

Glenohumeral joint

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SHOULDER COMPLEX

- The shoulder complex composed of the clavicle, scapula and humerus.
- The articular structure of shoulder complex are designed primary for mobility

COMPONENTS OF SHOULDER JOINT

1. Glenohumeral joint
2. Acromioclavicular joint
3. Sternoclavicular joint
4. Scapulothoracic joint

Glenohumeral joint

- Ball-and-socket synovial joint
- Three rotary and three translatory degrees of freedom
- The articulation is composed of the large head of the humerus and the smaller glenoid fossa
- The stability across the glenohumeral joint is balanced by both static and dynamic mechanisms.

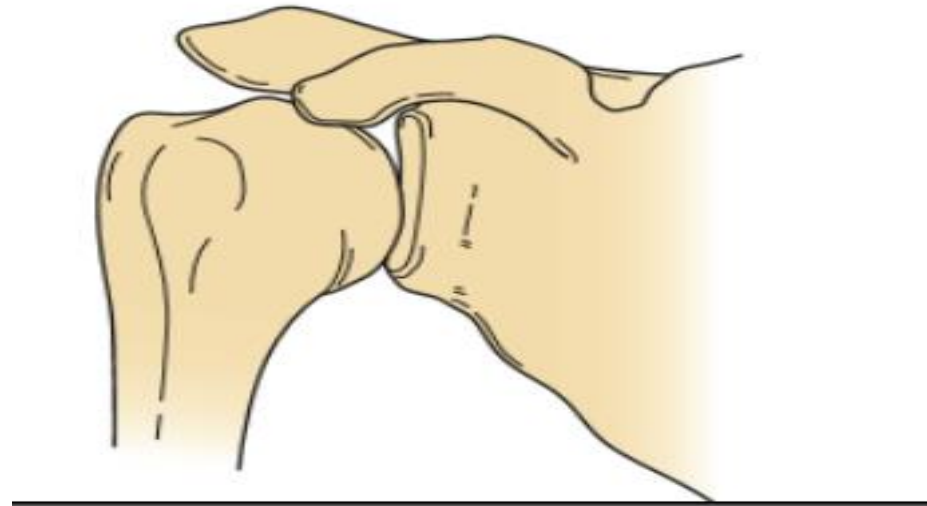


Fig:1 ,LEVANGIE, P. K.,AND NORKIN, C.C. 2005. JOINT STRUCTURE AND FUNCTION ; A COMPREHENSIVE ANALYSIS . FIFTH ED. PHILADELPHIA, PA: F. A. DAVIS Co.



Proximal articulating surface: glenoid fossa of humerus



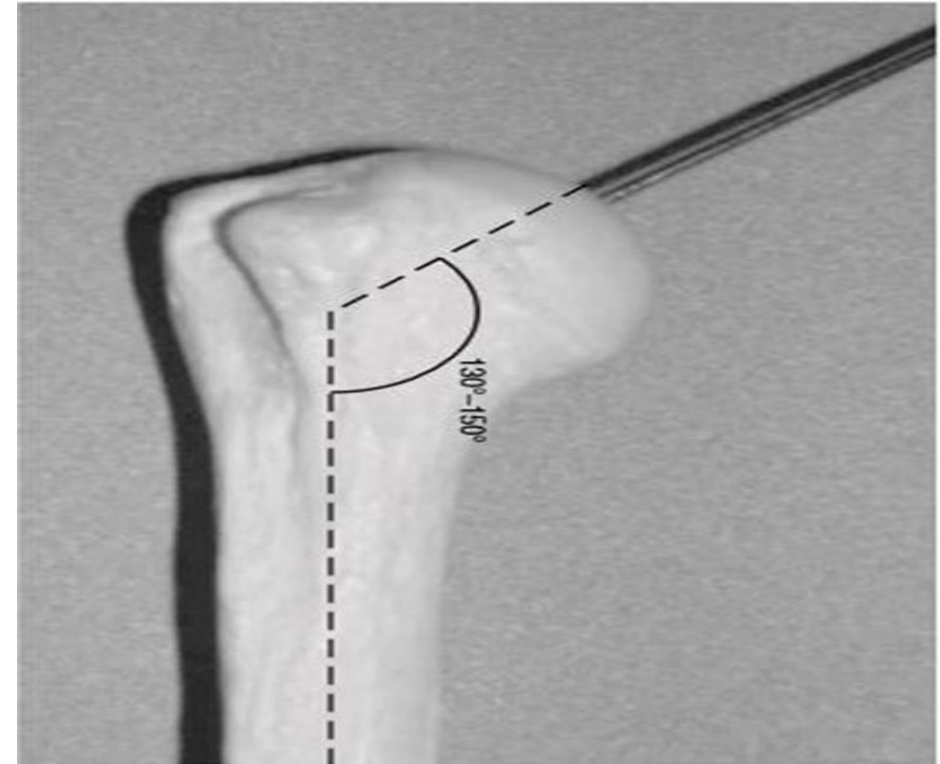
- Distal articulating surface: head of humerus.
- Proximal Articulation: Glenoid fossa
 - Shallow concavity
 - Orientation: upward tilt
 - Can be anterior tilt/posterior tilt also called anteversion or retroversion
 - Most commonly posterior tilt of 6-7 degree.



