Examination of the Shoulder

Ed Mulligan, PT, DPT, OCS, SCS, ATC
Clinical Orthopedic Rehabilitation Education

“treat the culprit – not the victim”
Subjective History: Points of Emphasis

- Age/Sex
- Hand Dominance
- Chief Complaint
- Patient-Centered Approach
  - Goals/Concerns/Expectations
- MOI and IDF Changes
- Previous Rx –
  - medical/therapeutic/self
- Meds/Injections

“I’ll have to do some x-rays to be sure, but I’m guessing you dislocated your shoulder.”
symptomatic complaint

● Current Status
  – work status
  – pain complaint - location, nature, severity, duration, aggravated or relieved by
  – neuro or vascular complaints
  – venous complaints - swelling and stiffness
  – neurological complaints - pallor and coolness
  – Severity – Irritability – Nature – Stage
Shoulder Pain Mapping

**SAIS**

- Similar presentation for RTC tear and stage I-II impingement

**RTC Tear**

- Differentiated from GHJI by age

**GHJ OA**

**GHJ Instability**

**ACJ Pathology**

- Tend to be more localized complaints

**Calcific Tendonitis**

Remember, Pain on palpation is SN but not very SP

Injection of hypertonic saline into healthy AC joints and SA space

ACJ pain pattern

Subacromial pain pattern

S.I.N.S.
Considerable Influence on Intervention Strategy

- **Severity**
  - How significantly this impairment affects the patient

- **Irritability**
  - The reactivity or stability of the condition
    - What does the patient have to do to set off the condition?
    - Once set off, how long and severe are the symptoms?
    - What does the patient have to do to calm the symptoms?
S.I.N.S.
Considerable Influence on Intervention Strategy

- **Nature**
  - Numbness/tingling, Weakness, Popping, Locking, Giving way, Clicking, Grinding, Skin changes

- **Stage**
  - Has the condition stabilized (better), become stagnant (same), or deteriorated (worse)?

First Treatment Decision: Are you going to treat their pain or impairment?
Medical **RED FLAGS**

... it doesn’t look, walk, or talk like a duck

- Insidious or unexplainable onset
- Severe and/or persistent pain unrelieved with rest or aggravated by exam, activity or exertion
- Systemic Illness/Constitutional Symptoms
  - Fever, sweats, excessive fatigue, nausea/vomiting, unintentional weight loss
- Nocturnal symptoms that disrupt sleep
  - not so much with shoulders
Factors to Baseline-Monitor

- Pain Level
- Self-report functional status
- Patient satisfaction—overall impression

Secondary Considerations
- Mobility and Strength Impairments
Numerical Pain Rating Scale

0-10 Pain Intensity Scale

No Pain    Moderate Pain    Worst Pain Possible

A 2-point change on the scale is considered a meaningful clinical change

Outcome Measurement Tool

Patient’s rating of their overall condition since the previous evaluation

Global Rating of Change Scale

-7 A very great deal worse
-6 A great deal worse
-5 Quite a bit worse
-4 Moderately worse
-3 Somewhat worse
-2 A little bit worse
-1 A tiny bit worse
0 About the same

+7 A very great deal better
+6 A great deal better
+5 Quite a bit better
+4 Moderately better
+3 Somewhat better
+2 A little bit better
+1 A tiny bit better
Outcome Assessment Tools

- **DASH** (Disabilities of the Arm, Shoulder, Hand)  
  - http://www.dash.iwh.on.ca/index.htm
- **CMS** (Constant-Murley Score)
- **ASES** (American Shoulder-Elbow Surgeon’s Assessment Form)
- **UCLA** (UCLA Rating Scale)
- **SPADI** (Shoulder Pain And Instability Index)
- **SST** (Simple Shoulder Test)
- **WOSI** (Western Ontario Shoulder Instability Index)
- **PENN** (Penn Shoulder Scale)
Outcome Tools for Assessment

