Shoulder Injuries in Sports

Akhtar Rasul

Outline

- This chapter outlines the anatomy of the shoulder girdle and discusses commonly presenting pathology around this area.
- Common Orthopaedic Assessment Tests.
- The role of Rehabilitation is covered with analysis of the function of commonly utilized exercise
- Role of clinical reasoning in determining the diagnosis and formulating a safe and effective rehabilitation Programme

Incidence of shoulder injury

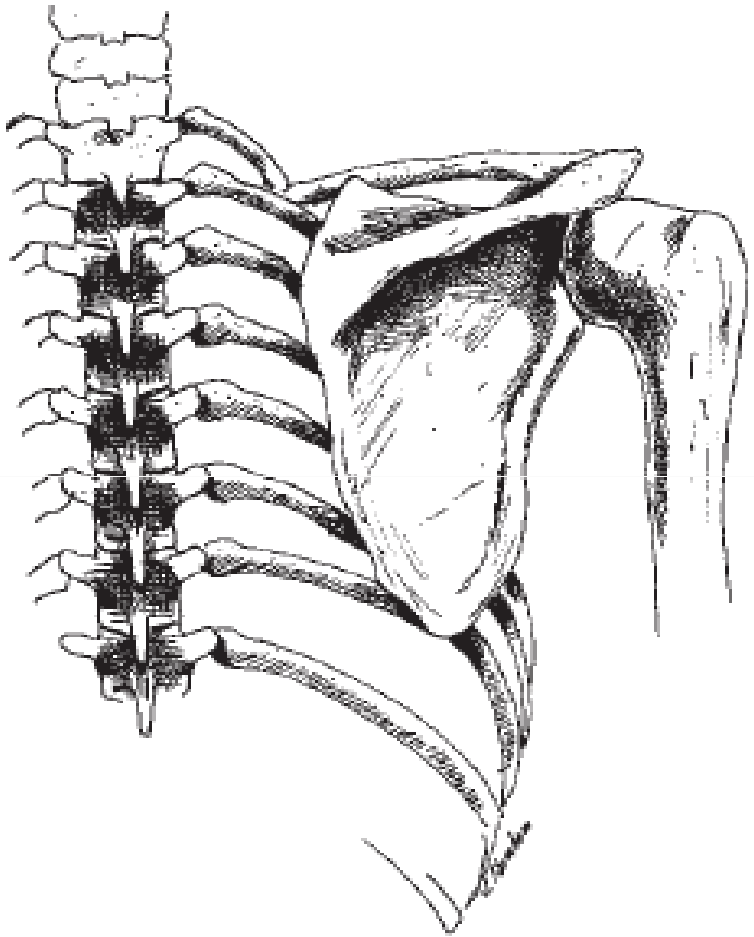
- The Glenohumeral joint is one of the most frequently injured areas of the upper extremity in competitive sports.
- Studies indicate that 8–20% of athletic injuries involve the Glenohumeral joint
- Racquet sports, sports involving throwing swimmers and rugby players (due to their arm position within the tackle).

- Even within non-overhead sports, such as skiing, shoulder injuries have been reported as high as 11.4% of all injuries

Static stabilisers of the Glenohumeral joint

- Superior Glenohumeral ligament
- Middle Glenohumeral ligament
- Inferior Glenohumeral ligament complex
- Coracohumeral ligament
- Glenoid labrum

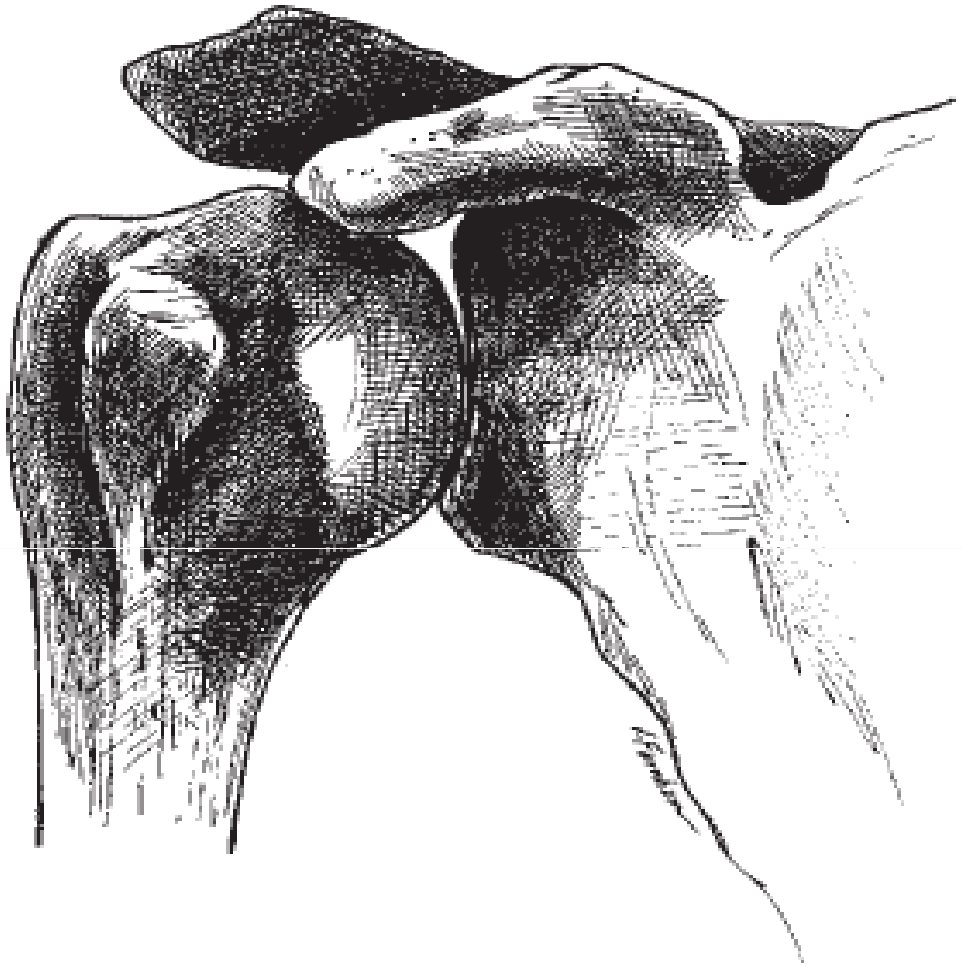
- Dynamic stabilization through dynamic muscle control
- Highly susceptible to injury and dysfunction



A posterior view of the three components

Glenohumeral Joint

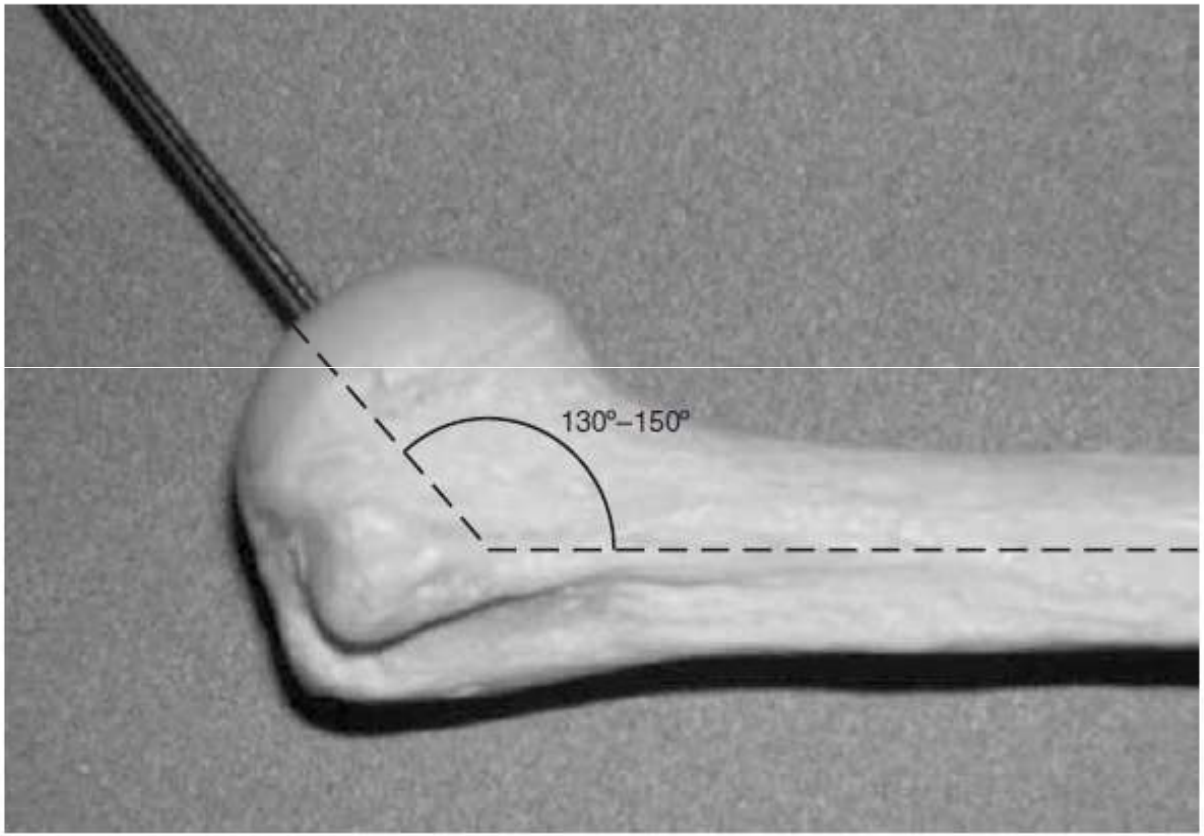
- The GH joint is a ball-and-socket synovial joint with three rotational and three translational degrees of freedom.
- It has a capsule and several associated ligaments and bursae
- The articulation is composed of the large head of the humerus and the smaller glenoid fossa
- Sacrificed articular congruency to serve the mobility needs

