Scapular Assessment & Dyskinesis: What’s Relevant?

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Disclaimers

- None
A Few Fun shoulder facts

- The shoulder is **most mobile** region in the human body

- ...and can **move faster** than any joint in the body as well

- A major league baseball pitch is between 160-170 Km/h (105 MPH)

- The cocking phase to ball release is about 80 degrees of motion in about 30 msec of time

- This equates to a shoulder velocity of about 9000 degrees/second of shoulder motion
What is Scapular Dyskinesis (SD)?

- The definition of dyskinesis is the alteration of normal scapular kinematics.
- ‘Dys’ (alteration of) ‘kinesis’ (motion) is a general term that reflects the loss of normal control of scapular motion.
- Dyskinesis by itself is not classified as an injury or a musculoskeletal diagnosis.
- Dyskinesis has been hypothesized to be a protective response to some glenohumeral joint pathologies.

Classification of SD: Kibler classification of scapular dysfunction

Type I or Inferior dysfunction

- The primary external visual feature is the prominence of the inferior angle as a result of anterior tilting of the scapula

- Inferior pattern presentation is better visualized while in the hands-on-hips position

- Common Associated Findings: Tightness/shortening of pectoralis minor and weakness of the middle and lower trapezius (Borstad & Ludewig, 2005)


Type 2 or Medial Dysfunction

- The primary external visual feature is the prominence of the entire medial scapular border.
- Classically referred to as scapular winging.
- As with Type 1, the Type 2 presentation becomes more evident in the hands-on-hips position and during active eccentric lowering from overhead.
- Medial pattern dysfunction most often occurs in patients with a weak serratus anterior, rhomboids, and all fibers of the trapezius.
Type 3 or Superior Dysfunction

- Characterized by excessive and early elevation of the scapula during arm elevation.
- This pattern has been referred to as compensatory shoulder hiking or shrug.
- Most often seen in patients with rotator cuff dysfunction (tears) and deltoid-rotator cuff force couple imbalances.

*Figure 3* Photograph illustrating a type III dyskinetic scapular pattern with excessive elevation of the superior border of the scapula.
A force couple is a group of muscles that exerts a movement, but check other unwanted movements from occurring in a joint.

A force-couple relationship is the act of muscles or muscle groups moving together, in a synergistic manner, to produce movement around a joint.

Example 1: Deltoid and Rotator Cuff
Example 2: Scapular Upward Rotators

- Upper Trapezius
- Lower Trapezius
- Serratus Anterior

The line of pull of these 3 muscles is what allows the scapula to upwardly rotate to clear room under the acromion for the long head of biceps and supraspinatus.
The Clinical Assessment Conundrum

- Shoulder assessment involves making complex clinical decisions in highly ambiguous situations
- Where are symptoms coming from?
  - Psychosocial factors?
  - Referred pain (cervical, Thoracic, Abdomen)
  - Stiff shoulder (frozen shoulder, osteoarthritis)
  - Posture
  - Soft tissue (rotator cuff/Bursa)
  - Combination of many of the above...

Lewis JS, McCreesh K, Barratt E, et al
Inter-rater reliability of the Shoulder Symptom Modification Procedure in people with shoulder pain
BMJ Open Sport & Exercise Medicine 2016
How do we Address this Diagnostic Conundrum?

1) Careful history (patients problems, goals, fears)

2) Outcome measures (DASH, Oxford shoulder score, NPS)

3) Measure impairment (ROM, strength, Pain)

4) Special Orthopaedic Testing (Identify at fault structure)

5) Imaging
Special Tests: What are they good for?

Multiple **Narrative & Systematic Reviews** have consistently demonstrated that **special tests can’t** be used to **structural differentiate**


- **Lewis & Tennent** (2007) How effective are our diagnostic tests for the RC?
- **Hegedus et al.** (2012) Which clinical tests …most value when examining the shoulder?
- **Hegedus & Lewis** (2015) Shoulder Assessment. *Grieve’s Modern MSK Physiotherapy*
- **Lewis, Hegedus, Jones** (2017) *Shoulder Pain: To operate or not to operate? Clinical Reasoning for Physiotherapists* (2nd Ed) Jones, Rivett
Hard to be Specific: But Maybe That’s Okay

- Special tests are very good at helping us reproduce patient symptoms (valuable) but not very good at telling where these symptoms are coming from (with some exceptions)
- For example: 2009 EMG study of muscles active with open and empty can tests
  - **Open can**: 8 other shoulder muscles are equally activated as supraspinatus
  - **Empty can**: 9 other shoulder muscles are equally activated as supraspinatus

Therefore it is very hard to say with any confidence that we are testing just the supraspinatus with these tests.

Why Most Orthopaedic Tests Can’t Structurally Differentiate: Morphology

- We were all taught that the 4 muscles of the rotator cuff were individual structures with separate insertions into the humerus.

- Which intuitively means that each of these tendons could be tested in isolation if placed in the appropriate position.
Based on cadaver studies, we see that the tendons of the rotator cuff blend together inseparably to form a common aponeurosis on the humerus.

This makes it very hard to differentially isolate just one of these muscles for our orthopaedic testing.

