

MYOLOGY

Definitions

Production of Movement = Skeletal muscle produces movement by exerting force (via a contraction) on tendons, which in turn pull on bones and other structures (i.e. skin)

Joint = Articulation of more than 1 bone; 2 bones make up a joint
Note: 2 bones that make up a joint do not move equally in response to a contraction; 1 BONE REMAINS STATIONARY.

Articulation = The meeting of 2 bones

Muscle Origin = Site of muscle attachment on the more stationary bone

Muscle Insertion = Site of muscle attachment on the more movable bone

Muscle Belly = Fleshy part of muscle between the origin and insertion.

Agonist (Prime Mover) = Muscle that contracts to cause an action/movement

Antagonist = Muscle that stretches and provides resistance to the agonist movement

NOTE: Agonist & Antagonist allow for smooth, controlled movements; if both contract together, there will be no movement. Whether a muscle is an agonist or antagonist depends on the MOVEMENT - different movements have different agonist and antagonist muscles.

*Rule - Muscles that Cross 2 Joints will perform movements at 2 joints

Example: Biceps cross the Shoulder Joint (originates on Scapula) and Elbow Joint (inserts on Radius), so produces Flexion of the arm and Flexion of the forearm.

Other examples: Triceps - Extension of Forearm and Extension of Arm

SHOULDER JOINT → Glenohumeral Joint

- ◆ Ball and Socket Joint
- ◆ Formed by the articulation of the Head of the Humerus and the Glenoid Cavity of the Scapula
- ◆ Triaxial (produces movement along 3 planes):
 - Flexion/Extension
 - Adduction/Abduction
 - Lateral/Medial Rotation
- ◆ Primary muscles to stabilize glenohumeral joint → Rotator Cuff Muscles
- ◆ Primary site of dislocation since not a solid joint structurally

Anatomical Components of Shoulder Joint:

1. Articular Capsule:

- ◆ Loose joint capsule that completely envelops the joint
- ◆ Extends
 - From → the Glenoid Cavity
 - To → Neck of the Humerus

2. Coracohumeral Ligament:

- ◆ Extends
 - From → Coracoid Process of the Scapula
 - To → Greater Tubercle of the Humerus

3. Glenohumeral Ligament:

- ◆ Extends
 - From → Glenoid Cavity
 - To → Lesser Tubercle & Neck of the Humerus

4. Transverse Humeral Ligament:

- ◆ Extends Horizontally From → Greater Tubercle
- To → Lesser Tubercle

5. Glenoid Labrum:

- ◆ A narrow rim of fibrocartilage around the edge of the Glenoid Cavity
- ◆ It deepens and enlarges the Glenoid Cavity; head of humerus sits in deeper.

ROTATOR CUFF MUSCLES

- ◆ Main Stabilizer of the Glenohumeral Joint
- ◆ Called Rotator Cuff because their tendons conjoin to form a "cuff" across the Greater and Lesser Tubercles of the Humerus (wrap around the head)
- ◆ Muscles act as a group to stabilize the head of the humerus into the glenoid fossa during shoulder movements.
- ◆ Role as stabilizers is VITAL because the ligaments of the shoulder joint are very loose
- ◆ "SITS" - - **S**upraspinatus, **I**nfraspinatus, **T**eres Minor, **S**ubscapularis

ELBOW JOINT

- ◆ Hinge Joint
- ◆ Formed by the articulation of the distal humerus and proximal radius/ulna
- ◆ 3 Articulations
 - Capitulum (of distal humerus) and Head of Radius
 - Trochlea (of distal humerus) and the Ulna
 - Olecranon Fossa (of distal humerus) and Olecranon of the Ulna

- ◆ Biaxial Movement (movement along 2 planes):
 - Flexion/Extension
 - Supination/Pronation

- ◆ Articulation between Radius and Ulna @ 3 sites:
 1. Interosseous Membrane - connective tissue between shafts of both bones
 2. Proximal Radioulnar Joint - between Head of the Radius and Radial Notch of Ulna
 3. Distal Radioulnar Joint - between Ulna and Ulnar Notch of the Radius

Anatomical Components of the Elbow Joint:

(Ligaments stabilize the Elbow Joint)

1. Articular Capsule:
 - ◆ Fibrocartilage that envelops the entire elbow joint (provides stability)
 - ◆ Extends across the Distal Humerus and Proximal Radius/Ulna

2. Ulnar Collateral Ligament (Medial Aspect):
 - ◆ Thick, triangular ligament that extends
 - From → Medial Epicondyle of the Humerus
 - To → Coronoid Process and Olecranon of Ulna

