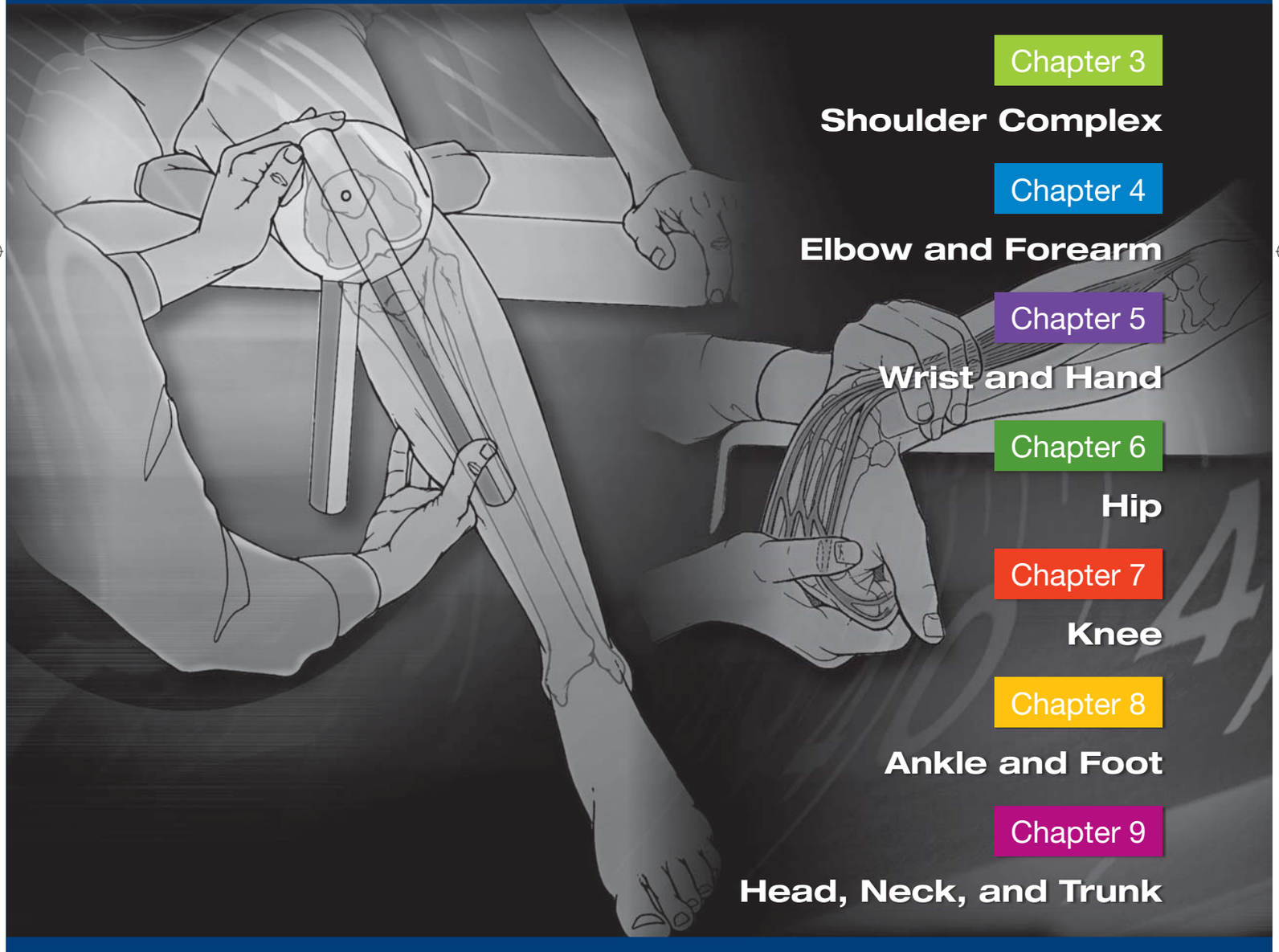
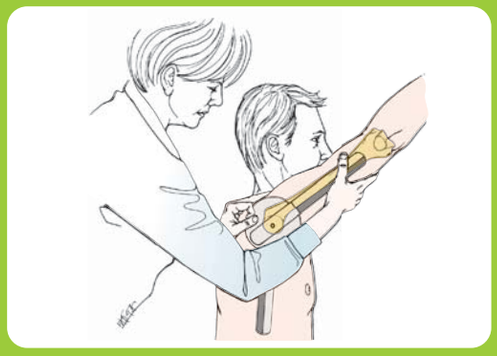
# Section II