- Distal articulating surface:
- Head of humerus is larger than the glenoid fossa.
- Only $1/3^{\text{rd}}$ is covered by glenoid.

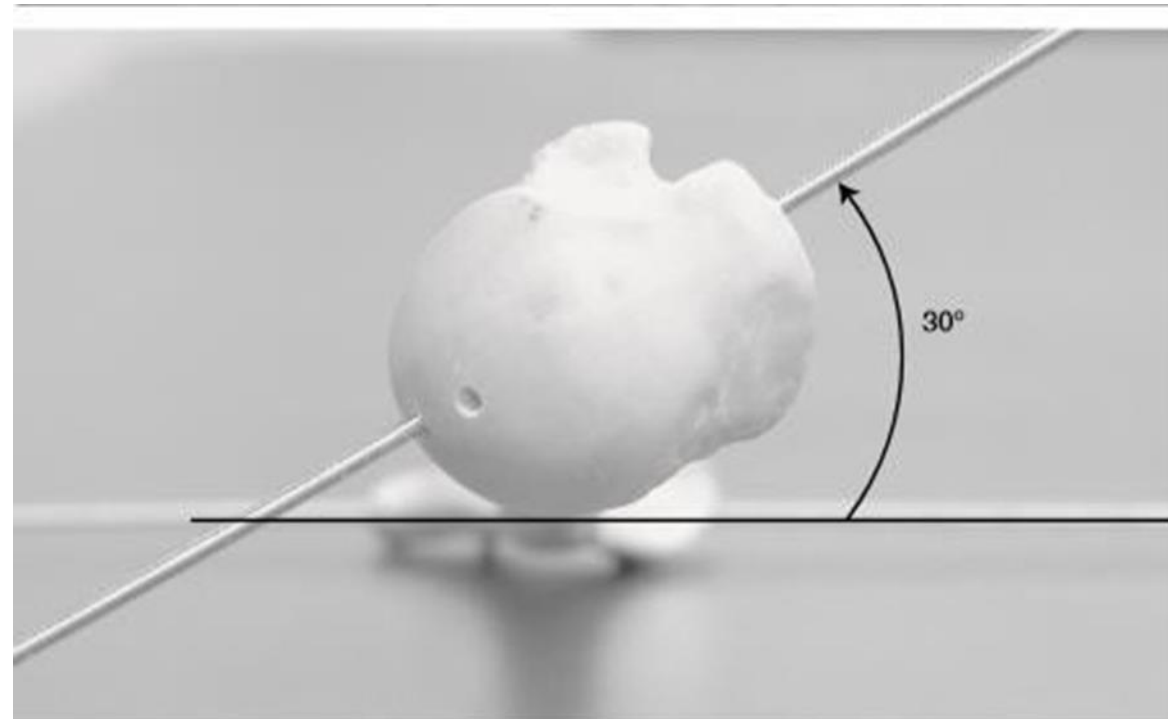
ANGLE OF INCLINATION

- Formed by an axis through the humeral head and neck through the shaft of the humerus.
- Normally between **130° to 150°**

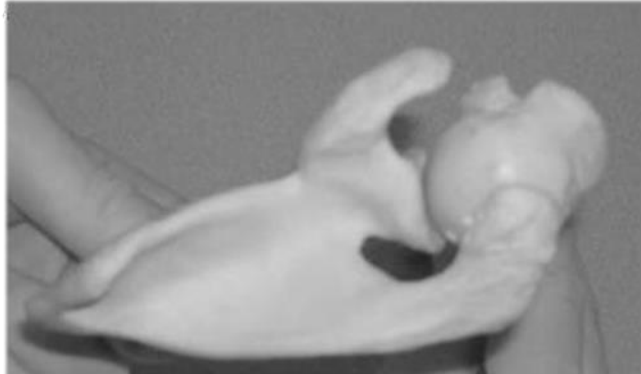
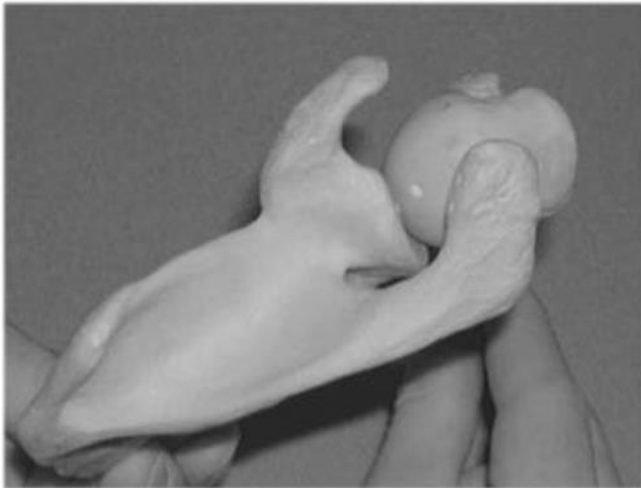


ANGLE OF TORSION

- Formed by an axis through the humeral head and neck in relation to an axis through the humeral condyles.
- Normal : 30° posterior.



