EVIDENCE-BASED EXAMINATION AND MANAGEMENT OF SHOULDER PATHOLOGIES

Michael Masaracchio
PT, DPT, PhD, OCS, SCS, FAAOMPT
Associate Professor
Director of the Anatomy Lab
Long Island University
Department of Physical Therapy
Senior Staff PT Masefield and Cavallaro PT
BKLYN/SI NYPTA Chapter Director
michael.masaracchio@liu.edu

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BRACHIAL PLEXUS

- Composed of the ventral rami of C5-T1
- Roots start between the anterior and middle scalene muscles
- Injury can occur from fractures and/or dislocations to the proximal humerus
- Cords of the brachial plexus just near or proximal to the coracoid process
- Axillary artery is in the middle of the medial cord and lateral cord

- Important nerves for shoulder function
  - Long thoracic nerve (C5-C7)
  - Suprascapular nerve (C5-C6)
  - Axillary nerve (C5-C6)
  - Upper and lower subscapular nerves (C5-C8)
BONES OF THE SHOULDER

Scapula
- Sits between ribs 2-7 (high variability)
- Anterior surface is concave
- Posterior surface is convex
- Spine of the scapula sits at T3/T4
- Inferior angle sits at T7

Humerus
- Head faces posteriorly, medially and superior (PMS)
- Amount of retroversion MAY dictate amount of ER of the shoulder
- Broken up into proximal third, middle third, and distal third
- Anatomical neck fractures are intra-articular
- Surgical neck fractures are extra-articular

Clavicle
- Connects the appendicular to axial skeleton
- Medial 2/3 is convex anteriorly
- Lateral 1/3 is concave anteriorly

JOINTS OF THE SHOULDER
- Glenohumeral joint
- Acromioclavicular joint
- Sternoclavicular joint
- Scapulothoracic joint
Glenohumeral Joint
- Unstable
- Humeral head
- Glenoid fossa
  - Upward tilt (5°)

Passive stability
- Bony fit
- Capsule
- Labrum
- Ligaments
  - SGHL
  - MGHL
  - IGHLC
  - CHL
  - CAL

Active stability
- Rotator cuff muscles
  - SITS
- Scapulothoracic muscles
  - Trapezius – MT, LT
  - Serratus anterior
  - Levator scapulae
  - Rhomboids
  - Latissimus dorsi

Figure 2.1. Lateral view of a disarticulated glenohumeral joint, showing the glenoid (G), humeral head (HH), PB-IIGHL (A), axillary pouch (B), and AB-IIGHL (C).

ARTHROKINEMATICS
- Roll and slide in opposite directions
- JOSPT 2007 (Schomacher) demonstrated further increases in shoulder ER with a posterior glide compared to an anterior glide in patients with frozen shoulder. This began to question the validity of the convex-concave rule.

SUBACROMIAL SPACE
- Supraspinatus
- Subacromial/sub-deltoid bursa
- Long head biceps tendon
- Impingement
  - Deltoid versus supraspinatus
- RC tear
- Bursitis
- AROM versus PROM
- Muscle weakness?
SCAPULOHUMERAL RHYTHM

HORIZONTAL PLANE ADJUSTMENTS
SAGITTAL PLANE ADJUSTMENTS
UPWARD AND DOWNWARD ROTATION

Deltoid
Supraspinatus
Subscapularis
Infraspinatus
Teres minor

ABDUCTION
Internal (Posterior) Impingement *(IMPORTANT)*

- Overhead athletes
- AB/ER (cocking phase)
- Anterior instability
- Internal Impingement Test
  - Sn: 88% -LR 0.13
  - Sp: 96% +LR 22
- Patient stands 90° shld AB 80° ER examiner resists IR then ER

Clinical Reasoning: in 90° of AB and 80° of ER if IR MMT << ER MMT the test is positive for intra-articular pathology. If ER MMT >> IR MMT the test is positive for rotator cuff pathology.
TREATMENT PHILOSOPHY TO GUIDE FUNCTIONAL MOVEMENT DEVELOPMENT

Human movement is complex and requires the integration of the neuro-musculo-skeletal system. Without the synchronous, coordinated, and combined function of these systems, efficient human movement is not possible. The APTA’s new mission statement “Transforming society by optimizing movement to improve the human experience” (APTA 2015) is the key to implementing thorough, patient specific treatment plans.

