THE SHOULDER COMPLEX

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ACROMIOCLAVICULAR JOINT

- The AC joint attaches the scapula to the clavicle.
- It is generally described as a **plane synovial joint** with 3 rotational and 3 translational DOF.
- It has a joint capsule, 2 major ligaments, and a joint disc that may or may not be present.
- The primary function of the AC joint is to allow the scapula to rotate in 3D during arm movement so that UE motion is increased.
- The AC joint also allows transmission of forces from the UE to the clavicle.

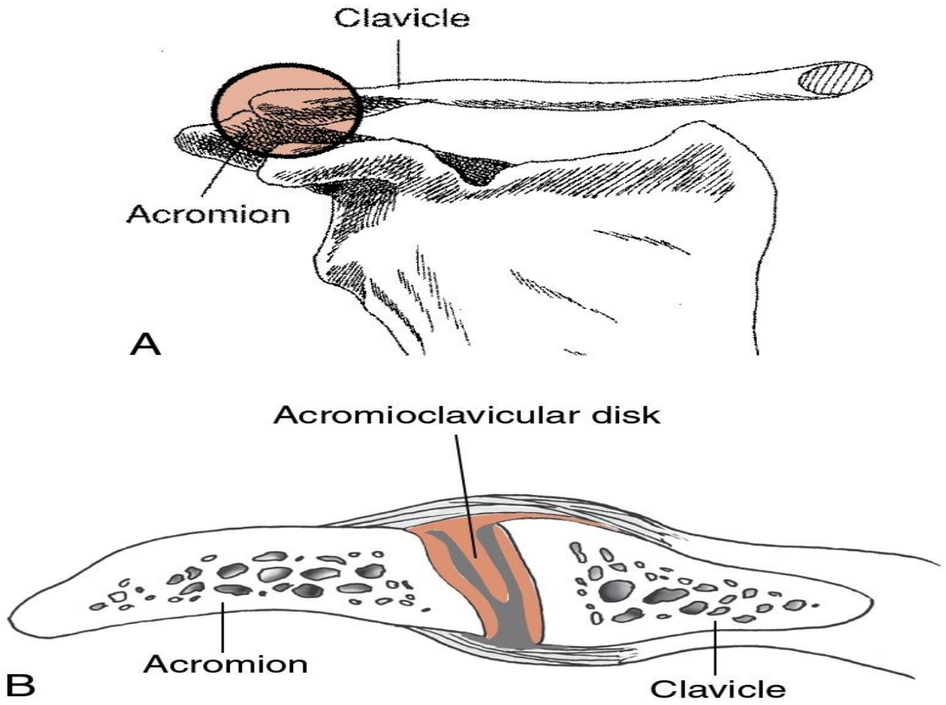

Figure 7–8 **A.** The acromioclavicular joint. **B.** A cross-section of the acromioclavicular joint shows the disc and the angulation of the articular surfaces.

AC ARTICULATING SURFACES

- The AC joint consists of the articulation between the lateral end of the clavicle and a small facet on the acromion of the scapula.
- The articular facets are considered to be incongruent and vary in configuration.
- They may be flat, reciprocally concave-convex, or reversed (reciprocally convex-concave).

AC JOINT DISC

- The disc of the AC joint may vary in size between individuals, within an individual as they age, and between shoulders of the same individual.
- Through 2 years of age, the joint is actually a fibrocartilaginous union.
- With use of the UE, a joint space develops at each articulating surface that may leave a “meniscoid” fibrocartilage remnant within the joint.

AC CAPSULE AND LIGAMENTS

- The capsule of the AC joint is weak and cannot maintain integrity of the joint without the reinforcement of the superior and inferior AC ligaments and the coracoclavicular ligaments.
- Superior AC is the main ligament limiting movement caused by anterior forces applied to the distal clavicle.
- The fibers of the superior AC ligament are reinforced by aponeurotic fibers of the trapezius and deltoid muscles, making the superior joint support stronger than the inferior.

