Structure and Function of the Bones and Joints of the Shoulder Girdle

LEARNING OBJECTIVES:

At the end of this laboratory exercise the student will be able to:

- Palpate the important skeletal landmarks of the shoulder complex
- Describe the contributions of the individual joints to shoulder complex motion
- Discuss the effects of limited joint mobility on shoulder function

NOTE: Answers to the Thought Questions from the chapter may be found at the end of this document.

Palpations

Practice palpation of the bony landmarks listed below. Using skin pencils, mark each structure on your partner. Repeat the palpations on one or two more subjects.

- Sternal notch
- Sternal angle
- Second rib
- Sternal end of the clavicle
- Sternoclavicular joint
- Superior surface of the clavicle
- Anterior surface of the clavicle
- Acromion
- Acromioclavicular joint
- Coracoid process
- Vertebral border of the scapula
- Axillary border of the scapula
- Inferior angle of the scapula
- Spine of the scapula
- Greater tubercle of the humerus
- Lesser tubercle of the humerus
- Intertubercular groove of the humerus
Normal Movement

1. Using the landmarks practiced above, palpate your partner’s scapula and clavicle at rest (normal standing posture). Consider all planes of motion, and record the changes in position of the clavicle and scapula.

   With the shoulder fully abducted:
   
   Clavicle
   
   **Answer:** Elevated and posteriorly rotated; may be retracted too

   Scapula
   
   **Answer:** Upwardly rotated; may be tilted posteriorly, externally rotated and abducted too

   While reaching the hand to the small of the back:

   Clavicle
   
   **Answer:** Anteriorly rotated; likely protracted but may be retracted; may be depressed

   Scapula
   
   **Answer:** Downwardly rotated; likely tilted anteriorly but may be tilted posteriorly; adducted

   While reaching as far forward as possible:

   Clavicle
   
   **Answer:** Protraced

   Scapula
   
   **Answer:** Abducted and upwardly and internally rotated

Then: Using a model or actual clavicle and scapula, simulate the articulation at the acromioclavicular joint. Reproduce the positions observed and recorded above.

2. Compare the resting position of the clavicle and scapula in two or three other subjects.

3. Consider several reasons that normal shoulder abduction ROM could be limited.

4. Observe your partner perform the following motions; point to the approximate center of rotation for that movement.

   sternoclavicular joint: clavicular elevation

   **Answer:** (p 142-143) Anterior surface just lateral to sternal end of clavicle

   sternoclavicular joint: protraction

   **Answer:** (p 142-143) Superior surface just lateral to sternal end of clavicle

   glenohumeral joint: flexion
Answer: (p 138) Lateral aspect of greater tubercle
glenohumeral joint: abduction
Answer: Anterior aspect of lesser tubercle
glenohumeral joint: lateral rotation
Answer: Through the superior surface of the acromion
scapulothoracic joint: upward rotation
Answer: (p 145) Approximately 1-2 inches inferior to midpoint of spine of scapula

5. Palpate your partner’s scapula during the following motions, noting the planes of motion. (p 146)

scapular elevation and depression
Answer: Mostly frontal plane, may include upward or downward rotation

scapular abduction and adduction
Answer: Mostly frontal plane, may include upward or downward rotation

shoulder lateral and medial rotation (arm trunk motion)
Answer: Motion in the transverse plane can occur without scapular motion but adduction and anterior tilt can substitute for shoulder medial rotation. Adduction and posterior tilt can substitute for lateral rotation.

6. Which has greater ROM?

sternoclavicular joint elevation or depression
Answer: (p 143) Elevation

scapulothoracic joint abduction or adduction
Answer: (p 147) Abduction

scapulothoracic joint upward or downward rotation
Answer: (p 147) Upward rotation

scapulothoracic joint anterior or posterior tilt
Answer: Anterior tilt but depends on starting position

Then: Repeat motions with a different subject. How do different subjects compare?

7. With your partner standing in the neutral position, palpate the epicondyles of the humerus (refer to Chapter 11). Note their relationship to the frontal plane. Have your subject fully abduct the arm. Does the relationship of the epicondyles to the frontal plane change? If so, what motion does this indicate?

Answer: (p 151-152) The humerus appears to laterally rotate in abduction.

Repeat this activity for shoulder flexion.
Answer: The humerus appears to rotate medially in flexion.

Repeat this activity for shoulder elevation in the plane of the scapula.
Answer: The humeral rotation generally disappears.

8. With your partner prone, and shoulder abducted to 90 degrees, observe active shoulder joint medial and lateral
rotation. Now perform passive rotations, gently exceeding your partner’s available ROM. Palpate your partner’s scapula and record any motion observed. (Consider all three planes)

See video, Scapular Substitutions for Medial and Lateral Rotation, available at http://thePoint.lww.com

Medial rotation

Answer: The scapula tilts anteriorly and may downwardly rotate.

Lateral rotation

Answer: The scapula tilts posteriorly.