3. Radial Collateral Ligament (Lateral Aspect):
 - ◆ Strong, triangular ligament that extends
 - From → Lateral Epicondyle of the Humerus
 - To → Annular Ligament of Radius and Radial Notch of Ulna

4. Radial Annular Ligament:
 - ◆ Encircles the Head/Neck of Radius and Radial Notch of Ulna

5. Olecranon Bursa
 - ◆ Fluid filled sac that lines the olecranon and provides lubrication of the joint

WRIST JOINT

- ◆ Condylloid Joint (Ellipsoidal) → the Convex, oval shaped projection of 1 bone (Carpals) fits into the oval shaped Concavity (Radius) of another bone
- ◆ Formed by 3 Separate Joint Articulations:
 1. Radiocarpal Joint → Distal End of the Radius and the Proximal Row of Carpals = Scaphoid, Lunate, Triquetrium
 2. Midcarpal Joint → articulation between the 2 rows of Carpal Banes (Proximal Row and the Distal Row)
 3. Carpometacarpal Joint → Distal Carpal Bones and the Metacarpal Bones of the Hand

IMPORTANT NOTE: The ULNA is NOT involved with the articulation of the Wrist

- ◆ Bi-Axial Movement (movement along 2 planes): Flexion/Extension
Radial/Ulnar Deviation (more ROM w/Ulnar)

Anatomical Components of the Wrist Joint:

1. Radiocarpal Ligament: MAIN LIGAMENT
 - Connects the Styloid Process of the Radius and Distal Aspect of the Ulna with the Scaphoid and Lunate (1st 2 carpal bones on thumb-side).
2. Ulnar Collateral Ligament: Stabilizer on Ulna side
 - Attaches the Styloid Process of the Ulna to the Pisiform
3. Radial Collateral Ligament: Stabilizer on Radial side
 - Attaches the Styloid Process of the Radius to the Scaphoid and Trapezium

MUSCLES of the HAND

- 3 Muscle Groups of the Hand characterized by location and movement:
 1. Muscles that control the THUMB → Thenar Eminence (located on radial side)
 2. Muscles that control the PINKY → Hypothenar Eminence (located on ulna side)
 3. Muscles that control fingers 2-4 → Central Compartment
- Thenar Eminence: "wad" underneath the Thumb
 - ALL originate on Carpal Bones on Radial Side (Scaphoid and/or Trapezium)
 - ALL insert onto the Thumb; all involved with Thumb movements (agonist muscles of Thumb); Opponens inserts on Metacarpal vs. Phalanges
 - Comprised of 3 Muscles based on DEPTH: Most Superficial = Abductor Pollicis Brevis
Intermediate = Flexor Pollicis Brevis
Deep Layer = Opponens Pollicis
 - ALL innervated by the MEDIAN Nerve
 - NO Referral Pain
- Hypothenar Eminence: Ulna side
 - ALL originate on Carpal Bones on Ulna Side (Pisiform or Hamate)
 - ALL insert onto the Little Finger #5; all involved with movement of the Pinky (agonist muscles of the Pinky); Opponens inserts on Metacarpal vs. Phalanges
 - Comprised of 3 Muscles based on DEPTH: Most Superficial = Abductor Digiti Minimi Manus
Intermediate = Flexor Digiti Minimi Manus
Deep Layer = Opponens Digiti Minimi Manus
 - All innervated by the ULNAR Nerve
 - NO Referral Pain
 - "Manus" refers to the Hand
- Central Compartment: Central Portion of Hand and Fingers 2-4
 - 4 Muscles: Adductor Pollicis (2 Heads)
Lumbricals Manus (No bony Origin or Insertion; O&I on Tendons)
Palmer Interossei (deep in Palm - palmar aspect)
Dorsal Interossei Manus (dorsal aspect)
 - ALL ULNAR Nerve except Lumbricals innervated by Median Nerve at fingers 2-3; Ulnar Nerve at fingers 4-5 (same as Flexor Digitorum Profundus - - its origin site)

HIP JOINT (similar to Shoulder or Glenohumeral Joint)

- ◆ Ball and Socket Joint
- ◆ Formed by the articulation of the Head of the Femur and the Acetabulum of the Pelvis
- ◆ Triaxial (produces movement along 3 planes):
 - Flexion/Extension
 - Adduction/Abduction
 - Lateral/Medial Rotation

Anatomical Components of Hip Joint:

6. Articular Capsule:

- ◆ Dense/Strong fibrocartilage to stabilize the joint
- ◆ Considered to be one of the strongest structures of the body
- ◆ Extends From → the Rim of the Acetabulum
To → Neck of the Femur

