SHOULDER JOINT ANATOMY AND KINESIOLOGY
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• The shoulder joint, also called the glenohumeral joint, consists of the scapula and humerus.

• The motions of the shoulder joint are flexion, extension and hyperextension, abduction and adduction, medial and lateral rotation, and horizontal abduction and adduction.
Because the shoulder joint is so mobile, it has few ligaments.

The nine muscles that cross the shoulder joint are the prime movers in shoulder joint motion.
Figure 10-1. The shoulder joint (anterior view).
Figure 10-2. Shoulder joint motions.
• **Flexion** is from 0 to 180 degrees, and extension is the return to anatomical position.
• Approximately 45 degrees of hyperextension are possible from the anatomical position.
• **Abduction and adduction** occur in the frontal plane around the **sagittal axis** with 180 degrees of motion possible.
• **Medial and lateral rotation** occur in the transverse plane around the vertical axis. It is possible to move 90 degrees in each direction.
• Horizontal abduction and horizontal adduction also occur in the transverse plane around the vertical axis.

• From an starting position for these motions of 90 degrees of shoulder abduction, there would be approximately 30 degrees of horizontal abduction (backward motion) and approximately 120 degrees of horizontal adduction (forward motion).
Figure 10-2. Shoulder joint motions.
Bones and Landmarks - Scapula

- The following landmarks of the scapula are important about the shoulder joint (glenohumeral joint):
  - **Glenoid fossa:**
  - A shallow, somewhat egg-shaped socket on the superior end, lateral side; articulates with the humerus.
Scapula

- **Glenoid labrum:**
- Fibrocartilaginous ring attached to the rim of the glenoid fossa, which deepens the articular cavity

- **Subscapular fossa:**
- Includes most of the area on the anterior (costal) surface, providing attachment for the subscapularis muscle.
Humerus

• **The humerus** is the longest and largest bone of the upper extremity.

• **Head:**
  • Semirounded proximal end; articulates with the scapula

• **Surgical neck:**
  • Slightly constricted area just below tubercles where the head meets the body

• **Anatomical neck:**
  • Circumferential groove separating the head from the tubercle

• **Shaft:**
  • the area between the surgical neck proximally and the epicondyles distally
Ligaments and Other Structures

- The joint capsule is a thin-walled, container that attaches around the rim of the glenoid fossa of the scapula and the anatomical neck of the humerus.

- The superior, middle, and inferior glenohumeral ligaments reinforce the anterior portion of the capsule.
Figure 10-6. Left shoulder joint capsule and coracohumeral ligament. Posterior view, muscles cut away.
The rotator cuff is the tendinous band formed by the blending together of the tendinous insertions of the subscapularis, supraspinatus, infraspinatus, and teres minor muscles. These muscles help to keep the head of the humerus “rotating” against the glenoid fossa during joint motion.
Muscles of the Shoulder Joint

The muscles that span the shoulder joint are as follows:

- Deltoid
- Pectoralis major
- Latissimus dorsi
- Teres major
- Supraspinatus
- Infraspinatus
- Teres minor
- Subscapularis
- Coracobrachialis
- Biceps brachii
- Triceps brachii, long head
- The deltoid muscle is a superficial muscle that covers the shoulder joint on three sides, giving the shoulder its characteristic rounded shape.
- Functionally, this muscle is separated into three parts: anterior, middle, and posterior.
Anterior Deltoid Muscle

O  Lateral third of the clavicle
I  Deltoid tuberosity
A  Shoulder abduction, flexion, medial rotation, and horizontal adduction
N  Axillary nerve (C5, C6)

Middle Deltoid Muscle

O  Acromion process
I  Deltoid tuberosity (same as anterior deltoid muscle)
A  Shoulder abduction
N  Axillary nerve (C5, C6)

Posterior Deltoid Muscle

O  Spine of scapula
I  Deltoid tuberosity (same as anterior deltoid muscle)
A  Shoulder abduction, extension, hyperextension, lateral rotation, horizontal abduction
N  Axillary nerve (C5, C6)