9. Carefully palpate your partner’s scapula through active shoulder abduction beginning from neutral position. Observe and record: (pp 153-154)

the shoulder position when the scapula begins to move

Answer: Early in the ROM

scapular motion around its medial–lateral axis

Answer: May tilt posteriorly at end range

scapular motion around its vertical axis

Answer: May rotate externally

scapulohumeral rhythm

Answer: Approximately 2:1 but may vary up to 4:1

10. Repeat the palpations while you perform passive shoulder abduction. Does scapular motion differ?

Answer: (p 154) Scapular contributions may increase in passive motion.

Then: Compare with your partner’s opposite shoulder.

Then: Compare with a different subject.

Application

1. Attempt to block clavicular motion while your partner fully abducts the shoulder. How does this affect ROM?

Answer: Without clavicular motion the scapula will be able to rotate upwardly only as much as the acromioclavicular joint will allow. So up to one-third of shoulder motion could be lost.

2. Attempt to block scapular motion while your partner fully abducts the shoulder. Repeat during passive motion. How does this affect ROM?

Answer: Passive motion may be limited by one third but active motion can be limited by up to 50%.

3. Using an Ace wrap or strap, block glenohumeral motion to approximately 45 degrees. Ask your partner to reach
as high as possible. Observe the shoulder complex and the whole patient, and compare motion with normal.

**Answer:** Additional motion comes from the scapulothoracic and sternoclavicular joints.

List three activities that would be difficult for a patient limited in this way.

**Answer:** Combing hair, reaching a high shelf, swimming, tennis serve

List three structures at potential risk for injury due to this change in movement pattern.

**Answer:** Structures in the subacromial space and overuse of scapulothoracic muscles

4. Palpate the space between the acromion and the humerus while your partner sits in a chair. With your patient fully relaxed, continue to palpate while applying traction to the humerus. Does the space change? If so, how?

**Answer:** The space will probably increase slightly.

5. Have your partner sit in a slouched position and palpate the position and alignment of both scapulae. How does this position compare with upright posture?

**Answer:** The scapulae may be downwardly rotated and/or abducted.

Have your partner remain in a slouched position and perform shoulder abduction. How does this compare with abduction in upright posture?

6. Record the motions of the sternoclavicular, scapulothoracic, and glenohumeral joints used in scratching the middle of your back.

▶ See video, Changes in Scapular Motion with Too Much Load, available at http://thePoint.lww.com

- **sternoclavicular joint**

  **Answer:** May include protraction, anterior rotation

- **scapulothoracic joint**

  **Answer:** May include downward rotation and anterior tilt

- **glenohumeral joint**

  **Answer:** Medial rotation and perhaps abduction and extension

How will limited shoulder medial rotation ROM change this movement pattern?

**Answer:** Increase scapular motion, particularly anterior tilt and downward rotation and then accompanying sternoclavicular joint motion
7. Record the position of the sternoclavicular, scapulothoracic, and glenohumeral joints while you are combing the hair on the crown of your head.

sternoclavicular joint

   **Answer:** Elevation

scapulothoracic joint

   **Answer:** Upward rotation

glenohumeral joint

   **Answer:** Abduction, lateral rotation, or abduction in the plane of the scapula

How will limited shoulder lateral rotation ROM change this movement pattern?

   **Answer:** Will increase difficulty in abduction and perhaps produce impingement. Will need to use abduction in the plane of the scapula, or flexion.

8. Measure shoulder abduction ROM with the shoulder joint in maximum medial rotation. How does it compare with unrestricted abduction ROM?

   **Answer:** Abduction ROM will probably be limited.

9. Measure shoulder flexion ROM with the shoulder joint in maximum lateral rotation. How does it compare with unrestricted ROM?

   **Answer:** Flexion ROM will probably be limited.

10. What shoulder complex motions are needed to do a push-up?

   **Answer:** Shoulder flexion or abduction to at least 90 degrees, scapulothoracic joint upward rotation and abduction, sternoclavicular joint elevation and protraction when the elbows are extended. With the elbows flexed, the shoulder hyperextends, the scapulothoracic joint adducts, and the sternoclavicular joint retracts.

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**Thought Problems with Answers**

1. Your patient presents with rounded, forward shoulder posture that you believe is contributing to his/her shoulder pain and dysfunction. As part of your rehabilitation program you decide to work on correcting the posture. Describe the motions at the sternoclavicular and scapulothoracic joints that you hope your intervention program will facilitate in order to restore a more ideal resting alignment of the shoulder girdle.

   **Answer:** This type of faulty alignment is typically associated with excessive sternoclavicular protraction, along with internal rotation, anterior tilt, and downward rotation at the scapulothoracic joint. Therefore, the aim of your intervention program should be to facilitate retraction at the sternoclavicular joint along with external rotation, posterior tilt, and upward rotation at the scapulothoracic joint.
2. Discuss why individuals with adhesive capsulitis frequently present with signs and symptoms consistent with impingement syndrome.

**ANSWER:** Tightness of the inferior glenohumeral capsuloligamentous complex leads to excessive superior translations of the humeral head when an individual attempts to raise the arm. This in turn results in excessive compressive forces being applied to the structures located in the subacromial space, with resultant shoulder pain. In this patient population it is not uncommon for their complaints of shoulder pain to subside as the extensibility of their joint capsule and their glenohumeral joint range of motion improves.