QuickDASH - abbreviated version of DASH

- 11 questions converted to a 100 point scale regarding pain and function with optional work and sports modules
- Correlates strongly with full DASH (r = 0.98)
- Clinimetric Qualities
  - Test-Retest Reliability ICC = 0.90 - .0.96 and SEM = 4.6 points
  - MCID = 8 points *
  - MCID = 10/14 points for DASH/Q-DASH **
  - MDC/MCID = 11/19 points***

*** Polson K, Man Ther, 2010
**** Sorenson AA, J Hand Surg, 2013
Shoulder Examination Overview

- **Inspection-Observation**
  - Posture, Spinal-Scapular-Humeral Positions
  - Symmetry
  - Scapulohumeral Rhythm
  - Cervical Clearing

- **Range of Motion**
  - Quantity and Quality
  - Substitution Patterns
  - Functional Reach Tests

- **Palpation**
- **MMT**
  - Scapular and Rotator Cuff
shoulder objective examination

**Observation/Inspection:**
- Posture
- Scapular/Shoulder Alignment
- Symmetrical Appearance
  - "popeye bicep", congenitally high or undescended scapula
- Anatomical Deformities
  - Step deformity, Sprengel's deformity, winging scapula, etc.
- Soft Tissue swelling, effusion, atrophy, etc.
- Body Type: Endo-Ecto-Mesomorphic
“you can see a lot by looking”

- scoliosis
- winging
- step off
- clavicle fracture
- pec rupture
- Sprengel’s
Postural Evaluation

Sagittal Plane Abnormalities
- Cervical/Lumbar Lordosis/ Thoracic Kyphosis
  - Impact on elevation
- Forward Shoulder
- Scapular Position
- Humeral Head Position

Frontal Plane Abnormalities
- Scapulae Position
  - Dominant shoulder low
- Scapulohumeral Rhythm
Humeral Head Palpation for Positional Faults

Good intratester but poor intertester reliability and moderately insensitive
Scapular Dyskinesis Examination

**Scapula** – malposition

**Infera** - inferomedial prominence

**Coracoid** - tenderness

**DysKinesis** – abnormal movement
S$^3$ – Stupid Scapula Syndrome
Inferior Scapular Border Dysfunction

- Inferior medial border (inferior angle) is prominent dorsally
- Inferior angle tilts posteriorly; acromion ventrally
- Sagittal plane rotation around a scapular plane axis resulting in a forward (anterior) tilt of the scapula
- Coracoid tender due to tight pec minor and biceps

**TREATMENT**
- most common with RC impingement
- Stretch pec minor
- Strengthen/facilitate serratus
Type I – Inferior Dysfunction
Medial Scapular Border Dysfunction

- Medial border is prominent as entire vertebral border wings off the thoracic wall
- Transverse plane internal rotation of the scapula
- Weak serratus and tight posterior glenohumeral structures

TREATMENT
- most common with instability
- Stretch/mobilize the posterior GH capsule
- Strengthen/facilitate the serratus (important scapula ER)
Type II – Medial Dysfunction

Sagittal Plane Elevation

Frontal Plane Elevation
Superior Scapular Border Dysfunction

- Superior border of scapula is prominent
- Excessive superior translation (elevation) of superior border of scapula on thorax with elevation maneuvers

**TREATMENT**
- most common with CT involvement
- Stretch levator scapulae
- Strengthen/facilitate lower trapezius
Reliability of Qualitative Evaluation of Scapular Dysfunction

- Low intra-intertester reliability with $\kappa$ ranging from $0.2 - 0.5$ 
  \textit{(poor-moderate agreement)}

  - Better agreement if just deciding yes or no in each cardinal plane (tilted or not; elevated or not, rotated or not)
  - More obvious abnormalities in elevated positions
  - IMO – still has value in that it focuses attention of proximal, dynamic control.

