Osteokinematics and Arthrokinematics of the Hip

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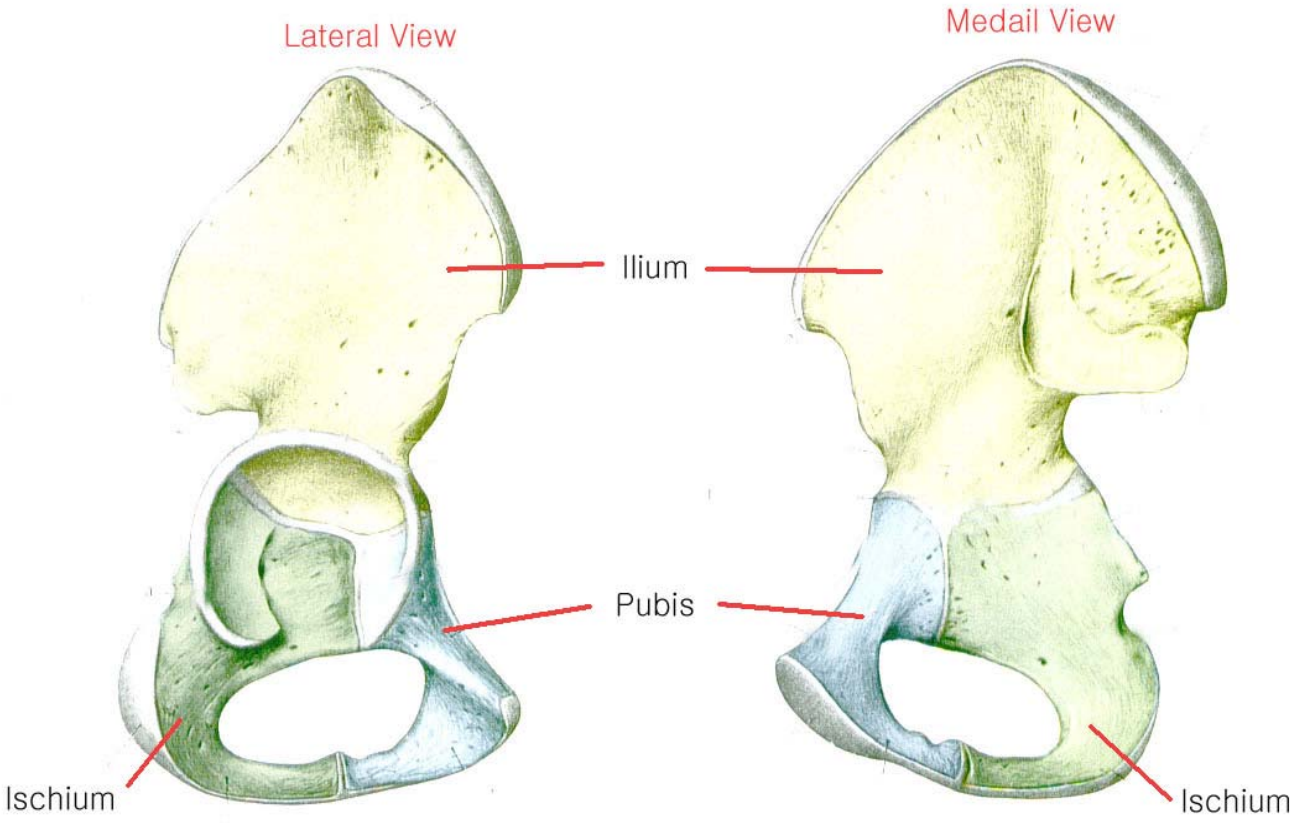
Introduction

The hip is the articulation between the large spherical head of the Femur and the deep socket provided by the acetabulum of the pelvic(ball-socket joint).
The hemoral head is stabilized by a deep socket that is surrounded by an extensive set of capsular ligaments.
Many large forceful muscles provide the necessary torques needed to propel the body up ward and forward.

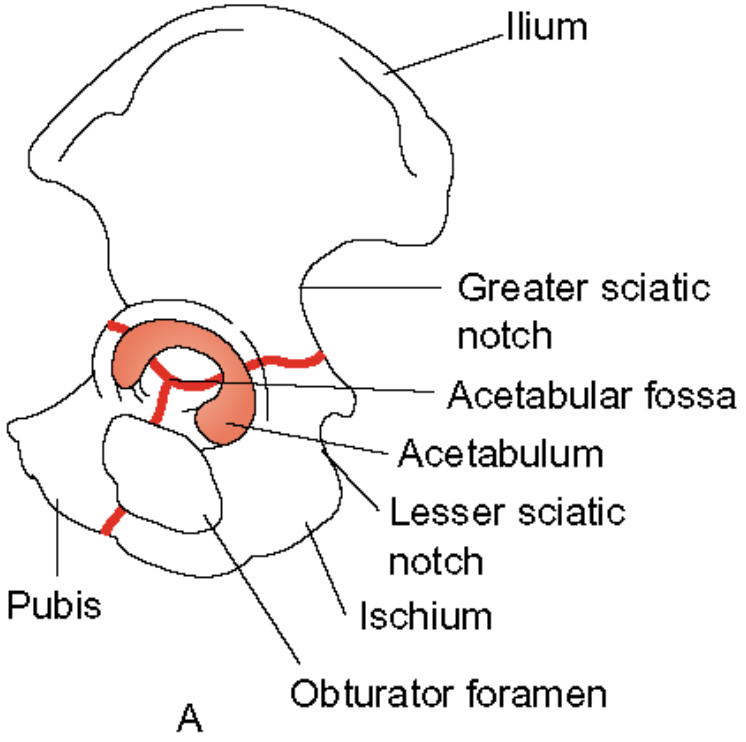
OSTEOLOGY

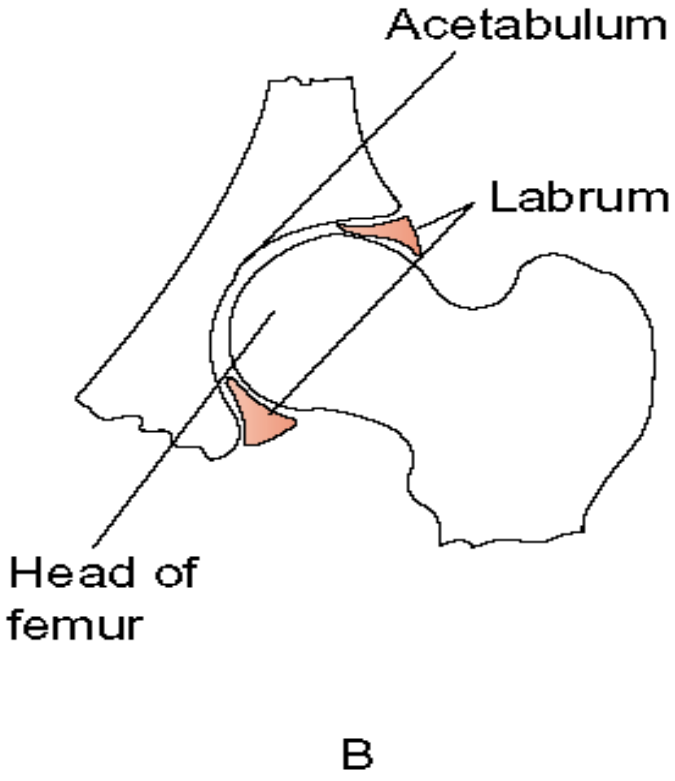
Innominte
- Ilium
- Pubis
- Ischium



OSTEOLOGY

Acetabulum
- Socket
  Ilium and Ischium : 80%, Pubis : 20%





OSTEOLOGY

Femur

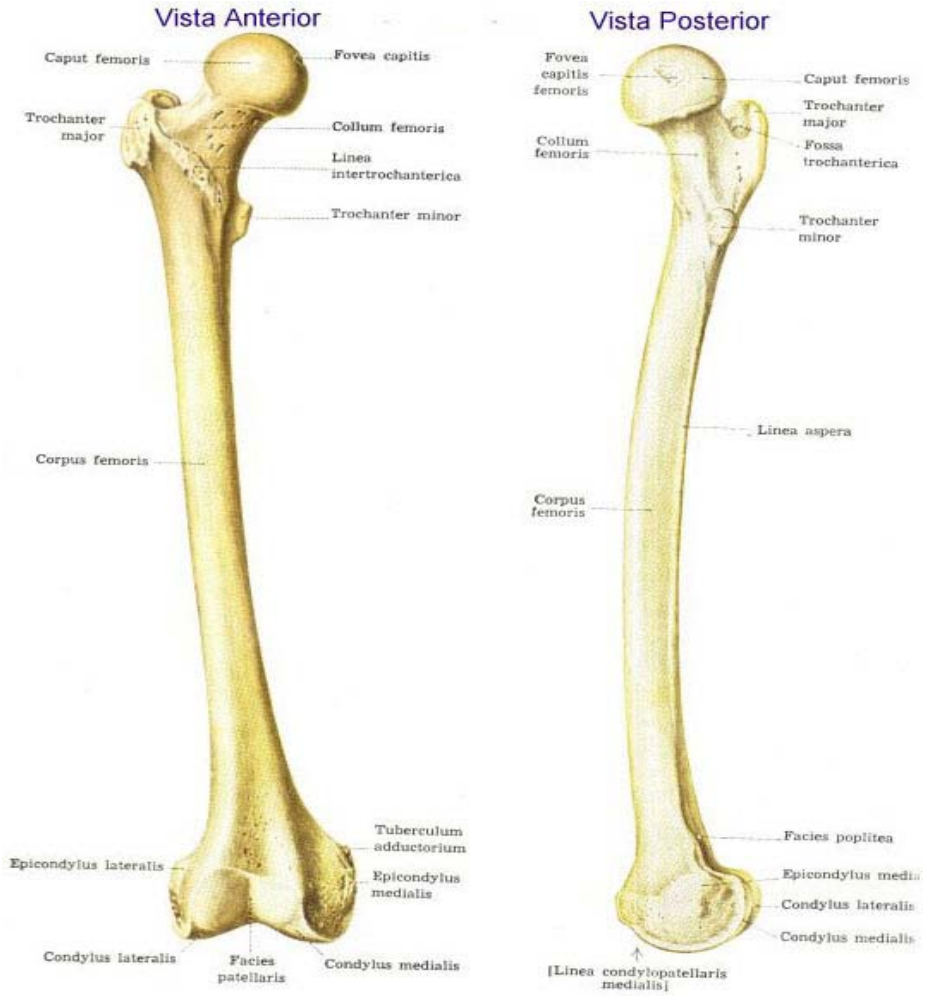
The femur is the longest and strongest bone of the human body.

