Chapter 9
The Hip Joint and Pelvic Girdle

Manual of Structural Kinesiology
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The Hip Joint and Pelvic Girdle

- Hip joint (acetabular femoral)
  - relatively stable due to
    - bony architecture
    - strong ligaments
    - large supportive muscles
  - functions in weight bearing & locomotion
    - enhanced significantly by its wide range of motion
    - ability to run, cross-over cut, side-step cut, jump, & many other directional changes

Bones

- Ball & socket joint
  - Head of femur connecting with acetabulum of pelvic girdle
  - Pelvic girdle
    - right & left pelvic bone joined together posteriorly by sacrum
    - pelvic bones are ilium, ischium, & pubis
  - Femur
    - longest bone in body

- Sacrum
  - extension of spinal column with 5 fused vertebrae
  - extending inferiorly is the coccyx
  - Pelvic bone - divided into 3 areas
    - Upper two fifths = ilium
    - Posterior & lower two fifths = ischium
    - Anterior & lower one fifth = pubis

Bony landmarks

- Anterior pelvis - origin for hip flexors
  - tensor fasciae latae - anterior iliac crest
  - sartorius - anterior superior iliac spine
  - rectus femoris - anterior inferior iliac spine

- Lateral pelvis - origin for hip abductors
  - gluteus medius & minimus - just below iliac crest
Bones

- **Bony landmarks**
  - Medially - origin for hip adductors
    - adductor magnus,
      adductor longus,
      adductor brevis,
      pectineus, & gracilis - pubis & its inferior ramus

- **Bony landmarks**
  - Posteriorly - origin for hip extensors
    - gluteus maximus
      posterior iliac crest & posterior sacrum & coccyx

  - Posteroinferiorly - origin for hip extensors
    - hamstrings - ischial tuberosity

- **Bony landmarks**
  - Proximal thigh - insertion for short muscles of hip
    - gluteal muscles & most of the six deep external rotators - greater trochanter
    - iliopsoas - lesser trochanter

  - Proximal thigh - origin for 3 knee extensors
    - three vasti muscles of quadriceps – anteriorly
    - hip adductors - linea aspera

- **Bony landmarks**
  - Patella - insertion for all 4 quadriceps muscles

  - Proximal tibia or fibula - insertion for remainder of hip muscles
    - sartorius, gracilis, & semitendinosus
    - upper anteromedial tibial surface just below medial condyle after crossing knee posteromedially
    - semimembranosus - posteromedially on medial tibial condyle

- **Bony landmarks**
  - Proximal tibia or fibula - insertion for remainder of hip muscles

  - Biceps femoris - laterally, primarily on fibula head with some fibers attaching on lateral tibial condyle
  
  - Iliotibial tract of tensor fasciae latae - anterolaterally on Gerdy’s tubercle of tibia

- **Anteriorly**
  - Two pelvic bones join to form symphysis pubis, amphiarthrodial

  - **Posteriorly**
    - Sacrum is between the 2 pelvic bones & forms the sacroiliac joints

    - Strong ligaments unite these bones to form rigid, slightly movable joints
Joints

- Large & heavy bones covered by thick, heavy muscles
- Very minimal oscillating-type movements occur in sacroiliac joints, as in walking
- Body movements usually involve entire pelvic girdle & hip joints
- In walking, hip flexion & extension occur with pelvic girdle rotation, forward in hip flexion & backward in hip extension

Joints

- Jogging & running result in faster movements & greater range of movement
- Pelvic rotation increases the length of stride in running; in kicking it results in a greater distance or more speed to the kick

Joints

- Acetabulofemoral joint - most mobile joints of body (except glenohumeral)
  - Multiaxial arrangement
  - Bony architecture provides stability
    - relatively few hip joint subluxations & dislocations
  - Enarthrodial-type joint
  - Femoral head inserting into acetabulum
  - Reinforced by extremely strong & dense ligamentous capsule, especially anteriorly