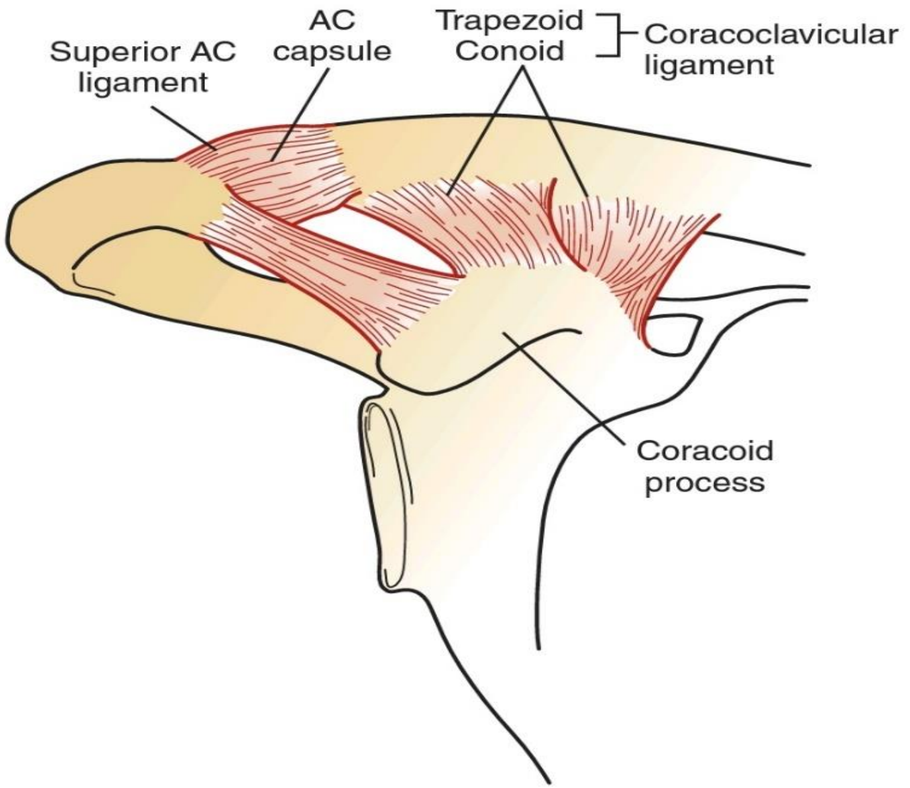

Figure 7–9 The acromioclavicular joint capsule and ligaments, including the coracoclavicular ligament with its conoid and trapezoid portions.

- The **coracoclavicular ligament**, although not belonging directly to the anatomic structure of the AC joint, firmly unites the clavicle and scapula and provides much of the joint's superior and inferior stability.
- This ligament is divided into a medial portion, the **conoid ligament**, and a lateral portion, the **trapezoid ligament**.
- The conoid ligament, medial and slightly posterior to the trapezoid, is more **triangular and vertically oriented.** The trapezoid ligament is **quadrilateral** in shape and is nearly **horizontal in orientation.**