# Regional Evaluation Techniques





# Shoulder Complex 3

## QUICK FIND



*(Continued)*

## QUICK FIND *(continued)*



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# Articulations and Movements

The *shoulder complex* is a related group of articulations. This group of articulations (Fig. 3-1) includes the sternoclavicular, acromioclavicular, scapulothoracic, and glenohumeral joints. The shoulder complex can be subdivided into two main components:

a. The *shoulder girdle*, which includes the sternoclavicular, acromioclavicular, and scapulothoracic joints

b. The shoulder joint, that is, the *glenohumeral joint.*

## The Shoulder Girdle

The shoulder girdle is connected directly to the trunk via the *sternoclavicular joint*. The medial end of the clavicle forms the lateral sternoclavicular joint surface, and the lateral aspect of the manubrium sternum and adjacent superior surface of the first costal cartilage make up the medial joint surface. An articular disc lies between the articular surfaces. Categorized as a saddle joint, the clavicular surface of the joint is convex vertically and concave horizontally, and articulates with the reciprocal surfaces on the medial aspect of the joint.[1]

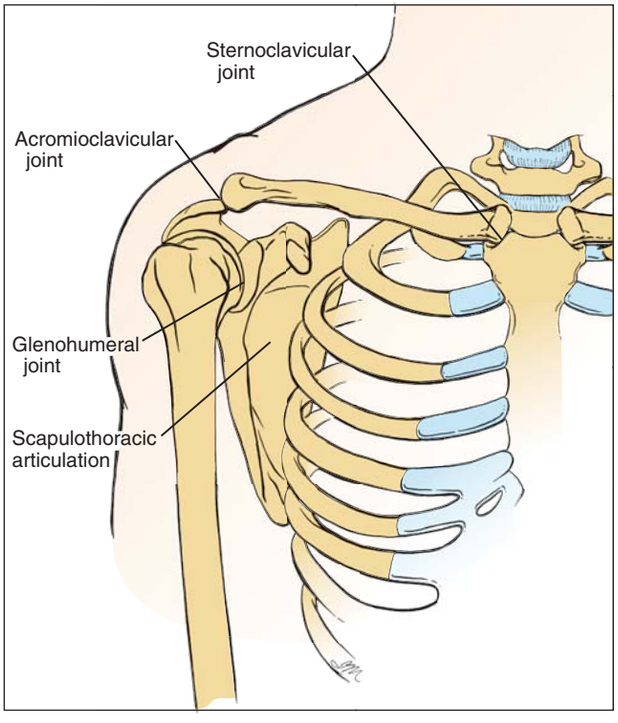


**Figure 3-1** Shoulder complex articulations.

Movements at the sternoclavicular joint include elevation, depression, protraction, retraction, and rotation of the clavicle. During elevation and depression, the lateral end of the clavicle moves superiorly and inferiorly, respectively, in the frontal plane around a sagittal axis. The lateral end of the clavicle moves in an anterior direction with protraction and in a posterior direction with retraction. Protraction and retraction movements of the clavicle occur in a horizontal plane about a vertical axis. Rotation of the clavicle takes place in a sagittal plane around a frontal axis (i.e., an axis that passes along the long axis of the clavicle). Mobility at the sternoclavicular joint is requisite for the clavicular and scapular motion essential to the normal performance of shoulder elevation (i.e., movement of the arm above shoulder level to a vertical position alongside the head).

