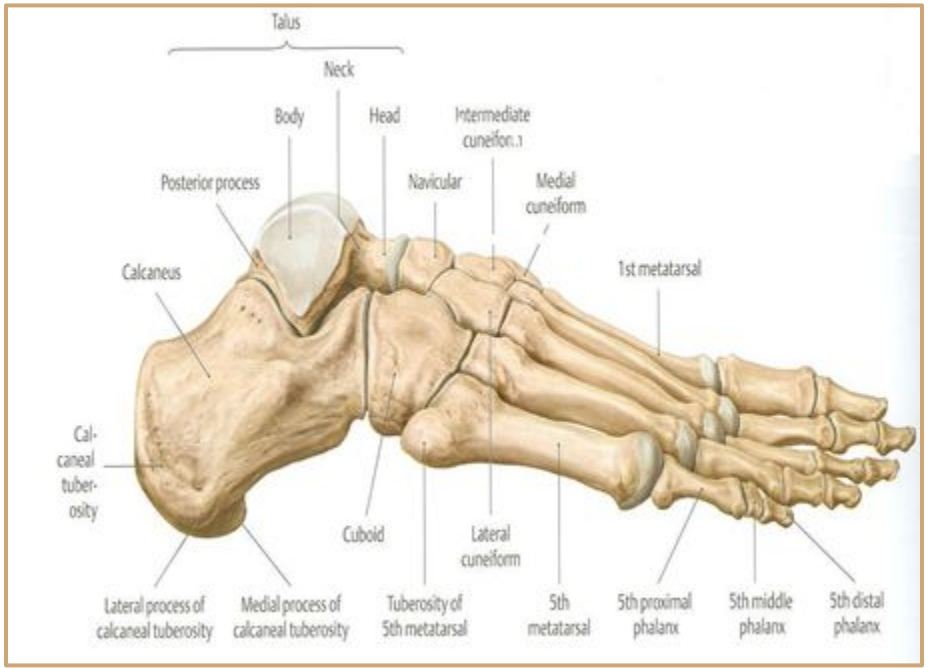
www.fammed.washington.edu/network/sfm/Orthorama/Hippose.jpg

Objectives (Ankle Joint)

- List the **type & articular surfaces** of ankle joint.
- Describe the **ligaments** of ankle joints.
- Describe **movements** of ankle joint.

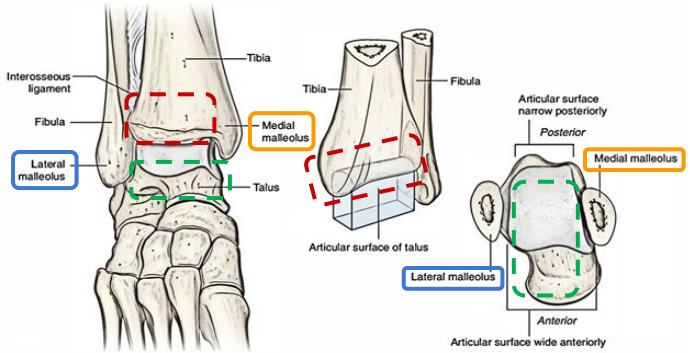
Skeleton of Foot





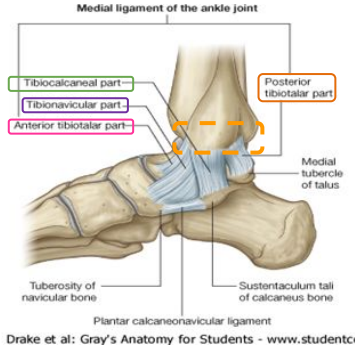
Type & Articular Surfaces

- **Type:**
  - It is a synovial, hinge joint.
- **Articular Surfaces:**
  - UPPER:
    - A socket formed by:
      - the **lower end of tibia**.
      - **Medial malleolus**
      - **Lateral malleolus**.
  - LOWER:
    - **Body of talus**.