Again, these tests are great at pain reproduction, but just not as specific as we would want them to be.

How to know if a clinical test is useful?

**Sensitivity vs Specificity**

**Sensitivity**
- Measures how good a clinical test is at actually detecting a specific problem
- If a test has a high sensitivity, you can be confident it will detect the injury... and so if the test result is **negative**... you can be nearly certain that they **don't** have disease.
- A highly sensitive test helps us rule out an injury when the result is negative.
- So we say: **Sensitivity rules out or “Snout”**

**Specificity**
- Measures the proportion of negatives that are correctly identified as such (e.g. the percentage of healthy people who are correctly identified as not having the condition). In other words its very good at excluding an injury.
- If the test has a high specificity and the result is **positive**... you can be near certain that they **do** have the injury you screened for.
- A very specific test helps rule in an injury with a high degree of confidence.
- So we say: **Specificity rule in or “Spin”**
Therefore a test that is both highly sensitive and highly specific is:

But there is unfortunately large discrepancies in the research so it is still very hard to make a clinical diagnosis with special tests alone.
<table>
<thead>
<tr>
<th>Test</th>
<th>Range of Diagnostic Values (%)</th>
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</thead>
<tbody>
<tr>
<td><strong>Subscapularis</strong></td>
<td></td>
</tr>
<tr>
<td>Life-off test (and lag sign)</td>
<td>Sensitivity: 17–100 Specificity: 60–98</td>
</tr>
<tr>
<td><strong>Supraspinatus and Infraspinatus</strong></td>
<td></td>
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<tr>
<td>Jobe’s test</td>
<td>Sensitivity: 53–89 Specificity: 65–82</td>
</tr>
<tr>
<td><strong>Teres Minor</strong></td>
<td></td>
</tr>
<tr>
<td>Hornblower's sign</td>
<td>Sensitivity: 100 Specificity: 93</td>
</tr>
<tr>
<td><strong>Biceps Tendon</strong></td>
<td></td>
</tr>
<tr>
<td>Speed’s test</td>
<td>Sensitivity: 53 Specificity: 67</td>
</tr>
</tbody>
</table>

If positive=Tear If negative=?
A Quick Word on Diagnostic Imaging for Shoulder Pathology

Imaging and shoulder pain

Multiple studies have shown that someone can have structural damage to their shoulder without any associated symptoms.

A 2011 study sample comprised of 51 subjects who had no symptoms in either shoulder were all given ultrasounds of their shoulders.

Ultrasound showed

- subacromial-subdeltoid bursal thickening in 78%
- acromioclavicular joint osteoarthritis in 65%
- supraspinatus tendinosis in 39%
- subscapularis tendinosis in 25%
- partial-thickness tear of the bursal side of the supraspinatus tendon in 22%
- posterior glenoid labral abnormality in 14%

Overall, asymptomatic shoulder abnormalities were found in 96% of participants.

But what about full thickness tears?

Sometimes even those with full thickness tears may not require surgery

- This stuff isn’t new!
- A 1995 study looked at the integrity of the rotator cuff in both dominant and non-dominant shoulders of 90 asymptomatic adults between the ages of 30 and 99 years using ultrasound.

- The prevalence of partial- or full-thickness tears increased markedly after 50 years of age: these were present in over 50% of dominant shoulders in the seventh decade and in 80% of subjects over 80 years of age.
- Therefore it might be proposed that rotator-cuff lesions are a natural correlate of ageing, and are often present with no clinical symptoms.
- Treatment should be based on a constellation of clinical findings and not on the results of imaging (patient age, occupation, goals, disability, special tests, failed conservative care)

Causes of Scapular Dyskinesis

- Multiple factors may cause dyskinesis...
- **Bony causes** include thoracic kyphosis or clavicle fracture
- **Joint causes** include AC instability or GH joint internal derangement (OA).
- **Neurological causes** include cervical radiculopathy, long thoracic or spinal accessory nerve palsy, types of dystrophies
- **Soft tissue** mechanisms for scapular dyskinesis involve inflexibility (tightness) of the pectoralis minor and biceps short head can create anterior tilt and protraction due to their pull on the coracoid.
- **Soft tissue posterior shoulder inflexibility** can lead to GH internal rotation deficit (GIRD), which creates a ‘wind-up’ of the scapula on the thorax with reduced humeral internal rotation and horizontal adduction.
- **Muscle weakness** around the scapula (Commonly seen ones include the external rotators, serratus anterior, and lower trapezius

Static Assessment
Normal Resting scapular position:

- **Elevated or Depressed**: The scapula should be held between the T2 and T7.
  
  To measure: Find C7 SP (first prominent one) and count down to T2. It should be aligned with the superior angle of the scapula.

- **Protracted or Retracted**: The medial scapular border should rest 2.5-3 inches lateral to the thoracic spinous processes.
  