There are several principles that all physical therapists should be aware of when teaching and guiding the development of movement patterns.

- Show movement rather than teach movement
- Understand that each patient has different reasons for why a specific movement pattern is/is not happening
  - Mobility: does a patient have enough GH mobility to reach overhead?
  - Stability: does a patient have enough scapular stability during overhead motion?
  - Controlled mobility: does a patient have adequate eccentric control of the external rotators of the shoulder?
  - Skill: does that patient have the proper biomechanics and motor control to perform a baseball pitch?
- Allow time for the patient to practice on their own without constant feedback
- The goal is to make the movement pattern autonomous for the patient where he/she does not need feedback or does not require time to think about it
- If improving strength is the goal, then develop strengthening programs based on sound scientific evidence like the Delorme method of strength training with rests between sets, as well as the proper weight and number of reps
- If improving motor control is the goal, then develop programs with no rest periods. Bombarding the nervous system is paramount to developing functional movement

To simplify, we would encourage you to consider the concept that proximal stability is needed for distal mobility. Stability of the scapula and proper scapulohumeral rhythm is necessary for all shoulder patients regardless of the pathology or diagnosis at hand.

A thorough exercise program for both the scapular stabilizers and the rotator cuff muscles is vitally important for all patients with shoulder dysfunction.
Pectoralis Major
- Patient supine
- Place the patient’s hand on the waist so the elbow is flexed to 90°
- Palpate the origins of the pectoralis major
- Have the patient perform horizontal adduction thus firing the pectoralis major
- Follow the fibers laterally as they insert on the humerus
- Begin with long longitudinal strokes and encourage active movement by the patient

Pectoralis Minor
- Patient supine
- Place the patient’s hand on the waist so the elbow is flexed to 90°
- Palpate along the lateral border of the pec major
- Slide under the pec major to palpate the pec minor
- Use the other hand to passively shorten the pectoralis major over the palpating hand
- Begin by strumming the pectoralis minor and encourage active movement by the patient
Subscapularis

Muscle Belly

- Patient supine
- Palpate the lateral border of the scapula
- Move anterior to the lateral border until soft tissue is felt – this is the subscapular fossa
- To verify palpation, have the patient perform internal rotation to contract the muscle
- Begin by strumming the subscapularis and encourage active movement by the patient

Tendon

- With your index fingers and thumbs, place your hands on the patient with your index fingers cupping over the superior aspect of the shoulder
- With your thumbs in the axilla, begin to palpate in the superior aspect of the armpit
- Slowly applying firm pressure, apply force in a superior direction until palpating the subscapularis tendon
**Supraspinatus**

*Muscle Belly*

- Patient sitting
- Palpate the medial border of the scapula
- Move superiorly until reaching the spine of the scapula
- Palpate along the spine of the scapula, from medial to lateral
- Near the posterior acromion process, move your fingers superiorly into a small depression, which is the supraspinous fossa
- Begin by performing CFM to the supraspinatus and encourage active movement by the patient

**Tendon**

- Palpate the anterior aspect of the acromion process
- Drop 1 finger’s-width below the anterior aspect of the acromion process and palpate the supraspinatus tendon on its way to the greater tubercle
- Begin by performing CFM to the supraspinatus and encourage active movement by the patient
**Infraspinatus/Teres Minor**

- Patient prone on elbows
- Have the patient shift his/her weight to the side being palpated
- Palpate the spine of the scapula and follow it the lateral aspect of the acromion
- Move inferiorly to palpate the greater tubercle
- Move your fingers 1 finger’s-width inferior to palpate the tendons of the infraspinatus and teres minor
- Begin by performing CFM to the infraspinatus and encourage active movement by the patient

