

Shoulder

- Complex multi-axial ball and socket joint
- Location of boney landmarks is extremely important in the evaluation of the shoulder
 - 3 bones
 - Clavicle "collar bone"
 - Scapula "shoulder blade"
 - Humerus Long bone upper arm

Shoulder Bones

- Clavicle
 - Sternal end
 - Acromial end articulates with Acromion process
- Scapula
 - Supraspinous Fossa
 - Scapular Spine
 - Infraspinous Fossa
 - Acromion Process
 - Coracoid Process
 - Subscapular Fossa (anterior surface)

Shoulder

- Humerus
 - Greater Tuberosity
 - Bicipital (intertubecular) groove
 - Lesser Tuberosity

Three joints make up the shoulder complex:

- a. Sternoclavicular Joint articulation of the sternum and clavicle
- b. Acromioclavicular Joint Articulation of the clavicle and acromion process and the clavicle.
- c. Glenohumeral Joint True shoulder joint. Glenoid fossa of the scapula and the head of the humerus

Shoulder Joints

SC joint – very important in shoulder function
pivot joint – only articulation between the axial and

appendicular skeleton.

- AC joint Weak pivot joint. Held together by ligaments. Injured frequently as forces transmitted through the hand/arm reach the AC joint - also direct blows
- GH joint Anatomically weak, most mobile joint in the body

Glenohumeral Joint

- Boney anatomy very unstable. Analogous to a golf ball on a golf tee.
- Ligament anatomy static restraints. Looser than most joints as to allow greater ROM. Ligaments are actually a thickening of the capsule.
- Muscular anatomy Dynamic restraints. Must have adequate strength in the scapular and humeral musculature to prevent both acute and chronic injuries.

Glenohumeral Joint

- Humeral movers include the pectoralis major, deltoid, latissimus dorsi, teres major, coracobrachialis and others .
- Scapular movers include the rhomboids, trapezius, pectoralis minor, levator scapulae, serratus anterior and the rotator cuff. These muscles are extremely important and often overlooked

- Supraspinatus (Abduction & ER)
- Infraspinatus (ER) Referred to as the
- Teres Minor (ER) "SITS"
- Subscapularis (IR) Muscles
- These 4 muscles surround the humeral head and hold the humerus in the glenoid fossa. *They are the most active dynamic stabilizers of the glenohumeral joint*.

Scapular Muscles

• The rotator cuff along with the other scapular muscles are not specifically addressed in a traditional strength training program. Weakness in the rotator cuff muscles can cause the humeral head to become "sloppy" within the glenoid fossa causing overuse conditions in the GH joint. The scapular muscles must steer the glenoid fossa to wherever the humeral head moves

Glenoid Fossa

- In an uninjured shoulder, the humeral head remains within a few millimeters (1/8 to ¼ inch)of the center of the fossa. At any one moment, only 25-30% of the humeral head is in contact with the glenoid fossa.
- Glenoid Labrum small rim of fibrocartilage attached to the glenoid fossa that deepen the glenoid fossa from approximately 2.5 mm. to 5 mm.

Glenohumeral Joint

- With any overuse injury to the GH joint, the scapular muscles must be evaluated also. In this joint perhaps more than any other, the problem may not be what it appears
- Must have proximal (scapular) stability before distal mobility

Abduction

- In order for the GH joint to move into abduction:
- 1. Middle deltoid and supraspinatus fire.
- 2. Rotator cuff (SS) fires to exert a downward force on the humeral head.
- 3. Scapula moves in an outward direction (serratus anterior, trapezius)
- 4. The AC and SC joints must pivot

Thoughts

- What if the rotator cuff is injured and does not exert enough of a downward push on the humeral head?
- What if one of the scapular muscles is injured and does not fire in sequence with the rotator cuff to move the scapula in the proper direction?
- The AC or SC joints do not pivot?
- The rotator cuff originates on the scapula yet the scapula has to move to keep up with the intentions of the rotator cuff acting on the humerus.