(powerful action of muscles, long stride length during walking)

The femur neck reducing of bony impingement against the pelvis

The femur bows slightly when subjected to body weight.

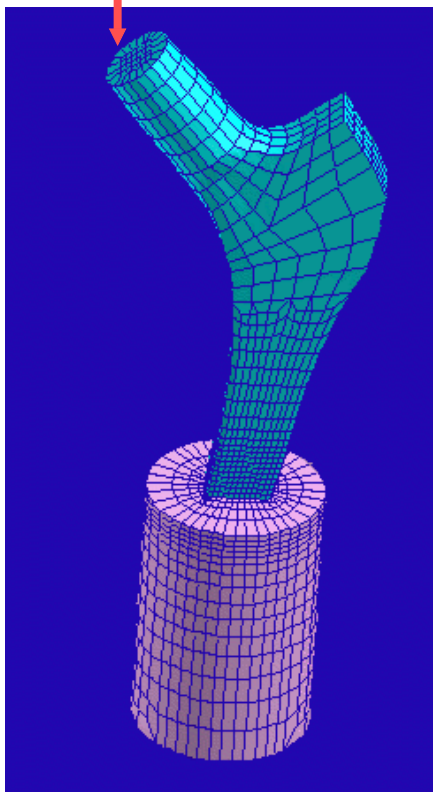
This bowing allows the femur to bear a greater load than if the femur were perfectly straight

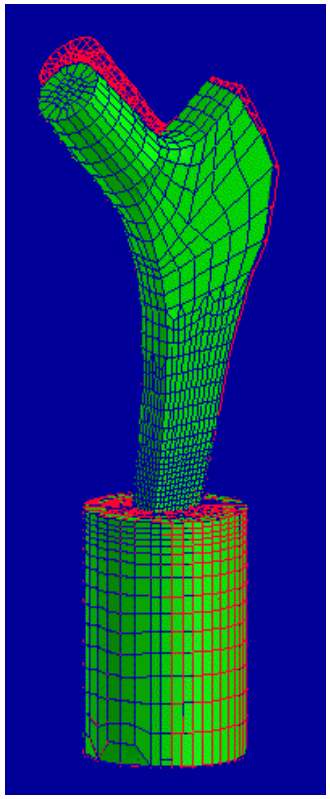


OSTEOLOGY

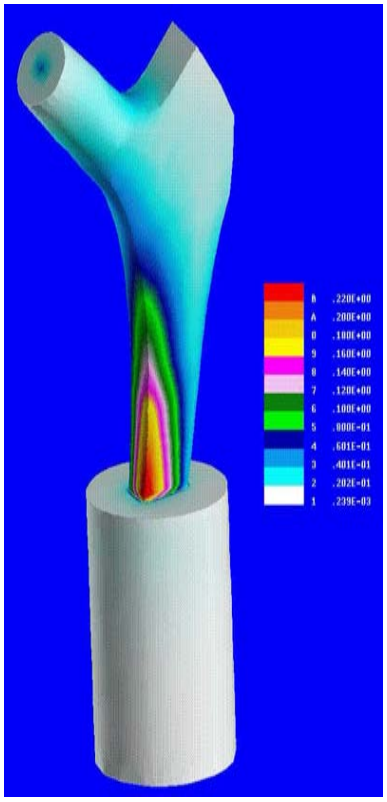
- Femur

200 kg

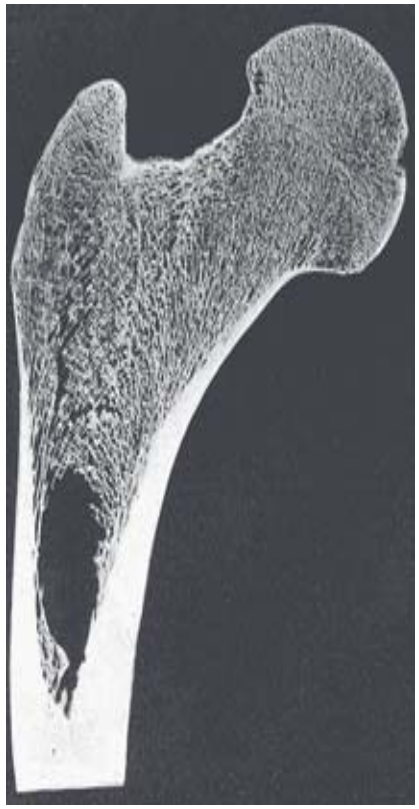




Deformations



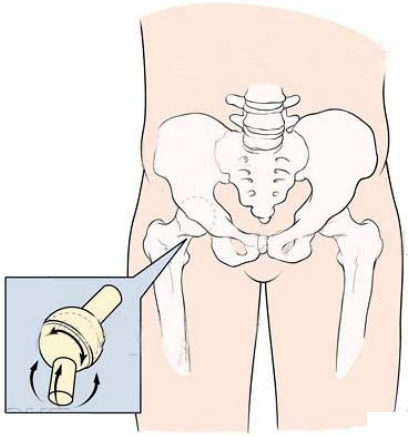
Stress Distribution

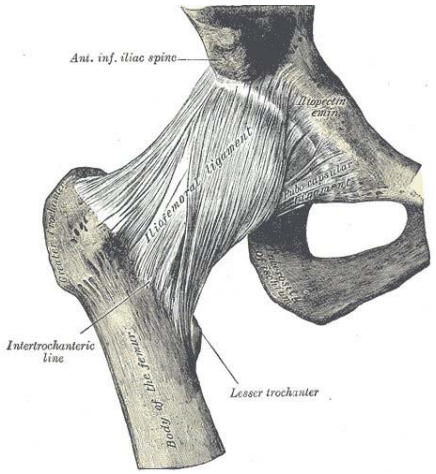


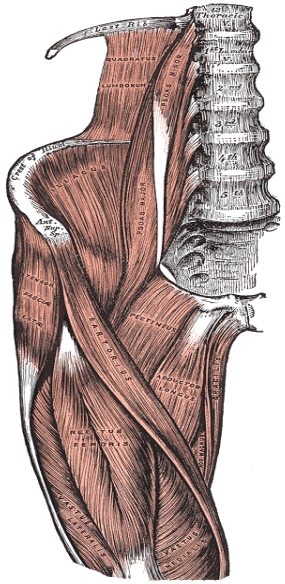
ARTHROLOGY

Functional Anatomy of the Hip Joint

- ball-in-socket joint
- Extensive ligaments and large muscles maintain the femoral head securely in the acetabulum