- The posterior orientation of the humeral head with regard to the humeral condyles is also called **posterior torsion, retrotorsion**, or **retroversion** of the humerus.





Glenoid Labrum

- The articular surface of the glenoid fossa is enhanced by the glenoid labrum.
- The core of labrum is composed of densely packed fibrous connective tissue.
- The composition of the labrum allows it to perform variety of functions:
 - Resistance to humeral head translations
 - Protection of bony edges of labrum
 - Reduction of joint friction
 - Dissipation of joint contact force

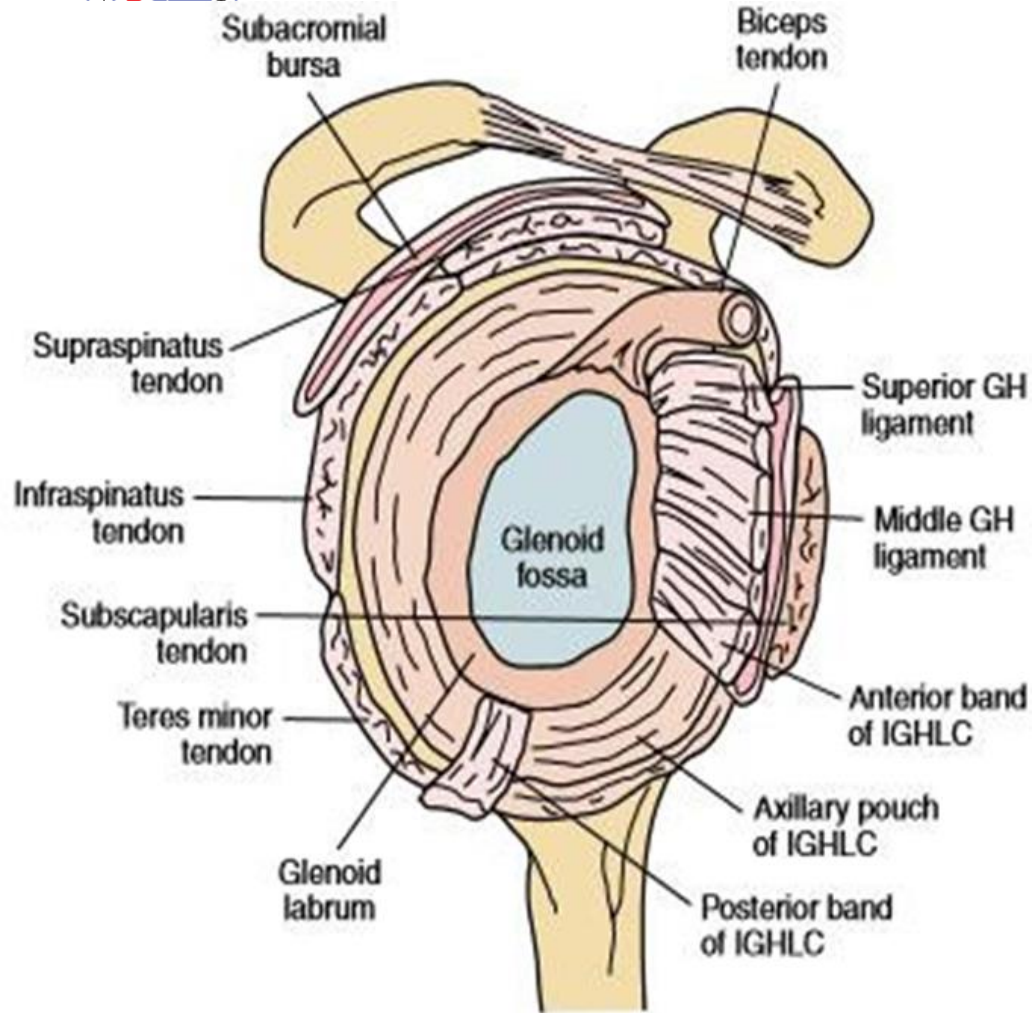
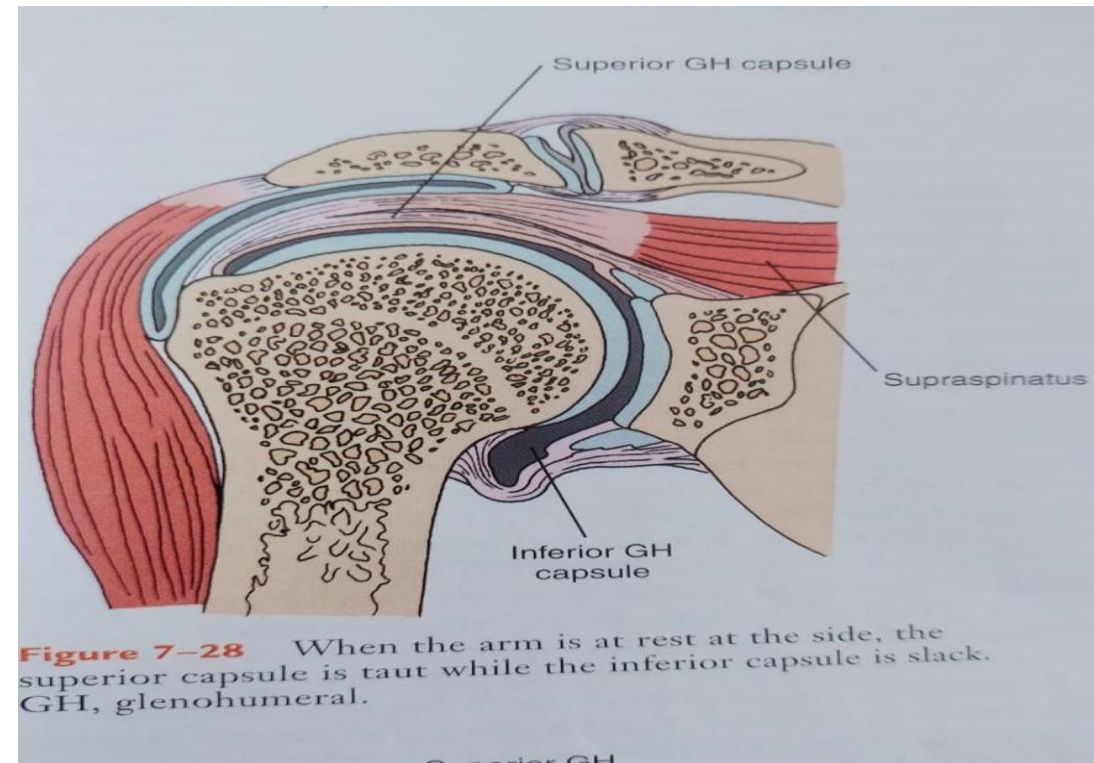