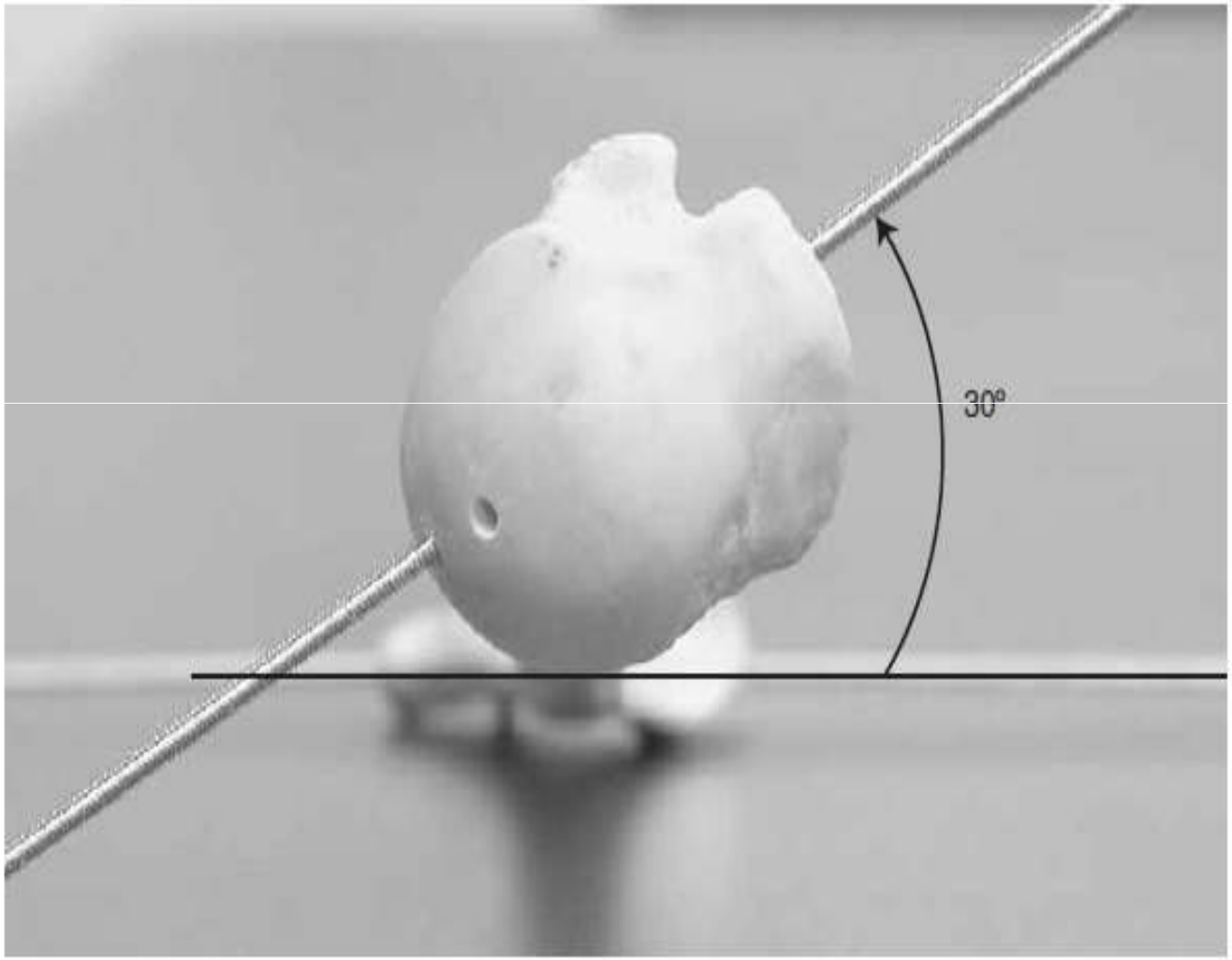


The glenohumeral joint.

- The humerus is the **distal segment** of the GH joint.
- The humeral head has an articular surface that is larger than that of the proximal glenoid articular surface, forming **one third to one half of a sphere**
- An axis through the humeral head and neck in relation to a longitudinal axis through the shaft of the humerus forms an angle of **130 to 150** in the frontal plane
- Angle of Inclination

- In the **transverse plane**, the axis through the humeral head and neck in relation to the axis through the humeral condyles forms an angle that varies far more
- than other parameters but is usually described as approximately **30 posteriorly** This angle is known as the **angle of torsion.**

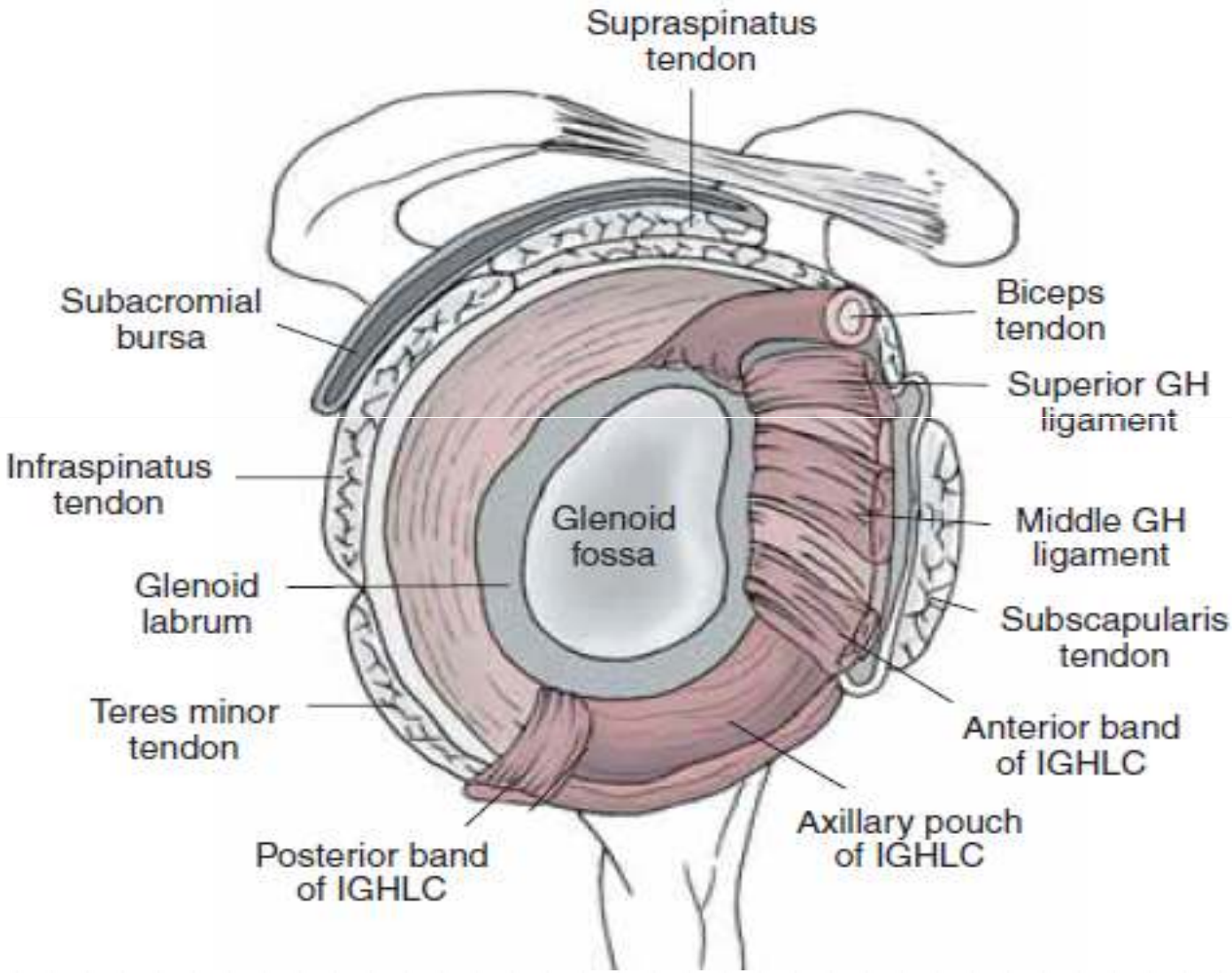

130°–150°


30°

Glenoidal Labrum

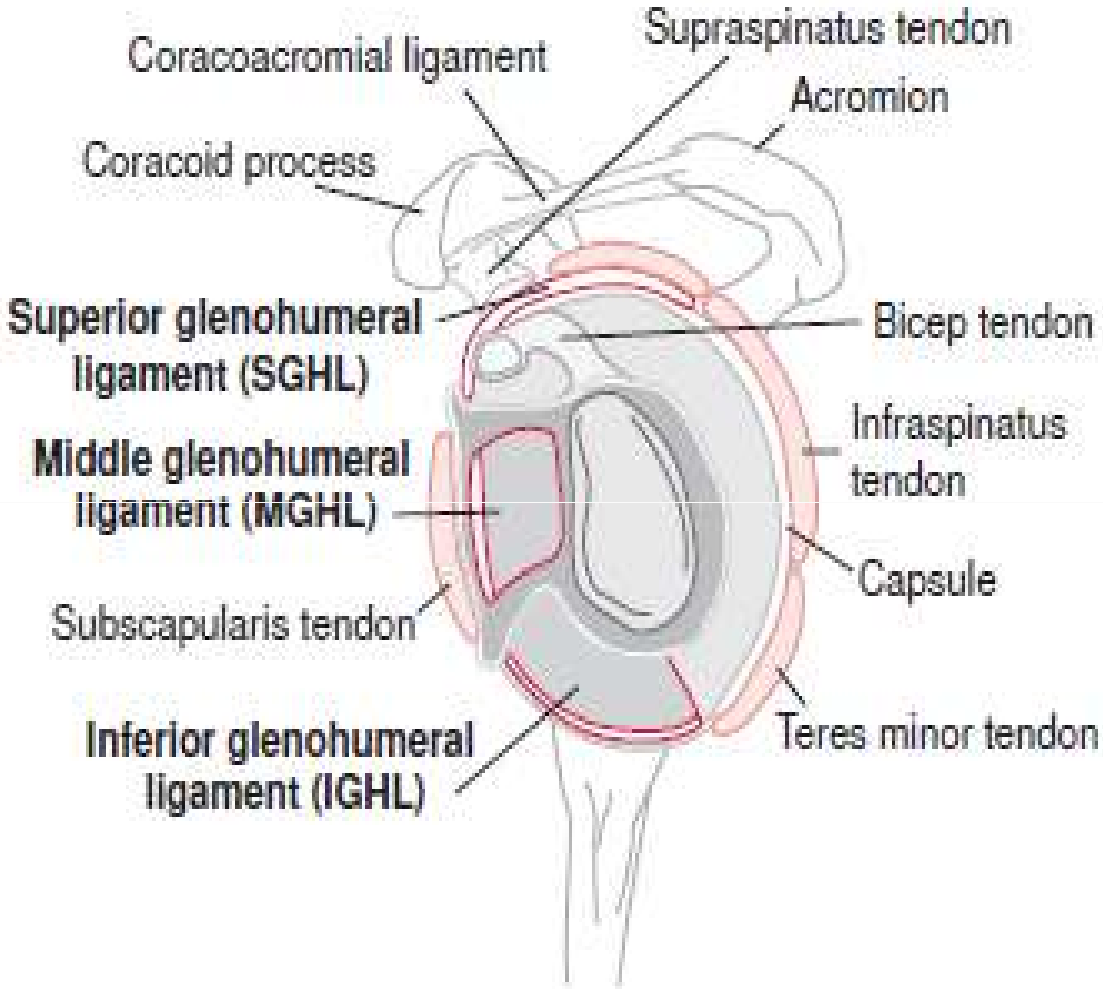
- When the arms hang dependently at the side, the two articular surfaces of the GH joint have little contact.
- The majority of the time, the inferior surface of the humeral head rests on only a small inferior portion of the fossa.
- The total available articular surface of the glenoid fossa is enhanced by an accessory structure, the **glenoid labrum**