Spinal Posture Influence on Shoulder Elevation

- **Increased cervical flexion**
  - Decreased UR and post tilt

- **Increased thoracic flexion**
  - Increased superior position and decreased post tilt

- **Slouched posture (vs. upright)**
  - Decreased UR and post tilt
Rule Out Cervical Spine Involvement

- Cervical Radiculopathy CPR
  - AROM in all planes with overpressure
Review of Clinical Prediction Rule for Cervical Radiculopathy

1. + Spurling’s Test
2. Relief with Cervical Distraction
3. Less than 60° cervical rotation
4. + ULTT

- If 3 positive tests:
  - SN = .39; SP = .94; +LR = 6.5; 65% post-test probability
- If 4 positive tests:
  - SN = .24; SP = .99; +LR = 30; 90% post-test probability
Shoulder ROM

- AROM to place stress on contractile and non-contractile tissues
- PROM to place stress only on non-contractile tissues

**Flexion**
- 120° of GH flexion; 30° scapular tilt; 30° spinal extension

**Abduction**

**Int Rotation** - 70° before shoulder protraction

**Ext Rotation at 0/90** – 75/90°

**Horz Abd** - 45° with elbow flexed and **Horz Add** - 135°
### Intratester and Intertester Reliability

<table>
<thead>
<tr>
<th>MOTION</th>
<th>Intratester ICC</th>
<th>Intertester ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>.98</td>
<td>.89</td>
</tr>
<tr>
<td>Extension</td>
<td>.94</td>
<td>.27</td>
</tr>
<tr>
<td>Abduction</td>
<td>.98</td>
<td>.87</td>
</tr>
<tr>
<td>Horz Abduction</td>
<td>.90</td>
<td>.30</td>
</tr>
<tr>
<td>Horz Adduction</td>
<td>.95</td>
<td>.41</td>
</tr>
<tr>
<td>External Rotation</td>
<td>.99</td>
<td>.88</td>
</tr>
<tr>
<td>Internal Rotation</td>
<td>.94</td>
<td>.55</td>
</tr>
</tbody>
</table>

Goniometric Reliability of Shoulder Measurements in a Clinical Setting

*Phys Ther* 67:668-673, 1987
ROM Assessment Considerations

● Elevation
  - Plane of Assessment
  - Allowance for scapular tilt and lumbar hyperextension
  - Slight elbow flexion so that LH of triceps does not restrict motion

● Internal Rotation/External Rotation
  - Allowance for elbow extension or scapular tilt-rotation
  - Plane of assessment and ° of elevation
  - Scapular (not humeral head or visual) stabilization

● Meaningful change may be up to 15°
Effect of Age, Sex, and Handedness on ROM

- Females ROM > Males
- ROM decreased with age for all motions except IR with increasing age
- Dominant arm ER ROM > Non-dominant in all ranges of abduction
- Non-dominant arm IR/Ext ROM > Dominant arm
- No difference in ROM for Flex or Abd

Rotational Normals – Total Arc

• What is normal?
  – Activity specific
  – Age, gender specificity
  – Total Range Theory

• Adaptations
  – Osseous
    – Humeral retroversion
    – Glenoid (scapular) retroversion
  – Capsular
  – Muscular
  – Sport self selects?
End Feels for the Asymptomatic or “Normal” Shoulder

- firm capsular or muscular tension for rotations, flexion, extension, adduction, and horizontal adduction
  - IR at 90 > ER at 0 > Flexion > ER at 0
- soft tissue approximation for horizontal adduction
- firm capsular or hard bony end feel for abduction
Pain-Resistance Sequence Selections: sequence of pain to the motion barrier

- Pain BEFORE, AT, or AFTER initial tissue resistance is met –
  - P1 before R1 – acute
  - P1 before R1-2 – subacute
  - P1 at R2 - chronic

