Osteology of the Shoulder

The Shoulder Complex & Shoulder Girdle
The shoulder complex

- 4 articulations involving
  - The sternum
  - The clavicle
  - The ribs
  - The scapula and
  - The humerus
Bony Landmarks provide attachment points for muscles and ligaments

- In essence, they provide the “direction”
KINEMATICS
Sternoclavicular Joint

**Kinematics**

- Saddle joint permitting the clavicle to move in all 3 planes
  - A fused SC would limit all shoulder motion!
- SCJ disc
  - Separates the joint into two cavities
    - Clavicle-disc
    - Disc-manubrium
Sternoclavicular Joint

Functions of the SCJ

- Provide movement of the scapula (along with the ACJ)
- Absorb forces from the upper extremity
Motions allowed at the SCJ

- Elevation-Depression of the clavicle
  - Elevation occurs with shoulder flexion and abduction
  - Depression with shoulder extension and adduction
Motions allowed at the SCJ

- Protraction-Retracton of the clavicle
  - Occurs mostly between the disc and the manubrium
- Protraction occurs with shoulder horizontal adduction
- Retraction with horizontal abduction, shoulder extension
Motions allowed at the SCJ

- Rotation
  - Occurs due to tightening of the coraco-clavicular ligament during humeral elevation (after 90)
  - If no posterior rotation available, can only get 120 of humeral elevation
Supporting Structures of the SCJ

- Costa-clavicular ligament
- Interclavicular ligament
- Ant and Post sternoclavicular ligaments
- Articular disc
- Joint capsule
Scapulothoracic Joint

- **Kinematics**
  - Not a synovial joint, but acts as a functional joint
  - Scapular motion is allowed via motion of the ACJ and SCJ
Functions of the STJ

- Provides mobility and stability for the orientation of the glenoid fossa and the humeral head for arm movements in all planes
  - Resting position: slightly upwardly rotated
  - Spine of scapula is across from T3 spinous process
- Provide a stable base for scapulo-humeral muscles
Scapulothoracic Joint Motions allowed

- Translatory
  - Elevation-Depression
  - Protraction-Retraction

- Rotary
  - Upward and Downward Rotation
  - Winging
  - Internal-External Rotation (Tipping)
Scapular Elevation & Depression
Scapulothoracic joint

- **Upward-Downward rotation**
  - Occurs around A-P axis of rotation that passes thru
    - AC joint or
    - SC joint
Scapulothoracic joint

- Winging
  - Occurs mostly in pathological state
    - Scapular muscle weakness
    - Nerve palsy
Internal-External Rotation

- Internal – also known as “Tipping”
- External rotation occurs with external rotation of the GH joint
Scapular Retraction & Protraction

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.
Acromioclavicular Joint

Kinematics

• Very difficult joint to characterize; wide variability in the size and shape of the lateral clavicle
  • The ACJ is characterized as a plane synovial joint

• ACJ disc
  • Helps with mobility;
    • Exists early in life but thins by age 20-30
Acromioclavicular Joint

- **Function of ACJ**
  - Allows the ability to raise the arm above the head
  - Acts like a strut to help with movement of the scapula resulting in a greater degree of arm rotation
Supporting structures of ACJ

- ACJ capsule
  - Very weak, relies on ligaments for reinforcement
- Acromioclavicular ligaments
- Coracoacromial ligament
- Coraco-clavicular ligament
  - Two sections
    - Conoid (medial)
    - Trapezoid (lateral)
  - Most important stabilizing structure at the ACJ
    - Prevents clavicle from over-riding the acromion
    - Transmits forces from the scapula to the clavicle
Acromioclavicular Joint

- Coracoid-Clavicle ligaments (Coraco-Clavicular)
- AC Joint ligaments
- Collarbone (Clavicle)
- Acromion
- Coracoid Acromion ligament
- Humerus
- Scapula (Shoulder Blade)
- Coracoid (part of scapula)
- Ribs

Figure IV
Glenohumeral Joint

- **Kinematics**
  - Classic ball and socket joint
  - Composed of glenoid fossa and humeral head
    - Fossa only articulates with 25% of the humeral head
  - Sacrifices stability for mobility
Coraco-acromial Arch

- Prevents upward dislocation of the humeral head
- Protects rotator cuff and humeral head from direct trauma
Glenoid labrum

- Fibrocartilaginous ring that lines the fossa
- Deepens the concavity of the glenoid fossa
- Increases joint stability
- Serves as attachment for GH ligaments
Glenohumeral Joint

- **Function of GHJ**
  - Primary source of motion from the shoulder complex
Kinematics of the GH Joint

- **Ball and Socket Joint**
  - 3 degrees of freedom
    - ABD/ADD
    - Flexion/Extension
    - IR/ER
    - Special Motions: HABD/HADD
Glenohumeral Joint Support

- GHJ capsule and ligaments
  - Capsular ligaments (GH ligaments)
  - Coracohumeral ligament
  - Coracoacromial ligament

- Glenoid labrum

- Muscles: hold humeral head against fossa
  - RTC
  - Long head of biceps
Rotator Cuff

- Muscles surrounding the humeral head that actively hold the head against the glenoid fossa.
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
During shoulder ABDuction or flexion

- 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
  - 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
# Pairing of shoulder girdle & shoulder joint movements

<table>
<thead>
<tr>
<th>GH joint</th>
<th>ST joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abduction</td>
<td>Upward rotation</td>
</tr>
<tr>
<td>Adduction</td>
<td>Downward rotation</td>
</tr>
<tr>
<td>Flexion</td>
<td>Upward rotation</td>
</tr>
<tr>
<td>Extension</td>
<td>Downward rotation/retraction</td>
</tr>
<tr>
<td>Internal rotation</td>
<td>Internal rotation/protration</td>
</tr>
<tr>
<td>External rotation</td>
<td>External rotation/retraction</td>
</tr>
<tr>
<td>Horizontal abduction</td>
<td>Retraction</td>
</tr>
<tr>
<td>Horizontal adduction</td>
<td>Protraction</td>
</tr>
</tbody>
</table>