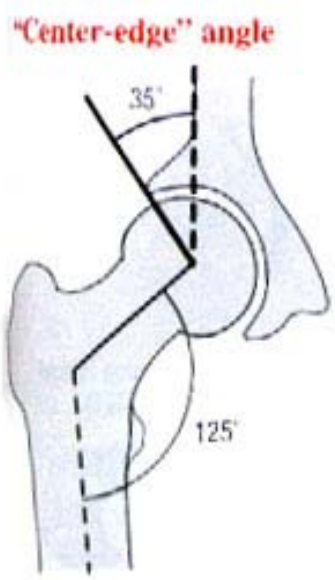


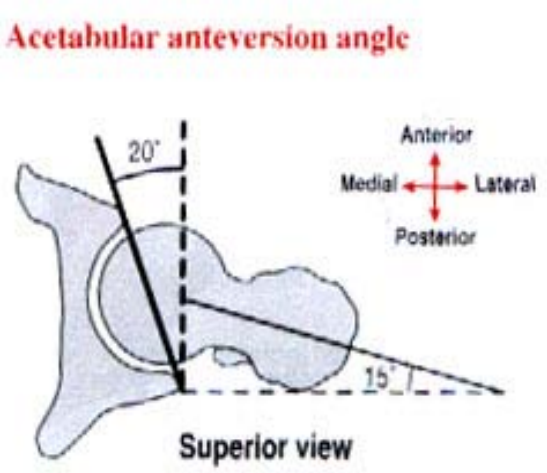


ACETABULAR ALIGNMENT

Center-Edge Angle
- 35-40°

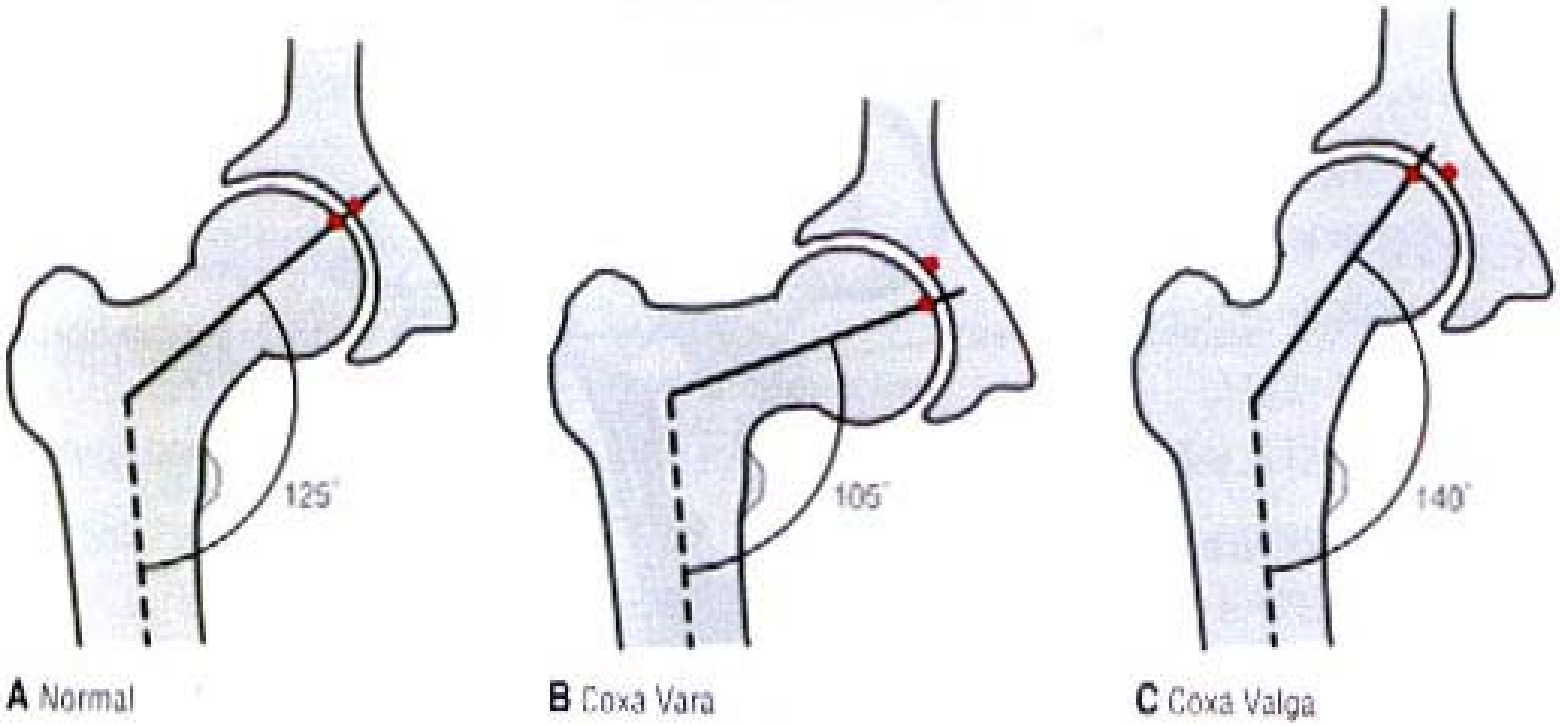
Acetabular Anteversion Angle
- Normal angle of about 20° exposes part of the anterior side of the femoral head





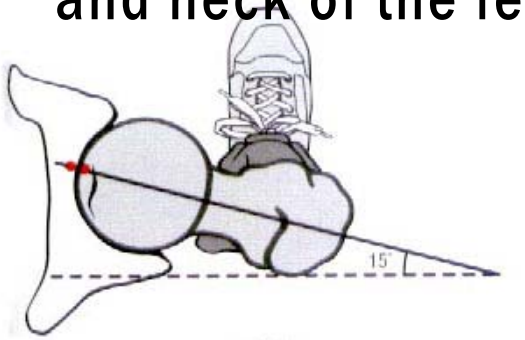
Angle of Inclination

- The angle within the frontal plane between the femoral neck and the medial side of the femoral shaft

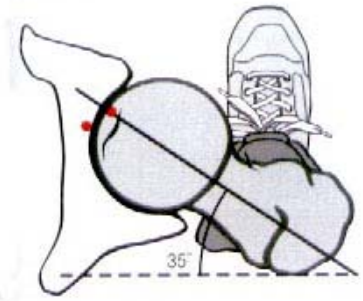


Torsion Angle

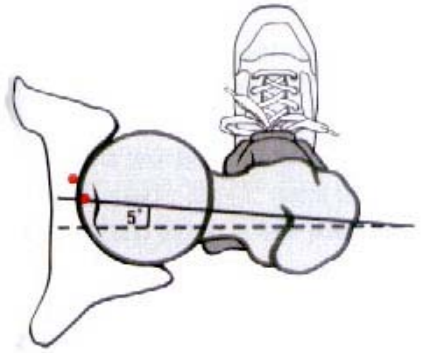
- The relative rotation(angle) that exists between the shaft and neck of the femur



Normal anterversion

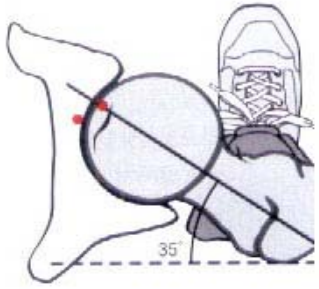


Excessive anteversion

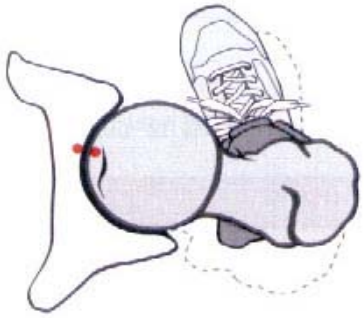


Retroversion

- "In-toeing" is a walking pattern with exaggerated posturing of hip internal rotation



Excessive anteversion



Excessive anteversion with "in-toeing"

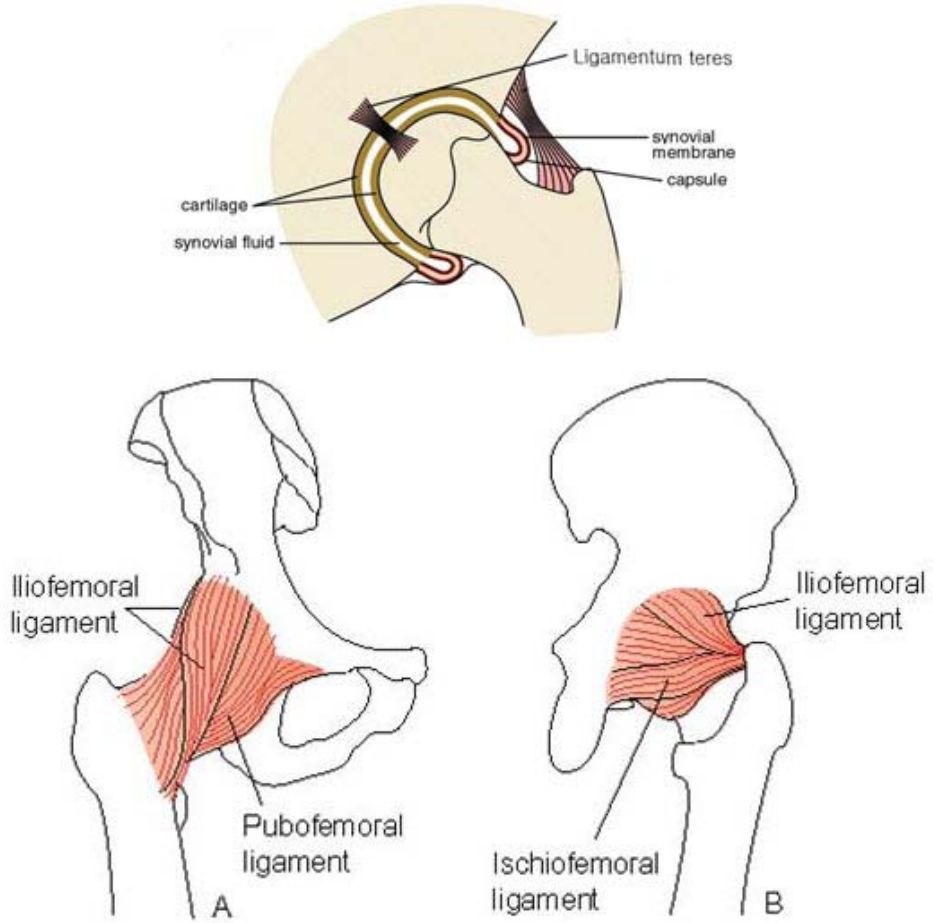
CAPSULE AND LIGAMENT OF THE HIP

Ligamentum teres

Iliofemoral ligament
(Y- ligament)

Pubofemoral

Ischiofemoral



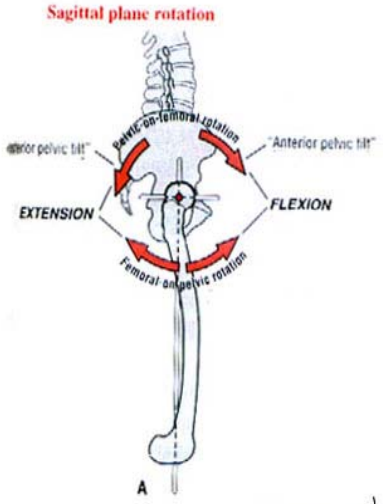
Femoral on Pelvic Osteokinematics

Ro[t]ation of the Femur in the Sagittal Plane.