Evaluation Procedure

Evaluation needs to be thorough and address all areas of the shoulder region. I suggest you start anterior and medial (SC joint) or posterior and medial (vertebral border or superior angle of the scapula). In either case, move in a lateral direction towards the arm and then to the opposite side of the body of where you began. Then you may return to the head of the humerus to finish up.

Evaluation Procedure

Example:

Sternoclavicular joint, follow clavicle to acromial end and AC joint. Following the AC joint around to the posterior side of the body, you will be palpating the scapular spine. Above the scapular spine, you will palpate the supraspinatus muscle. Below the scapular spine will be the infraspinatus muscle. (While in the neighborhood, you could locate the inferior and superior angles of the scapula as well as the vertebral (medial) and axilliary (lateral) borders.

Evaluation Procedure

Moving back to the acromion process, anteriorly and inferior, you can find the coracoid process. Moving back to the AC joint and moving inferior, you can feel the joint line of the GH joint and the greater tubercle. Moving medially on the humerus, you will palpate the bicipital groove. The long head of the biceps brachii is here. If you externally rotate the GH joint, you will be able to palpate the lesser tubercle. The subscapularis muscle inserts here.

Injuries to the Shoulder Complex

- Mechanisms
 - Direct Trauma
 - Indirect Trauma
 - Chronic, overuse Trauma
- Sternoclavicular Joint
 - Sprains
 - Sternoclavicular Ligaments
 - Interclavicular Ligaments Anterior vs. Posterior sprain

Injuries to the Shoulder Complex

- Clavicular Injuries
 - Contusions
 - Fractures
 - Greenstick Fracture
- Acromioclavicular Joint
 - Sprain/Separations
 - Degrees: First, second, third

AC Separations

- 1st Degree No deformity pain with palpation of the AC joint
- 2nd Degree AC ligaments are torn. <u>Clavicle will maintain</u> <u>its anatomical position</u> but the scapula will drop inferior to the clavicle because of the weight of the arm. Step down deformity.
- 3rd degree AC ligaments are ruptured as well as the coracoclavicular ligaments. Scapula will drop inferior but clavicle will rise as it is no longer attached at the distal end. Piano key sign

AC Separations

- Orthopedic Surgeons actually have six classifications of AC separation.
- Articular disc
- HOPE
 - H: Depends on degree
 - O: 1st no real observation, 2nd step down deformity, 3rd clavicle elevated
 - P: 1^{st} pain, 2^{nd} , 3^{rd} deformity
 - S: AC shear test, ac traction, piano key test

Glenohumeral Injuries

- Subluxations and dislocations
 - Anterior, posterior, inferior
 - MOI Anterior Abduction and external rotation
 - MOI Posterior Anterior blow, forward flexed shoulder forcing it posterior
 - MOI Inferior fall on the point of the shoulder, force coming down on top of the shoulder from above

GH Dislocation

- H: If dislocated they will tell you it is out of joint. If subluxated, they will tell you "it popped out and popped back in."
 - Rim subluxations
- O: If dislocated, arm will be in an unusual position depending on where the humeral head is. If subluxed, they normally grab the shoulder or the elbow on the involved side

GH Dislocations

- P: Pain generally around shoulder. Inferior to AC joint will reveal a absence of the humeral head when compared to the uninjured side. Will normally have pain at anterior, inferior capsule behind the pectoralis major tendon.
- S: If dislocated, none
- If subluxation = (+) apprehension test

Dislocation Thoughts

• Labrum

• Ligaments/capsule

• Muscles

- Supraspinatus / Subacromial Bursa
 - Strain, tendinitis, bursitis
 - Scapular muscle issues?
- Infraspinatus/Teres Minor
 - Strain (acute vs. overuse)
- Subscapularis
 - Strain (acute vs. overuse)

- Supraspinatus Abduction & stabilization
 - superior greater tubercle (humerus)