- The labrum superiorly is loosely attached, whereas the inferior portion is firmly attached and relatively immobile.
- The glenoid labrum also serves as the attachment site for the Glenohumeral ligaments and the tendon of the **long head of the biceps brachii.**

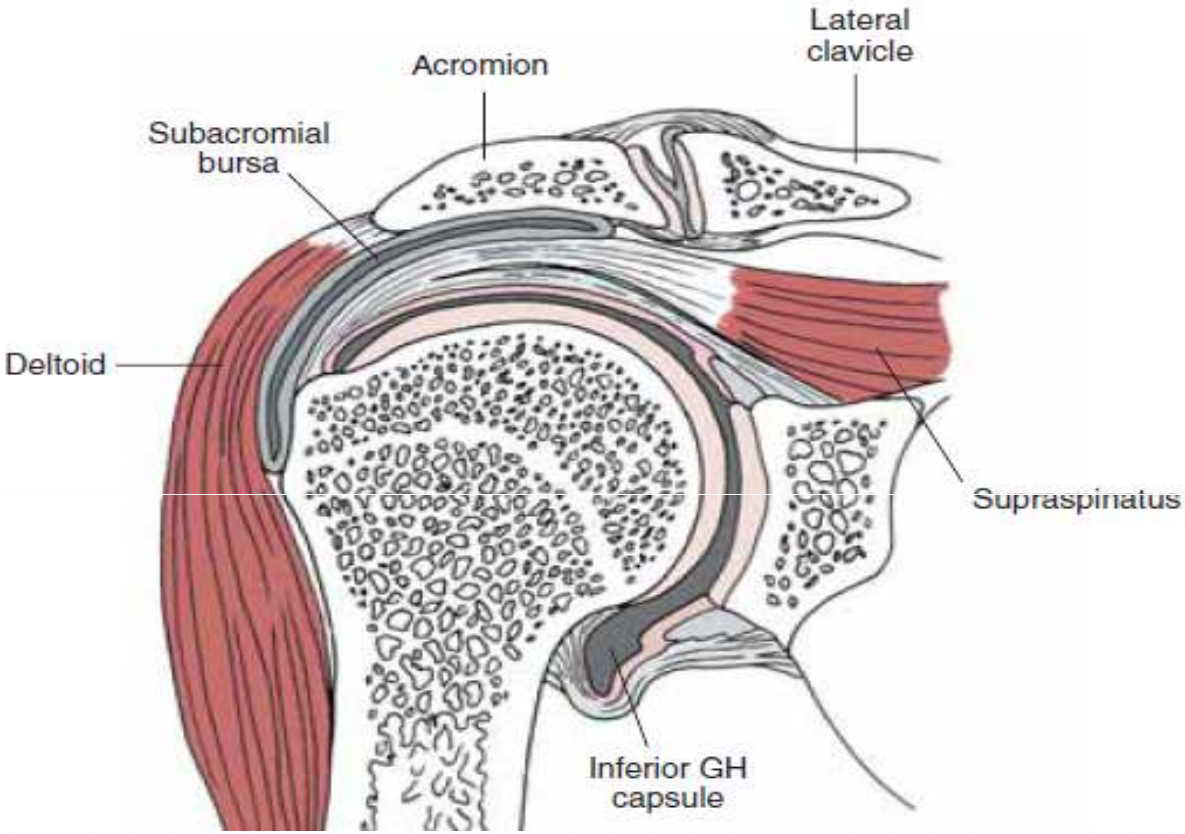

Supraspinatus tendon
Subacromial bursa
Biceps tendon
Superior GH ligament
Infraspinatus tendon
Glenoid fossa
Middle GH ligament
Glenoid labrum
Subscapularis tendon
Teres minor tendon
Anterior band of IGHLC
Axillary pouch of IGHLC
Posterior band of IGHLC

Glenohumeral Capsule and Ligaments

- The entire GH joint is surrounded by a large, loose capsule that is **taut superiorly and slack anteriorly and inferiorly** in the resting position (arm dependent at the side)
- The capsular surface area is **twice** that of the humeral head.
- More than **2.5 cm** of distraction of the head from the glenoid fossa is allowed in the **loose-packed position.**



Lateral aspect, left shoulder

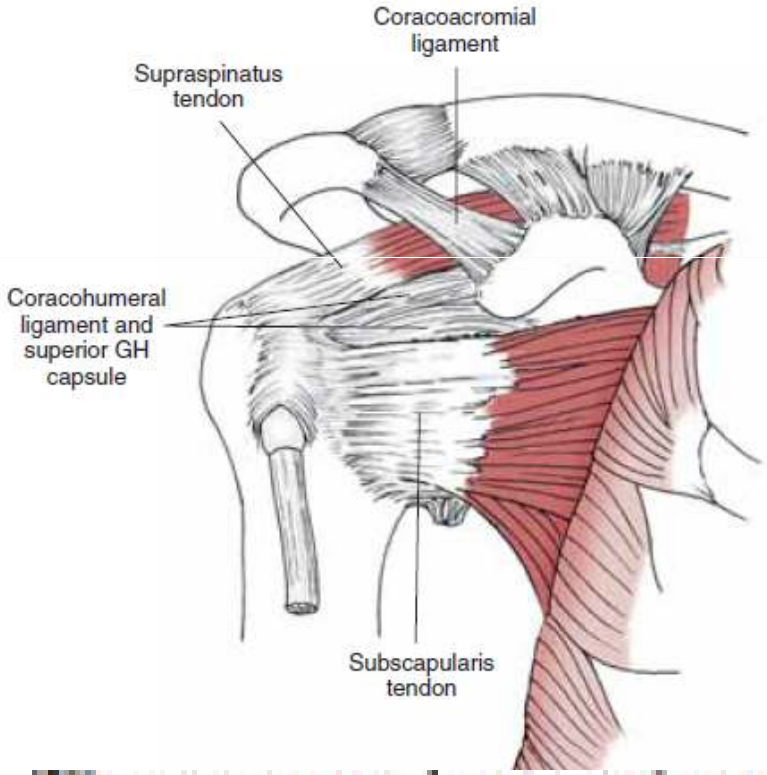


When the arm is at rest at the side, the superior capsule is taut, whereas the inferior capsule is slack.

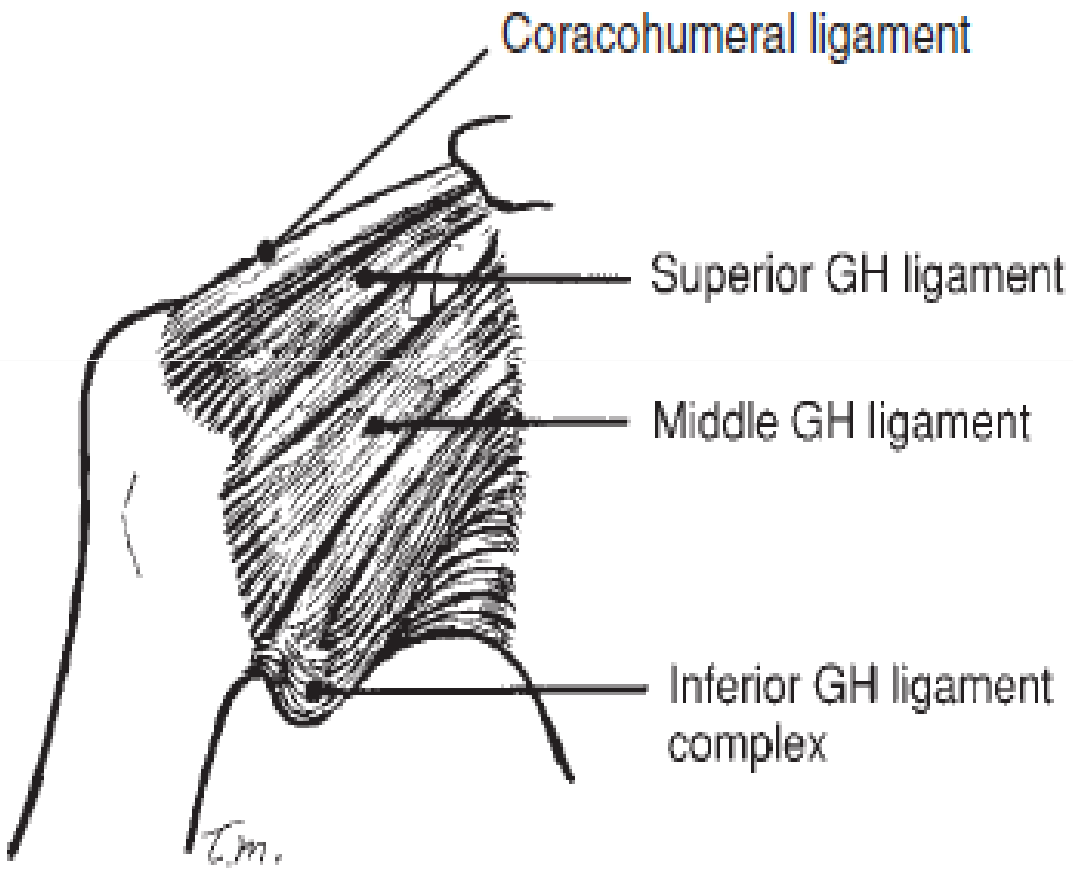
- The relative laxity of the GH capsule is necessary for the **large excursion** of joint surfaces but provides little stability without the **reinforcement** of ligaments and muscles.
- When the humerus is abducted and laterally rotated on the glenoid fossa, the capsule twists on itself and tightens, making abduction and lateral rotation the **close-packed position** for the GH joint

