

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

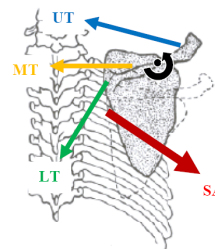


Introduction

- 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, 1998; 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 measurer to determine the distance between the inferior angle and the spinous process at rest, 45° and 90° Abd.
 - Is not reliable (Odom, et al. 2001)

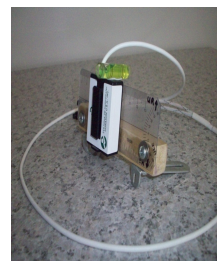


Assessment Tools

- Electrical inclinometer
- Digital protractor
- Fluid-dampened inclinometer



Instrumentation: Electrical inclinometer

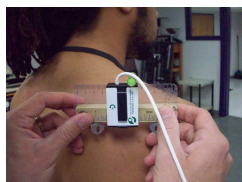


- 2-D electrical inclinometer (Noraxon USA, Inc, Scottsdale, AZ)
- Modify with adjustable arms (Ingram and Tucker, unpublished)



Instrumentation: Electrical inclinometer

- 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



Instrumentation: Electrical inclinometer

- 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)



Instrumentation: Digital protractor



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



Instrumentation: Digital protractor



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



Instrumentation: Fluid-dampened inclinometer



- Universal inclinometer (Performance Attainment Associates, Lindstrom, MN)
- Replace short base with long base



Instrumentation: Fluid-dampened inclinometer

- Pros:
 - ▢ Excellent choice for the tight budget
 - • \$70

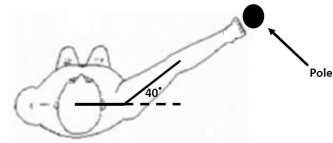


Instrumentation: Fluid-dampened inclinometer

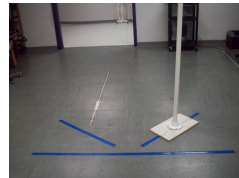
- Cons:
 - ▢ Reliability and validity have not been tested
 - ▢ Primitive
 - Measurement value is subjective
 - no sync capabilities
 - ▢ Takes practice



Measurement Procedures: Set-up



Measurement Procedures: Set-up



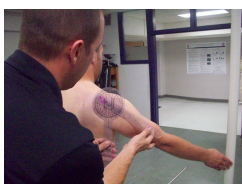
Measurement Procedures: Set-up



Measurement Procedures: Step 1



Measurement Procedures: Step 2

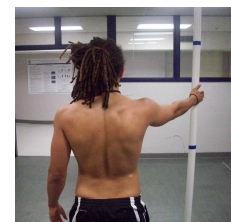


- Measure GH angles:
 - ▣ 60°
 - ▣ 90°
 - ▣ 120°
- Mark the angles



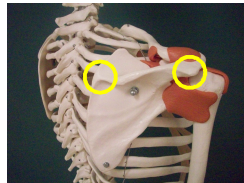
Measurement Procedures: Step 3

- Patient moves arm to each mark and holds



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- Find and mark the landmarks:
 - Root of scapular spine
 - Posterolateral acromion



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Measurement Procedures: Step 3

- Patient moves arm to each mark and holds
- Find and mark the landmarks:
 - Root of scapular spine
 - Posterolateral acromion
- Considerations for female patients

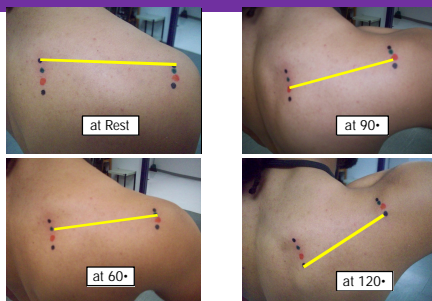


Measurement Procedures: Step 4

- 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

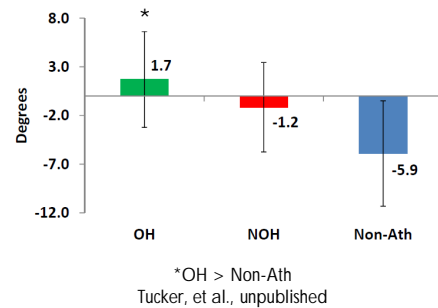


Lets go to the research...

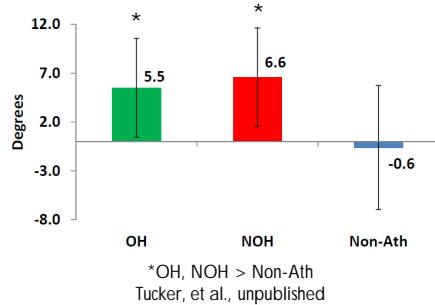
- Downar and Sauers (2005) found difference between the throwing and non-throwing shoulder of healthy professional baseball players.
- Laudner, et al. (2007) found that pitchers have less upward rotation at 60° and 90° compared to position players



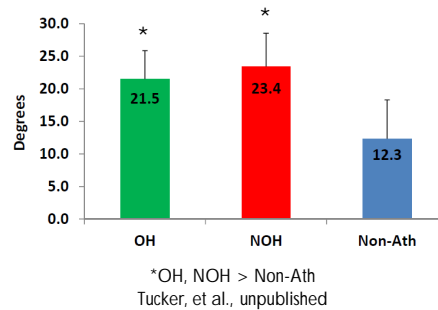
Results: at Rest



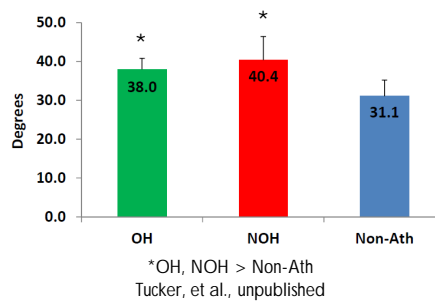
Results: at 60°



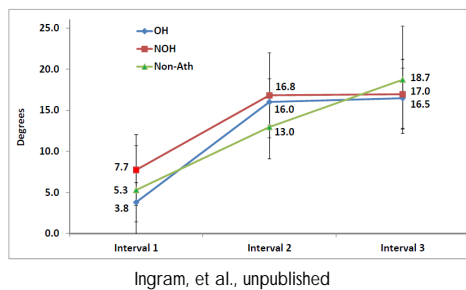
Results: at 90°



Results: at 120°



Degree of Change



How to implement into clinical practice

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



Example: Implementation at UCA

Structure/Joint	Test/Assessment	Meets Requirements
Hamstrings	90°+ of passive hip flexion w/ knee extended (prone)	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Quads/hip flexors	Negative Thomas test	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Hip external rotation	45°+ of passive hip ER (prone)	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Hip internal rotation	45°+ of passive hip IR (prone)	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Shoulder int/ext rotation	GIRD assessment ER lost = ER gained	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Back extension	18 inches+ of back extension (prone)	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Standing shoulder posture	Subacromial space is above lumbar spine	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Scapular upward rotation	25°+ of upward rotation at 90° of scaption	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
Cone endurance	Leg extension off table in prone position for 60 s	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)
* Ankle range of motion	Normal bilateral ankle PROM (DF, PF, Inv, Ev)	<input type="checkbox"/> Yes <input type="checkbox"/> No (mark improvement)

* If previous injury to structure/joint



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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