- **SYMPTOMATIC ARC**: includes pain, clicking, grating, crepitation
  - 70-120° indicative of chronic subdeltoid bursitis, supraspinatus tendinitis, or upper fiber subscapularis tendinitis
  - above 120° usually indicative of AC joint

- **PAINLESS**: provide overpressure at EROM to further stress the joint
Manual Muscle Testing

Reliability, Construct Validity, Relevance?
Assessing ER Strength - Position Matters

- Greatest torque production in resting position of 45° elevation in scapular plane
  
  Mulligan, et al, 2009
  Riemann, et al, 2010

- ER/IR Ratio = approx. 85-90% in normals

- Able to differentiate symptomatic from asymptomatic subjects by middle trap to external rotation strength ratio in both sitting positions

  Mulligan, et al, 2009
Palpation

position, tenderness, nodules, swellings, crepitus, vascular pulses, or temperature changes

- Positional relationships – HH or scapular positions
- Coracoid tenderness – SICK scapula and/or adhesive capsulitis
- RC – more SN than SP (SS/LHB)
- ACJ (everyone has OA over 40)
Special Tests

Used for confirmation or denial – not discovery

“We’ll get the trainer out here to look at it, but my guess is that you just pulled something”
Possible Starting Rationale for Special Tests

**IRRST**
- SN – 86; SP – 96
- + LR = 22; - LR = 0.13

**IR MMT >> ER MMT**
**RC Pathology**
- Tendinopathy/SAIS
- Anterolateral shoulder pain; painful arc; weakness in elevation; nocturnal pain

**Inconclusive**

**ER MMT >> IR MMT**
**EA Pathology**
- LHB Tendinopathy; ACJ
- Palpatory pain; visual anomalies;

**IA Pathology**
- Capsulolabral Pathology
- Joint “noise”, apprehension;
Glenohumeral Stability Testing

- **Sulcus** – MDL (inferior)
- **Load/Shift** – A/P translational laxity
- **Apprehension** – provocative anterior
- **Push/Pull** – provocative posterior
- **Labral** – compression, shear, or tension
Manual Stability Special Tests

Laxity Detection
- Sulcus Test
- Load and Shift

Provocative Maneuvers
- Apprehension Sign
- Relocation Test
- Anterior Release-Surprise

Don’t “push” to hard.
*Feel the movement – don’t create the movement*
Laxity Testing
Reliability and Diagnostic Accuracy

- **Sulcus**
  - SP – 93; SN – 17;
  - +LR = 2.4; -LR = 0.89
  - Moderate Kappa coefficients

Nagakawa S, *Arthroscopy*, 2005

- **Load/Shift**
  - High specificity; low sensitivity

(details next slide)
Shoulder Stability Testing
Diagnostic Accuracy

**Table 1. Validity of clinical tests for shoulder instability**

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Likelihood ratio (+)</th>
<th>Likelihood ratio (−)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load and shift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior</td>
<td>50</td>
<td>100</td>
<td>&gt;100</td>
<td>0.5</td>
<td>29</td>
</tr>
<tr>
<td>Posterior</td>
<td>14</td>
<td>100</td>
<td>&gt;100</td>
<td>0.9</td>
<td>29</td>
</tr>
<tr>
<td>Inferior</td>
<td>8</td>
<td>100</td>
<td>80</td>
<td>0.9</td>
<td>29</td>
</tr>
<tr>
<td>Sulcus sign</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1cm</td>
<td>72</td>
<td>85</td>
<td>5</td>
<td>0.3</td>
<td>28</td>
</tr>
<tr>
<td>&gt;2cm</td>
<td>28</td>
<td>97</td>
<td>9</td>
<td>0.7</td>
<td>28</td>
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<tr>
<td>Provocative tests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apprehension</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Augmentation</td>
<td>68</td>
<td>100</td>
<td>&gt;100</td>
<td>0.3</td>
<td>39</td>
</tr>
<tr>
<td>Relocation</td>
<td>57</td>
<td>100</td>
<td>&gt;100</td>
<td>0.5</td>
<td>39</td>
</tr>
<tr>
<td>Release</td>
<td>92</td>
<td>89</td>
<td>8</td>
<td>0.1</td>
<td>39</td>
</tr>
</tbody>
</table>