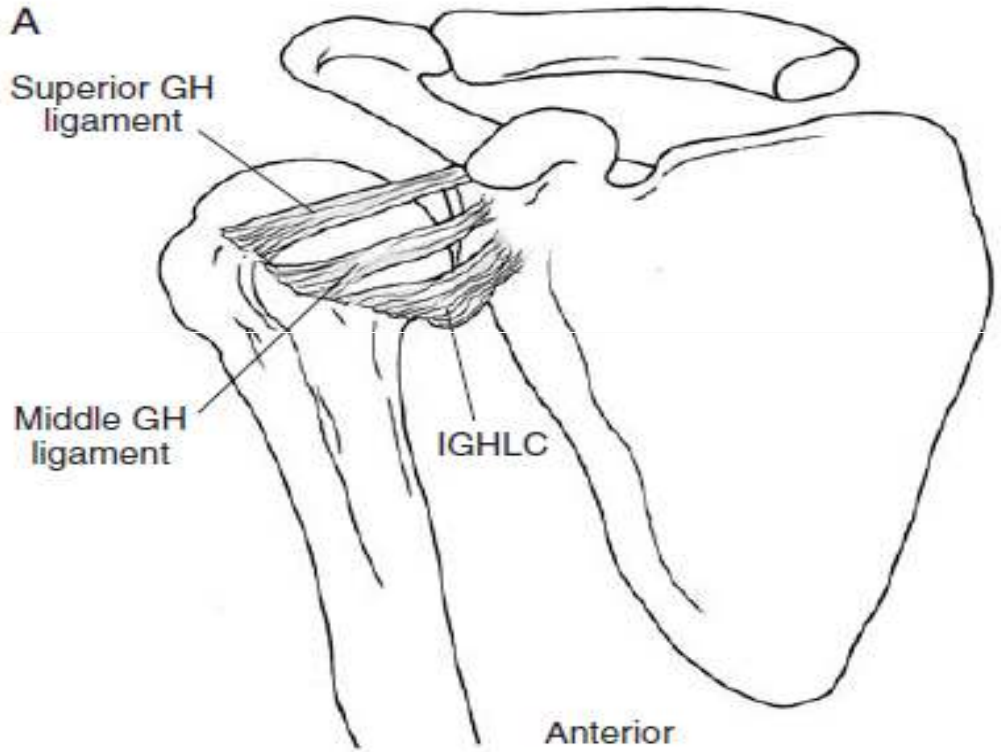
- The capsule is reinforced by the **superior, middle,** and **inferior GH ligaments,** as well as by the **coracohumeral ligament**
- Thin area of capsule between the superior and the middle GH ligaments (known as the **foramen of Weitbrecht**) is a particular point of weakness in the capsule.
- Although the capsule is reinforced anteriorly by the **subscapularis** tendon, the foramen of Weitbrecht is a common site of extrusion of the humeral head with anterior dislocation of the joint.

- GH ligament, the superior capsule, and the coracohumeral ligament as interconnected structures that bridge the space between the **supraspinatus** and **subscapularis** muscle tendons, forming what they described as the **rotator interval capsule**
- The inferior GH ligament has been described as having at least three portions and thus has been termed the **inferior GH ligament complex** (**IGHLC**)

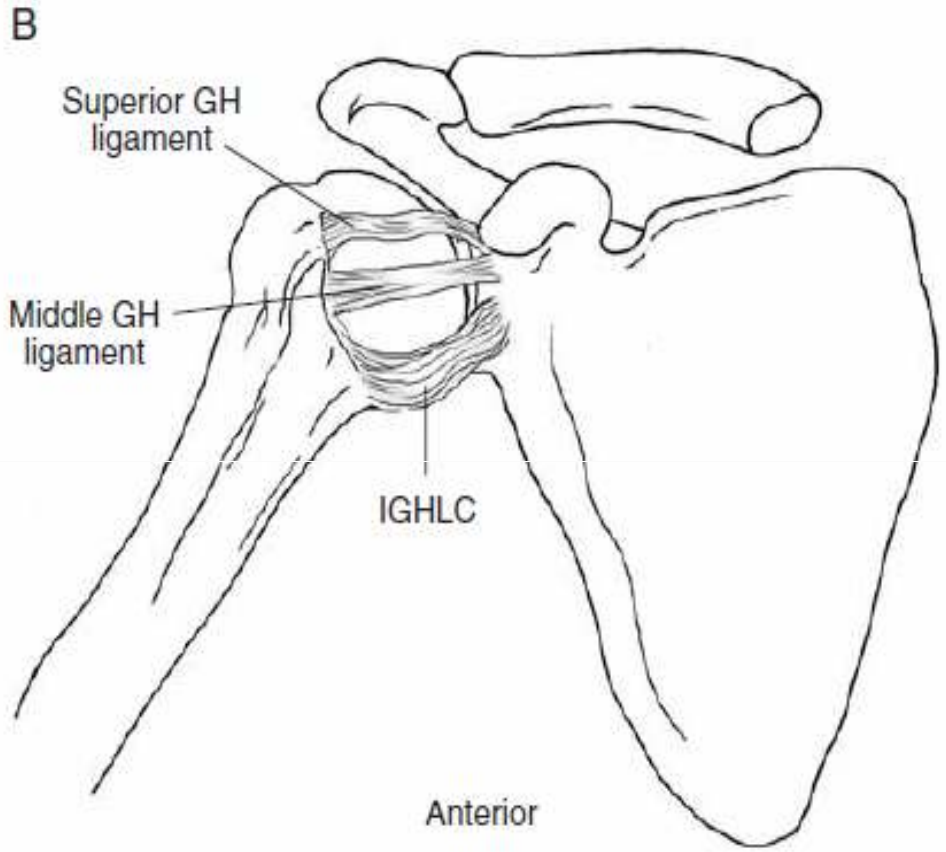


The rotator interval capsule

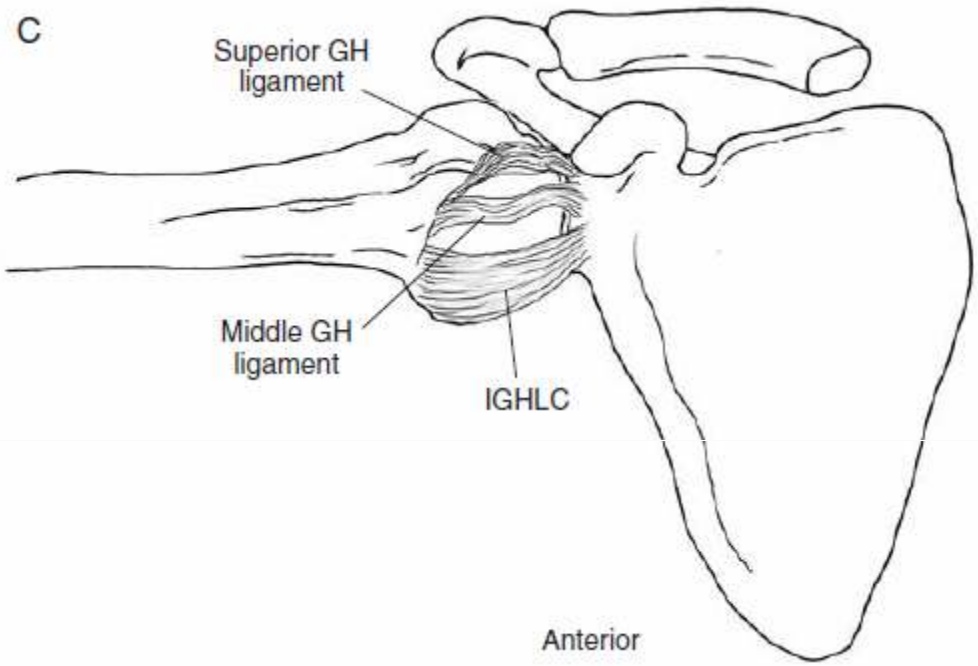

Coracohumeral ligament
Superior GH ligament
Middle GH ligament
Inferior GH ligament complex



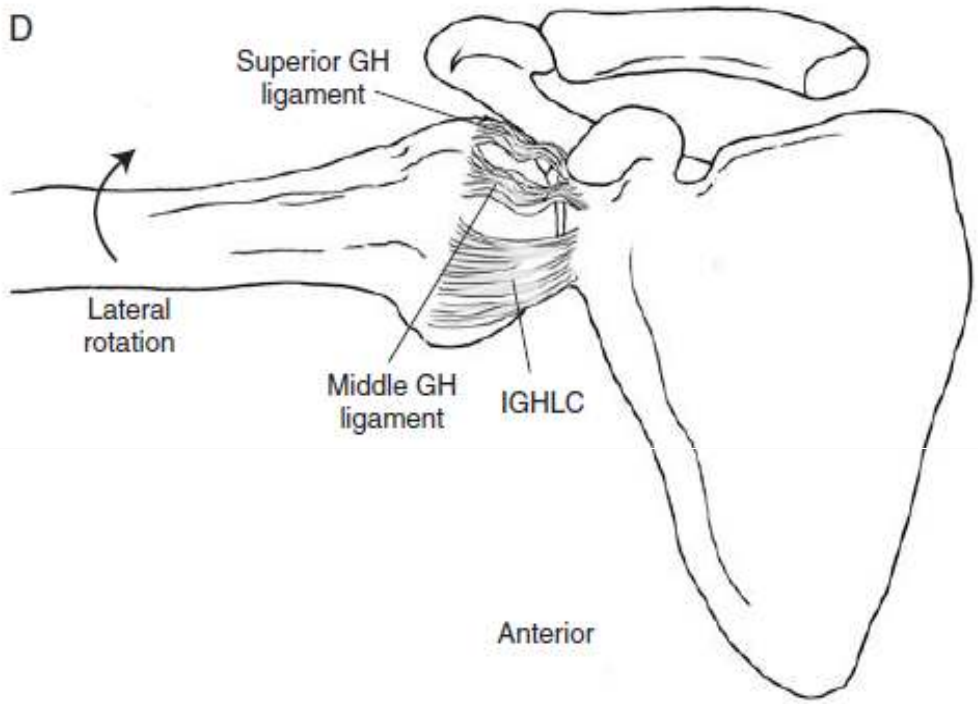
The GH ligaments at rest (A);