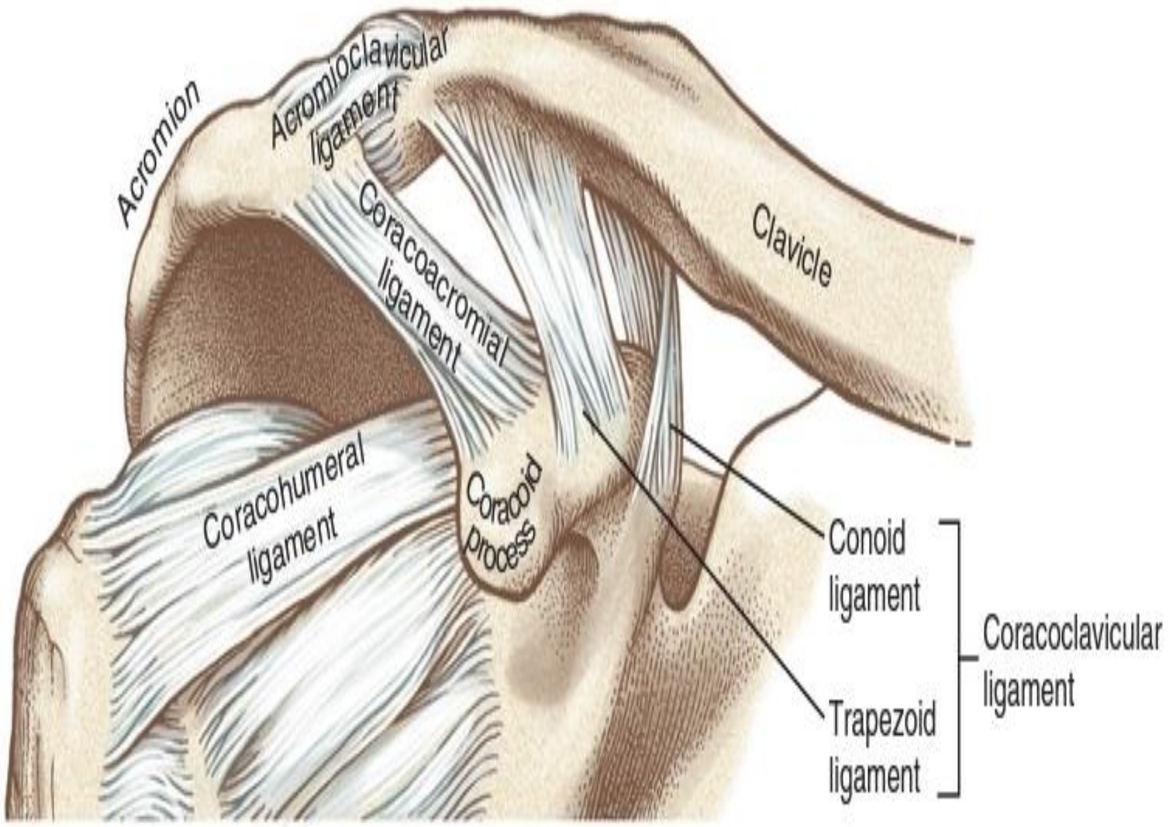

FIG. 5.17 An anterior view of the right acromioclavicular joint including many surrounding ligaments.

- The 2 portions are separated by adipose tissue and a large bursa.
- Both ligaments attach to the undersurface of the clavicle and influence the biomechanics of the shoulder.
- Although the AC capsule and ligament can resist small rotary and translatory forces at the AC joint, restraint of larger translations is credited to the coracoclavicular ligament.
- In addition, both portions of the coracoclavicular ligament **limit upward rotation of the scapula at the AC joint.**

- When medially directed forces on the humerus are transferred to the glenoid fossa of the scapula, medial displacement of the scapula on the clavicle is prevented by the coracoclavicular ligament complex, in particular the horizontal trapezoid portion.
- These medial forces are transferred to the clavicle and then to the strong SC joint.