Testing:

Empty Can Test

Impingement Tests

Drop Arm Test

- Overuse issues (change in mechanics, advanced impingement)

- Infraspinatus/Teres Minor
 - External rotators-posterior humerus
 - Injured less frequently than supraspinatus
 - Resistive stress testing-location, location, location
- Subscapularis
 - Internal Rotator-anterior humerus
 - Palpation and resistive stress testing

Biceps Tendon

- Bicipital Tendonitis (tenosynovitis)
 - Inflammation of tendon or synovial sheath
 - Transverse ligament
 - SLAP lesion
 - Speed's test for biceps tendon irritation
 - SLAP lesion Physician. May have popping and clicking "deep in the shoulder".

Proximal Humeral Apophisitis

• Occurs in non-skeletally mature athletes. This is an inflammation of the growth plate near the humeral head. The young athlete will have constant pain but it will be below the shoulder joint on the humerus approximately where the contour of the biceps changes. This will require a physicians referral

Brachial Plexus Injuries

- Burner or Stinger
 - Same injury
 - Causes
 - Direct blow to the base of the neck above the clavicle (compression injury)
 - Shoulder depression and opposite side neck lateral flexion (traction stinger)
 - Cervical spine flexion combined with head rotation to the same side (compression stinger)

Brachial Plexus Injuries

- H: Athlete will describe burning, tingling, dead arm, shot of pain.
- O: Affected arm will be dangling and the same side shoulder will also lean to that side.
- P: Optional
- S: Athlete must be symptom free and have (=) bilateral strength in the following motions:
 - Abduction (deltoid), Ext. Rotation (infraspinatus) and grip strength (both median and ulnar nerve)

Brachial Plexus Injury

- Rehabilitation
 - Will depend on mechanism
 - Compression from direct blow= rest
 - Traction = strengthening + rest
 - Compression from neck flexion = stretching + rest

The amount of rest time will depend on when equal strength returns

Elbow

- Synovial Hinge Joint articulation of the humerus, radius and ulna (also radioulnar joint)
- Very stable in full extension most vulnerable between 10-60 degrees of flexion.

Elbow Anatomy

• 3 Bones

- Humerus (not humorous)
 - Landmarks medial and lateral epicondyles, olecranon fossa.
- Ulna
 - Landmark Olecranon process
- Radius
 - Radial tuberosity, head of the radius

Elbow

- Small, thin joint capsule but relatively strong joint
- Minor trauma will impede ROM greatly and ROM does not return quickly
- Muscular Anatomy
 - Flexors:
 - Biceps brachii, brachialis, brachioradialis, wrist flexors
 - Extensors
 - Triceps, wrist extensors
 - Others
 - Pronator teres, pronator quadratus, supinator

Elbow

Ligaments

- Lateral collateral (radial collateral)
 - Lateral epicondyle distal to the annular ligament of the radius. Annular ligament surrounds the head of the radius. This is the weaker of the two collateral ligaments.
- Medial Collateral (ulnar collateral)
 - 2 portions both originate on the medial epicondyle and course distal to attach on the ulna

- Sprains Common
 - Valgus or varus force
 - Hyperextension
 - Sprains may also involve the musculature
 - Overuse SPRAINS also occur in the elbow
- Strains
 - Common in repetitive and throwing athletes

• Strains

- Acute strains sudden overload applied to contractile (muscular) units
 - Most common at flexor and extensor units located at the medial and lateral epicondyles.
 - Chronic strains
 - Remember that a chronic injury starts as an acute injury

- Strains around the elbow are named "strangely"?
 - Medial *epicondylitis* is the term given when the wrist flexor or pronator muscles are strained. This injury is commonly termed golfers elbow. It can be evaluated both passively or resistively.
 - Lateral *epicondylitis* is the term given when the wrist extensor or supinator muscles are strained. This can also be evaluated passively or resistively.

