CLINICAL TECHNIQUES TO QUANTIFY SCAPULAR UPWARD ROTATION

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Outline
- Scapular kinematics
- Importance of measuring upward rotation
- Assessment tools
- Measurement procedures
- Clinical implementation

Introduction
- Normal movement of the scapula at the scapulothoracic region is essential to normal function at the glenohumeral joint (Inman, et al. 1996)
- Coordinated movement of the scapula and glenohumeral joint during elevation of the arm is known as scapulohumeral rhythm (Inman, et al. 1996)

Scapular Kinematics
- Upward Rotation:
  - Upper trapezius
  - Lower trapezius
  - Serratus anterior
- An appropriate amount of upward rotation allows the humerus to be elevated

Scapular Dyskinesis
- An imbalance of the serratus anterior and upper trapezius causes decreased upward rotation (Ludewig and Cook, 2000)

Importance of Measuring Upward Rotation
- This form of scapular dyskinesis has been associated with shoulder injuries such as instability, impingement, SLAP lesions and rotator cuff tears (Kibler, 1991; Burkhart and Morgan, 1999; Burkhart, et al. 2000)
- Clinical assessment of upward rotation is essential to the diagnosis, treatment and prevention of shoulder injuries
Importance of Measuring Upward Rotation

- Decreased upward rotation...is it a sign of things to come?
- The car analogy
- Sometimes things are obvious and sometimes they are not

Importance of Measuring Upward Rotation

- A need to quantify:
  - More accurate
  - More reliable
  - Make comparisons
- Lateral Scapular Slide Test: uses a tape measure to determine the distance between the inferior angle and the spinous process at rest, 45°, and 90° Abd. Is not reliable (Edson et al. 2001)

Assessment Tools

- Electrical inclinometer
- Digital protractor
- Fluid-dampened inclinometer

Instrumentation: Electrical inclinometer

- 2-D electrical inclinometer (Noraxon USA, Inc, Scottsdale, AZ)
- Modifies with adjustable arms (Ingram and Tucker, unpublished)

Pros:
- Reliable and valid (Tucker and Ingram 2012)
- Can sync with other measurements such as EMG and isokinetic data
- Can measure A/P tilt
- Blinded measurement
- Measures degree to the 100th decimal

Cons:
- Expensive
  - Inclinometer • $700
  - System: $10K – 20K
- Takes practice
Instrumentation: Digital protractor

- **Pro 360 digital protractor**
  (Macklanburg Duncan, Oklahoma City, OK)

- Modify with two adjustable arms and a bubble level to measure static scapular upward rotation (Johnson, et al. 2001)

**Pros:**
- Reliable and valid (Johnson, et al. 2001)
- Less expensive
  - $200
- Measures degree to the 10th decimal

**Cons:**
- No sync capabilities
- Takes practice

Instrumentation: Fluid-dampened inclinometer

- **Universal inclinometer**
  (Performance Attainment Associates, Lindstrom MN)

- Replace short base with long base

**Pros:**
- Excellent choice for the tight budget
  - $70

**Cons:**
- Reliability and validity have not been tested
- Primitive
  - Measurement value is subjective
  - No sync capabilities
- Takes practice
Measurement Procedures: Set-up

Measure GH angles:
- 60°
- 90°
- 120°

Mark the angles

Measurement Procedures: Step 1

Patient moves arm to each mark and holds
Measurement Procedures: Step 3
- Patient moves arm to each mark and holds
- Find and mark the landmarks:
  - Root of scapular spine
  - Posterolateral acromion

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- Considerations for female patients

Measurement Procedures: Step 4
- Take measurements at each GH angle
  - Rest
  - 60°
  - 90°
  - 120°
- Take 3 at each GH angle and average

Special Consideration

What is normal upward rotation?

“The only normal people are the ones you don’t know very well.” - Joe Ancis
Let's go to the research...

- Downar and Sauers (2005) found a difference between the throwing and non-throwing shoulder of healthy professional baseball players.

- Laudner, et al. (2007) found that pitchers have less upward rotation at 60° and 90° compared to position players.

### Results: at Rest

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<th>Degrees</th>
<th>OH</th>
<th>NOH</th>
<th>Non-Ath</th>
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<tr>
<td>OH</td>
<td>1.7</td>
<td>-1.2</td>
<td>-5.9</td>
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*OH > Non-Ath
Tucker, et al., unpublished

### Results: at 60°

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<td>5.5</td>
<td>6.6</td>
<td>-0.6</td>
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*OH, NOH > Non-Ath
Tucker, et al., unpublished

### Results: at 90°

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<td>21.4</td>
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*OH, NOH > Non-Ath
Tucker, et al., unpublished

### Results: at 120°

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*OH, NOH > Non-Ath
Tucker, et al., unpublished

### Degree of Change

Ingram, et al., unpublished
How to implement into clinical practice

- Individual assessment based on need
  - or
- Mass assessment of a team
- Assess at multiple times (i.e., annually, biannually, monthly) in order to make comparisons

Example: Implementation at UCA

Take Home Points

- Quantification of scapular upward rotation is an important ingredient in the evaluation process
- There are pros and cons to various assessment tools
  - All take practice, but practice = proficiency
- Implementation is based on your setting and needs
  - Have a plan

Thank You

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