Joints

- Acetabulofemoral joint
  - Iliofemoral or Y ligament – located anteriorly, prevents hyperextension
  - Pubofemoral ligament - located anteromedially & inferiorly, limits excessive extension & abduction

Joints

- Acetabulofemoral joint
  - Teres ligament - attaches from deep in acetabulum to a depression in femoral head, slightly limits adduction
  - Ischiofemoral ligament – located posteriorly, extends from ischium to trochanteric fossa of femur, limits internal rotation

Joints

- Some disagreement about exact possible range of each movement in hip joint
  - 0 to 130 degrees of flexion
  - 0 to 30 degrees of extension
Joints

- 0 to 35 degrees of abduction
- 0 to 30 degrees of adduction

Joints

- 0 to 45 degrees of internal rotation
- 0 to 50 degrees of external rotation

Joints

- Pelvic girdle moves back & forth within 3 planes for a total of 6 different movements
  - All pelvic girdle rotation results from motion at one or more locations
    - right hip
    - left hip
    - lumbar spine

Motions accompanying pelvic rotation

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Movements

- Anterior & posterior pelvic rotation
  - sagittal or anteroposterior plane
- Right & left lateral rotation
  - lateral or frontal plane
- Right transverse (clockwise) rotation & left transverse (counterclockwise) rotation
  - horizontal or transverse plane of motion

Movements

- Hip flexion
  - movement of femur straight anteriorly toward pelvis
- Hip extension
  - movement of the femur straight posteriorly away from the pelvis; sometimes referred to as hyperextension
Movements

• Hip abduction
  – movement of femur laterally to side away from midline
• Hip adduction
  – movement of femur medially toward midline

• Hip external rotation
  – rotary movement of femur laterally around its longitudinal axis away from midline; lateral rotation
• Hip internal rotation
  – rotary movement of femur medially around its longitudinal axis toward to midline; medial rotation

• Hip diagonal abduction
  – movement of femur in a diagonal plane away from midline of body
• Hip diagonal adduction
  – movement of femur in a diagonal plane toward midline of body

• Anterior pelvic rotation
  – anterior movement of upper pelvis; iliac crest tilts forward in a sagittal plane; anterior tilt
• Posterior pelvic rotation
  – posterior movement of upper pelvis; iliac crest tilts backward in a sagittal plane; posterior tilt

• Left lateral pelvic rotation
  – in frontal plane left pelvis moves inferiorly in relation to right pelvis; either left pelvis rotates downward or right pelvis rotates upward; left lateral tilt
• Right lateral pelvic rotation
  – in frontal plane right pelvis moves inferiorly in relation to left pelvis; either right pelvis rotates downward or left pelvis rotates upward; right lateral tilt

• Left transverse pelvic rotation
  – in horizontal plane pelvis rotates to body’s left; right iliac crest moves anteriorly in relation to left iliac crest, which moves posteriorly
• Right transverse pelvic rotation
  – in horizontal plane pelvis rotates to body’s right; left iliac crest moves anteriorly in relation to right iliac crest, which moves posteriorly
Muscles

- Seven two-joint muscles have one action at hip & another at knee

Modified from Anthony CP, Kolthoff NJ: Textbook of anatomy and physiology, ed 9, St. Louis, 1975, Mosby.

Muscles

- Muscles involved in hip & pelvic girdle motions depend largely on direction of movement and position of body in relation to earth & gravitational forces
- Body part that moves most will be the part least stabilized
  - Standing on both feet & contracting hip flexors, the trunk & pelvis rotate anteriorly
  - Lying supine & contracting hip flexors, the thighs move forward into flexion on the stable pelvis

Muscles

- Hip flexor muscles used in moving thighs up toward trunk
- Hip extensor muscles used eccentrically when pelvis & trunk move downward slowly on the femur and concentrically when trunk is raised on femur (rising to standing position)
- In downward phase of knee-bend exercise, movement at hips & knees is flexion
  - muscles primarily involved - hip & knee extensors in eccentric contraction