- Little leaguers elbow
 - Injury to the growth plate of the humerus at or near the medial epicondyle. Wrist flexor musculature begins to avulse the medial epicondyle from the humerus.
 - S&S
 - Persistent pain
 - Stiffness, inability to warm up elbow
 - Increase pain with the use of the arm

- Olecranon Bursa
- Dislocation check radial pulse (picture)
- Fracture elbow/radius, ulna check radial pulse
- Ulnar Nerve Contusion
- Compartment Syndrome Volkman's Ischemic Contracture

Evaluation of Elbow Injuries

- Pain around the joint can indicate either muscular or ligament disruption.
- Muscular elbow and wrist flexion and extension, supination, pronation.
- Ligament Valgus (abduction) and varus (adduction) stress tests

Wrist and Hand

- 8 carpals two rows of 4 bones
 - Scaphoid, lunate, triquetrum, pisiform(proximal row)
 - Trapezium, trapezoid, capitate, hamate(distal row)
 - Some Lovers Try Positions That They Can't Handle
 - So Long Top Part, Here Comes The Thumb
 - Never Lower Tillie's Pants, Terrible Things Could Happen
- 5 metacarpals
 - Labeled from thumb (1st MC) to pinky (5th MC)

Wrist and Hand

• 14 phalanges – 2 for the thumb, 3 for each of the fingers

• Any injury to the wrist and hand should be considered serious until proven otherwise. A "sprained wrist" is not always the case!

Carpal Injuries

- Distal row of carpals injured more frequently
 - Scaphoid Anatomical snuffbox most frequently fractured carpal high rate of non-union
 - MOI is normally unclear
 - Pain in snuffbox ulnar deviation not excruciating
 - Many of these fractures go undetected by the average person
 - Referral to physician cast 8 + weeks

Carpal Injuries

- Lunate depression on dorsal side of the wrist
 - Most frequently dislocated carpal.
 - Testing palpation
 - Murphy's Sign
- Hamate Hook can be fractured crushing the ulnar artery and nerve - paresthesia
- Pisiform Can become avulsed b/c of attachment of flexor carpi ulnaris. Palpation

Carpal Tunnel Syndrome

- Carpal tunnel formed by "floor" of carpal bones and transverse carpal ligament
- Syndrome caused by trauma, inflammation or hypertrophy of tendons that pass through the carpal tunnel
- Normally acute in athletics but can happen with repetitive movements

Carpal Tunnel Syndrome

- Athlete could describe pain, numbress, or tingling in middle and index fingers as well as the thumb
- Possible atrophy in thenar eminence (if long term)
 - Testing
 - Phalen's Test
 - Tinel Sign median nerve

Metacarpal Injuries

• Metacarpal fractures and contusions

Fracture – pain between joints, crepitus, rotation of finger attached to suspected metacarpal

- Longitudinal stress
- Percussion (tap) test
- Other tests
 - These are sometimes tricky to detect. Best option is to have the athlete x-rayed.

Phalanges

• Strains

- Athlete should be able to fully flex and extend at each joint (DIP, PIP) with equal strength
 - Mallet Finger
 - Boutonniere Deformity
- Sprains very common
 - "Jammed finger"
 - Point tender, swelling, pain
 - Check in all four directions (abduction/adduction, palmar and dorsal stress)
 - May take months for all S&S to leave

Phalanges

- If pain stays at the joint line of the phalange, fracture is less likely but not ruled out
- Can cause an avulsion fracture
- PIP is affected more than DIP
- Dislocation easily recognized
- Fracture "V" type deformity

Thumb

- Strains as with other 4 fingers
- Sprains Demand more importance than other 4 fingers
 - Radial and ulnar collateral ligaments
 - Skiers Thumb sprain of ulnar collateral ligament
 - MUST RECOGNIZE AND REFER- athlete may lose the ability to pinch
 - Thumb is forced into hyper abduction
 - Pain at the MCP joint on the dorsal side of the hand
 - Laxity with abduction at MCP joint