Flexion

80◆with knee extended

- Hamstrings and gracil

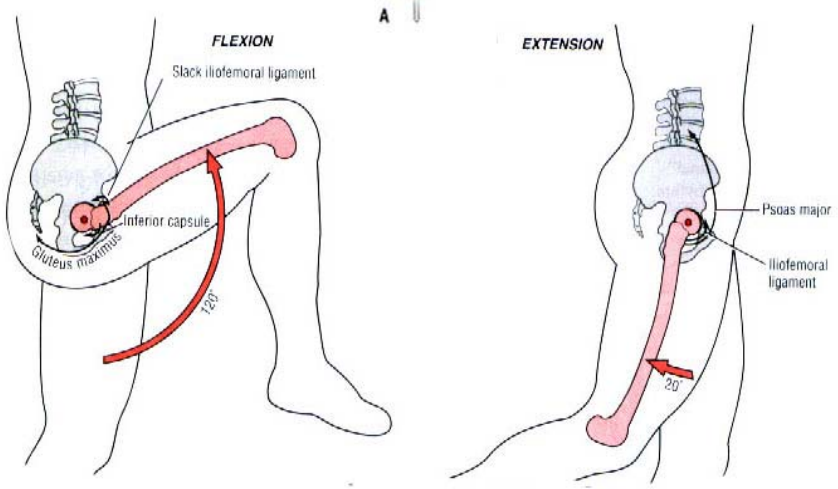


120◆with knee fully

-Inferior fivers of isc

ligament .

-Inferior capsule.



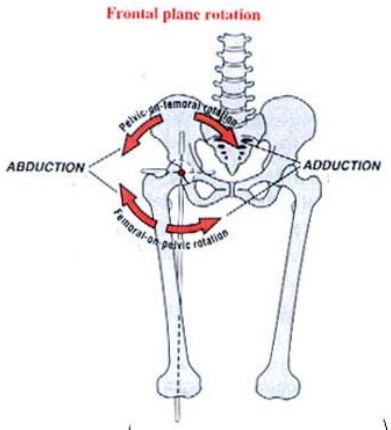
Extension

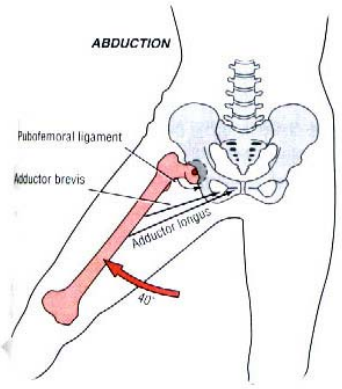
20◆of extension(with knee

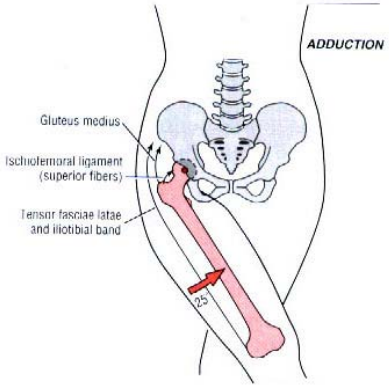
Femoral on Pelvic Osteokinematics

Rotation of the Femur in the Frontal Plane

Abduction : 40
-Puhofemoral ligament,
capsule,
adductor and hamstring





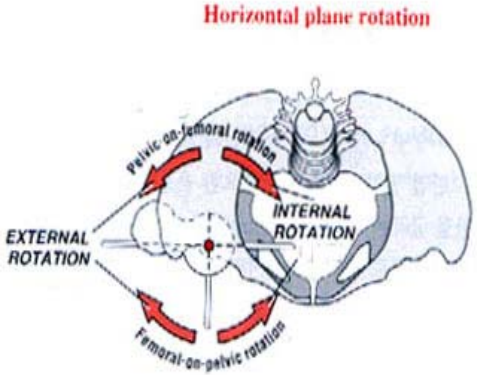


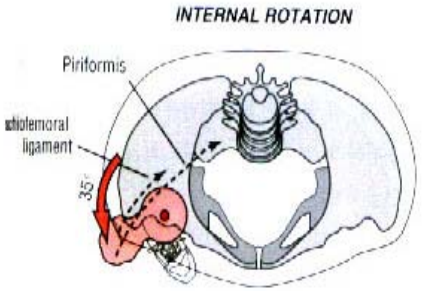
Adduction : 25
-Superior fibers of ischiofemoral

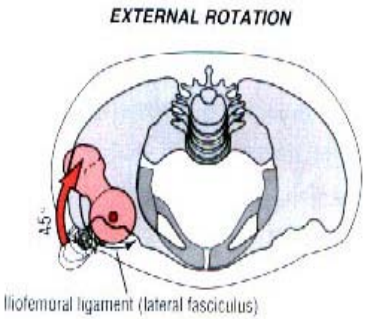
Femoral on Pelvic Osteokinematics

Rotation of the Femur in the Horizontal al Plane

Internal Rotation : *3*
Ischiofemoral ligame
rotator
muscles(e.g., pirifo





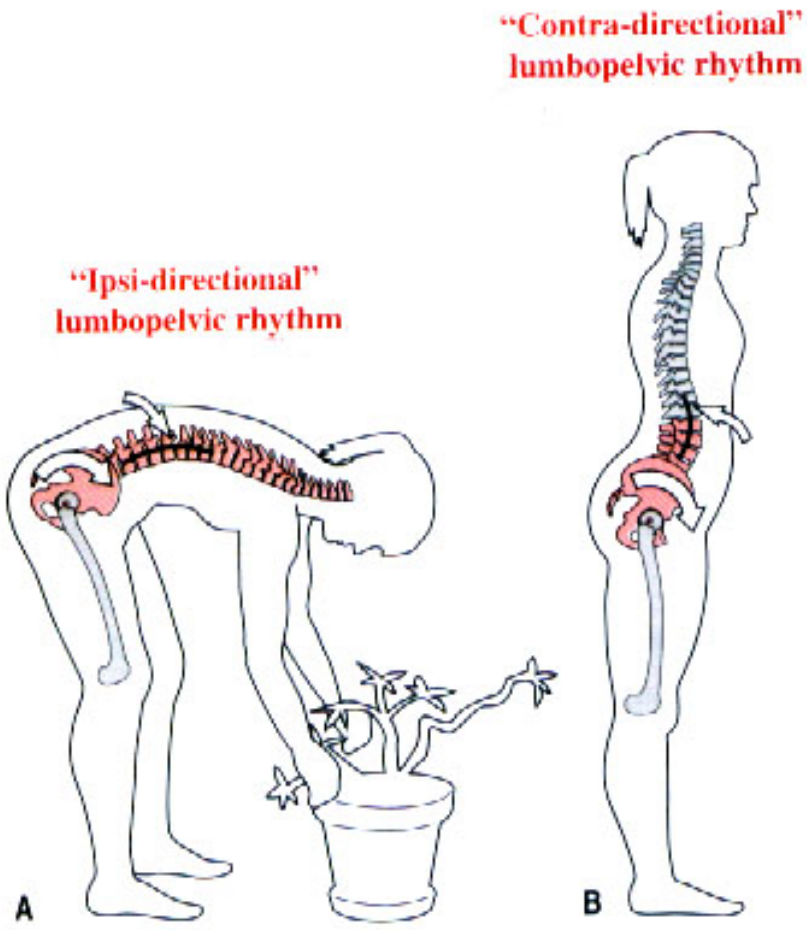


External Rotation : 45 Latera fasciculus of iliofemoral ligament, iliotibial band, and

