The Shoulder Complex

The Shoulder Girdle & Glenohumeral Joint

• The shoulder complex includes the following bones:
  • Sternalum
  • Clavicle
  • Ribs
  • Scapula
  • Humerus

Lippert pg 115

• The Shoulder complex includes the following joints:
  • Scapulothoracic articulation
  • Acromioclavicular joint (AC)
  • Sternoclavicular joint (SC)
  • Glenohumeral joint (GH)

Lippert pg 115
Osteology of the Sternum

- Manubrium
- Body xiphoid process
- Clavicular notch

Scapula (Dorsal aspect)

- (Vertebral)
- (Axillary)
Osteology: Scapula

- Superior angle
- Inferior angle
- Superior border
- Vertebra border
- Axillary border
- Spine
- Coracoid process
- Acromion process
- Glenoid fossa
- Subscapular fossa
- Supraspinous fossa
- Infraspinous fossa
- Superior glenoid tubercle
- Inferior glenoid tubercle

Osteology: Clavicle

Clavicle
- Sternal end
- Acromial end
- Body

Osteology: Proximal Humerus: Posterior Aspect

Humerus
- Head
- Surgical neck
- Anatomical neck
- Greater Tubercle
- Bicepital groove

Intertubercular groove (Bicepital groove)
Humerus
- Lesser tubercle
- Deltoid tuberosity

Intertubercular groove (bicipital groove)

Deltoid Tuberosity
Lippert pg 133

Ribs
- Head
- Neck
- Tubercle
- Angle
- Costal groove
- Articular facet

Biel, pg 173

Joints of the Shoulder Complex
- Sternoclavicular
- Scapulothoracic
- Acromioclavicular
- Glenohumoral
Sternoclavicular Joint
- Only direct attachment between UE to the axial skeleton
- Articulation between the medial aspect of the clavicle and the manubrium
- Saddle joint permitting the clavicle to move in all 3 planes
  - Allows for:
    - Elevation & Depression
    - Protraction & Retraction
    - Axial Rotation

Sculptural Elevation & Depression
- Not a joint in the pure sense of the word
- Motion between the scapula & rib cage
  - Elevation & Depression
    - The scapula must be able to slide over the rib cage
  - Protraction & Retraction
    - The scapula must be able to move medially and laterally around the rib cage
  - Upward and Downward Rotation
    - In the glenoid fossa...
Their scapulae are protracted...

The inferior angle of the scapula can be visualized in “A” in a neutral position. It moves up and out as the UE are flexed and ABDucted as indicated by the arrow in “B.”

The reference points are the inferior and superior angles of the scapula.

Scapular Upward & Downward Rotation

The inferior angle of the scapula can be visualized in “A” in a neutral position. It moves up and out as the UE are flexed and ABDucted as indicated by the arrow in “B.”

The reference points are the inferior and superior angles of the scapula.

Acromioclavicular Joint

- Articulation of the acromion process of scapula and the lateral end of clavicle
- Plane joint
- Minimal motion, but important for normal shoulder motion
- Allows for: upward and downward rotation, rotation in the horizontal plane, rotation in the sagittal plane
Glenohumeral Joint

- Articulation of the humeral head & glenoid fossa
- Ball and socket joint
  - Extreme motion in all 3 planes & extreme instability
  - Thin ligaments (secondary stability)
  - Musculature (Primary Stability)
- Allows for: flexion, extension, hyperextension, abduction, adduction, horizontal abduction, horizontal adduction, internal rotation, external rotation, circumduction, scaption

Glenohumeral Joint

Allows for: flexion, extension, hyperextension, abduction, adduction, horizontal abduction, horizontal adduction, internal rotation, external rotation, circumduction, "scaption"

“Scaption”

- Elevation of the glenohumeral joint in the plane of the scapula, which is approximately 30 degrees of horizontal adduction from the frontal plane.
Glenohumeral Support

- **Rotator Cuff**
  - Muscles surrounding the humeral head that actively hold the head against the glenoid fossa.

- **Capsular Ligaments**
  - Thin fibrous capsule encasing the superior, middle, and inferior aspects of the joint.

- **Coracohumeral Ligament**
  - Limits extreme ER, flexion, extension, and inferior displacement of the humeral head.