Muscles

- Medial - primarily hip adduction
  - Adductor brevis
  - Adductor longus
  - Adductor magnus
  - Gracilis

Muscles

- Posterior - primarily hip extension
  - Gluteus maximus
  - Biceps femoris
  - Semitendinosus
  - Semimembranosus
  - External rotators
Muscles

- Lateral - primarily hip abduction
  - Gluteus medius
  - Gluteus minimus
  - External rotators
  - Tensor fasciae latae

- Pelvic muscles acting on hip joint
  - Iliac region - iliopsoas muscle flexes hip
    - Iliacus
    - Psoas major
    - Psoas minor

- Pelvic muscles acting on hip joint
  - Gluteal region - extend & rotate hip
    - Gluteus maximus
    - Gluteus medius
    - Gluteus minimi
    - Tensor fascia latae
    - Six deep external rotators - piriformis, obturator externus, obturator internus, gemellus superior, gemellus inferior, & quadratus femoris

- Thigh - divided into 3 compartments by intermuscular septa

- Anterior compartment - primarily knee extensors
  - Rectus femoris
  - Vastus medialis
  - Vastus intermedius
  - Vastus lateralis
  - Sartorius

- Posterior compartment - hamstring group
  - Biceps femoris
  - Semitendinosus
  - Semimembranosus

- Medial compartment - primarily adductors
  - Adductor brevis
  - Adductor longus
  - Adductor magnus
  - Pectineus
  - Gracilis
Nerves

- All hip & pelvic girdle muscles - innervated from lumbar & sacral plexus (lumbosacral plexus)

Nerves

- Lumbar plexus - formed by anterior rami of spinal nerves L1 through L4 & some fibers from T12
  - Lower abdomen and the anterior & medial portions of lower extremity

Nerves

- Sacral plexus - formed by anterior rami of L4, L5, & S1 through S4
  - Lower back, pelvis, perineum, posterior surface of thigh & leg, and dorsal & plantar surfaces of foot

Nerves

- Lumbar plexus - major nerves
  - Femoral n. - anterior muscles
    - Arises from posterior division of lumbar plexus
    - Iliopsoas
    - Rectus femoris
    - Vastus medialis
    - Vastus intermedius
    - Vastus lateralis
    - Pectineus
    - Sartorius
    - Sensation to anterior & lateral thigh and medial leg & foot

Nerves

- Lumbar plexus - major nerves
  - Obturator nerve
    - Arises from anterior division of lumbar plexus
    - Adductor brevis
    - Adductor longus
    - Adductor magnus
    - Gracilis
    - Obturator externus
    - Sensation to medial thigh

Nerves

- Sacral plexus
  - Superior gluteal nerve
    - Arises from L4, L5, & S1 to innervate gluteus medius, gluteus minimus, & tensor fasciae latae
  - Inferior gluteal nerve
    - Arises from L5, S1, & S2 to supply gluteus maximus
  - Branches from sacral plexus
    - Piriformis (S1, S2), gemellus superior (L5, S1, S2), gemellus inferior & obturator internus (L4, L5, S1, S2), & quadratus femoris (L4, L5, S1)
Nerves

- Sacral plexus
  - Sciatic nerve
    - Tibial division
      - Semitendinosus, semimembranosus, biceps femoris (long head) & adductor magnus
      - Sensation for posterolateral lower leg & plantar aspect of foot
    - Common peroneal (fibular) division
      - Sensation to anterolateral lower leg & dorsum of foot
Gluteus Medius Muscle

Abduction of hip
Internal rotation & flexion (anterior fibers)
External rotation & extension (posterior fibers)

Gluteus Minimus Muscle

Abduction of hip
Internal rotation as femur abducts
Flexion of hip

Six Deep Lateral Rotator Muscles

Piniformis, Gemellus superior, Gemellus inferior, Obturator externus, Obturator internus, Quadratus femoris