* Likelihood ratio expresses the odds that a positive test result would occur in a patient with, as opposed to a patient without, shoulder instability. A test is considered useful if a likelihood ratio is >10.\(^{[38]}\)
* Likelihood ratio for a negative test result.
* With respect to predicting multidirectional instability.

NA = not available.

NOTE: SP > SN

Provocative Testing
Reliability and Diagnostic Accuracy

- **Apprehension**
  - $SP = 96; SN = 72; +LR = 20; -LR = 0.29$
  - High specificity; low sensitivity when using apprehension (instead of pain)
  

- **Relocation-Release**
  - $SP = 99; SN = 64;$
  - $+LR = 59; -LR = 37$
Value of Release Test

High probability (influenced by age) in presence of positive release test in patients with acute dislocation

Sulcus Test
Load and Shift
Instability Testing Summary

<table>
<thead>
<tr>
<th>Clinical test</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>LR+</th>
<th>LR−</th>
<th>Overall accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprehension</td>
<td>98.3</td>
<td>71.6</td>
<td>65.9</td>
<td>98.7</td>
<td>3.46</td>
<td>0.02</td>
<td>81.7</td>
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<tr>
<td>Relocation</td>
<td>96.7</td>
<td>78.0</td>
<td>71.1</td>
<td>97.7</td>
<td>4.39</td>
<td>0.04</td>
<td>85.2</td>
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<tr>
<td>Release test</td>
<td>91.7</td>
<td>83.5</td>
<td>75.3</td>
<td>94.8</td>
<td>5.55</td>
<td>0.10</td>
<td>86.4</td>
</tr>
<tr>
<td>Anterior drawer</td>
<td>58.3</td>
<td>92.7</td>
<td>81.4</td>
<td>80.2</td>
<td>7.95</td>
<td>0.45</td>
<td>80.5</td>
</tr>
<tr>
<td>Load and shift</td>
<td>71.7</td>
<td>89.9</td>
<td>79.6</td>
<td>85.2</td>
<td>7.10</td>
<td>0.32</td>
<td>83.4</td>
</tr>
<tr>
<td>Hyperabduction</td>
<td>66.7</td>
<td>89.0</td>
<td>76.9</td>
<td>82.9</td>
<td>6.06</td>
<td>0.37</td>
<td>81.1</td>
</tr>
</tbody>
</table>

*PPV*, positive predictive value; *NPV*, negative predictive value; *LR+*, likelihood ratio for positive test result; *LR−*, likelihood ratio for negative test result.

Testing for Posterior Instability

Push-Pull Test for Posterior Instability
Posterior Instability

Posterior Apprehension Test
a.k.a. – Jerk Test

Examiner passively horz add, IR with posterior shear

SP = 99
SN = 19

Subacromial Impingement Testing
Subacromial Impingement Testing

Flexion-Int. Rotation-Horz. Adduction
induce anterosuperior obligate translation

- Hawkins-Kennedy and Neer-Walsh
  - more SN than SP
- Clancy - minimal diagnostic value
- Yocum/Jobe - personal experience – SP
- Presence of Painful Arc - SP
Impingement Provocation Tests
to rule out the problem

Overpressure to Internal Rotation – Horizontal Adduction – Flexion
Impingement Provocation Tests

to rule in the problem (so they must have high specificity)

1. **Painful Arc**

2. **Yergason’s Test** for bicipital involvement

3. **Jobe EC Test** for supraspinatus involvement

4. **Limited ROM** in IR and elevation

5. **Anterolateral shoulder/arm pain**
Conclusion

- No single test is capable of significantly shifting the probability of SAIS being present or not
- Impingement tests tend to be somewhat sensitive but not very specific
- Common SAIS impairments seem to have more (unproven) specificity value
Can a cluster of tests elevate the LRs?