- **Glenoid Labrum**
  - A fibrocartilagenous ring that deepens the socket of the GH joint in the glenoid fossa.
Glenohumeral Support

- Long Head of the Biceps
- The proximal aspect wraps around the superior aspect of the humeral head, attaching to the superior glenoid tubercle
  - Providing anterior stability as a partial extension of the glenoid labrum

When there is movement of the GH joint, there is also scapular motion
shoulder anatomy explained

Scapulohumeral Rhythm

- During shoulder ABduction or flexion (greater than 30 degrees)
  - There is a 2:1 ratio between the GH joint motion and the scapulothoracic joint that take place
  - For every 2 degrees of GH ABD or flexion
  - The scapula upwardly rotates 1 degree
  - Without scapular rotation, the humerus would not be able to attain full ROM, it would be impinged under the acromion

Lippert pg 120
Myology of the Shoulder Girdle

- Trapezius (3 parts)
- Levator scapula
- Rhomboids
- Serratus anterior
- Pectoralis minor

Upper Trapezius

<table>
<thead>
<tr>
<th>Origin</th>
<th>Occiput, nuchal ligament on cervical vertebrae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Lateral third of the clavicle</td>
</tr>
<tr>
<td>Action</td>
<td>Scapular elevation &amp; upward rotation</td>
</tr>
<tr>
<td>Innervation</td>
<td>Spinal accessory n. (Cranial n. XI)</td>
</tr>
</tbody>
</table>

Middle Trapezius

<table>
<thead>
<tr>
<th>Origin</th>
<th>Nuchal ligament, spinous processes of C7-T5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Medial aspect of acromion process</td>
</tr>
<tr>
<td>Action</td>
<td>Scapular retraction</td>
</tr>
<tr>
<td>Innervation</td>
<td>Spinal Accessory n. (Cranial n. XI)</td>
</tr>
</tbody>
</table>
**Myology of the Shoulder Girdle**

### Lower Trapezius
- **Origin**: Spinous processes T6-T12
- **Insertion**: Base of the spine of the scapula
- **Action**: Scapular depression, upward rotation and retraction of the scapula
- **Innervation**: Spinal accessory n., Cranial n. XI

### Levator Scapula
- **Origin**: Transverse processes of C1-C4
- **Insertion**: Vertebral border of the scapula between the superior angle and the base of the spine
- **Action**: Scapular elevation, downward rotation
- **Innervation**: Dorsal Scapular n., (spinal nerves C3-C5)

### Rhomboids
- **Origin**: Nuchal ligament and spinous processes C7-T5
- **Insertion**: Vertebral border of the scapula from the base to the inferior angle
- **Action**: Scapular retraction & elevation, downward rotation
- **Innervation**: Dorsal scapular n.
**Myology of the Shoulder Girdle**

<table>
<thead>
<tr>
<th>Serratus Anterior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
</tbody>
</table>

Scapular Winging
(2° to weak serratus anterior)

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**Myology of the Shoulder Girdle**

<table>
<thead>
<tr>
<th>Pectoralis Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
</tbody>
</table>

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**Force Couples**

- **Upward rotation of scapula**
  - UT pulls up
  - Lt pulls down
  - Serratus anterior pulls outward

- **Downward rotation of scapula**
  - Pectoralis minor pulls down
  - Rhomboids pull in
  - Levator scapula pulls up
How would you strengthen the scapular elevators?

How would you strengthen the scapular retractors?

How would you strengthen the scapular protractors?

Deltoids (3)
- Pectoralis Major
- Latissimus Dorsi
- Teres Major
- Supraspinatus
- Infraspinatus
- Teres Minor
- Subscapularis
- Coracobrachialis
- Biceps brachii
- Triceps brachii

Myology of the GH Joint

Deltooids (3)
- Pectoralis Major
- Latissimus Dorsi
- Teres Major
- Supraspinatus
- Infraspinatus
- Teres Minor
- Subscapularis
- Coracobrachialis
- Biceps brachii
- Triceps brachii

Myology of the Shoulder Joint

<table>
<thead>
<tr>
<th>Supraspinatus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
<tr>
<td><strong>“Tidbit”</strong></td>
</tr>
</tbody>
</table>

Lippert pg 135
Infraspinatus
- **Origin**: Infraspinatus fossa of the scapula
- **Insertion**: Greater tubercle of the humerus
- **Action**: SH ER, stabilization of the GH joint
- **Innervation**: Suprascapular n.

**“tidbit”**: One of the rotator cuff muscles

Teres Minor
- **Origin**: Posterior lateral border of the scapula near the inferior angle
- **Insertion**: Greater tubercle of the humerus (inferior to the infraspinatus)
- **Action**: SH ER, stabilization of the GH joint
- **Innervation**: Axillary n.

