Structure and Function of the Pelvic Girdle
Objectives

• Identify the bones and bony landmarks of the hip and pelvis

• Identify and describe the supporting structures of the hip joint

• Describe the kinematics of the hip, a ball and socket joint (planes of motion and axis of rotation); identify the position of the hip based of observation

• Describe the difference between open chain and closed chain kinematic strategies at the hip joint
The Pelvis
The Hip

• The most proximal joint of the lower extremity responsible for motion in all 3 planes.
• This mobility makes the hip prone to injury if all of the supporting structures are not working properly.
• Unlike the shoulder, another ball and socket joint, the hip joint is very stable. Having said that, will the hip have as much motion as the shoulder? Why?
Osteology of the Hip/Pelvis

The “pelvis” is really the union of 3 bones:
• The ilium, the ischium & the pubis
Osteology of the Hip/Pelvis

Anterior View Right Hip
Osteology of the Hip/Pelvis

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Osteology of the Hip

The Pubis

the superior pubic ramus &
the inferior pubic ramus
joined anteriorly by:

Pubic Symphysis
Osteology of the Hip

The Acetabulum

deep cup shaped structure encasing the head of the femur formed by all 3 bones

Permits motion in all 3 planes
Osteology of the Hip

Femur - Right - Posterior

1. Greater trochanter
2. Neck
3. Head
4. Fovea
5. Intertrochanteric crest
6. Lesser trochanter
Osteology of the Hip

The Bony Features of the Femur

Anterior Aspect Right Femur

- anatomical neck

Posterior Aspect Right Femur

- fovea capitis
- head of the femur
- intertrochanteric line
- lesser trochanter
- greater trochanter
- intertrochanteric crest
- gluteal tuberosity
- linea aspera
Kinematics of Pelvis

There is no joints within pelvis where movement is “normal”

Remember, joints between ilium, ischium, and pubis are fused

Combo of movements of spinal column and hip joint can result in pelvic motion
Kinematics of the Pelvis

The Pelvic girdle moves back and forth within 3 planes for a total of six different motions

Long arc motion: pelvis and lumbar spine move in same direction (pelvis and lumbar spine move)

Short arc motion: pelvis and lumbar spine move in opposite directions (pelvic motion with straight trunk, offsets)
Motions of the pelvis

Anterior/Posterior Tilting (Long Arc)

- Pelvis rotates anterior about stationary femoral heads, while the lumbar spine flexes as well
  --Lumbar spine and pelvis combine for increased flexion (hip flexion moment)

- Pelvis rotates posterior about stationary femoral heads, while the lumbar spine extends as well
  --Lumbar spine and pelvis combine for increase extension (hip extension moment)
Lumbo-Pelvic Rhythm for flexion

A. Normal lumbar and hip flexion
B. Limited hip flexion with excessive lumbar flexion
C. Limited lumbar flexion with excessive hip flexion
Motions of the pelvis

Anterior/Posterior Tilt (Short Arc)
-caused by:

-Anterior tilt:
  -hip flexion
  -trunk extensors

-Posterior tilt:
  -hip extensors
  -trunk flexors
Motions of the Pelvis

Anterior pelvic rotation

Posterior pelvic rotation
Motions of the Pelvis

Lateral Tilting (Long Arc)
- Pelvis and lumbar spine move in same frontal plane direction, on a stationary femur
  --combines for increased trunk lateral flexion (ipsilateral hip abduction moment)

| Left lateral tilt = Left lateral flexion of trunk |
| Right lateral tilt = Right lateral flexion of trunk |
Lumbo-Pelvic Rhythm for Lateral Flexion
Motions of the pelvis

Lateral tilting (Short Arc)
- Describes as the direction the ilium moves inferior
- Seen in single leg stance
  - causes trunk lateral flexion to higher side
  - hip abduction in stance leg

-Caused by:

Right lateral tilt (ilium inferior on R) –
  - Left** quadratus lumborum
  - Right** hip abductors

**Opposite for Left lateral tilt
Motions of the pelvis – short arc lateral tilt to the Left
Motions of the Pelvis

Forward/Backward Rotation (long arc)
- Pelvis and lumbar spine rotate in the same direction, on a stationary femur
  -- combines for increased trunk rotation
  ipsilateral internal rotation
  contralateral external rotation
Motions of the Pelvis

Forward/Backward Rotation (short arc)
-seen in walking and running

-Left side rotates forward on the Left, then trunk/spine will rotate to the right to maintain straight posture.

Very subtle
Joint Motions

Hip

- flexion/extension
- internal/external rotation
- ABDuction/ADDuction
- circumduction
Hip Flexion

Hip Extension
Lateral Rotation = External Rotation

Medial Rotation = Internal Rotation
Internal vs External rotation

Right hip is rotated what direction?
Left hip is rotated what direction?
Describe the position of the hips
Describe position of the hips
The Hip: Angle of Inclination

Frontal plane angle between shaft and femoral neck;

- **Coxa vara** ($<120^\circ$)
- **Normal** ($120^\circ$-$135^\circ$)
- **Coxa valga** ($>135^\circ$)
Varus or Valgus..that is the question

Varus: inward deviation of the distal bone

Valgus deformity: outward angulation of the distal segment of a bone or joint
Would these knees be considered varus or valgus?
Ligaments in the Pelvis

Iliofemoral (Y), Ischiofemoral, pubofemoral
Where was the plumb line to describe optimal posture? Ant or post to hip joint
The Ilioinguinal Ligament

No function at hip joint; Separates abd wall and thigh. One border of the femoral triangle
Common Hip Pathologies

Osteoarthritis of the hip
Degeneration of the articular cartilage of the joint
Trauma
Wear & tear
Later in life
Common Hip Pathologies

Avascular Necrosis of the Femoral Head

Fig. 1. Blood Supply to Head and Neck of Femur
Common Hip Pathologies

Hip Fractures
  Intertrochanteric
  Femoral neck**

Iliotibial Band Syndrome
  Overuse injury causing lateral knee pain
    Cyclists
    Runners

Hamstring Strain
  Overload of the muscle