  To measure (grossly): place pinky at the spinous process and see if your index finger rests on the medial scapular border.
Static Assessment continued

Can visually assess to see if scapula is:

- **Winged**
- **Anteriorly tipped**:
- **Downwardly rotated** (spine of scapula should sit 10-15 degrees upwardly)
Dynamic Scapular Assessment

Does anyone see anything wrong here?
https://www.instagram.com/p/Baud2veHXIF/?taken-by=jessephysio

6 fundamental scapular motions
(Done with hands on hips and in scapular plane)

Best to assess both shoulders at same time to note asymmetry

- Protraction/Retraction
- Elevation/Depression
- Upward rotation/Downward rotation
  (done with weight of arm and using small pound weight)
Dynamic Assessment Continued

- Wall pushup test
  - great measure for serratus anterior strength

- Abnormalities may be seen right away but may take 5-10 pushups
Posterior Capsule Tightness: Generalized Internal Rotation Deficit (GIRD)

- Condition resulting in the loss of internal rotation of the glenohumeral joint as compared to the contralateral side
- Most often caused by tightness of the posterior shoulder capsule
- Posterior capsular tightness leads to anterosuperior translation of humeral head during arm flexion, which can lead to impingement

To Test:
Internal rotation at 90 degrees abduction:
- Observe how quickly slack is taken up in the posterior capsule by observing when humeral head anterior migration starts
- Should get between 60-70 degrees of IR before humeral lifts anteriorly
Internal Rotation at 90 degrees Abduction
Scapular Assistance Test (SAT)

- AROM and pain is evaluated during arm flexion in scapular plane
- Examiner then applies an assist to scapular upward rotation
- This test is positive if ROM is increased or pain is reduced as the therapist manually assists scapular upward rotation during active shoulder flexion

Inter-rater reliability of the SAT and found coefficient of agreements ranging between 77% and 91% concluding that this test is acceptable for clinical use

Rabin et al. The intertester reliability of the scapular assistance test. JOSPT. 2006;36:653-660.
Scapular Retraction Test (SRT)

- Painful motion or special test is assessed for pain and/or limited ROM (open or empty can, etc).
- Examiner manually retracts scapula and retests pain provoking maneuver.
- Manual retraction of the scapula is performed by compression of the scapular medial border as the patient repeats the movement that provoked symptoms.
- A positive test is demonstrated when there is less pain when scapula is held in retraction.

The use of this maneuver demonstrates the important role proximal stabilization plays in shoulder function and can educate the patient on the need and result of improved scapular control and stabilization. AKA: helps with buy in.

Tate AR et al. Effect of the scapular repositioning test on shoulder impingement symptoms and elevation strength in overhead athletes. JOSPT. 2008;38:4-1.
What We Know Now

- Diagnosing the underlying structures responsible for shoulder symptoms is difficult.

- Clinical tests designed to assess structural integrity are unlikely to selectively isolate an individual tissue from adjacent structures.

- A number of studies have shown poor correlation between symptoms and imaging methods currently used in shoulder assessment.

Due to the poor validity and lack of diagnostic value of existing tests, and difficulty in concluding a definitive structural diagnosis in shoulder pain, alternative methods of assessment have been suggested...

Shoulder Symptom Modification Procedure (SSMP)

- Provides an alternative approach for shoulder assessment
- The SSMP is less concerned with structure and more concerned with function
- Process involves identifying the movement, posture, or activity that most appropriately reproduces the patient’s symptoms (Patient identifies what they want fixed)
- The SSMP is a series of mechanical techniques that are applied while the patient performs the activity or movement with the aim alleviating symptoms or improving range of motion
The SSMP involves four principal procedures:

- (1) the influence of the thoracic posture on symptoms
- (2) the influence of scapular position on symptoms
- (3) the influence of humeral head position
- (4) procedures to neuromodulate symptoms
Influence of the Thoracic Posture on Symptoms

Thoracic Kyphosis modification:
- Performed by active extension with instruction to “place your finger on your sternum and push it forward”
- If active thoracic extension helps with painful or limited shoulder movement it’s classified as positive
- When positive, this active extension posture can be complimented with thoracic taping aiming to maintain reduced thoracic kyphosis.
Influence of Scapular Position on symptoms

- Includes evaluation of the effect of manual scapular elevation, depression, protraction, retraction, and tilt (posterior/anterior) on shoulder symptoms and mobility

- If positive, exercises can be tailored to the specific motions needed to reduce symptoms
Influence of Humeral Head Position

- Involves the influence of manual techniques on the humeral head
- Humeral head modifications included external rotation, anterior-posterior (AP) pressure, or posterior-anterior (PA) pressure, depression, elevation
- If changes in humeral head position alter symptoms than the test often becomes the treatment
Procedures to Neuromodulate Symptoms

- Includes manual therapy techniques aiming to modify the shoulder symptoms
- Manual cervical distraction in sitting
- Cervical mobilization with movement
- Soft tissue techniques (such as stripping, friction) over neck and shoulder musculature
- Unloading taping techniques
Quick Note on Management

- Avoid fear inducing language that ultimately makes the patient feel fragile
- Find symptom altering movements that help with compliance and beliefs about getting better
- Use passive care only as a way to facilitate movement
- Educate the patient that research shows good results with active care and can even prevent surgery
- Nothing wrong with modalities like acupuncture, electro-therapies or hands on therapies as long as they are not being made to feel dependent on them for their shoulder well being
thank you!