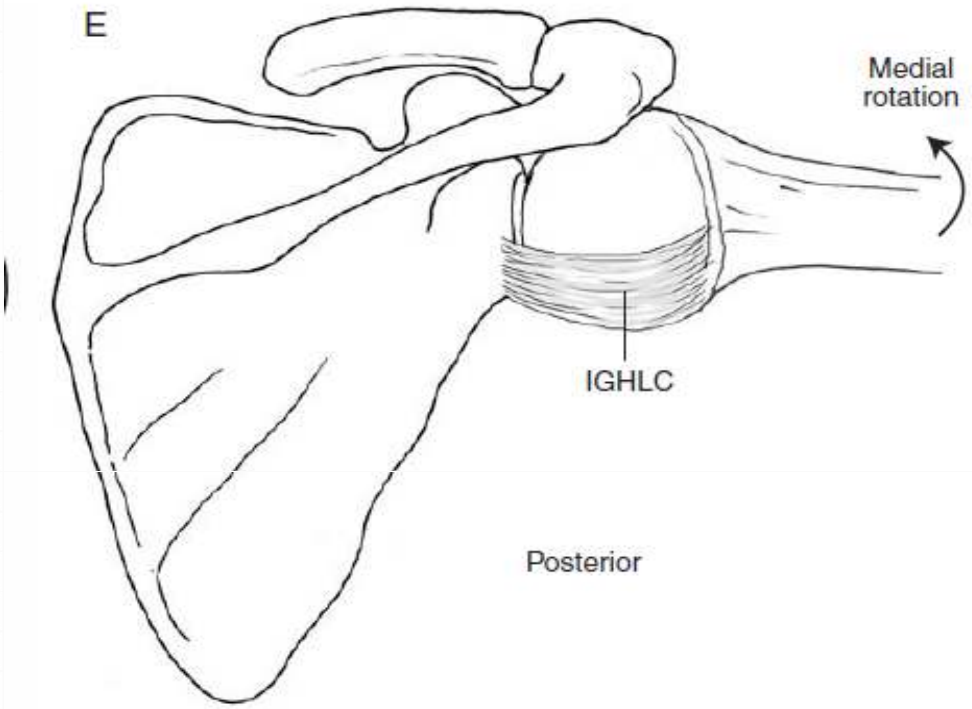
; at 45° humeral abduction and neutral rotation (**B**):



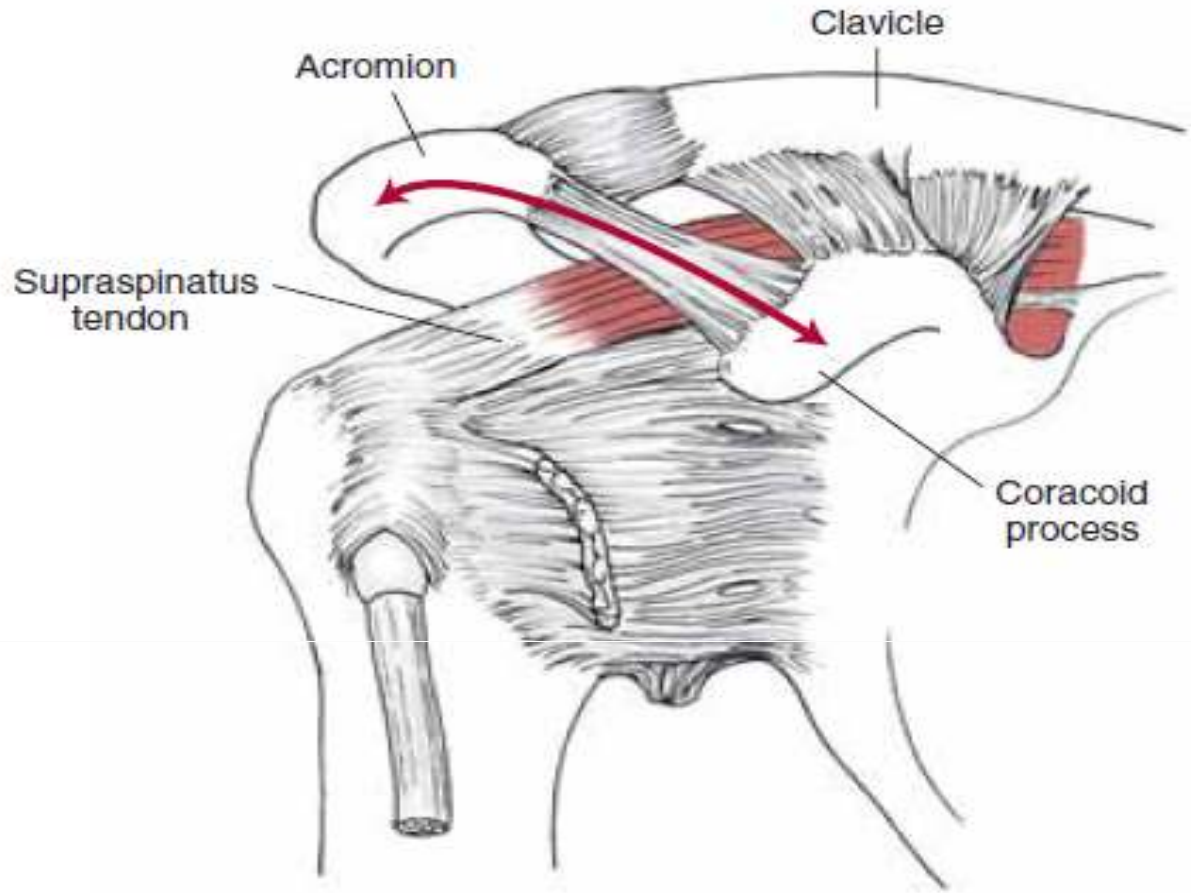
at 90° humeral abduction and neutral



at 90° humeral abduction and external rotation (D).



and at 90° humeral abduction and medial rotation (E).



The coracoacromial arch is formed by the coracoid process anteriorly, the acromion posteriorly, and the coracoacromial ligament superiorly. Together, these structures form an osteoligamentous arch over the humeral head.

Table 3-1 Normal Joint Motions and Bony Positions Around the Shoulder Joint

Scapula	
Rotation through arc of 65 degrees with shoulder abduction	
Translation on thorax up to 15 cm	
Glenohumeral Joint	
Abduction	140 degrees
Internal/external rotation	90 degrees/90 degrees
Translation	
Anterior–posterior	5–10 mm
Inferior–superior	4–5 mm
Total rotations	
Baseball	185 degrees
Tennis	165 degrees

Table 3-2 Forces and Loads on the Shoulder in Normal Athletic Activity

Rotational Velocities	
Baseball	7000 degrees/sec
Tennis serve	1500 degrees/sec
Tennis forehand	245 degrees/sec
Tennis backhand	870 degrees/sec
Angular Velocities	
Baseball	1150 degrees/sec
Acceleration Forces	
Internal rotation	60 Nm
Horizontal adduction	70 Nm
Anterior shear	400 Nm
Deceleration Forces	
Horizontal abduction	80 Nm
Posterior shear	500 Nm
Compression	70 Nm

Table 3-3 Active Shoulder Range of Motion

	American Academy of Orthopedic Surgeons*	Kendall, McCreary, and Provance†	Hoppenfeld‡	American Medical Association§
Flexion	0–180	0–180	0–90	0–150
Extension	0–60	0–45	0–45	0–50
Abduction	0–180	0–180	0–180	0–180
Medial Rotation	0–70	0–70	0–55	0–90
Lateral Rotation	0–90	0–90	0–45	0–90

Assessment of injury risk

- Traditionally been performed via **visual observation** of specific joints/bony landmarks, and the corresponding position they have to one another.
- **Good posture** has been described as a state of muscular and skeletal balance that protects the supporting structures of the body against injury or progressive deformity, irrespective of the attitudes in which the structures are resting or working
- **Forward Head Posture**
- Thus **thoracic posture** needs to be optimized in patients with impingement-like symptoms, during all daily activities, and exercises directed at improving thoracic extension should be considered

- To be continued

Shoulder girdle, scapular and Glenohumeral joint position

- The role of the scapula is extremely important in providing a stable base from which the Glenohumeral joint functions, as well as determining the overall position of the shoulder girdle
- Position of the scapula and the length-tension relationships
- Trapezius and serratus anterior

- This increased thoracic kyphosis causes the scapular to become abducted due to lengthening of:
  - the rhomboid and lower trapezius
- shortening the:
  - serratus anterior, latissimus dorsi, subscapularis, teres major and pectoralis major and minor muscles
- Humerus pulled into an anterior and/or internally rotated position, and further anteriorly tilting the scapula

Impact of thoracic kyphosis

- Altered Scapulohumeral rhythm
- Perpetuation of various forms of impingements, either in the subacromial space or inter-articular, during arm elevation ➔ ability of the scapula to tilt posteriorly is inhibited by overactive pectoralis minor

Functional examination

- **Active movements**: Inform us about the patient's willingness to move.
- **Passive movements**: Test the integrity of the inert structures.
- **Resisted tests** (maximal isometric contractions from a neutral, generally mid range, position): Examine the contractile structures, assess pain and muscle strength.

- ***PALPATION***

Abnormal findings: at rest: warmth, fluid, synovial thickening on movement: crepitus, end-feel.

- ***END-FEEL***

Normal/physiological:

- **Hard**: e.g. elbow extension, knee extension
- **Capsular** (elastic): e.g. rotations at shoulder, elbow, Hip extra-articular (tissue approximation): flexion at elbow, hip.
- **Soft:** soft tissue approximation

Pathological:

- **Too hard**: e.g. osteoarthrosis
- **Too soft**: e.g. loose body in the elbow joint muscle spasm (involuntary muscle contraction): e.g. arthritis
- **Empty** (voluntary muscle contraction, not always the same range): e.g. abscess
- **Springy Block**: e.g. meniscus subluxation.