Can a cluster of findings elevate or reduce the likelihood of SAIS?
Yes ... Cluster Testing Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>No. (% of Patients with Positive Test Results</th>
<th>Pretest Probability</th>
<th>Pretest Odds</th>
<th>Likelihood Ratio</th>
<th>Post-Test Odds</th>
<th>Post-Test Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall impingement syndrome*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All three tests positive</td>
<td>61/231 (26.4)</td>
<td>0.65</td>
<td>1.86</td>
<td>10.56</td>
<td>19.64</td>
<td>0.95</td>
</tr>
<tr>
<td>Two of three tests positive</td>
<td>86/231 (37.2)</td>
<td>0.65</td>
<td>1.86</td>
<td>5.03</td>
<td>9.36</td>
<td>0.90</td>
</tr>
<tr>
<td>One of three tests positive</td>
<td>60/231 (26.0)</td>
<td>0.65</td>
<td>1.86</td>
<td>0.90</td>
<td>1.67</td>
<td>0.63</td>
</tr>
<tr>
<td>None of three tests positive</td>
<td>24/231 (10.4)</td>
<td>0.65</td>
<td>1.86</td>
<td>0.17</td>
<td>0.32</td>
<td>0.24</td>
</tr>
<tr>
<td>Full-thickness rotator cuff tear†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All three tests positive</td>
<td>50/153 (32.7)</td>
<td>0.39</td>
<td>0.64</td>
<td>15.57</td>
<td>9.96</td>
<td>0.91</td>
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<tr>
<td>Two of three tests positive</td>
<td>53/153 (34.6)</td>
<td>0.39</td>
<td>0.64</td>
<td>3.57</td>
<td>2.28</td>
<td>0.69</td>
</tr>
<tr>
<td>One of three tests positive</td>
<td>36/153 (23.5)</td>
<td>0.39</td>
<td>0.64</td>
<td>0.79</td>
<td>0.51</td>
<td>0.33</td>
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<tr>
<td>None of three tests positive</td>
<td>14/153 (9.2)</td>
<td>0.39</td>
<td>0.64</td>
<td>0.16</td>
<td>0.10</td>
<td>0.09</td>
</tr>
</tbody>
</table>

* A total of 352 patients (231 in the subject group and 121 in the control group) who underwent all three tests (the Hawkins-Kennedy impingement sign, the painful arc sign, and the infraspinatus muscle test) were included in this analysis. The subject group included patients with bursitis, partial-thickness rotator cuff tear, or full-thickness rotator cuff tear; the control group was the nonimpingement group.
† A total of 348 patients (153 in the subject group and 195 in the control group) who underwent all three tests (the painful arc sign, drop-arm sign, and the infraspinatus test) were included in this analysis. The subject group included patients with a full-thickness rotator cuff tear only; the control group included patients without impingement and patients with bursitis or a partial-thickness rotator cuff tear.

# Diagnostic Testing Summary

<table>
<thead>
<tr>
<th>Test</th>
<th>Rule In</th>
<th>Rule Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawkins-Kennedy</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Neer-Walsh</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Clancy</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Speed’s</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Yergason’s</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Painful Arc</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Reverse Capsular Pattern</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cluster Testing</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Best (most accurate) Combination

Subacromial Impingement Syndrome

- + Hawkins-Kennedy (Park) or + Neer (Michener)
- Presence of a painful arc
- Weakness in ER

Positive LR > 10; Negative LR < 0.2
SAIS Testing for Treatment

- **Clarification**
  - Painful Arc
  - Cause (Internal vs. External) - age and relocation/containment