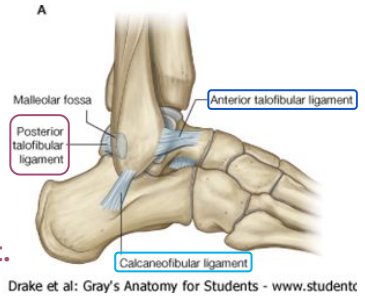


Ligaments

- **MEDIAL (DELTOID) LIGAMENT:**
  - A strong triangular ligament.
  - **Apex:** Attached to medial malleolus.
  - **Base:** Subdivided into 4 parts:
    - **Anterior tibiotalar part.**
    - **Tibionavicular part.**
    - **Tibiocalcaneal part.**
    - **Posterior tibiotalar part.**

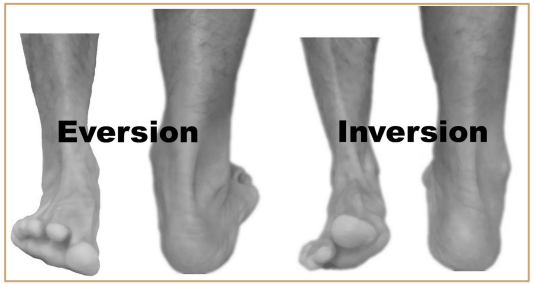


- **LATERAL LIGAMENTS:**
  - **Composed of 3 separate ligaments:**
    - **Anterior talofibular ligament.**
    - **Calcaneofibular ligament.**
    - **Posterior talofibular ligament.**



Movements of Ankle Joint

	Movements of Lower Limbs Joints		
	Ankle Joint		
Flexion	**(Plantarflexion)**		
	Initiated By: Soleus	**Maintained By:** Gastrocnemius	**Assisted By:** Other muscles in posterior compartment of leg **(tibialis posterior, flexor digitorum longus & flexor hallucis longus)** + muscles of lateral compartment of leg **(peroneus longus & peroneus brevis).**
Extension	**(Dorsiflexion)**		
	(Performed By): Muscles of anterior compartment of leg **(tibialis anterior, extensor hallucis longus, extensor digitorum longus & peroneus tertius).**		
Inversion & Eversion	**Occurs at the Talo-calceno-navicular joint.** Not on the Ankle joint		



Summary of Lower Limbs Joints Movements

Movements of Lower Limbs Joints

	Hip Joint	Knee Joint			Ankle Joint		
Flexion	Iliopsoas (Main Flexor) Pectineus Rectus Femoris	**(Assisted By):** Sartorius	**(Assisted By):** Gracilis Popliteus	**(Mainly):** Hamstring Muscles: - Biceps Femoris - Semitendinosus. - Semimembranosus.	**(Plantarflexion)** **Initiated By:** Soleus	**Maintained By:** Gastrocnemius	**Assisted By:** other muscles in posterior compartment of leg **(tibialis posterior, flexor digitorum longus & flexor hallucis longus)** + muscles of lateral compartment of leg **(peroneus longus & peroneus brevis).**
Extension	Hamstrings (Mainly) Gluteus Maximus (Powerful Extensor)	Quadriceps Femoris			**(Dorsiflexion)** **(Performed By):** Muscles of anterior compartment of leg **(tibialis anterior, extensor hallucis longus, extensor digitorum longus & peroneus tertius).**		
Medial Rotation	Gluteus Medius Gluteus Minimus	**Active Rotation** (When the Knee Is Flexed) **(Mainly):** Semitendinosus, Semimembranosus **(Assisted By):** Sartorius, Gracilis		**Inactive Rotation** (Independent) **(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.**	
Lateral Rotation	Gluteus Maximus Quadratus Femoris Piriformis Obturator Externus Obturator Internus	Biceps Femoris					
Adduction	Adductors Gracilis						
Abduction	Gluteus Medius Gluteus Minimus Sartorius						
Inversion & Eversion					**Occurs at the Talo-calceno-navicular joint.** Not on the Ankle Joint		

Nerve Supply of All Joints

REMEMBER HILTON'S LAW:

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

MCQ:

Flash cards test :)

1- Which muscle of the following starts the plantar flexion?