- **Sensitivity** is the ability to identify *everyone* with a specific condition. True Positive
- **Specificity** is the proportion of patients without a specific condition who have a negative test. True Negative.
- A **positive likelihood ratio** describes the impact that a positive test has on raising the suspicion that a condition actually exists

Anterior instability

- *Anterior load and shift test* (Hawkins et al. 1996)
  - The humeral head is grasped with the one hand, while the other hand stabilises the scapula. The humeral head is loaded medially into the joint and then an anterior and posterior shearing force is applied.
- *Anterior drawer test* (Gerber and Ganz 1984)
  - The patient is placed supine and the arm abducted over the edge of plinth. The examiner stabilises the scapula with one arm whilst the other grasps the humeral head and translates it in an anteromedial direction on the glenoid. Unilateral increases in humeral head translation of the symptomatic shoulder indicate anterior glenohumeral joint instability.
- *Apprehension test (Jobe et al. 1989)*
- Relocation test

Figure 17.2 Apprehension test

Figure 17.3 Relocation test.

Posterior instability

- *Posterior load and shift – posterior drawer test* (Gerber and Ganz 1984)
- *Posterior apprehension test*

Inferior laxity

- The sulcus sign (Neer and Foster 1980)

Figure 17.4 Sulcus test.

SLAP lesions

- O'Brien test (O'Brien et al. 1998)

Figure 17.5 O'Brien's Test.

Posterior slide test

- ***Biceps load test I*** **(Kim et al. 1999)**

Figure 17.6 Biceps Load 1.

Long head of the biceps

- ***Yergason's test*** **(Yergason 1931)**
  - The patient is seated or standing with the elbow flexed to 90 degrees and forearm pronated. The examiner Resists active supination and elbow flexion whilst feeling for subluxation of the biceps tendon out of the bicipital groove

Figure 17.7 Yergason's Test.

- ***Speed's Test*** **(Bennett 1998)**
  - The patient's supinated arm is held at 90 degrees elbow flexion and then flexed forwards against resistance. Pain felt in the bicipital groove indicates biceps tendon pathology.

Figure 17.8 Speeds Test.

AC joint

- ***Cross chest adduction*** **(Scarf/Forced** adduction test) (Silliman and Hawkins 1994)
  - The symptomatic shoulder is flexed to 90 degrees and then forcibly adducted across the chest

Figure 17.9 Scarf Test.

Subacromial impingement

- *Neer impingement test* (Neer and Welsh 1977)
  - In this test, there is forced elevation of the humerus in the scapula plane whilst the shoulder is internally rotated with the other hand on the top of the shoulder girdle to stabilise.
  - A positive test gives rise to pain with passive abduction, which indicates impingement within the subacromial space

Figure 17.10 Neer Test.

- continue

Preventing shoulder injuries

- Maintain adequate strength & flexibility of all shoulder muscles
- Good posture
- Proper techniques
- Proper warm up
- Proper protective gear

Types of Injuries

- Sprains
- Dislocations
- Strains
- Overuse
- Fractures

AC Sprain

Shoulder separation

Mechanism

- Impact to tip of shoulder
- Fall on outstretched arm

Signs and symptoms

- Deformity at AC joint
  - distal end of clavicle rides superiorly
- Pain with movement and palpation
- “+” piano key sign

Degrees of injury

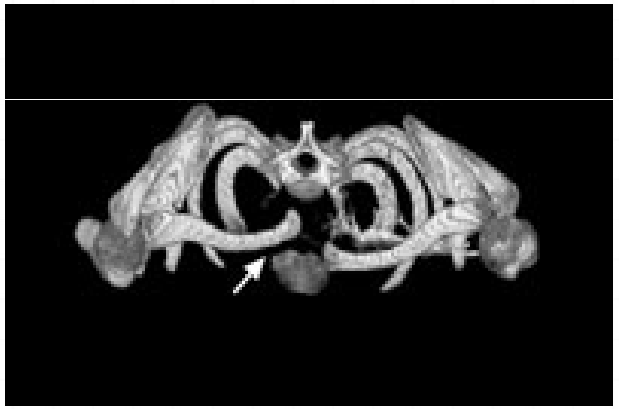
- 1st degree: no deformity, pain w/ palpation & motion, mild stretching of AC ligament
- 2nd degree: displacement of distal end of clavicle, unable to abduct arm or bring it across body, pain
- 3rd degree: complete rupture of AC and CC ligaments, with dislocation of the distal end of clavicle, severe pain, LOM, instability

Treatment

- RICE
- Immobilization
- Physician referral if more than 1st degree
- Possible surgery

SC Sprain

- Relatively uncommon injury



Mechanism of injury

- Indirect force transmitted through the humerus, the shoulder joint and the clavicle
- Direct impact to clavicle

Signs & symptoms

- 3 degrees
- May have deformity at sternal end
- Swelling
- Pain
- Inability to abduct shoulder through full ROM

Treatment

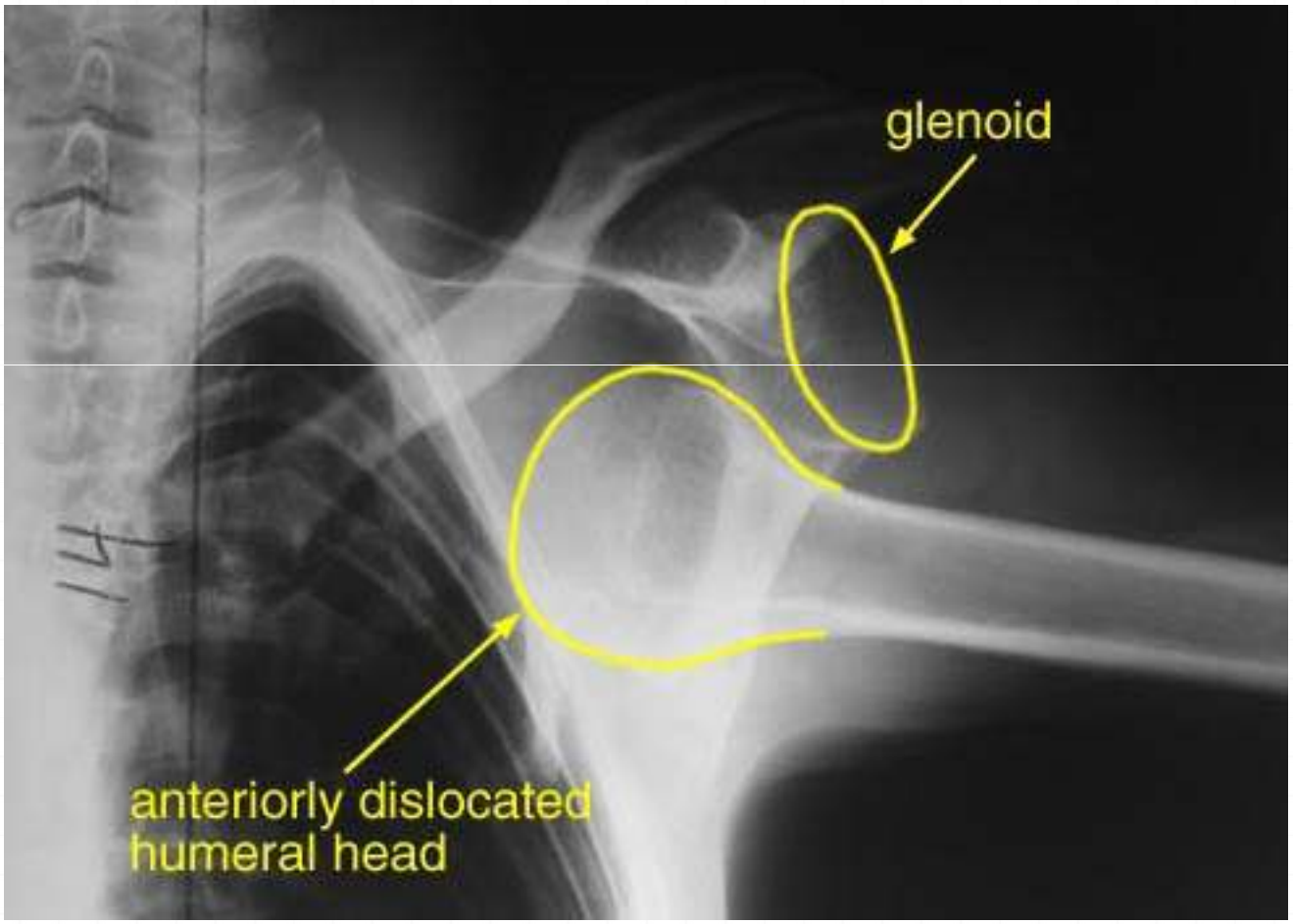
- RICE
- Immobilization
- Physician referral

Glenohumeral dislocation

- Shoulder dislocation
- Anterior—most common
- Posterior
- Inferior
- Multidirectional

Anterior shoulder dislocation

Anterior shoulder dislocation



GH dislocation

GH dislocation

Mechanism

- Arm forced into external rotation abduction and extension
- Posterior force driving the head of the humerus posteriorly

Signs & symptoms

- Deformity—step off (deltoid will look flattened
- Arm in slight abduction, external rotation
- Will not be able to move shoulder joint
- Unable to touch opposite shoulder with hand of affected side
- Pain

Treatment

- Immobilization
- ER to have shoulder reduced by a physician
- Immobilization for 1-2 weeks
- No activity 4-6 weeks
- Rehab-ROM and strengthening
- High incidence of recurrence after the first dislocation

Shoulder reduction

Immobilization of shoulder joint

Shoulder subluxation

- Partial dislocation/spontaneous reduction

Mechanism

- External rotation, abduction, extension

Signs & symptoms

- Pain
- Limited ROM

Treatment

- Ice
- Immobilization
- Physician referral
- Rehab—strengthening muscles around joint

Rotator Cuff Strain

- 3 degrees
- Most involve supraspinatus
- Tears usually at insertion on humerus

Rotator cuff strain

Mechanism

- Dynamic rotation of arm at high velocity (overhead throwing)
- Usually involves individuals with a history of impingement or instability

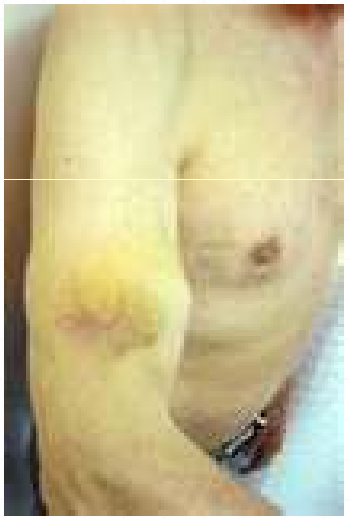
Signs & symptoms

- Pain w/ muscle contraction
- Loss of strength
- Complete tear produces pain, loss of function, swelling