Fig:2 LEVANGIE, P. K., AND NORKIN, C.C. 2005. JOINT STRUCTURE AND FUNCTION ; A COMPREHENSIVE ANALYSIS . FIFTH ED. PHILADELPHIA, PA: F. A. DAVIS Co.

CAPSULE

- ❖ Capsule is large and loose.
- ❖ It is taut superiorly and loose inferiorly and anteriorly when arm is at side.
- ❖ Capsule is tight when humerus is abducted and laterally rotated- close pack position.
- ❖ Capsule is reinforced by ligaments and rotator cuff muscles





BURSAE

- Small fibrous sacs that secrete synovial fluid internally to lessen friction between soft tissues around the joint.
- Shoulder contains-
 - i. subcoracoid bursa
 - ii. subscapularis bursa
 - iii. subacromial bursa

LIGAMENTS

Glenohumeral ligament

- 3 fibrous bands derived from thickening of the anterior part of fibrous membrane.
- All 3 converge upward and medially blend with glenoid labrum
- Superior band/ Superior glenohumeral ligament – attached to the upper end of lesser tubercle
- Middle band/ middle GHL- attached to lower part of lesser tubercle
- This ligament runs obliquely.
- Inferior band/ IGHL- lower part of anatomical neck of humerus

- **CORACOHUMERAL LIGAMENT** - extends from coracoid process to anatomical neck of humerus.
- **TRANSVERSE HUMERAL LIGAMENT** – runs obliquely from the greater to the lesser tubercle of the humerus , bridging over the intertubercular groove.

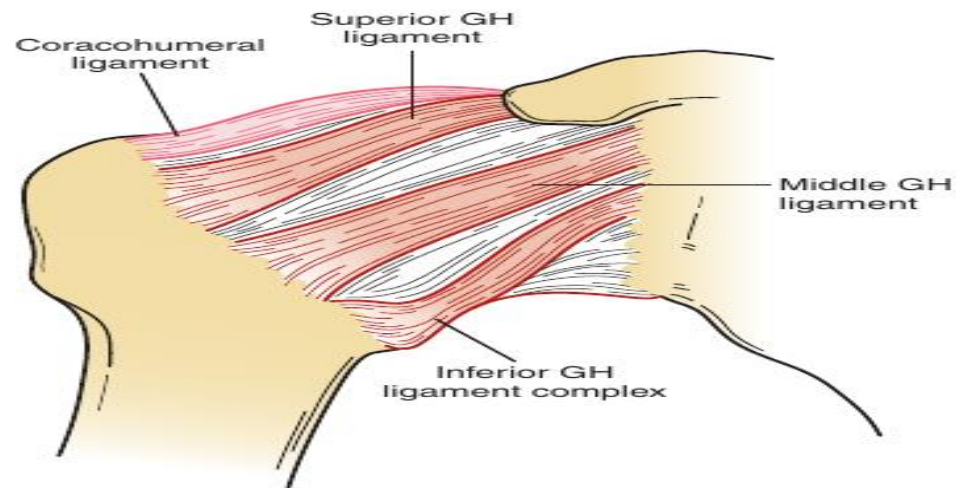


Fig:3 LEVANGIE, P. K.,AND NORKIN, C.C. 2005. JOINT STRUCTURE AND FUNCTION ; A COMPREHENSIVE ANALYSIS . FIFTH ED. PHILADELPHIA, PA: F. A. DAVIS Co.