7. Iliofemoral Ligament:

- ◆ Thickened Portion of the Articular Capsule (Left side)
- ◆ Extends From → AIIS of the Pelvis
To → Intertrochanteric Crest of the Femur

8. Pubofemoral Ligament:

- ◆ Thickened Portion of the Articular Capsule (Right side)
- ◆ Extends From → Pubic Ramus
To → Neck of the Femur

9. Ischiofemoral Ligament:

- ◆ Thickened Portion of the Articular Capsule
- ◆ Extends From → Ischium
To → Neck of the Femur

10. Ligament of the Head of the Femur (Fovea Centralis):

- ◆ Flat, Triangular Band
- ◆ Extends From → Acetabulum
To → Head of the Femur

11. Acetabular Labrum:

- ◆ Fibrocartilage rim around the margin of the Acetabulum
- ◆ Enhances the depth (deepens and enlarges) the Acetabulum (head of Femur sits in deeper).

Note: Dent on Head of the Femur = Fovea Centralis (or Fovea Capitis) - a ligament runs from Fovea Centralis into the Acetabulum for stability - - to prevent dislocation.

KNEE JOINT → Tibiofemoral Joint

(similar to Elbow Joint)

- ◆ Hinge Joint
- ◆ Formed by the articulation of the Distal Femur and Proximal Tibia & Fibula
- ◆ Consists of Three Joints within a single joint capsule
- ◆ 3 Articulations → Lateral Femoral Condyle and Lateral Tibial Condyle
→ Medial Femoral Condyle and Medial Tibial Condyle
→ Patella and Anterior Aspect of Femur (not a "true" joint/articulation)

- ◆ Biaxial Movement (movement along 2 planes): Flexion/Extension
Lateral/Medial Rotation

NOTE: Knee Joint must be FLEXED in order to perform Lateral/Medial Rotation @ Knee

Anatomical Components of the Knee Joint:

6. Articular Capsule:
 - ◆ Composed of Fibrocartilage and Expansions of Muscle Tendons (provides stability)

7. Medial and Lateral Patellar Retinacula:
 - ◆ Fused tendons of Quadriceps Muscles (Vastus Medialis and Lateralis) and TFL that strengthen the anterior surface of the joint.

8. Patellar Ligament (stabilizes the anterior aspect of Knee joint):
 - ◆ Continuation of the Common Tendon of the Quadriceps Muscles
 - ◆ Extends From → Patella
To → Tibial Tuberosity

9. Medial (Tibial) Collateral Ligament:
 - ◆ Broad, flat ligament on medial surface of knee that extends
From → Medial Femoral Condyle
To → Medial Tibial Condyle

10. Lateral (Fibular) Collateral Ligament:
 - ◆ Strong, round ligament on lateral surface of knee that extends
From → Lateral Femoral Condyle
To → Lateral Aspect of the Fibular Head

11. Anterior Cruciate Ligament - Limits excessive hyperextension of the knee
 - ◆ Intra-capsular (within the joint capsule) ligament that extends
From → Anterior Aspect of Tibia (Medial Tibial Spine)
To → Posteromedial Aspect of the Lateral Femoral Condyle

12. Posterior Cruciate Ligament - Resists excessive hyperflexion of the knee (MVA; knee hits dash)
 - ◆ Intra-capsular (within the joint capsule) ligament that extends
From → Posterior Aspect of Tibia (Lateral Tibial Spine)
To → Anterolateral Aspect of the Medial Femoral Condyle

13. Medial/Lateral Menisci:

- ◆ Fibrocartilage Discs located between the Femoral and Tibial Condyles that help compensate for the irregular shape of the bones
- ◆ Help to circulate synovial fluid throughout the joint space

14. Bursa (fluid-filled sac - lubricant)

- a) Prepatellar Bursa - located between the Patella & Skin
- b) Intrapatellar Bursa - located between Superior Aspect of Tibia & Patellar Ligament
- c) Suprapatellar Bursa - located between the Inferior Aspect of Femur & Surface of Quadriceps Muscles.