A- Peroneus longus

B- Peroneus brevis

C- soleus

D- gastrocnemius

2- which one of the following is a lateral ligament for the ankle joint:

A- Tibionavicular part

B-Anterior talofibular ligament

C- Tibiocalcaneal part

D-Posterior tibiotalar part

3-which one of the following consider is the type of the ankle joint:

A-fibrous joint

B-cartilaginous joint

C-synovial hinge joint

D-synovial ellipsoid joint

4-which one of the following consider is the type of the hip joint:

A-synovial hinge joint

B-synovial , ball and socket joint

C- synovial, modified hinge

D-synovial ellipsoid joint

5- Bursa between femur and quadriceps tendon:

A- Suprapatellar bursa.

B- Deep Infrapatellar bursa.

C- Prepatellar bursa.

D- Subcutaneous Infrapatellar bursa.

6-The muscle that extends the hip & flexes the knee joint is:

A- Gluteus maximus.

B- Quadriceps femoris.

C- Sartorius.

D- Semitendinosus.

7-Pubofemoral ligament is :

A- Anterior to hip joint.

B- Posterior to hip joint.

C- Anterior inferior to hip joint.

8-TRAUMATIC Dislocation of Hip Joint can happen due:

A- Common in motor vehicle accidents.

B- Falling from high altitude.

C- Osteoporosis.

D- Fails of developing.

9-what it is HILTON'S LAW

.....

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

10-capsule of hip joint attach Medially to

.....

Transverse acetabular ligament,•Acetabular labrum

11- fracture neck of the femur can results

.....

Avascular necrosis of the head of the femur

1-C

2-B

3-C

4-B

5-A

6-D

7-C

8-A

9-

10-

11-

Team Members

Lamia Abdullah Alkuwaiz (Team Leader)
Rawan Mohammad Alharbi
Abeer Alabduljabbar
Afnan Abdulaziz Almustafa
Ahad Algrain
Alanoud Almansour
Albandari Alshaye
AlFhadah abdullah alsaleem
Arwa Alzahrani
Dana Abdulaziz Alrasheed
Dimah Khalid Alaraifi
Ghada Alhaidari
Ghada Almuhanna
Ghaida Alsanad
Hadeel Khalid Awartani
Haifa Alessa
Khulood Alwehabi
Layan Hassan Alwatban
Lojain Azizalrahman
Lujain Tariq AlZaid
Maha Barakah
Majd Khalid AlBarrak
Norah Alharbi
Nouf Alotaibi
Noura Mohammed Alothaim
Rahaf Turki Alshammari
Reham Alhalabi
Rinad Musaed Alghoraiby
Sara Alsultan
Shahad Alzahrani
Wafa Alotaibi
Wejdan Fahad Albadrani
Wjdan AlShamry

Faisal Fahad Alsaif (Team Leader)
Abdulaziz Al dukhayel
Fahad Alfaiz
Akram Alfandi
Saad Aloqile
Saleh Almoaiqel
Abdulaziz Alabdulkareem
Abdullah Almeaither
Yazeed Aldossari
Muath Alhumood
Abdulrahman Almotairi
Abdulelah Aldossari
Abdulrahman Alduhayyim
Hamdan Aldossari
Abdullah Alqarni
Mohammed Alomar
Abdulrahman Aldawood
Saud Alghufaily
Hassan Aloraini
Khalid Almutairi
Abdulmajeed
Alwardi
Abdulrahman Alageel
Rayyan Almousa
Sultan Alfuhaid
Ali Alammari
Fahad Alshughaithry
Fayez Ghiyath
Aldarsouni
Mohammed Alquwayfili
Abduljabbar Al-yamani
Sultan Al-nasser
Majed Aljohani
Zeyad Al-khenaizan
Mohammed Nouri
Abdulaziz Al-drgam
Fahad Aldhowaihy
Omar alyabis