FUNCTIONS OF GH LIGAMENT

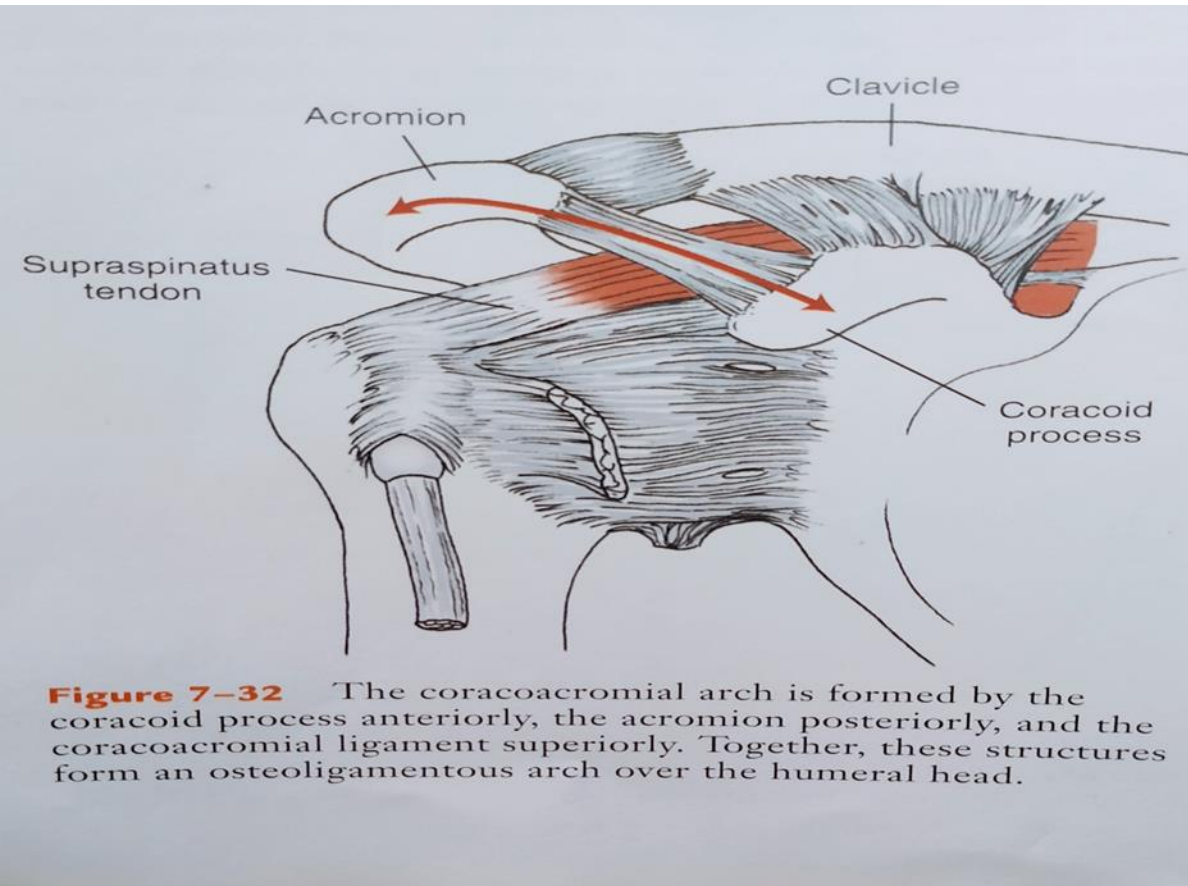


- Superior GH ligament- limits anterior and inferior translation at 0 degrees of abduction (stabilizes joint in neutral position)
- Middle GH ligament- limits anterior translation at 45 degree of abduction



- Inferior glenohumeral ligament has 3 components:
 - Anterior band of IGHLIC – limits anterior translation beyond 45 degrees abduction + external rotation
 - Posterior band of IGHLIC – limits posterior translation with arm at 45 degrees of abduction and internal rotation.
 - Axillary pouch: It allow full range of abduction in shoulder and stabilise the joint.