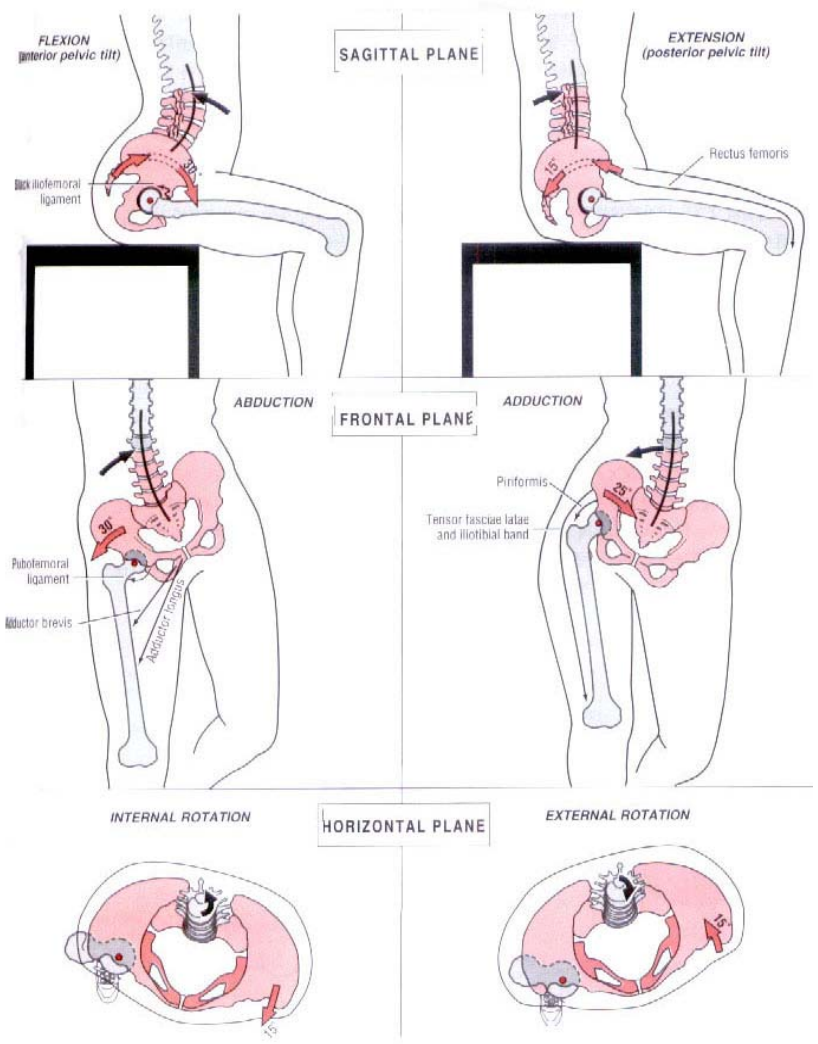
Pelvic on Femoral Osteokinematics

Ipsi-directional
Lumbopelvic Rhythm
- Trunk flexion

Contra-directional
Lumbopelvic Rhythm.
- Trunk extension



Pelvic on Femoral Osteokinematics



Flexion (anterior pelvic tilt) : 30
Extension (posterior pelvic tilt)
: 15

Abduction : 30Adduction : 25

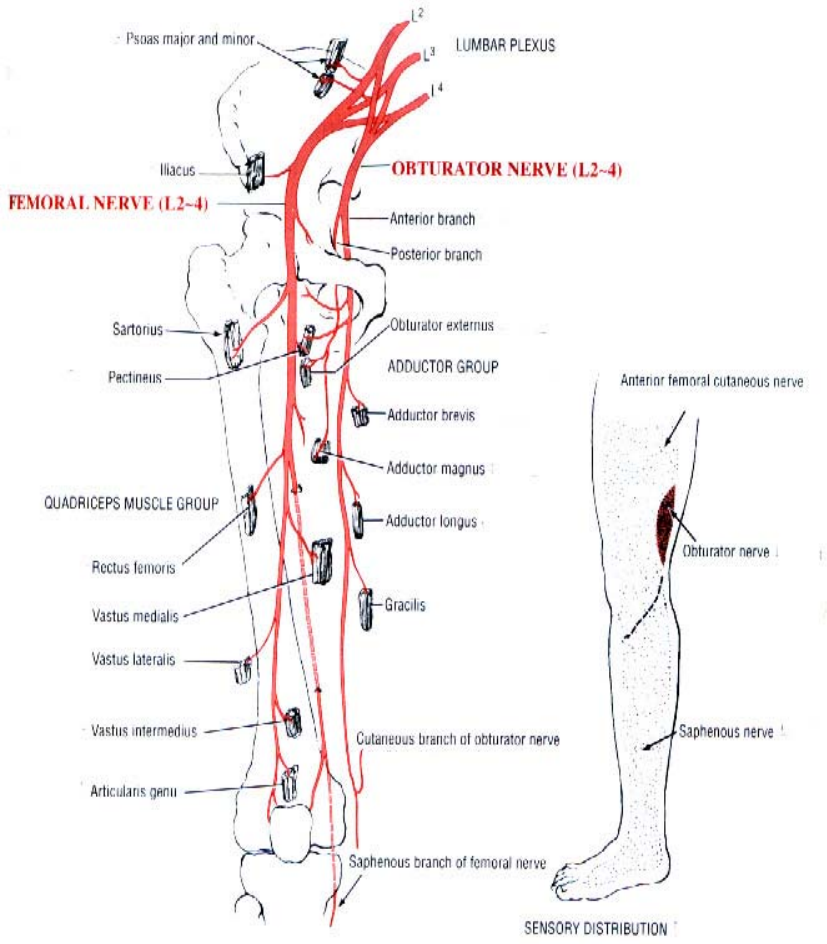
Internal rotation : 15External
rotation : 15

MUSCLE AND JOINT INTERACTION

Innervation to Muscles
- Lumbar plexus

Femoral nerve(L2-L4)
- innervate most hip flexors and all knee extensors.

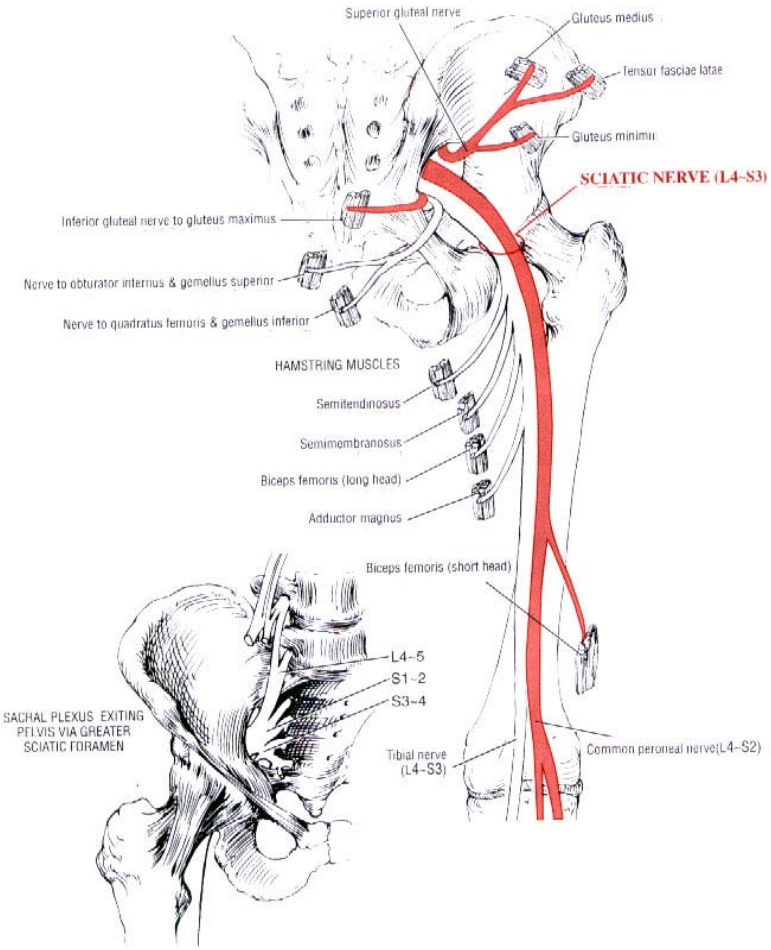
Obturator nerve(L2-L4)
- innervate hip adductor muscles.



MUSCLE AND JOINT INTERACTION

Innervation to Muscles
- Sacral Plexus

Sciatic nerve(L4-S3)



Muscular Function at the Hip

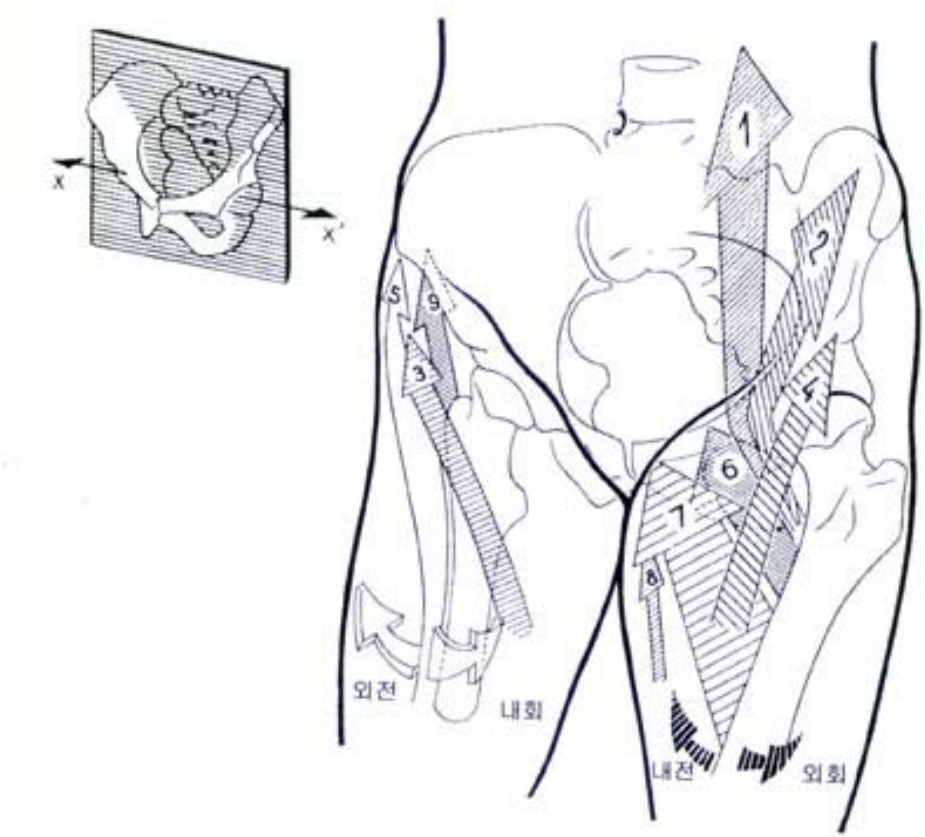
Hip Flexor Muscles

Primary

Iliopsoas
Tensor fasciae latae
Sartorius
Rectus femoris
Adductor longus
Pectineus