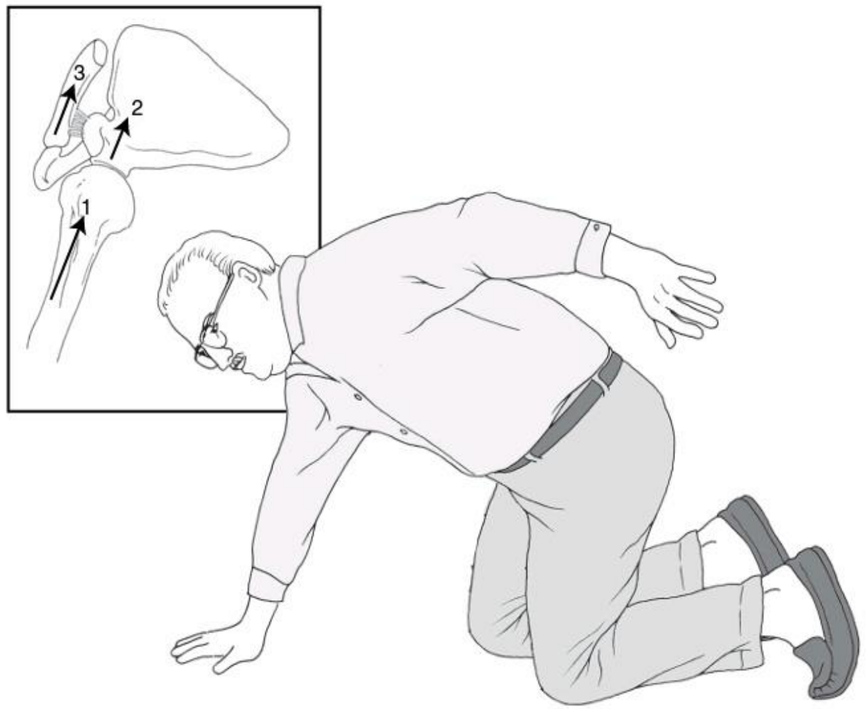

Figure 7–10 When a person bears weight on an arm, a medially directed force up the humerus (1) is transferred to the scapula (2) through the glenoid fossa and then to the clavicle (3) through the coracoclavicular ligament.

AC MOTIONS

- The articular facets of the AC joint are small, afford limited motion, and have a wide range of individual differences.
- For these reasons, studies are inconsistent in identifying the movement and axes of motion for this joint.
- The primary rotary motions that take place at the AC joint are