CORACOACROMIAL ARCH



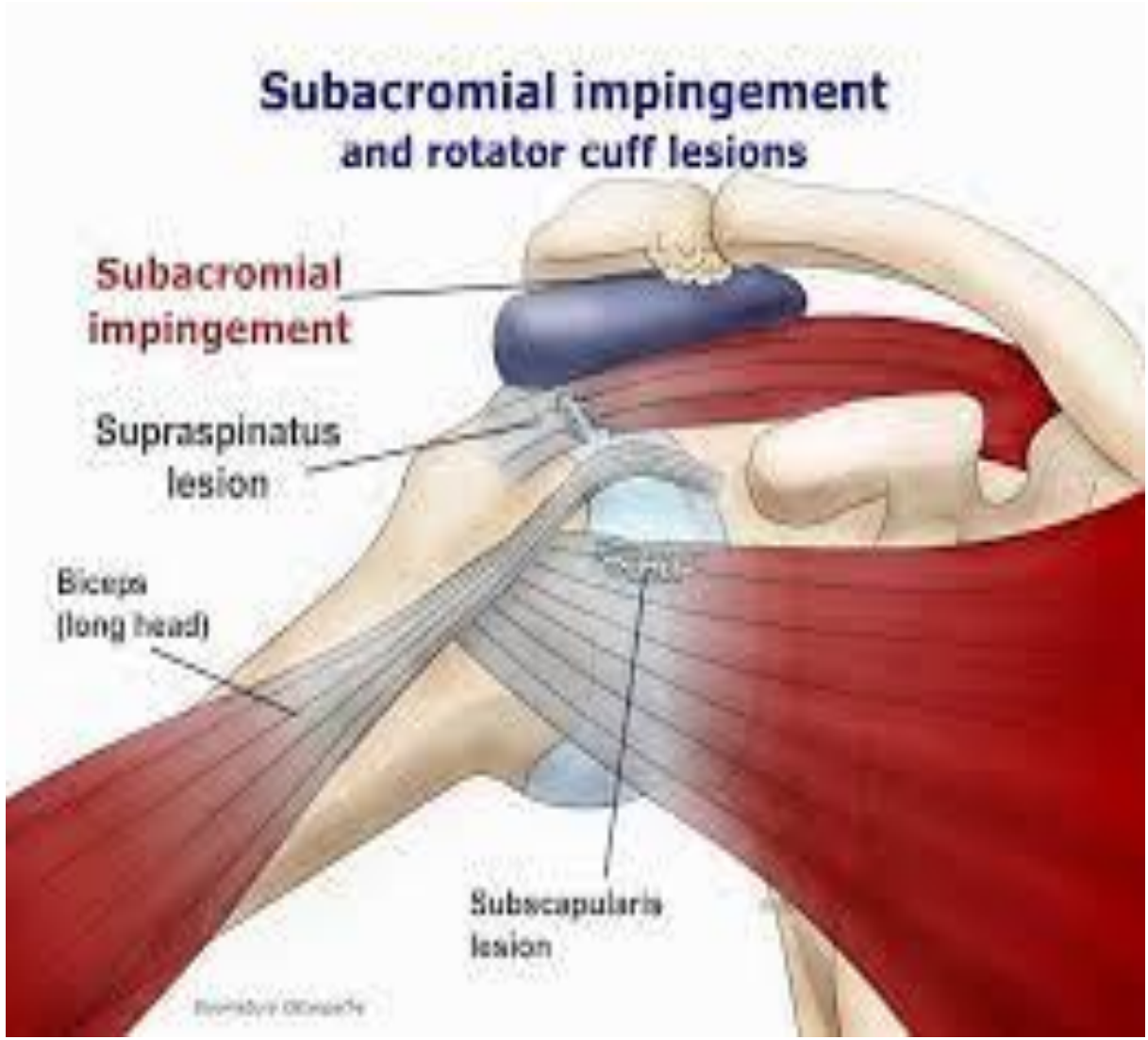
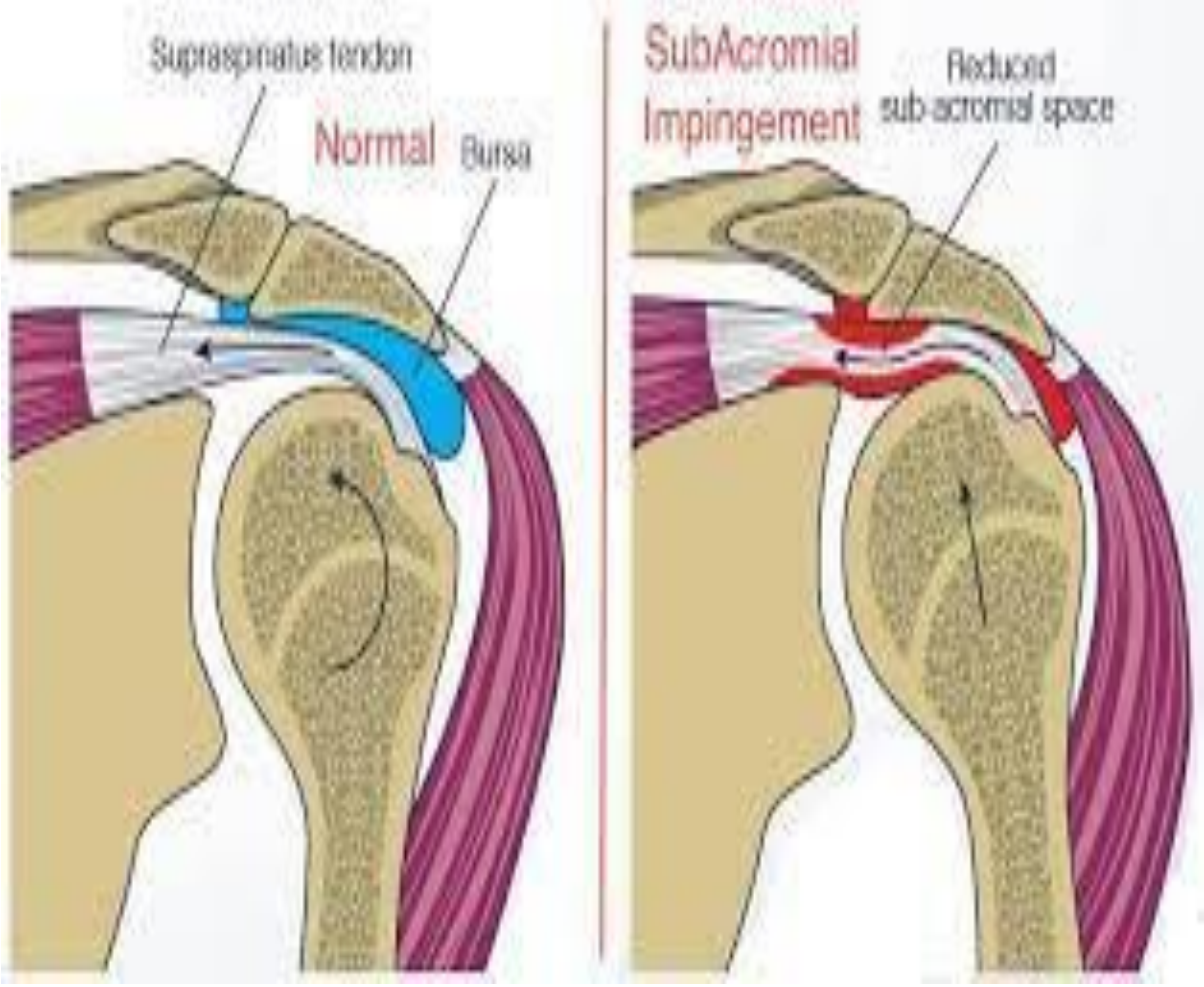
- Coracoclavicular ligament attaching from the inferior part of AC joint and to coracoid process forms the **coracoacromial arch**.
- This arch protects the joint from any hit or fall by an object.
- The space between the arch and the joint is called **subacromial space** or **supraspinatus outlet**.
- The space is around **10mm**.
- When arm is elevated, the space is **5mm**.