Secondary

Adductor brevis
Gracilis
Gluteus minimus
(anterior fibers)



Muscular Function at the Hip

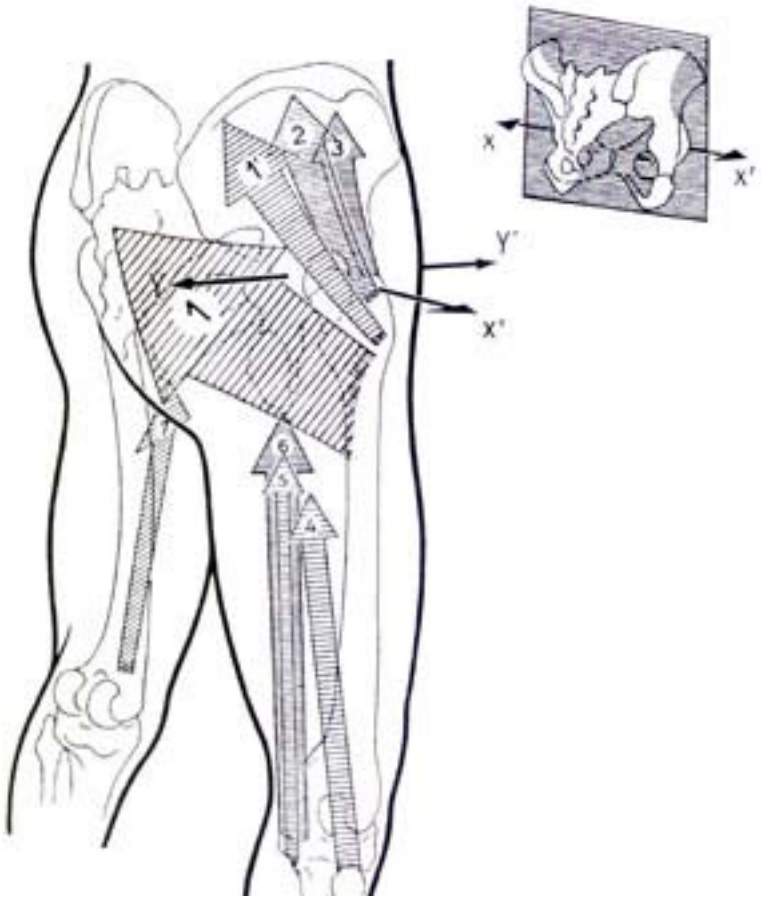
Hip Extensor Muscles

Primary

Gluteus maximus
Biceps femoris
(long head)
Semitendinosus
Semimembranosus
Adductor magnus
(posterior head)

Secondary

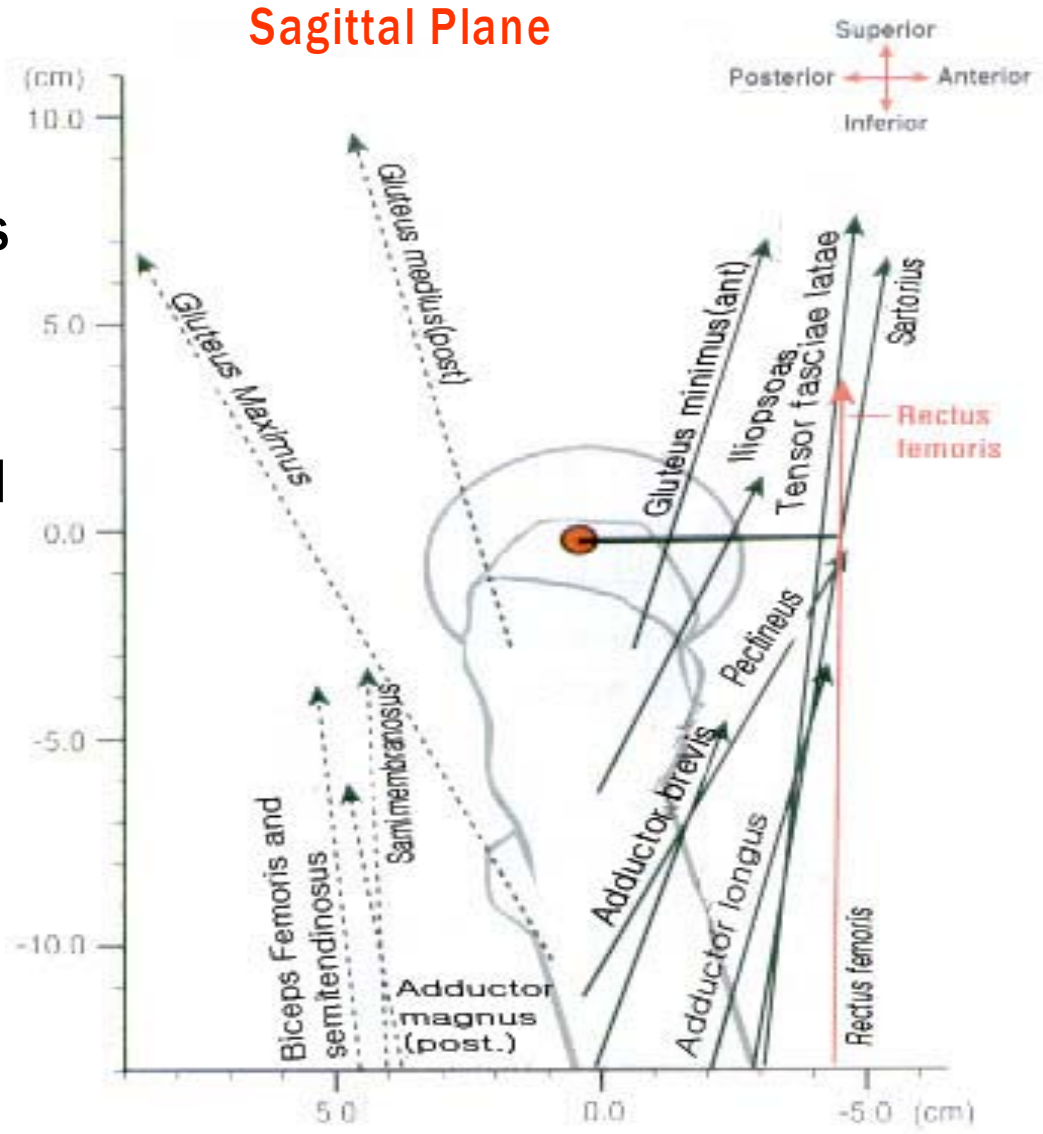
Gluteus medius
(posterior fibers)