Treatment

- RICE
- Decrease level of activity
- Exercises to strengthen rotator cuff

Biceps tendon rupture



Mechanism

- Direct blow
- Severe contraction of biceps

Signs & symptoms

- Unable to flex elbow
- Deformity of biceps—balling up of muscle belly
- Pain

Treatment

- Ice
- Immobilization
- Physician referral

Tendonitis

- Rotator cuff
- Biceps
- Common among athletes performing overhead motions due to overuse or muscle weakness

Mechanism

- Repetitive overhead motion causing inflammation of tendon

Signs & symptoms

- Swelling
- Crepitus
- Pain with motion

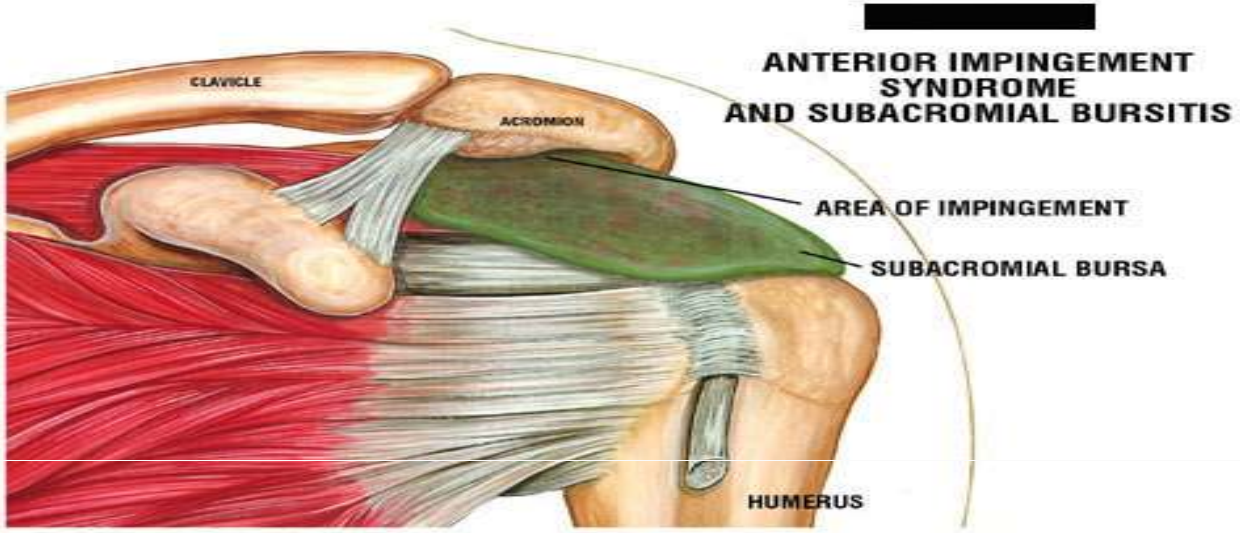
Treatment

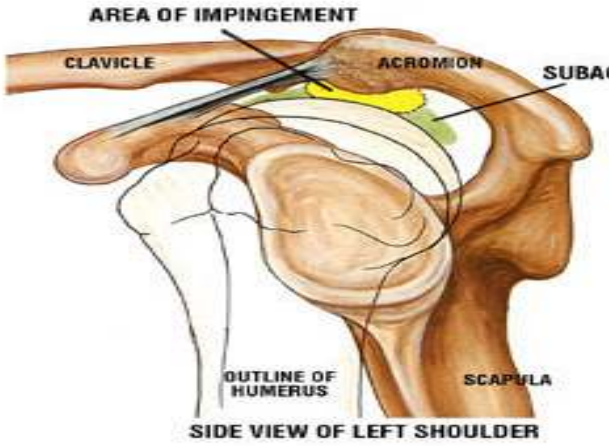
- Rest
- Ice
- Heat
- NSAIDS
- Stretching
- Strengthening

Impingement syndrome

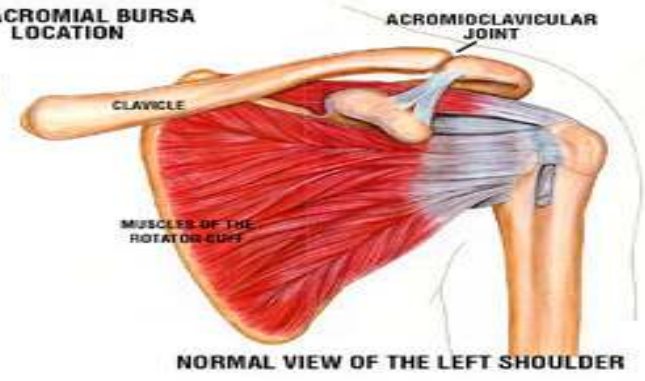
- Involves compression of supraspinatus tendon, subacromial bursa, long head of biceps tendon (all are under the coracoacromial arch)

Impingement



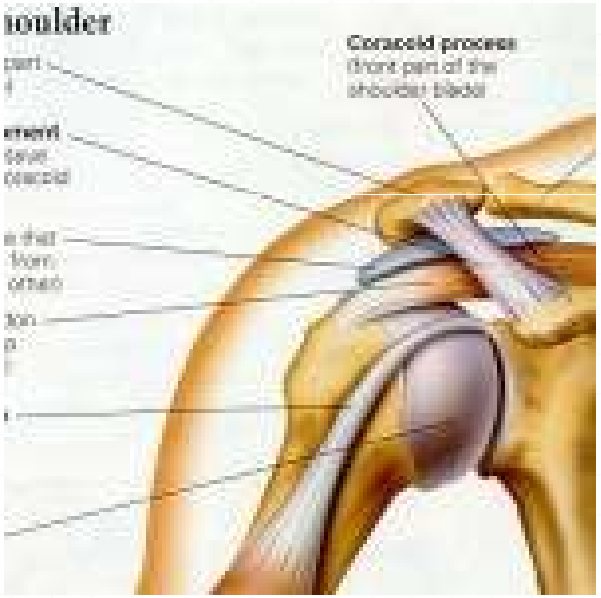


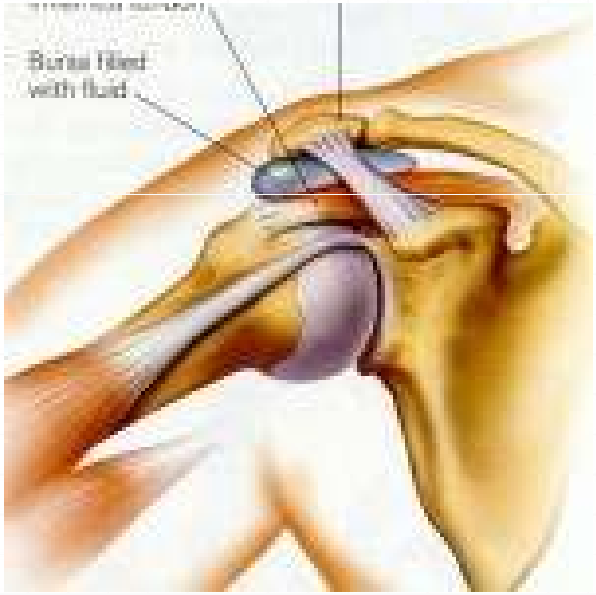
SIDE VIEW OF LEFT SHOULDER



NORMAL VIEW OF THE LEFT SHOULDER

Impingement





Mechanism

- Repetitive overhead motions

Signs & symptoms

- Diffuse pain around the acromion process when arm is in overhead position
- External rotators are weak
- “+” impingement test
- Empty can test may increase pain
- Pinching sensation

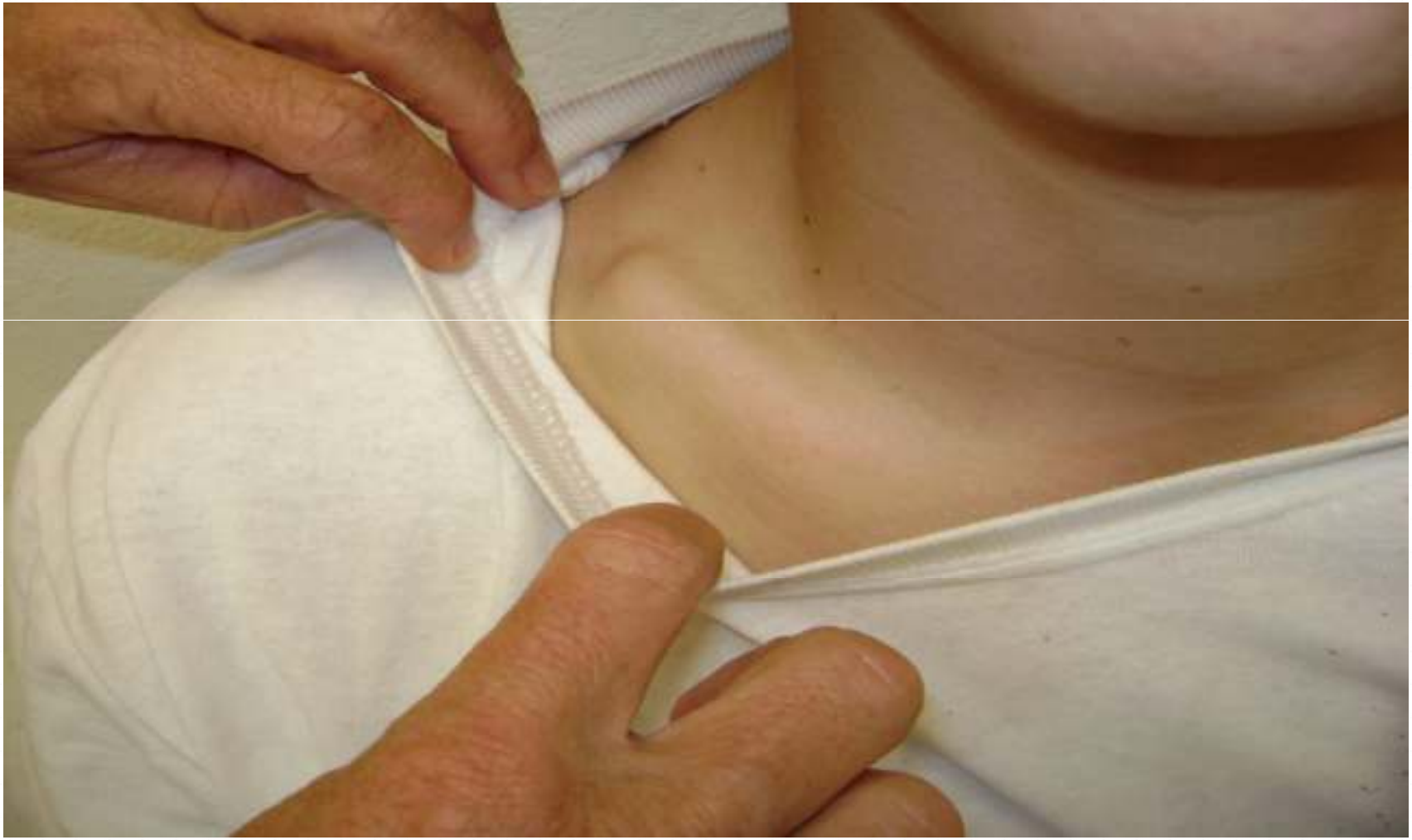
Treatment

- RICE
- Restore normal biomechanics to shoulder
- Strengthen RC muscles and muscles that produce movement of scapula
- Stretch posterior and inferior joint capsule