1. Internal / external rotation,

2. Anterior / posterior tilting or tipping, and

3. Upward / downward rotation.

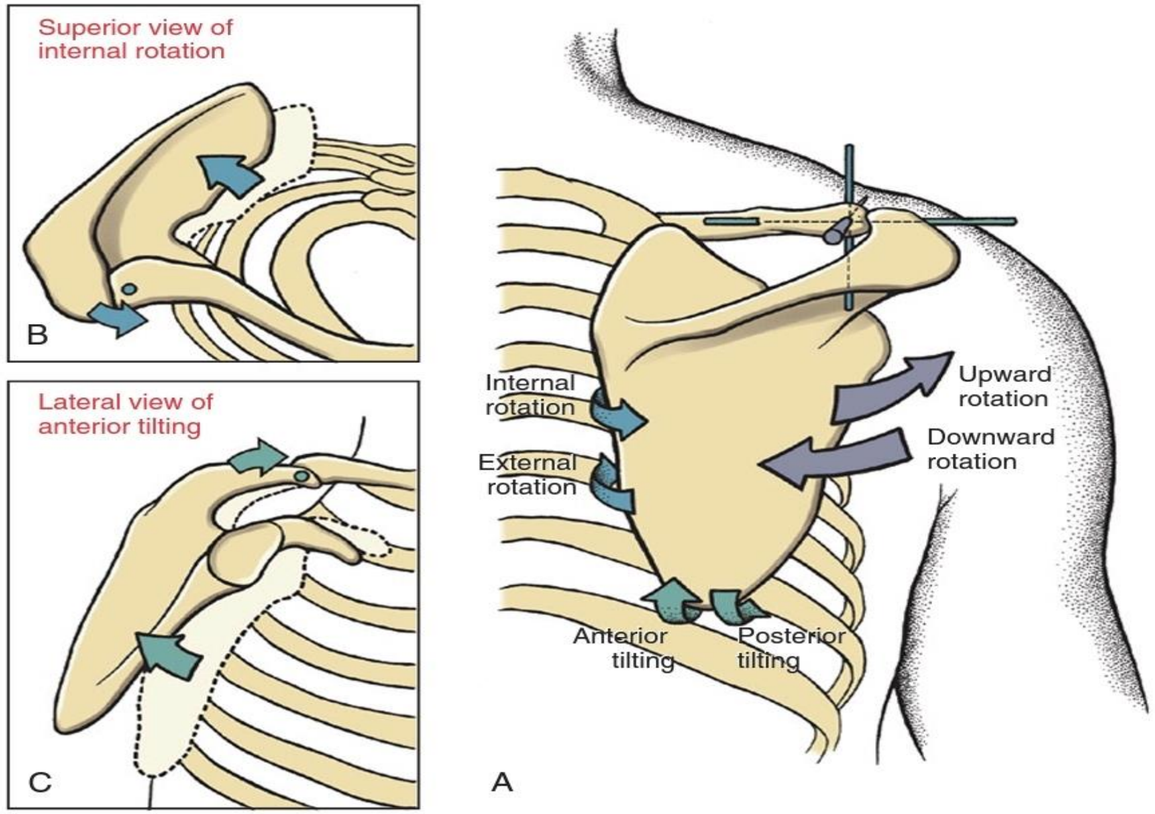

FIG. 5.19 (A) Posterior view showing the osteokinematics of the right acromioclavicular (AC) joint. The primary motions of upward and downward rotation are shown in purple. Horizontal and sagittal plane adjustment motions, considered as secondary motions, are shown in blue and green, respectively. Note that each plane of movement is color-coded with a corresponding axis of rotation. Images (B) and (C) show examples of rotational adjustment motions at the AC joint: internal rotation during scapulothoracic protraction (B), and anterior tilting during scapulothoracic elevation (C).

- These motions occur around axes that are oriented to the plane of the scapula rather than to the cardinal planes.

Internal/external rotation - Vertical axis

Anterior/ posterior tilting - Oblique “coronal” axis

Upward/downward rotation - Oblique “A-P” axis

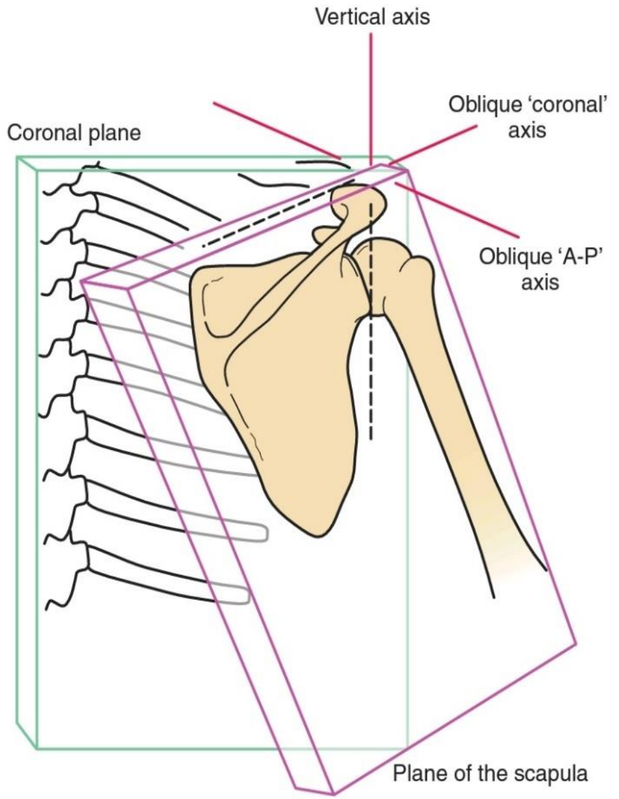

Figure 7–11 The acromioclavicular rotary axes of motion are oriented in relation to the plane of the scapula, rather than in relation to the cardinal planes.