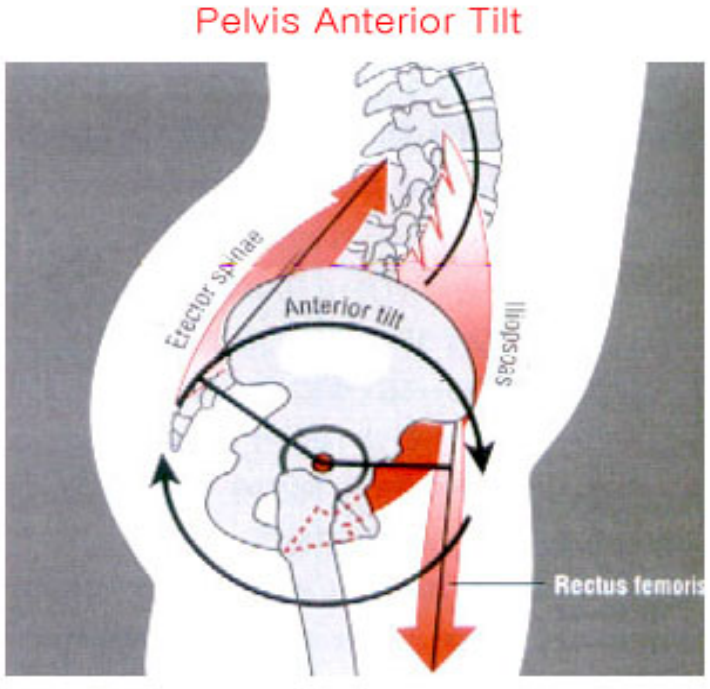
Muscular Function at the Hip

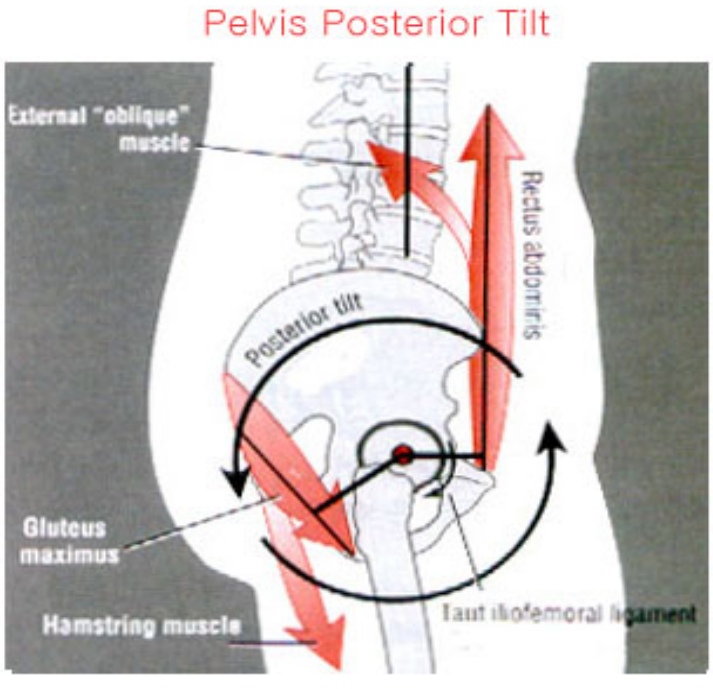
Flexors : solid lines

Extensors : dashed lines



Muscular Function at the Hip





Overall function of the Hip Flexors.
Anterior Pelvic Tilt
Performed by a force-couple between the hip flexors and low-back extensor muscles.

Overall function of the Hip Extensor.
Posterior Pelvic Tilt
Performed by a force-couple between the hip extensors and trunk muscles.

Muscular Function at the Hip

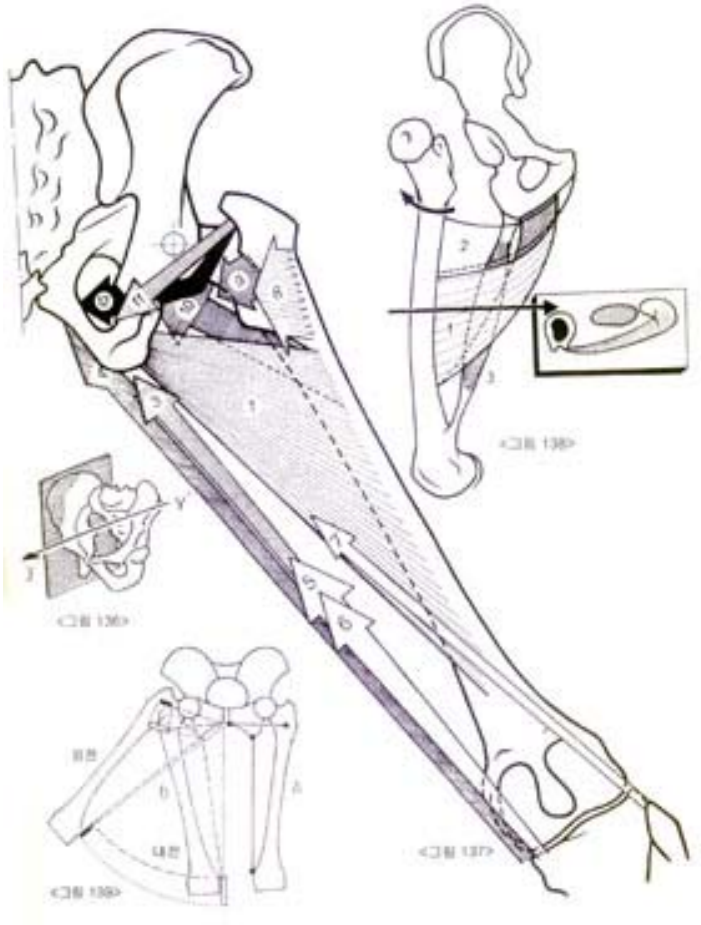
Hip Adductor Muscles

Primary

Adductor longus
Adductor brevis
Pectineus
Gracilis
Adductor magnus
(both heads)

Secondary

Biceps femoris
(long head)
Quadratus femoris
Gluteus maximus
(lower fibers)



Muscular Function at the Hip

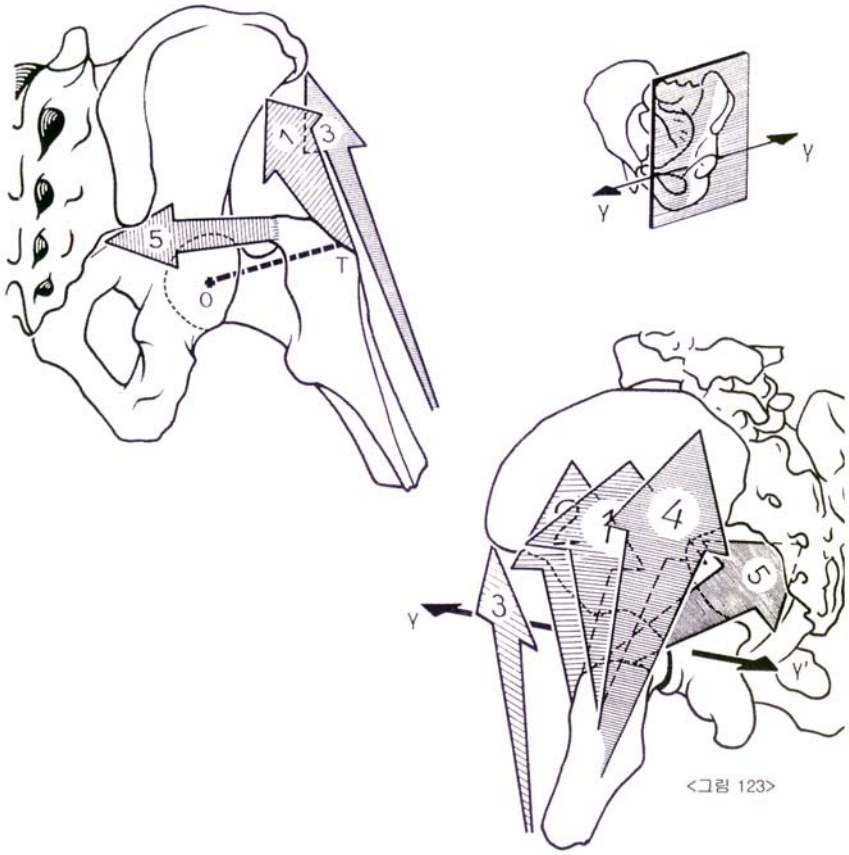
Hip Abductior Muscles

Primary

Gluteus medius
Gluteus minimus
Tensor fasciae latae

Secondary

Pirifomis
Sartorius



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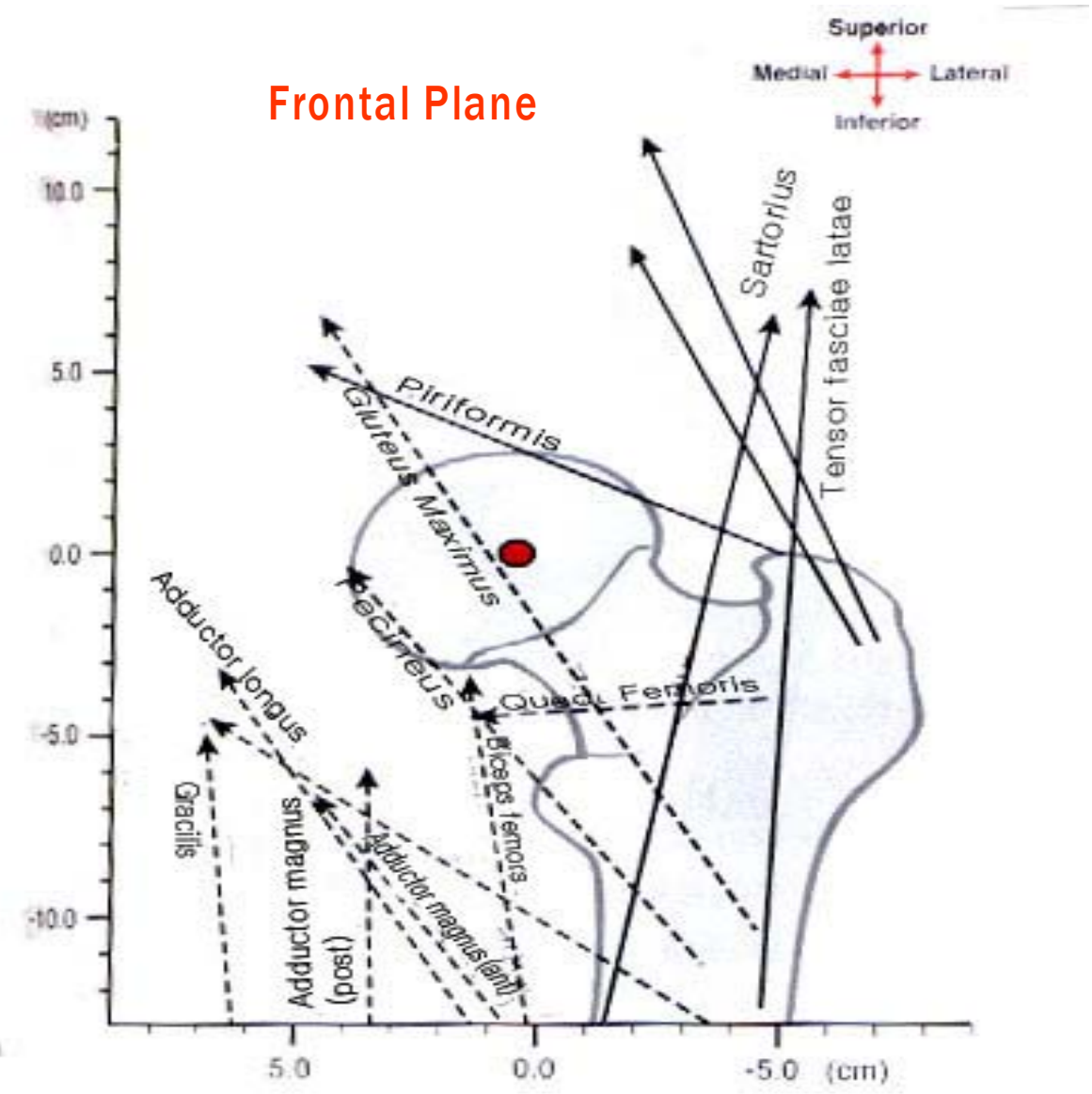
Muscular Function at the Hip