The *acromioclavicular joint*, linking the clavicle and scapula, is classified as a plane joint formed by the relatively flat articular surfaces of the lateral end of the clavicle and the acromion process of the scapula. In some instances, the joint surfaces are partially separated by an articular disc.[1] At the acromioclavicular joint, limited gliding motions between the clavicle and scapula during shoulder girdle movement allow scapular motion independent of clavicular motion, and alignment of the scapula against the chest wall.[2]

A physiological or functional joint, the *scapulothoracic joint* consists of flexible soft tissues (i.e., subscapularis and serratus anterior) sandwiched between the scapula and the chest wall that allow the scapula to move over the thorax. Scapular motions are accompanied by movement of the clavicle via the acromioclavicular joint.

Scapular motions include elevation, depression, retraction, protraction, lateral (upward) rotation, and medial (downward) rotation. Movement of the scapula in a cranial direction is called elevation and is accompanied by elevation of the clavicle. The scapula and clavicle move in a caudal direction with scapular depression. Scapular retraction and protraction occur in the horizontal plane around a vertical axis as the medial border of the scapula moves either toward (retraction) or away from (protraction) the vertebral column. Scapular retraction and protraction are accompanied by retraction and protraction of the clavicle, respectively. The scapula also rotates laterally and medially, with reference to the movement of the inferior angle, so that the glenoid cavity moves in either an upward (cranial) or a downward (caudal) direction, respectively (Fig. 3-2).

In the clinical setting, motion at the sternoclavicular joint and scapula is not easily measured, and it is not possible to measure motion at the acromioclavicular joint. Therefore,

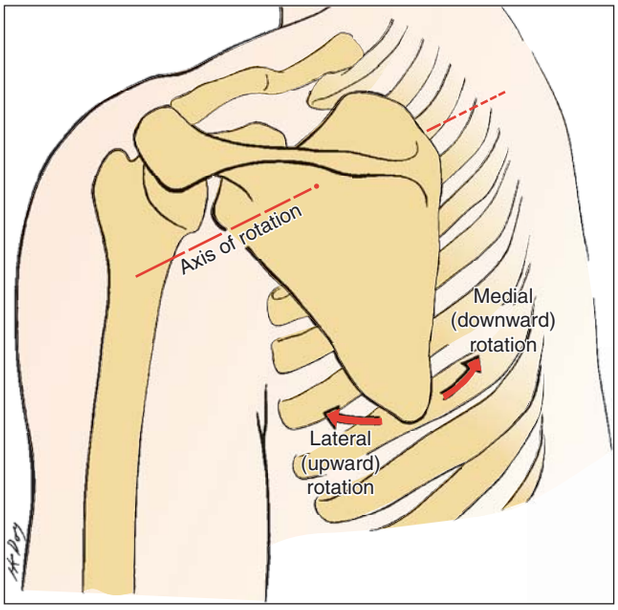


**Figure 3-2** Scapular axis of rotation.

scapular and clavicular motions are normally assessed by visual observation of active movement and through passive movement.

## The Glenohumeral Joint

The *glenohumeral or shoulder joint* is a ball-and-socket joint formed medially by the concave surface of the scapular glenoid cavity and laterally by the convex surface of the head of the humerus. The axes around which glenohumeral joint motions occur are illustrated in Figures 3-3 and 3-4. In Figure 3-4, from the anatomical position, the glenohumeral joint may be flexed and extended in the sagittal plane with movement occurring around a frontal axis. The movements of shoulder abduction and adduction occur in the frontal plane around a sagittal axis. In Figure 3-3, the shoulder is positioned in 90° abduction for the purpose of illustrating the vertical axis around which the movements of shoulder horizontal adduction and abduction occur in the transverse plane. With the shoulder in 90° abduction, shoulder internal and external rotation takes place in a sagittal plane about the longitudinal axis of the humerus (Fig. 3-3). However, with the arm at the side in anatomical position, internal and external rotation takes place in a horizontal plane about the longitudinal axis of the humerus.