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**GHJ Mobilization**

- Stabilize distal humerus, apply mobilization force as close to joint line as possible
- Decide grade and apply an oscillatory force
- Make sure force is consistently applied parallel to joint surface
- Changing humeral position
- Fine tuning of direction
- Reflection in action
- Apply distraction when applicable
<table>
<thead>
<tr>
<th>Inferior/anterior glide</th>
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<tr>
<td>• At 90 degrees or below</td>
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<tr>
<td>• Over 90 degrees of flexion/abduction</td>
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<tr>
<td>o Control position of humerus with non-mobilizing hand.</td>
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<td>o Patient can be seated for more aggressive mobilization</td>
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<th>FABER</th>
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<tr>
<td>• Prone with support as needed</td>
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<tr>
<td>• Caution must be taken to not “chicken wing” the arm</td>
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<tr>
<td>• Contraindicated in patients with anterior instability</td>
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<tr>
<td>Posterior Mobilization</td>
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<td>-----------------------</td>
</tr>
<tr>
<td>• At 90 degrees or below</td>
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<td>• Over 90 degrees of flexion/abduction</td>
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<tr>
<td>o Control position of humerus with non-mobilizing hand</td>
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<td></td>
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<tr>
<td><strong>AC Joint Mobilization</strong></td>
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<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>- Patient supine</td>
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<tr>
<td>- Palpate to distal end of clavicle</td>
</tr>
<tr>
<td>- Change position of humerus accordingly</td>
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<tr>
<td>- Frequency/Intensity/Duration</td>
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<tr>
<td>- Fine tuning of direction</td>
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First Rib Non-Thrust
- Palpate the clavicle anteriorly
- Move your fingers posteriorly into the supraclavicular triangle
- Using the pads of digits 2 and 3, apply a force inferiorly (deep) to palpate the posterior border of the first rib. You should be posterior to the clavicle and anterior to the trapezius.

THORACIC SPINE THRUST MANIPULATION
- The patient is supine
- The patient is instructed to cross the arms over the chest
- The therapist then instructs the patient to roll to one side so the therapist can place the manipulative hand on the patient’s back, using a “pistol grip” with a small towel roll between the therapist’s fingers
- The patient is then instructed to roll back onto the therapist’s hand
- The therapist then pulls down the patient’s arm to induce spinal flexion and subsequently leans over the patient’s arms
- The therapist’s other hand is placed behind the patient’s neck, and gentle neck flexion is induced to the appropriate level of the upper thoracic spine
- The therapist then instructed the patient to take in a deep breath and performed a high-velocity, low-amplitude thrust through the patient’s arms, as the patient breathes out.
Posterior Capsule/Cuff
- Sleeper Stretch
- Cross Body Stretch
- Pin and Stretch mobilization technique
  - Patient sitting
  - Therapist is slightly behind and to the side
  - Therapist pins the soft tissue and the patient passively stretches the posterior capsule with the other hand

Capsule or cuff?
All designed to stretch the posterior cuff or posterior capsule to normalize GHJ mechanics and prevent overhead pathology
## THERAPEUTIC EXERCISES AND NEUROMUSCULAR CONTROL DRILLS

<table>
<thead>
<tr>
<th>Lower Trapezius Re-education</th>
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<tbody>
<tr>
<td>- Guide the patient from the inferior angle of the scapula</td>
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<tr>
<td>- Patient actively performs scapular depression AND retraction (concentric) and slowly “let’s the therapist win” (eccentric)</td>
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<td>- Avoid substitution from the latissimus dorsi and rhomboids</td>
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<thead>
<tr>
<th>I, T, Y Exercises</th>
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<tr>
<td>Recommend beginning with high repetitions to improve motor control before progressing to resistance.</td>
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<tr>
<td>- Can add physioball or other equipment to challenge proprioception</td>
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<tr>
<td>- Consider using visual or tactile feedback to ensure proper ST muscle activation</td>
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<tr>
<td>- Avoid substitutions from the latissimus dorsi, upper trapezius, and rhomboids</td>
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</table>
**Subscapularis/Serratus**

Recommend beginning with high repetitions to improve motor control before progressing to resistance.

- Diagonal – maintain elbow flexion at 90° throughout motion
- Dynamic hug – maintain elbow flexion at 15° throughout motion; change angles frequently
- Maintain mid and lower cervical spine in extension as well as thoracic spine in extension
- Avoid substitution from upper trapezius, pec minor, pec major

**ER/IR – RC**

Recommend beginning with high repetitions to improve motor control before progressing to resistance.