Fig:4

LEVANGIE, P. K., AND NORKIN, C.C. 2005. JOINT STRUCTURE AND FUNCTION ; A COMPREHENSIVE ANALYSIS . FIFTH ED. PHILADELPHIA, PA: F. A. DAVIS Co.



- The contents of subacromial space are subacromial bursa, rotator cuff tendon, Long head of biceps.
- The space can decrease by anatomical factors like change in shape of acromion, acromion bony spur, AC joint osteophytes etc resulting in impingement





PLANES OF MOTION

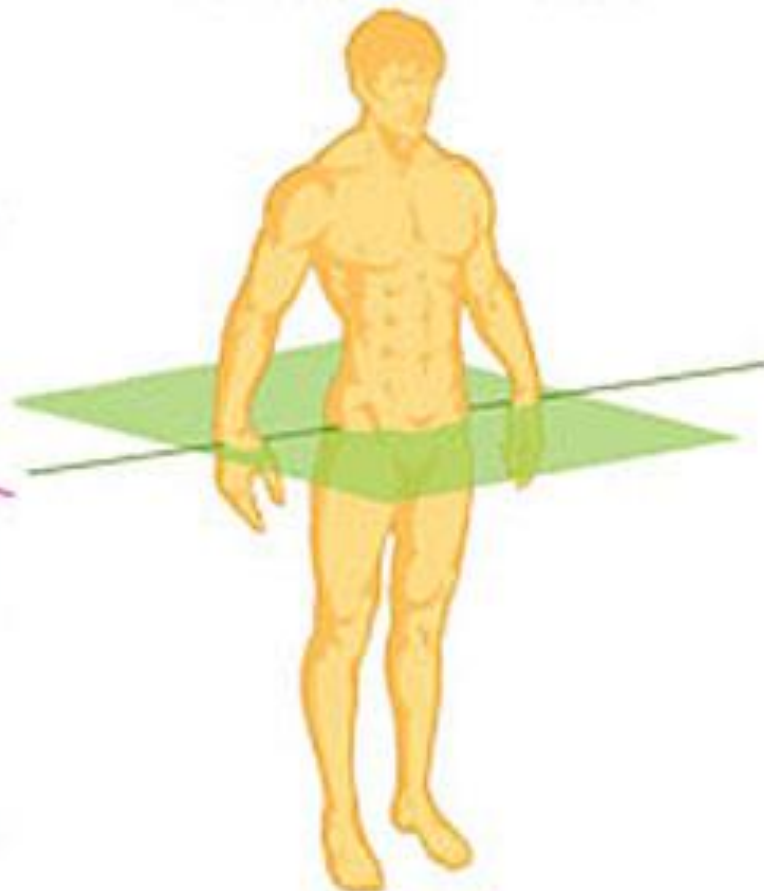


- Glenohumeral joint occurs in the axial, sagittal, coronal and scapular planes.
- Flexion and extension- sagittal plane
- Internal and external rotation- axial plane
- abduction and adduction - coronal plane

Sagittal plane



Horizontal plane



Frontal plane





- For complete range of abduction to occur , there must be 30-40 degrees of lateral rotation, for the clearance of greater tubercle under the coracoacromial arch.