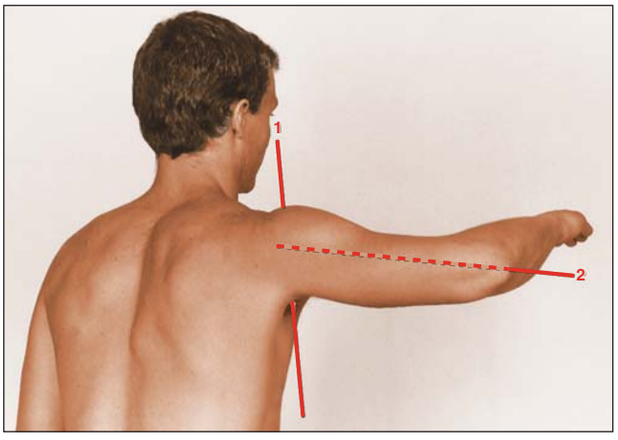


**Figure 3-3** Glenohumeral axes: *(1)* horizontal abduction–adduction; *(2)* internal–external rotation.

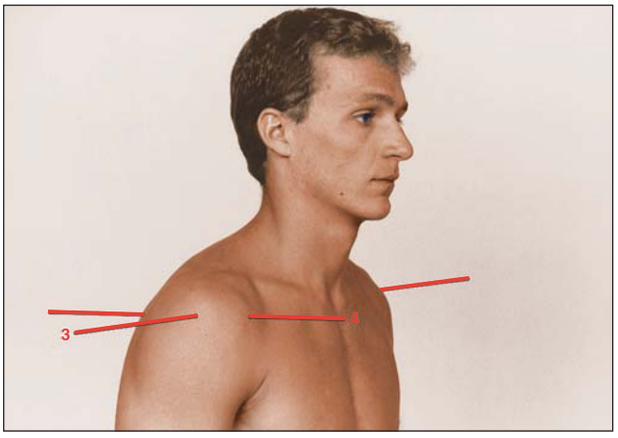


**Figure 3-4** Glenohumeral axes: *(3)* flexion–extension; *(4)* abduction–adduction.

## The Shoulder Complex

Normal function in performing activities of daily living (ADL) depends on the integrated movement patterns of the joints of the shoulder girdle and the shoulder (glenohumeral) joint. Shoulder (glenohumeral joint) movements are accompanied at varying points in the range of motion (ROM) by scapular, clavicular, and trunk motions. The movements at the scapulothoracic, acromioclavicular, sternoclavicular, and spinal articulations extend the ROM capabilities of the glenohumeral joint. Shoulder elevation is an example of movement that requires the integrated movement patterns of all the joints of the shoulder complex.

**Shoulder elevation** is the term used to describe movement of the arm above shoulder level (i.e., 90°) to a vertical position alongside the head (i.e., 180°). The vertical position may be arrived at by moving the arm

through either the sagittal plane or the frontal plane, and the movements are referred to as *shoulder elevation through flexion* or *shoulder elevation through abduction*, respectively. In the clinical setting, these movements may be referred to simply as *shoulder flexion* and *shoulder abduction*.

Moving the arm through other vertical planes located between the sagittal and frontal planes will also bring the arm to the vertical position alongside the head. The plane of the scapula lies 30° to 45° anterior to the frontal plane.[3] The scapular plane is the plane of reference for diagonal movements of shoulder elevation and is the plane often used when the arm is raised to perform overhead activities. This midplane elevation is called *scaption*[4] (Fig. 3-5).

Figures 3-6A and 3-7A illustrate the integrated movement patterns of the joints of the shoulder complex during the normal performance of two ADL, combing one's hair and reaching into a back pocket. Figures 3-6B and 3-7B illustrate the changes that occur in the integrated movement patterns when motion is restricted at one of the joints of the shoulder complex, in this case the glenohumeral joint. Observe how increased movement (i.e., substitute motion) of the scapula and trunk is used to compensate for the loss of motion at the glenohumeral joint. The completion of the two ADL would not be possible without employing the substitute motions.