Internal and External Rotation

- IR/ER of the scapula in relation to the clavicle occurs around an approximately **vertical axis** through the AC joint.
- IR & ER at the AC joint can best be visualized as bringing the glenoid fossa of the scapula anteromedially and posterolaterally, respectively.
- IR- Anteromedially
- ER - Posterolaterally

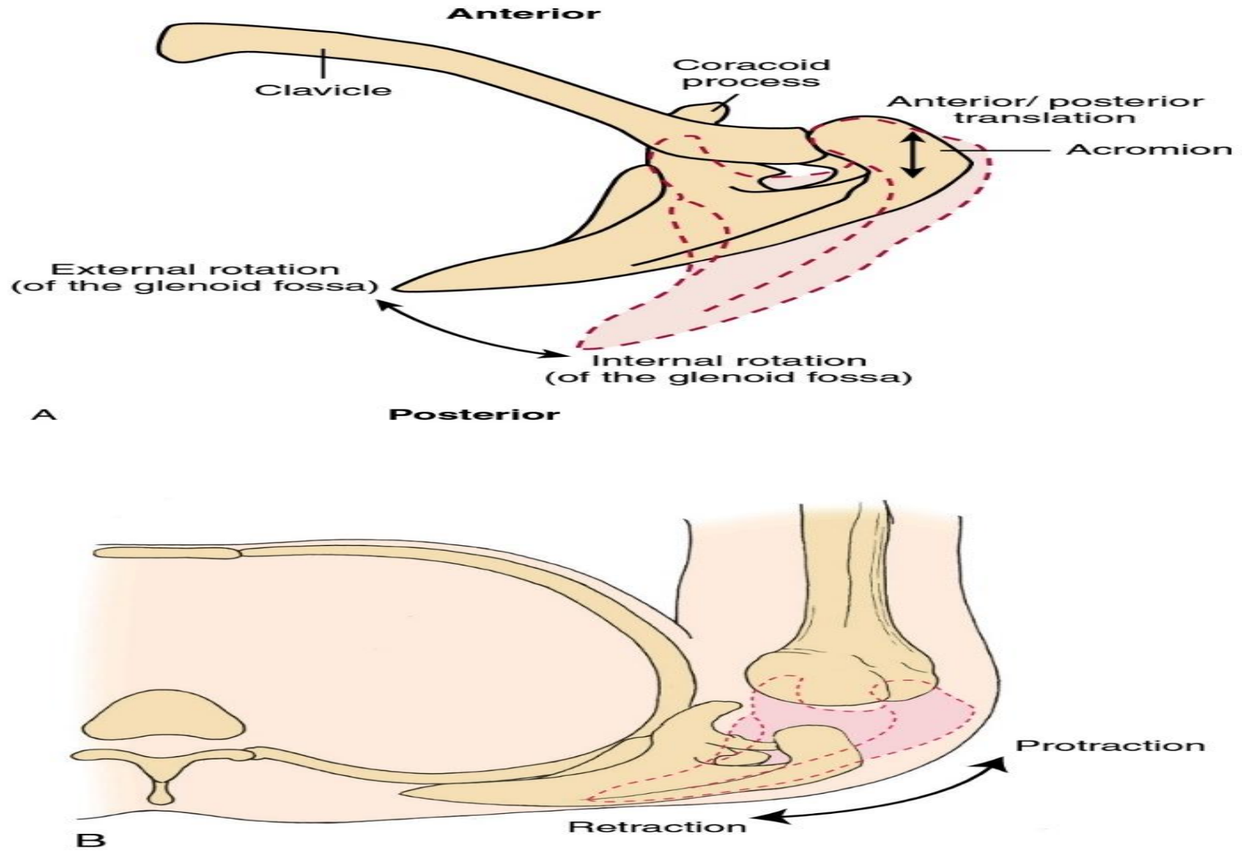

Figure 7–12 **A.** A superior view of scapular internal and external rotation at the acromioclavicular joint. Although the directional arrows are drawn at the vertebral border, the motions are named with the glenoid fossa of the scapula as the reference. The acromion also has small amounts of anterior and posterior translatory motions that can occur. **B.** Protraction and retraction of the scapula require internal and external rotation for the scapula to follow the convex thorax and orient the glenoid fossa with the plane of elevation.