Abductors : solid lines

Adductors : dashed lines



Muscular Function at the Hip

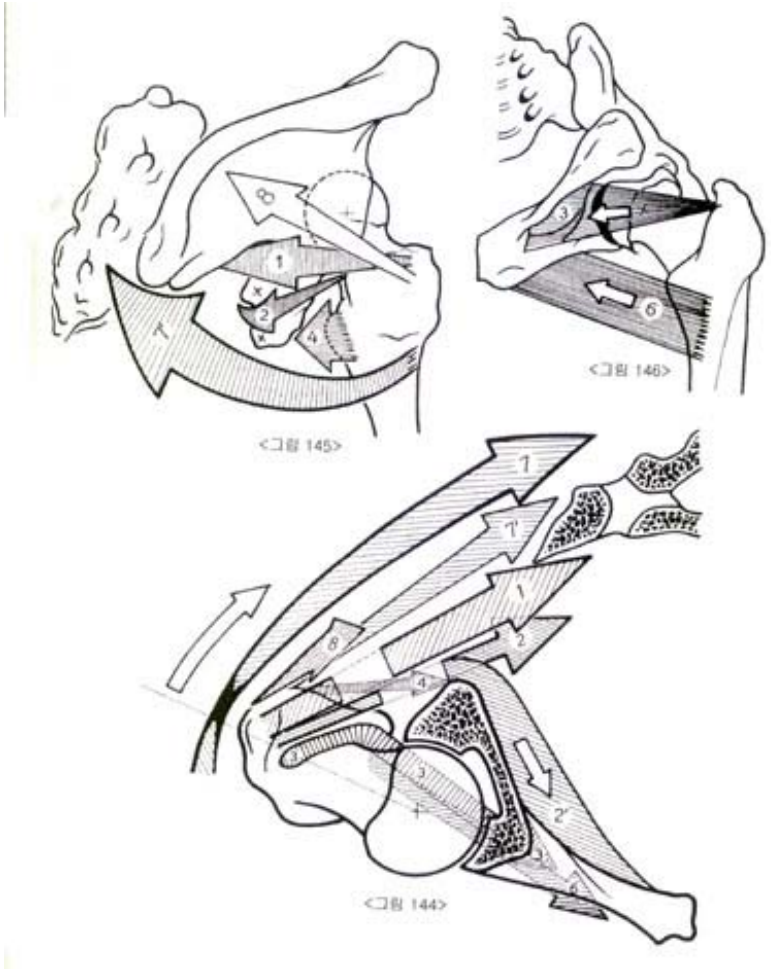
Hip External Rotatior Muscles

Primary

Gluteus Maximus
Pirifomis
Obturator intermus
Gemellus superior
Gemellus inferior
Quadratus femoris
Sartorius

Secondary

Gluteus medius
(posterior fibers)
Gluteus minimus
(posterior fibers)
Obturator extermus
Biceps femoris
(long head)

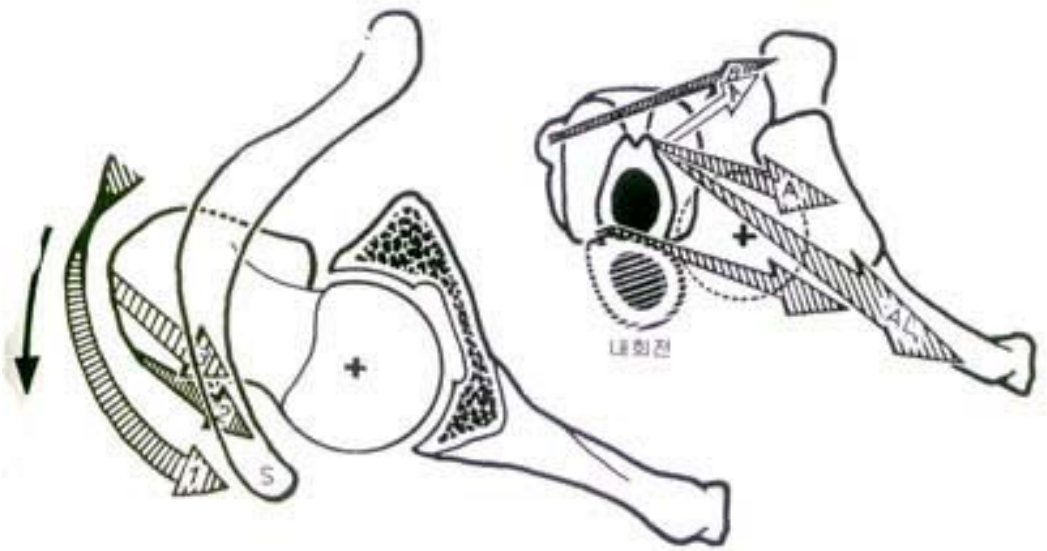


Muscular Function at the Hip

Hip Internal Rotator Muscles

Secondary

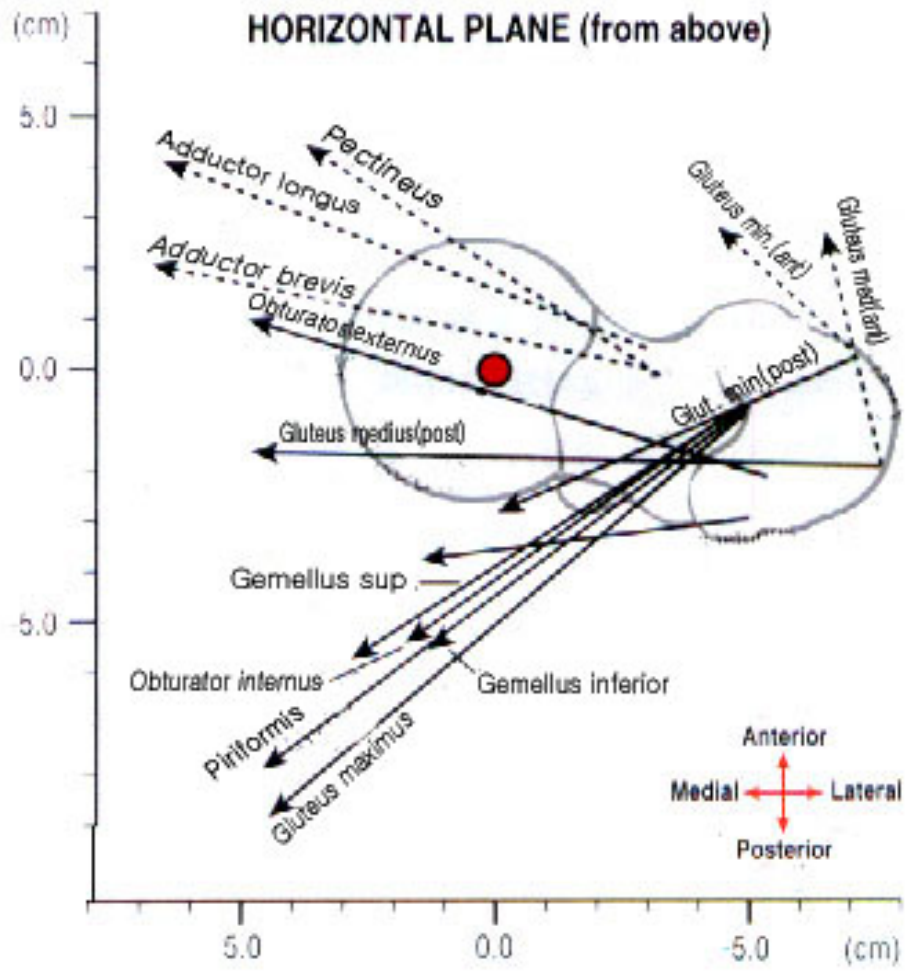
Gluteus minimus
(anterior fibers)
Gluteus medius
(anterior fibers)
Tensor fasciae latae
Adductor longus
Adductor brevis
Pectineus
Semitendinosus
Semimembranosus



Muscular Function at the Hip

External rotators : solid lines

Internal rotators : dashed lines



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Thank You

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