The joints and movements of the shoulder complex are summarized in Tables 3-1 to 3-3.

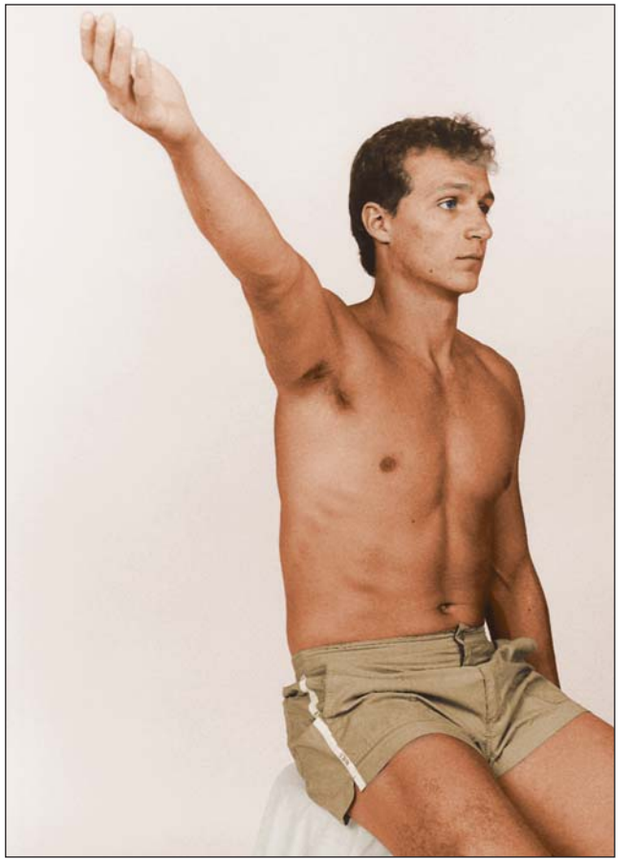

**Figure 3-5** Elevation: plane of the scapula.

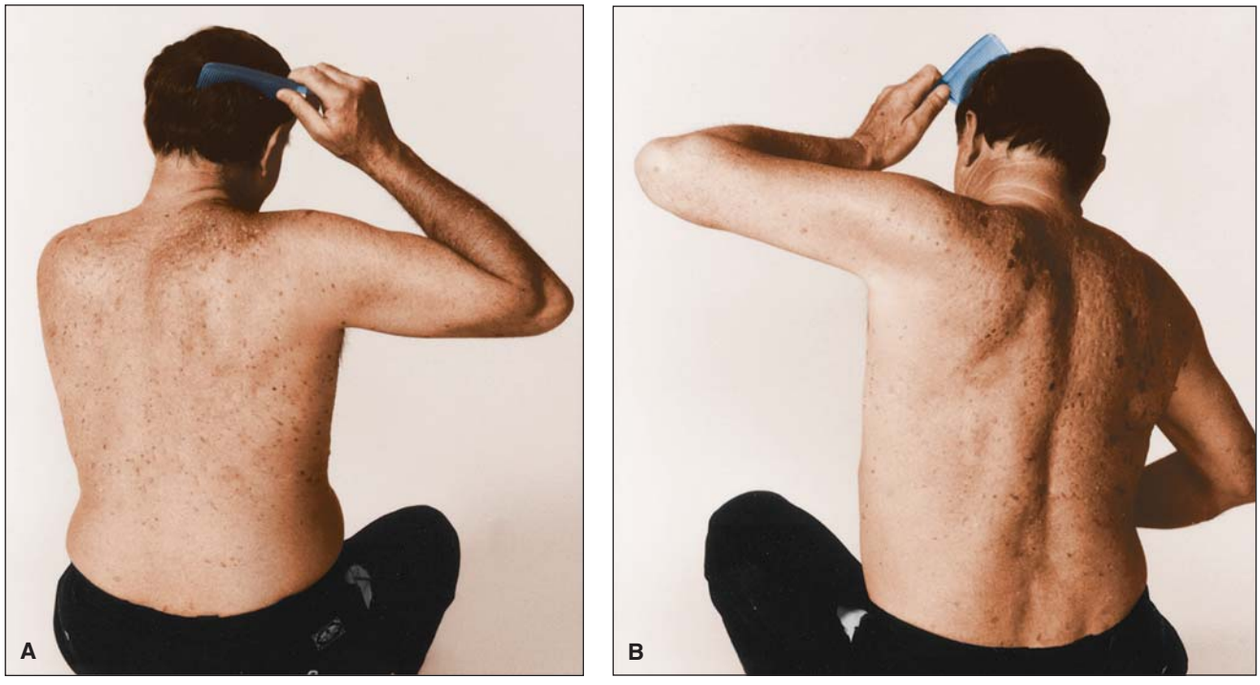


**Figure 3-6** **A.** Patient combs hair using normal right upper extremity. **B.** Patient attempts to comb hair using left upper extremity with restricted glenohumeral joint movement. Substitute motions are observed at the left shoulder girdle and more distant joints.


**Figure 3-7** **A.** Patient reaches into back pocket using normal right upper extremity. **B.** Patient attempts to reach into back pocket using left upper extremity with restricted glenohumeral joint movement. Substitute motions are observed at the left shoulder girdle and more distant joints.

## TABLE 3-1 Joint Structure: Scapular Movements

| | Elevation | Depression | Abduction (Protraction) | Adduction (Retraction) |
|---|---|---|---|---|
| **Articulation**[1,5] | Scapulothoracic<br>Acromioclavicular<br>Sternoclavicular | Scapulothoracic<br>Acromioclavicular<br>Sternoclavicular | Scapulothoracic<br>Acromioclavicular<br>Sternoclavicular | Scapulothoracic<br>Acromioclavicular<br>Sternoclavicular |
| **Plane** | Frontal | Frontal | Horizontal | Horizontal |
| **Axis** | Sagittal | Sagittal | Vertical | Vertical |