- Consider the use of a towel to maintain the position of the humerus
- Make sure scapula is not protracted or anteriorly tilted during this exercise
- Can use visual and tactile cues as needed
- Can also be performed standing, supine, etc
- Ensure proper activation with isometrics first, avoiding firing of deltoid, pec group.
<table>
<thead>
<tr>
<th>Rotator Cuff and Scapular Stabilization</th>
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<tbody>
<tr>
<td>Recommend beginning with high repetitions to improve motor control before progressing to resistance.</td>
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<tr>
<td>- At 90/90, encourage posterior tipping of scapula and little to no pec or deltoid activation</td>
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<tr>
<td>- Leaning on wall: bear weight to encourage serratus activity; or perform wax on/wax off</td>
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<tr>
<td>- Can use tactile cues as needed</td>
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<tr>
<td>- Maintain lower cervical and upper thoracic spine in extension</td>
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<tr>
<th>Dynamic Stabilization Exercises</th>
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<tr>
<td>- Timed drills</td>
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<tr>
<td>- Observe signs of fatigue</td>
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<tr>
<td>- Compensation</td>
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<tr>
<td>- Excessive motion</td>
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<tr>
<td>- Change ranges of motion often</td>
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<tr>
<td>- Band, manual, dumbbells</td>
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<tr>
<td>- Can also use these drills for RC muscles as well</td>
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<tr>
<td>Craniocervical Flexion</td>
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<tr>
<td>- Place a blood pressure cuff under the patient’s external occipital protuberance</td>
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<tr>
<td>- Have the patient hold the gauge and inflate the cuff to 20 mmHg</td>
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<tr>
<td>- Ask the patient to perform craniocervical flexion by pressing the back of the neck into the blood pressure cuff, elevating the needle to 22 mmHg</td>
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<tr>
<td>- Have the patient hold this for 10 seconds</td>
</tr>
<tr>
<td>- Have the patient continue to increase the cuff by 2 mmHg and assess if the patient can maintain for 10 seconds</td>
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<thead>
<tr>
<th>Scapular Muscles</th>
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<tr>
<td>- Begin with the elbow straight, the patient retracts the scapula</td>
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<tr>
<td>- The patient then bends the elbow pulling the theraband towards the patient</td>
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<tr>
<td>- When the patient’s scapula reaches full posterior tipping the exercise is complete, not when arm is extended</td>
</tr>
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</table>
Plyometric Exercises

- Later phases of rehab
- Good for return to sport and throwing as it breaks down the motion
- Emphasizes both concentric and eccentric contractions
- Visual feedback important in the beginning.

Functional Movements

Recommend beginning with high repetitions to improve motor control before progressing to resistance.

- Exercise combines RC and scapular muscles
- Encourages scapular stability while performing dynamic overhead movements
History
An 18-year-old male high school pitcher presents to your clinic complaining of right shoulder pain. The patient reports the symptoms began 3 weeks ago after practice. He states he saw the trainer at school who iced his right shoulder. The patient reports the intensity of the pain has increased over the last 3 weeks, with a decrease in symptom onset time during throwing. He states the pain is over the posterior and lateral aspect of his right shoulder. Symptoms are temporarily relieved with ice and over the counter anti-inflammatory medication. He is right hand dominant, lives at home with his parents, and works part time in a sporting goods store. He is the starting pitcher for the school team. They practice 5x/week for 2 hours, and have a game once a week. He starts a game once every 5 days.

Based on the history only what are the three most likely differential diagnoses?

<table>
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<tr>
<th>Past Medical History</th>
<th>unremarkable</th>
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<tbody>
<tr>
<td>Medication</td>
<td>Aleve</td>
</tr>
<tr>
<td>Observation</td>
<td>increased scapular winging, forward head posture, increased thoracic kyphosis</td>
</tr>
<tr>
<td>Active of Motion</td>
<td>right shoulder flexion = 0°-160°, abduction = 0°-160°, internal rotation = 0°-50°, external rotation = 0° = 125°</td>
</tr>
<tr>
<td>Passive of Motion</td>
<td>right shoulder within normal limits, except external rotation = 0°-132°</td>
</tr>
<tr>
<td>Manual Muscle Testing</td>
<td>within normal limits, except right external rotation = 3+/5 (secondary to pain), serratus anterior, middle and lower trapezius = 4-/5</td>
</tr>
<tr>
<td>Special Tests</td>
<td>pain at end range active/passive external rotation pain at late cocking and deceleration phases of pitching altered scapular-humeral rhythm (early upward rotation with flexion and abduction) poor eccentric scapular control</td>
</tr>
</tbody>
</table>

1. What special tests should be conducted?
2. What structures should you palpate on this patient?
3. With all the findings, what is the diagnosis?
4. What types of manual therapy may you consider?
5. What types of therapeutic exercise may you consider?
REFERENCES