Clavicle Fracture

- Most common in distal third

Clavicle Fracture



Clavicle Fracture

Clavicle Fracture

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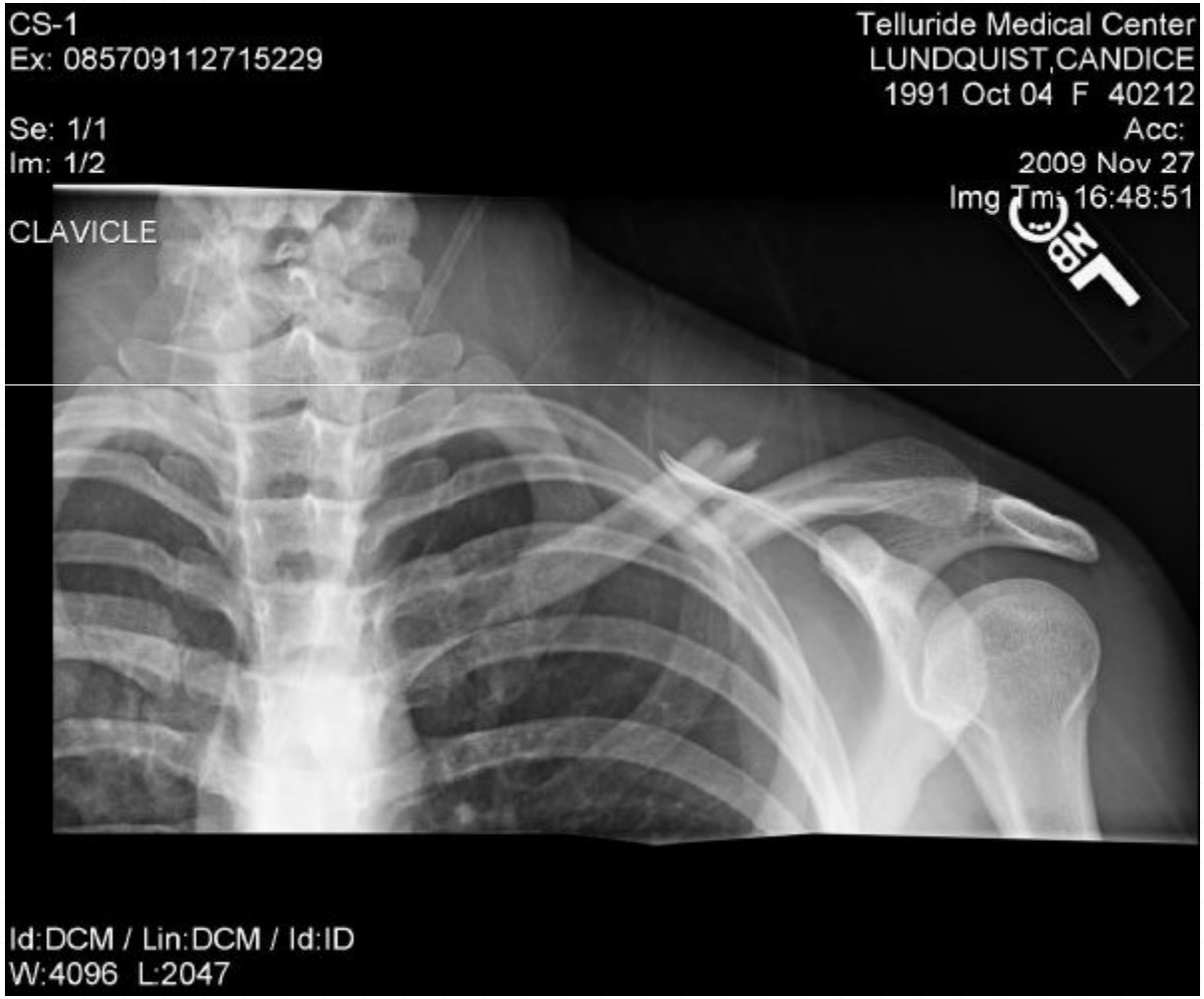


Clavicle fracture

Mechanism

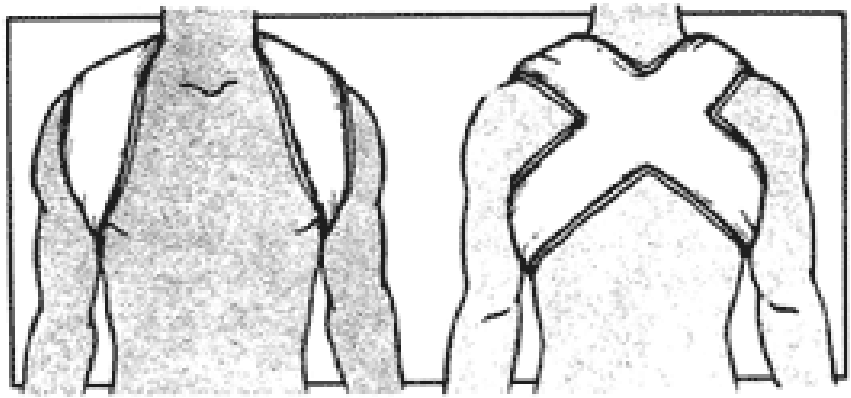
- Fall on tip of shoulder
- Direct blow to clavicle

Signs & symptoms

- Pain
- Deformity
- Hold arm close to side

Treatment

- Ice
- Immobilization
- ER visit



Clavicle fracture surgical repair

Humeral Fracture

Mechanism

- Direct blow
- Dislocation
- Fall on outstretched arm

Signs & symptoms

- Pain
- Hear a crack
- Unable to move arm
- Swelling,
- Possible deformity
- Discoloration of superficial tissue

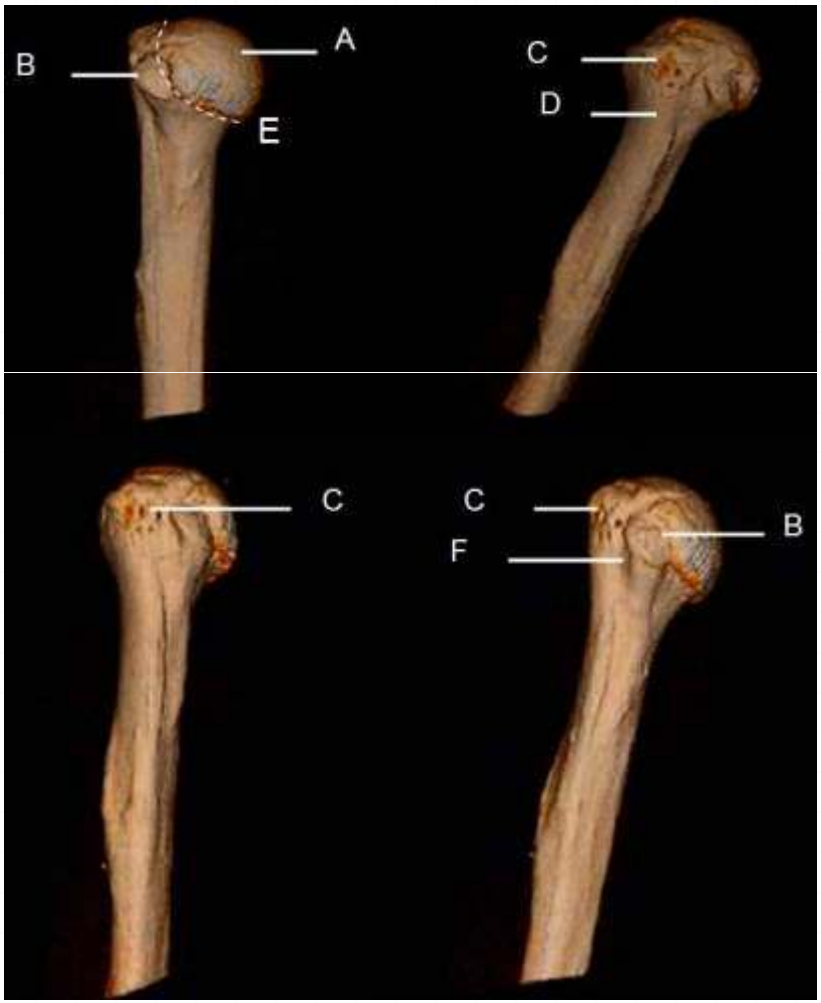
Treatment

- Splint/immobilize
- Treat for shock
- ER visit
- Possible surgery
- 2-6 months recovery

Epiphyseal Fracture

- Fracture to growth plate in younger athlete

Epiphyseal fracture



Epiphyseal fracture

Epiphyseal Fracture

Mechanism

- Falling on elbow, driving head of humerus into the glenoid fossa
- Blow to head of humerus

Signs & symptoms

- Pain
- Inability or desire to move arm
- Feeling a “pop”

Treatment

- Ice
- Immobilization
- Physician referral
- Possible surgery to hold head of humerus to shaft to ensure proper healing and growth

Shoulder Pointer

- Contusion to tip of shoulder

Mechanism

- Direct blow to tip of shoulder

Signs & symptoms

- POT
- Pain
- Discoloration
- Swelling
- Decreased motion

Treatment

- Ice
- Protective padding
- Modify activity