| **Normal limiting factors**[5–9,*] **(See Fig. 3-8A and B)** | Tension in the costoclavicular ligament, inferior sternoclavicular joint capsule, lower fibers of trapezius, pectoralis minor, and subclavius | Tension in the interclavicular ligament, sternoclavicular ligament, articular disk, upper fibers of trapezius, and levator scapulae; bony contact between the clavicle and the superior aspect of the 1st rib | Tension in the trapezoid ligament, posterior sternoclavicular ligament, posterior lamina of the costoclavicular ligament, trapezius, and rhomboids | Tension in the conoid ligament, anterior lamina of the costoclavicular ligament, anterior sternoclavicular ligament, pectoralis minor, and serratus anterior |
| **Normal end feel**[6,10] | Firm | Firm/hard | Firm | Firm |
| **Normal AROM**[5,†] | 10–12 cm<br>(total range for elevation–depression) | | 10–12 cm<br>(total range for abduction–adduction) | |
| | **Medial Rotation (Downward Rotation)** | **Lateral Rotation (Upward Rotation)** | | |
| **Articulation**[1,5] | Scapulothoracic<br>Acromioclavicular<br>Sternoclavicular | Scapulothoracic<br>Acromioclavicular<br>Sternoclavicular | | |
| **Plane** | Frontal | Frontal | | |
| **Axis** | Sagittal | Sagittal | | |
| **Normal limiting factors**[5–9,*] **(See Fig. 3-8A and B)** | Tension in the conoid ligament and serratus anterior | Tension in the trapezoid ligament, the rhomboid muscles and the levator scapulae | | |
| **Normal end feel**[6,10] | Firm | Firm | | |
| **Normal AROM**[5] | 45°–60°<br>(total range for medial-lateral rotation) | | | |

*Note:* Medial and lateral rotations of the scapula are associated with extension and/or adduction, and flexion and/or abduction of the shoulder, respectively.