Figure 10.8. The three parts of the deltoid muscle (lateral view).
• The **pectoralis major muscle** is a large muscle of the chest,
• It is superficial except for its distal attachment lying under the deltoid muscle.
• Because this muscle crosses the joint on the anterior surface from medial to lateral,
• it is effective in **adduction and medial rotation of the shoulder joint.**
Figure 10-9. The two parts of the pectoralis major muscle (anterior view).
<table>
<thead>
<tr>
<th>Pectoralis Major Muscle, Clavicular Portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>O: Medial third of clavicle</td>
</tr>
<tr>
<td>I: Lateral lip of bicipital groove of humerus</td>
</tr>
<tr>
<td>A: Shoulder flexion—first 60 degrees</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pectoralis Major Muscle, Sternal Portion</th>
</tr>
</thead>
<tbody>
<tr>
<td>O: Sternum, costal cartilage of first six ribs</td>
</tr>
<tr>
<td>I: Lateral lip of bicipital groove of humerus (same as clavicular portion)</td>
</tr>
<tr>
<td>A: Shoulder extension—first 60 degrees (from 180 degrees to 120 degrees)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pectoralis Major Muscle, Clavicular and Sternal Portions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Shoulder adduction, medial rotation, and horizontal adduction</td>
</tr>
<tr>
<td>N: Lateral and medial pectoral nerve (C5, C6, C7, C8, T1)</td>
</tr>
</tbody>
</table>

*Figure 10-9. The two parts of the pectoralis major muscle (anterior view).*
• The **latissimus dorsi muscle** is a broad muscle located on the back.

• The latissimus dorsi muscle is a strong agonist in extension, hyperextension, adduction, and medial rotation of the shoulder.
<table>
<thead>
<tr>
<th>O</th>
<th>Spinous processes of T7 through L5 (via dorsolumbar fascia), posterior surface of sacrum, iliac crest, and lower three ribs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Medial floor of bicipital groove of humerus</td>
</tr>
<tr>
<td>A</td>
<td>Shoulder extension, adduction, medial rotation, hyperextension</td>
</tr>
<tr>
<td>N</td>
<td>Thoracodorsal nerve (C6, C7, C8)</td>
</tr>
</tbody>
</table>

**Figure 10-10.** The latissimus dorsi muscle (posterior view). Note that the humeral attachment is on the anterior surface, as indicated by the dotted line.
• The teres major muscle has its proximal attachment on the axillary border of the scapula, just below the teres minor muscle.
**Teres Major Muscle**

<table>
<thead>
<tr>
<th>O</th>
<th>Axillary border of scapula near the inferior angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Crest below lesser tubercle inferior to the latissimus dorsi muscle attachment</td>
</tr>
<tr>
<td>A</td>
<td>Shoulder extension, adduction, and medial rotation</td>
</tr>
<tr>
<td>N</td>
<td>Lower subscapular nerve (C5, C6, C7)</td>
</tr>
</tbody>
</table>

*Figure 10-11.* The teres major muscle (posterior view). Note that the humeral attachment is on the anterior surface, as indicated by the dotted line.
• **The supraspinatus muscle** lies above the spine of the scapula.

• **It is active muscle throughout abduction.**

• In addition to its joint movement function, the supraspinatus muscle is very important in stabilizing the head of the humerus against the glenoid fossa.
## Supraspinatus Muscle

<table>
<thead>
<tr>
<th>O</th>
<th>Supraspinous fossa of the scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Greater tubercle of the humerus</td>
</tr>
</tbody>
</table>

A  Shoulder abduction  
N  Suprascapular nerve (C5, C6)

**Figure 10-12.** The supraspinatus muscle (posterior view).
• The infraspinatus muscle lies below the spine of the scapula.

**Infraspinatus Muscle**

- **O** Infraspinous fossa of scapula
- **I** Greater tubercle of humerus
- **A** Shoulder lateral rotation, horizontal abduction
- **N** Suprascapular nerve (C5, C6)

*Figure 10-13. The infraspinatus and teres minor muscles (posterior view).*
• The teres minor muscle is closely related to the infraspinatus muscle in both anatomical location and function.