Subscapularis
- **Origin**: Subscapular fossa of the scapula
- **Insertion**: Lesser tubercle of the humerus
- **Action**: SH IR, stabilization of the GH joint
- **Innervation**: Upper and lower subscapular n.
- **“tidbit”**: One of the rotator cuff muscles
The Rotator Cuff

- **SITS**
  - Supraspinatus
  - Infraspinatus
  - Teres Minor
  - Subscapularis

**Myology of the Shoulder**

**Latissimus Dorsi**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Thoracolumbar fascia, spinous processes of lower thoracic and lumbar vertebrae, posterior iliac crest, lower 4 ribs and inferior angle of scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Floor of intertubercular groove of humerus</td>
</tr>
<tr>
<td>Action</td>
<td>Sh ADD, Sh extension, Sh IR, scapular depression</td>
</tr>
<tr>
<td>Innervation</td>
<td>Thoracodorsal n.</td>
</tr>
<tr>
<td>“tidbit”</td>
<td>Necessary for “crutchwalking” and transfers!</td>
</tr>
</tbody>
</table>

**Teres Major**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Inferior angle of the scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Crest of the lesser tubercle of the humerus</td>
</tr>
<tr>
<td>Action</td>
<td>Sh ADD, Sh extension, Sh IR</td>
</tr>
<tr>
<td>Innervation</td>
<td>Lower scapular n.</td>
</tr>
</tbody>
</table>
**Myology of the Shoulder**

**Biceps Brachii**

| **Origin** | Long head: supraglenoid tubercle of glenoid fossa  
Short head: coracoid process of the scapula |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Radial tuberosity of the radius</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Sh. flexion, elbow flexion, forearm supination</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Musculocutaneous n.</td>
</tr>
</tbody>
</table>

"Tidbit" The actions of the biceps brachii are "perfect" in combination for opening a bottle of wine. "The Corkscrew effect"

**Coracobrachialis**

<table>
<thead>
<tr>
<th><strong>Origin</strong></th>
<th>Coracoid process of the scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Medial aspect of the proximal shaft of the humerus</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Sh. flexion</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Musculocutaneous n.</td>
</tr>
</tbody>
</table>
**Myology of the Shoulder**

**Long Head of the Triceps Brachii**
- **Origin**: Infraglenoid tubercle of the scapula
- **Insertion**: Olecranon process of the ulna
- **Action**: H extension, elbow extension
- **Innervation**: Radial n.

**Deltoid: Anterior**
- **Origin**: Anterior surface of the lateral aspect of the clavicle
- **Insertion**: Deltoid tuberosity of the humerus
- **Action**: Sh flexion, HADD, Sh IR, Sh ABD
- **Innervation**: Axillary n.

**Deltoid: Middle**
- **Origin**: Superior lateral surface of the acromion
- **Insertion**: Deltoid tuberosity of the humerus
- **Action**: Sh ABD, Sh flexion
- **Innervation**: Axillary n.
Myology of the Shoulder

**Deltoid: Posterior**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Spine of the scapula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Deltoit tuberosity of the humerus</td>
</tr>
<tr>
<td>Action</td>
<td>Sh extension, HABD, Sh IR</td>
</tr>
<tr>
<td>Innervation</td>
<td>Axillary n.</td>
</tr>
</tbody>
</table>

**Pectoralis Major**

| Origin       | Clavicular portion: anterior margin of the medial portion of the clavicle
|--------------| Sternal portion: lateral margin of the manubrium and body of the sternum and cartilage of the first 6-7 ribs |
| Insertion    | Crest of the greater tubercle of the humerus |
| Action       | Clavicular: Sh IR, Sh flexion, HADD
|              | Sternal: Sh IR, Sh ADD, Sh extension, Sh depression |
| Innervation  | Clavicular: lateral pectoral n.
|              | Sternal: lat & medial pectoral n. |

What upper extremity muscles can you identify on him?
What muscles would need to work synergistically for her to be able to perform this activity?

**Common Shoulder Pathologies**

- **AC separation**
  - Ligamentous injury at the AC joint
- **Fractures**
  - Clavicular, humeral
- **Shoulder dislocations and subluxations**
- **Impingement syndrome**
  - Soft tissue compression
- **Adhesive capsulitis**
  - Inflammation and fibrosis of shoulder joint capsule that leads to pain and loss of ROM

- **RTC tear**
  - Tear in the tendinous insertion of one or more of the RTC muscles
- **Scapular winging**
- **Bicipital tendonitis**