Anterior and Posterior Tilting

- The second AC motion is anterior/posterior tilting or tipping of the scapula in relation to the clavicle around an **oblique "coronal" axis** through the joint.
- Anterior tilting results in the acromion tilting forward and the inferior angle tilting backward. Posterior tilting rotates the acromion backward and the inferior angle forward.

Scapular Elevation – Anterior tipping
Scapular Depression – Posterior tipping

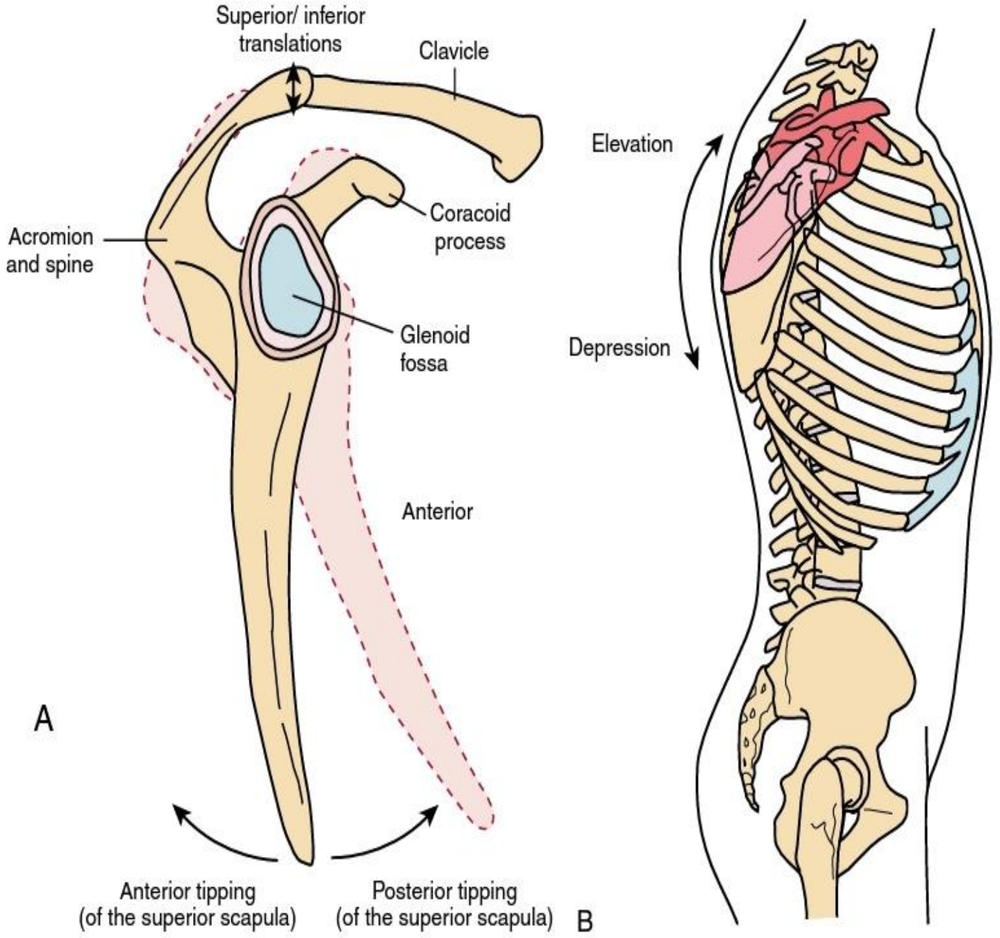

Figure 7–13 **A.** A lateral view of scapular anterior and posterior tilting at the acromioclavicular joint. Although the directional arrows are drawn at the inferior angle, the motions are named with the superior aspect of the scapula as the reference. The acromion also has small amounts of anterior and posterior translatory motions that can occur. **B.** Elevation and depression of the scapula can include anterior and posterior tilting, respectively, for the scapula to follow the convex thorax.