- **Tissue**
  - Distraction – Abduction to differentiate inert from contractile

- **Source**
  - Impingement Relief Maneuvers
    - Posterior Glide – capsule
    - Inferior Glide – RC weak
  - SRM – weak scapular rotators; tight pec minor
  - SRT – weak scapular retractors
  - Speed’s (non-specific test) /Yergason - SP
SAT - Scapular Assistance Test

- Upward rotation and posterior tilting facilitated by examiner during active scapular plane elevation
- A positive test is present if the patient reports relief of impingement symptoms through the previously painful arc
- Indicates need for elevation force couple training (serratus and low trap)
- Proven to improve scapular kinematics and increase acromiohumeral clearance

SAT - Scapular Assistance Test

Acceptable interrater reliability

- .53 kappa coefficient and 77% agreement in scapular plane
- .62 kappa coefficient and 91% agreement in sagittal plane

SRT – Scapular Retraction Test

- Assist maintenance of scapular retraction and posterior tilt while the patient actively elevates the arm in the scapular plane.

- A positive test is present if the patient reports relief of impingement symptoms through the painful arc and/or if empty can test findings improve (i.e. less pain, more torque).

- Indicates need for scapular retractor training and stretching of the pec minor.
### Effect of Scapular Retraction on Supraspinatus MMT

<table>
<thead>
<tr>
<th>Group</th>
<th>EC</th>
<th>95% CI</th>
<th>SRT</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injured</td>
<td>14 + 4.23</td>
<td>9.28 – 18.28</td>
<td>18 + 4.68</td>
<td>13.04 – 23.14</td>
</tr>
<tr>
<td>Control</td>
<td>29 + 16.19</td>
<td>22.62 – 35.34</td>
<td>33 + 18.20</td>
<td>26.29 – 40.57</td>
</tr>
</tbody>
</table>

*a Scapular retraction test results significantly greater than empty can results for both groups*

Pathology of the LH of the Biceps

- Upper Cut test is most accurate with overall accuracy of 77%
- Other tests
  - Bear Hug SN = 0.79
  - Speed’s SP = 0.81

Rotator Cuff Integrity Tests

- Drop Arm Test – highly SP
- External Rotation Lag Sign
  - Highly SP, moderate SN
- Subscapularis Tests
  - Belly Press Test
  - Lift Off/IR Lag Sign
  - Bear Hug
Rotator Cuff Special Tests

Drop Arm and Lag Signs are highly specific

Bear Hug has highest + LR;
Overall about 40% SN, 90% SP
Rotator Cuff Cluster Testing

Because individual rotator cuff integrity tests tend to have poor overall accuracy – cluster testing is indicated.

Litaker Clinical Cluster to detect presence of RC Tear

- 5 point scale
  - 2 points – age ≥ 65
  - 2 points – ER MMT weakness
  - 1 point – night pain

- If combined score of ≥ 4 + LR = 10.9
- If combined score of ≤ 2 - LR = 0.23
## Rotator Cuff Tear Clusters

<table>
<thead>
<tr>
<th>Cluster Findings</th>
<th>Source</th>
<th>Diagnostic Value</th>
</tr>
</thead>
</table>
| 1. Weak supraspinatus  
2. Weak external rotators  
3. + Impingement test  
or 2 of 3 above and > 60 YO | Murrell, Lancet, 2001                       | 98% predictive value                                   |
| 1. Weakness in external rotators  
2. Painful Arc  
| Weakness of > 50% relative to the other side in 10° shoulder abduction          | McCabe, J Ortho Sports Phys Ther, 2005     | indicative of a large or massive rotator cuff tear    |
Rotator Cuff Diagnostic Testing Summary

<table>
<thead>
<tr>
<th>Test</th>
<th>Rule In</th>
<th>Rule Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 60</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Night Pain/US Pain (personal experience/opinion)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Drop Arm Test or</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Lift Off/Belly Press/Bear Hug (subscap)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Normal Empty Can Strength</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Negative ER Lag Sign</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Cluster Testing (painful arc or impingement/weakness/+ drop arm)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Likelihood Ratio of 15 for of Rotator Cuff Tear with presence of painful arc, + drop arm sign, and weakness in ER – Park, JBJS, 2005.
What are you thinking?