*There is a paucity of definitive research that identifies the normal limiting factors (NLF) of joint motion. The NLF and end feels listed here are based on knowledge of anatomy, clinical experience, and available references.

†AROM, active range of motion.

## TABLE 3-2 Joint Structure: Glenohumeral Joint Movements

| | Extension | Internal Rotation | External Rotation | Horizontal Abduction | Horizontal Adduction |
|---|---|---|---|---|---|
| **Articulation**[1,5] | Glenohumeral | Glenohumeral | Glenohumeral | Glenohumeral | Glenohumeral |
| **Plane** | Sagittal | Horizontal | Horizontal | Horizontal | Horizontal |
| **Axis** | Frontal | Longitudinal | Longitudinal | Vertical | Vertical |
| **Normal limiting factors**[5–9,*] (See Fig. 3-8B) | Tension in the anterior band of the coracohumeral ligament, anterior joint capsule, and clavicular fibers of pectoralis major | Tension in the posterior joint capsule, infraspinatus, and teres minor | Tension in all bands of the glenohumeral ligament, coracohumeral ligament, the anterior joint capsule, subscapularis, pectoralis major, teres major, and latissimus dorsi | Tension in the anterior joint capsule, the glenohumeral ligament, and pectoralis major | Tension in the posterior joint capsule<br>Soft tissue apposition |
| **Normal end feel**[6,10] | Firm | Firm | Firm | Firm | Firm/soft |
| **Normal AROM**[11] **(AROM**[12]**)** | 0°–60° (0°–60°) | 0°–70° (0°–70°) | 0°–90° (0°–90°) | 0°–45° (–) | 0°–135° (–) |

*There is a paucity of definitive research that identifies the normal limiting factors (NLF) of joint motion. The NLF and end feels listed here are based on knowledge of anatomy, clinical experience, and available references.

## TABLE 3-3 Joint Structure: Shoulder Complex Movements

| | Elevation Through Flexion | Elevation Through Abduction |
|---|---|---|
| **Articulation**[1,5] | Glenohumeral<br>Acromioclavicular<br>Sternoclavicular<br>Scapulothoracic | Glenohumeral<br>Acromioclavicular<br>Sternoclavicular<br>Scapulothoracic<br>Subdeltoid[1] |
| **Plane** | Sagittal | Frontal |
| **Axis** | Frontal | Sagittal |
| **Normal limiting factors**[5–9,*] (See Fig. 3-8B) | Tension in the posterior band of the coracohumeral ligament, posterior joint capsule, shoulder extensors, and external rotators; scapular movement limited by tension in rhomboids, levator scapulae, and the trapezoid ligament | Tension in the middle and inferior bands of the glenohumeral ligament, inferior joint capsule, shoulder adductors; greater tuberosity of the humerus contacting the upper portion of the glenoid and glenoid labrum or the lateral surface of the acromion; scapular movement limited by tension in rhomboids, levator scapulae, and the trapezoid ligament |
| **Normal end feel**[6,10] | Firm | Firm/hard |
| **Normal AROM**[1,5,11] **(AROM**[12]**)** | 0°–180° (0°–165°)<br>0°–60°, glenohumeral<br>60°–180°, glenohumeral, scapular movement, and trunk movement | 0°–180° (0°–165°)<br>0°–30°, glenohumeral<br>30°–180°, glenohumeral, scapular movement, and trunk movement |
| **Capsular pattern**[10,13] | Glenohumeral: external rotation, abduction (only through 90°–120° range), internal rotation<br>Sternoclavicular/acromioclavicular: pain at extreme range of motion notably horizontal adduction and full elevation | |

*There is a paucity of definitive research that identifies the normal limiting factors (NLF) of joint motion. The NLF and end feels listed here are based on knowledge of anatomy, clinical experience, and available references.