**Teres Minor Muscle**

<table>
<thead>
<tr>
<th>O</th>
<th>Axillary border of scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Greater tubercle of humerus</td>
</tr>
<tr>
<td>A</td>
<td>Shoulder lateral rotation, horizontal abduction</td>
</tr>
<tr>
<td>N</td>
<td>Axillary nerve (C5, C6)</td>
</tr>
</tbody>
</table>

*Figure 10-13.* The infraspinatus and teres minor muscles (posterior view).
• The subscapularis muscle is located deep on the “underside” of the scapula, lying next to the rib cage.

• The subscapularis has a horizontal line of pull and attaches anteriorly on the humerus, it is a prime mover in medial rotation and assists in adduction of the shoulder.
<table>
<thead>
<tr>
<th>O</th>
<th>Subcapular fossa of the scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Lesser tubercle of the humerus</td>
</tr>
<tr>
<td>A</td>
<td>Shoulder medial rotation</td>
</tr>
<tr>
<td>N</td>
<td>Upper and lower subscapular nerve</td>
</tr>
<tr>
<td></td>
<td>(C5, C6)</td>
</tr>
</tbody>
</table>

Figure 10-16. The subscapularis muscle (anterior view).
If you observe the distal attachments of the supraspinatus, infraspinatus, and teres minor muscles on the greater tubercle of the humerus, you will notice that they are essentially in a line.
• For this reason, they are collectively referred to as the SIT muscles, taking the first letter from each muscle.

• These three muscles plus the subscapularis are referred to as the rotator cuff, or SITS muscles.
• **The coracobrachialis muscle** derives its name from its attachments on the coracoid process of the scapula and on the humerus, or arm.

• It has an almost vertical line of pull quite close to the joint axis. Therefore, most of its force is directed back into the joint, stabilizing the head against the glenoid fossa.
**Coracobrachialis Muscle**

- **O** Coracoid process of the scapula
- **I** Medial surface of the humerus near the midpoint
- **A** Stabilizes the shoulder joint
- **N** Musculocutaneous nerve (C6, C7)

*Figure 10-17. The coracobrachialis muscle (anterior view).*
<table>
<thead>
<tr>
<th>Action</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Anterior deltoid, pectoralis major (clavicular)*</td>
</tr>
<tr>
<td>Extension</td>
<td>Posterior deltoid, latissimus dorsi, teres major, pectoralis major (sternal)†</td>
</tr>
<tr>
<td>Hyperextension</td>
<td>Latissimus dorsi, posterior deltid</td>
</tr>
<tr>
<td>Abduction</td>
<td>Deltoid, supraspinatus</td>
</tr>
<tr>
<td>Adduction</td>
<td>Pectoralis major, teres major, latissimus dorsi</td>
</tr>
<tr>
<td>Horizontal abduction</td>
<td>Posterior deltoid, infraspinatus, teres minor</td>
</tr>
<tr>
<td>Horizontal adduction</td>
<td>Pectoralis major, anterior deltoid</td>
</tr>
<tr>
<td>Lateral rotation</td>
<td>Infraspinatus, teres minor, posterior deltid</td>
</tr>
<tr>
<td>Medial rotation</td>
<td>Latissimus dorsi, teres major, subscapularis, pectoralis major, anterior deltid</td>
</tr>
</tbody>
</table>

*To approximately 60 degrees.
†To approximately 120 degrees.
• As abduction occurs, the humeral head rolls across the glenoid fossa.
• At the same time, the head glides inferiorly, keeping the head of the humerus articulating with the glenoid fossa.
• This is accomplished by the rotator cuff muscles.
• In addition to abducting the shoulder joint, the supraspinatus muscle pulls the humeral head into the glenoid fossa.

• The other rotator cuff muscles (subscapularis, infraspinatus, and teres minor) pull the head in and downward against the glenoid fossa.
Figure 10-21. Force couple of the deltoid and rotator cuff muscles (SITS) rotating the humeral head in the glenoid fossa during shoulder abduction.
Points to Remember

• The shoulder is a triaxial ball-and-socket joint.
• The close-packed position is abduction and lateral rotation.
• Concave joint surfaces move in the same direction as the joint motion.
• Convex joint surfaces move in the opposite direction as the joint motion.
• A force couple has muscles pulling in different directions to achieve the same motion.