Upward/Downward Rotation

- Upward/ downward rotation of the scapula in relation to the clavicle about an **oblique "A-P" axis** approximately perpendicular to the plane of the scapula, passing midway between the joint surfaces of the AC joint.
- Upward rotation tilts the glenoid fossa upward, and downward rotation is the opposite motion.

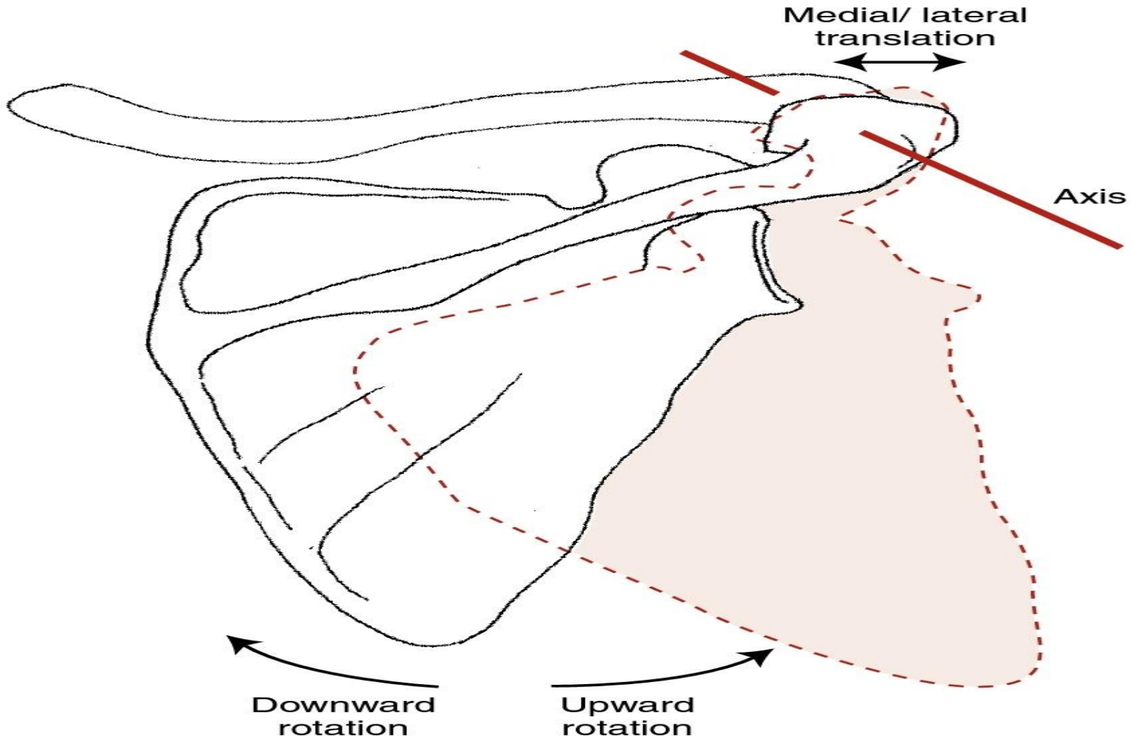

Figure 7–14 Upward/downward rotation of the scapula at the acromioclavicular joint occurs around an approximately A-P (perpendicular to the plane of the scapula) axis. Although the directional arrows are drawn at the inferior angle, the motions are named with the glenoid fossa of the scapula as the reference. The acromion also has a small magnitude of medial and lateral translatory motions that can occur.

AC STRESS

- Unlike the SC joint, the AC joint is susceptible to both trauma and degenerative changes.
- Trauma to the AC joint most often occurs in the first 3 decades of life, during either contact sports or a fall on the shoulder with the arm adducted.
- Typically the result of high inferior forces on the acromion, trauma results in AC joint disruption ranging from sprains and subluxations to dislocations.
- Degenerative change is common from the second decade on, with the joint space frequently narrowed by the 6^{th} decade.