ANKLE JOINT → Talocrural Joint or Mortise Joint

- ◆ Hinge Joint
- ◆ Formed by the Articulation of:
 1. Medial Malleolus of Distal Tibia and Talus
 2. Lateral Malleolus of Distal Fibula and Talus

INTERTARSAL JOINT

- ◆ Planar Joint → articular surfaces are flat or slightly curved
- ◆ Formed by 3 Joint Articulations:
 4. Subtalar Joint → articulation between the Talus and Calcaneus
 5. Talocalcaneonavicular Joint → between the Talus, Calcaneus (medial) and Navicular
 6. Calcaneocuboid Joint → articulation between Calcaneus (distal) and Cuboid
- ◆ Bi-Axial Movement (movement along 2 planes):
 - Dorsiflexion/Plantarflexion (Ankle joint)
 - Eversion/Inversion (Intertarsal joint)

Anatomical Components of the Ankle and Intertarsal Joints:

3. Articular Capsule:
 - Composed of Fibrocartilage and is Thin Anteriorly and Posteriorly
 - Extends from Malleoli to the Talus
4. Deltoid Ligament: *Made up of 3 Ligaments*
 - ◆ Reinforces the Medial Aspect of Articular Capsule - very strong; not commonly injured.
 - ◆ Extends From → Medial Malleolus
 - To → portions of the Talus - Tibiotalar Ligament
 - Calcaneus - Tibiocalcaneal Ligament
 - Navicular - Tibionavicular Ligament
5. Plantar Calcaneonavicular (Spring) Ligament:
 - ◆ Extends From → Medial Aspect of Calcaneus (superior)
 - To → Navicular
6. Anterior Talofibular Ligament: *Most Commonly Injured*
 - ◆ Extends From → Lateral Malleolus
 - To → Talus
 - ◆ One of the most injured ankle ligaments associated with ankle sprains - inversion sprain
5. Posterior Talofibular Ligament
 - ◆ Extends From → Lateral Malleolus
 - To → Talus
6. Calcaneofibular Ligament
 - ◆ Extends From → Lateral Malleolus
 - To → Lateral Aspect of the Calcaneus

- ◆ One of the most injured ankle ligaments associated with ankle sprains

Other Notes:

1. Tensor Fascia Latae

- ◆ TFL gets its name because it *tenses* the *fascia latae* (aka **Iliotibial Band**), which is a broad covering of fascia that lies over the muscles of the thigh.
- ◆ TFL muscle inserts on Iliotibial Band.

2. The Pes Anserine Tendon

- ◆ Located on the Anteromedial Aspect of the Tibia
- ◆ 3 Muscles attach (insertion) to this region of the Tibia:
 - A. Sartorius - attaches most ANTERIOR
 - B. Semitendinosus - attaches most POSTERIOR
 - C. Gracilis - attached/located in between Sartorius and Semitendinosus

"SGT Duck" to remember muscles and order: "S"artorius (Anterior)
"G"racilis (in between)
Semi"T"endinosus (Posterior)

3. Deep Rotators

- ◆ Muscles run Medial to Lateral to perform Lateral Rotation (all perform same action and only one action)
- ◆ All innervated by Lumbar Spine Nerve except for Obturator Externus (Obturator Nerve)
- ◆ Most insert on Greater Trochanter of Femur (4 of 6) except Obturator Externus (Medial Aspect of Femur) and Quadratus Femoris (Intertrochanteric Crest of Femur)
- ◆ Only Piriformis refers pain - - sciatica-like pain.

4. Quadricep Muscles

- ◆ Rectus Femoris is the only Quad muscle that crosses 2 planes - hip & knee so performs movements of both the thigh (flexion) and leg (extension).
- ◆ ALL Quads perform Extension of Leg
- ◆ ALL are innervated by the Femoral Nerve
- ◆ ALL insert on Tibial Tuberosity
- ◆ All 3 "Vastus" have same Origin - Posterior Aspect of mid shaft of Femur (Linea Aspera)

5. Adductor Muscles

- ◆ Medial Aspect of the Thigh
- ◆ Site of "Groin Pull" - when adductor muscles are strained and pain is felt in their proximal attachment (all Originate on the Pubis - Adductor Magnus also originates on Ischial Tuberosity)
- ◆ ALL innervated by the Obturator Nerve except Pectineus (Femoral Nerve) and Adductor Magnus - innervated by Sciatic Nerve (known as the 4th Hamstring Muscle)

6. Hamstring Muscles

- ◆ Posterior Aspect of Thigh
- ◆ ALL Originate on the Ischial Tuberosity (Biceps Femoris short head on the Linea Aspera)
- ◆ As a group, ALL Extension of Thigh and Flexion the Leg (main)
- ◆ ALL innervated by Sciatic Nerve

- ◆ Biceps Femoris unique in that it also performs Lateral Rotation of Leg
- ◆ ALL refer pain into posterior knee
- ◆ Name given because butchers would hang pig carcasses by their hamstring tendons