ARTHROKINEMATICS



- The convex humeral head moves within concave glenoid fossa.
- According to convex-concave theory of joint motion, with motion of the humerus, the convex head rolls in the same direction and slides in the opposite direction



❖ Abduction & adduction

- Abduction and adduction -frontal plane ,axis -anterior posterior direction

Arthrokinematics

- Arthrokinematics of abduction is the **convex head of the humerus rolling superiorly** while simultaneously **sliding inferiorly**
- The arthrokinematics of adduction are similar to abduction but occur in a reverse direction.



❖ Flexion and extension

- Flexion and extension at the GH joint is defined as a rotation of the humerus in the Sagittal plane about a medial-lateral axis of rotation.

Arthrokinematics

- If the motion occurs in Sagittal plane ,the arthrokinematics involve a spinning of the humeral head.

BOX 17.1 Summary of Joint Arthrokinematics of the GH Joint

Physiological Motion of the Humerus

	Roll	Slide
Flexion	Spin (minimal roll and slide)	
Horizontal adduction	Anterior	Posterior
Internal rotation at 0° Abduction	Anterior	Posterior
Extension	Spin (minimal roll and slide)	
Horizontal abduction	Posterior	Anterior
External rotation at 0° Abduction	Posterior	Anterior
Abduction	Superior	Inferior

Fig:6 LEVANGIE, P. K., AND NORKIN, C.C. 2005. JOINT STRUCTURE AND FUNCTION ; A COMPREHENSIVE ANALYSIS . FIFTH ED. PHILADELPHIA, PA: F. A. DAVIS Co.



- The convex humeral head is a substantially larger surface and may have different radius of curvature than the shallow concave fossa.
- Elevation of humerus requires the articular surface of humeral head slide inferiorly in a direction opposite to the movement of shaft of humerus.

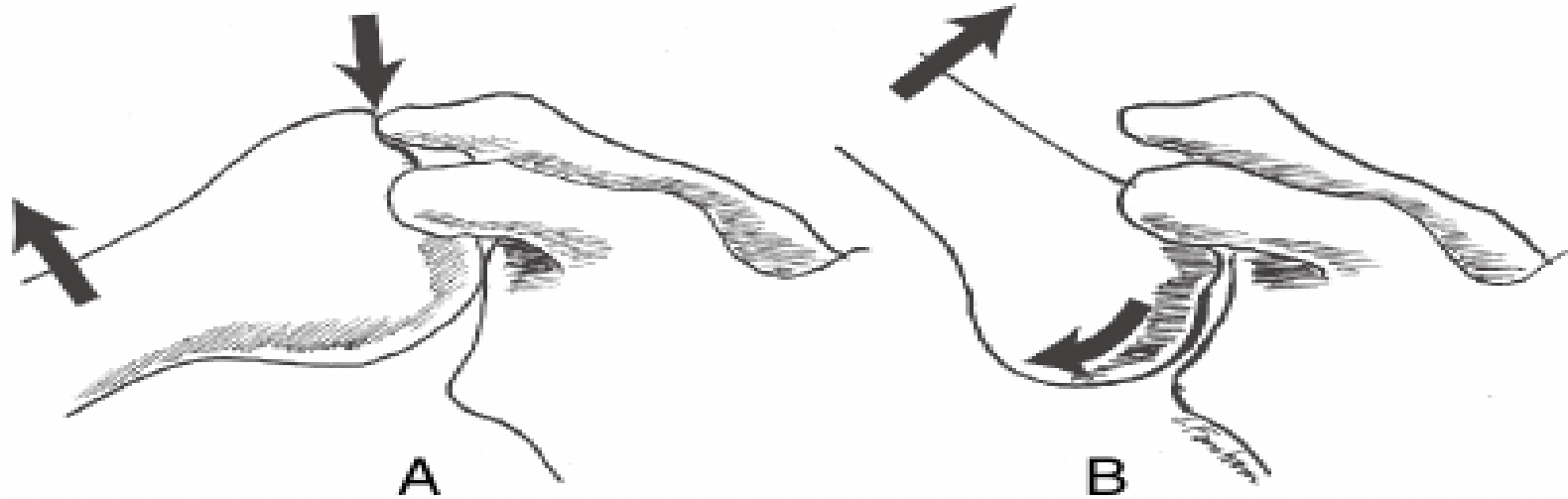


Figure 7-33 **A.** Without downward sliding of the articular surface of the humeral head, the humeral head will roll up the glenoid fossa and impinge upon the coracoacromial arch. **B.** With downward sliding of the humeral head's articular surface as the humeral abducts, a full range of motion can occur.

Fig:10:LEVANGIE, P. K.,AND NORKIN, C.C. 2005. JOINT STRUCTURE AND FUNCTION ; A COMPREHENSIVE ANALYSIS . FIFTH ED. PHILADELPHIA, PA: F. A. DAVIS Co.