Semitendinosus Muscle

Flexion of knee
Extension of hip
Internal rotation of hip
Internal rotation of flexed knee
Posterior pelvic rotation

Semimembranosus Muscle

Flexion of knee
Extension of hip
Internal rotation of hip
Internal rotation of flexed knee
Posterior pelvic rotation

Biceps Femoris Muscle

Flexion of knee
Extension of hip
External rotation of hip
External rotation of flexed knee
Posterior pelvic rotation
Adductor Brevis Muscle
- Adduction of hip
- External rotation as it adducts hip
- Assists in flexion of hip

Adductor Longus Muscle
- Adduction of hip
- Assists in flexion of hip

Adductor Magnus Muscle
- Adduction of hip
- External rotation as hip adducts
- Extension of hip

Pectineus Muscle
- Flexion of hip
- Adduction of hip
- External rotation of hip

Gracilis Muscle
- Adduction of hip
- Weak flexion of knee
- Internal rotation of hip
- Assists with flexion of hip

Hip Flexion
- Agonists
  - Psoas
  - Iliacus (iliopsoas)
  - Rectus Femoris
  - Pectineus
    - Sartorius
    - Tensor Fasciae Latae
Hip Extension

- Agonists
  - Gluteus Maximus
  - Biceps Femoris (Long Head)
  - Semitendinosus
  - Semimembranosus

Hip Abduction

- Agonists
  - Gluteus Medius
  - Tensor Fasciae Latae
  - Gluteus Maximus
  - Gluteus Minimus

Hip Adduction

- Agonists
  - Adductor Brevis
  - Adductor Longus
  - Adductor Magnus
  - Gracilis

Hip Internal Rotation

- Agonists
  - Gluteus Minimus
  - Gluteus Medius
  - Tensor Fasciae Latae

Hip External Rotation

- Agonists
  - Gluteus Maximus
  - Six Deep External Rotators

Web Sites

1. Radiologic Anatomy Browser
   http://radlinux1.usuf1.usuhs.mil/rad/iong
   - This site has numerous radiological views of the musculoskeletal system.

2. University of Arkansas Medical School Gross Anatomy for Medical Students
   http://anatomy.uams.edu/anatomyhtml/gross.html
   - Dissections, anatomy tables, atlas images, links, etc.

3. Loyola University Medical Center: Structure of the Human Body
   www.meddean.luc.edu/lumen/meded/grossanatomy/index.html
   - An excellent site with many slides, dissections, tutorials, etc. for the study of human anatomy

4. Wheeless’ Textbook of Orthopaedics
   www.wheelessonline.com/
   - This site has an extensive index of links to the fractures, joints, muscles, nerves, trauma, medications, medical topics, lab tests, and links to orthopedic journals and other orthopedic and medical news.
Web Sites

Premiere Medical Search Engine
www.medsite.com
- This site allows the reader to enter any medical condition and it will search the net to find relevant articles.

Virtual Hospital
www.vh.org
- Numerous slides, patient information, etc.

Arthroscopy.com
www.arthroscopy.com/sports.htm
- Patient information on various musculoskeletal problems of the lower extremity

Human Anatomy Online
www.innerbody.com/image/musc08.html
- Interactive musculoskeletal anatomy

The Hip and Knee Institute
www.hipsandknees.com/hip/contents.htm
- Arthritis of the Hip Joint

Adam Healthcare Center
http://adam.about.com/surgery/100006.htm
- Hip joint replacement

American Academy of Orthopaedic Surgeons
http://orthoinfo.aaos.org/category.cfm?topcategory=Hip
- Patient education library on the hip

Sports Injury Bulletin
- Groin strain causes

HealthGate Data Corp
- Groin Strain

The Physician and Sportsmedicine
- Symptomatic Snapping Hip

Neurography Institute
www.neurography.com/Images/Piriformis/Piriformis1.htm
- Piriformis Syndrome