- Mechanical symptoms with “weakness”
- “Clicking” in my joint with weight training

Losing velocity and unable to get arm to “loosen” up
Common SLAP “history”

- Pain tends to be present with activity and goes away with rest (unless RC also involved)
Labral Provocation Tests
Superior Labral Anterior to Posterior Lesions

- Labral shredding
- Labral avulsion
- Type I
- Type II
- Type III
- Type IV
- Labral bucket handle
- Bicipital tendon involvement

Fat suppressed oblique coronal T-1 weighted MRA
Shortcomings of Labral Testing

- diagnostic accuracy of SLAP tests is inconsistent secondary to:
  - great propensity for concurrent co-morbidities
  - wide variety of superior labral pathology
  - inconsistent reference standards

so,

probably best to select test based on mechanism of injury
Mechanism of Injury Based Selection

- Compression
  - Passive Compression
- Traction
  - Active-Compression
- Peel-Back
  - Resisted Supination-
    Passive Ext. Rotation

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive injury</td>
<td>Active compression</td>
</tr>
<tr>
<td></td>
<td>Compression-rotation</td>
</tr>
<tr>
<td></td>
<td>Clunk</td>
</tr>
<tr>
<td></td>
<td>Anterior slide</td>
</tr>
<tr>
<td>Traction injury</td>
<td>Speed’s</td>
</tr>
<tr>
<td></td>
<td>Dynamic Speed’s</td>
</tr>
<tr>
<td>Peel-back injury (overhead athlete)</td>
<td>Active compression</td>
</tr>
<tr>
<td></td>
<td>Pronated load</td>
</tr>
<tr>
<td></td>
<td>Resisted supination external rotation</td>
</tr>
<tr>
<td></td>
<td>Biceps load I and II</td>
</tr>
<tr>
<td></td>
<td>Pain provocation</td>
</tr>
<tr>
<td></td>
<td>Crank</td>
</tr>
</tbody>
</table>
Superior Glenoid Labral Pathology

Active Compression Test

- Alleviation of “deep” symptoms in supinated/externally rotated position
- No one has been able to reproduce the high specificity and sensitivity initially reported by O’Brien
Myer’s Test for Superior Glenoid Labral Injury

Resisted Supination External Rotation Test

- Examiner simultaneously resists forearm supination while passively externally rotating the shoulder
- Moderate shifts in positive and negative likelihood ratio if reproduction of deep shoulder pain
- Test is only proven accurate in dominant arm overhead athletes
Resisted Supination – External Rotation
Superior Glenoid Labral Injury

The Passive Compression Test

- Long axis compression while shoulder is abducted 30° and externally rotated
- Positive test if pain or mechanical clicking reproduced with passive extension
The Passive Compression Test

<table>
<thead>
<tr>
<th>Study</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>+ LR</th>
<th>- LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim, et al, 2007</td>
<td>82</td>
<td>86</td>
<td>92</td>
<td>64</td>
<td>5.9</td>
<td>.21</td>
</tr>
</tbody>
</table>

Reliability Kappa .77
Overall Accuracy 51/61 = 84%
Pre-test Prevalence 33/61 = 54%

Based on 54% pre-test probability the post-test probability is approaching 90% with a + test and down around 12% with a negative finding.
Superior Glenoid Labral Pathology

Additional Tests – high SP but low SN

Crank Test
“scouring” like compression in 90-160°
SP-75; SN-34  +LR-1.4;-LR-.88

Anterior Slide Test
Anterosuperior axial load
SP-86; SN-17  +LR-1.2;-LR-.97

Bicep Load Tests
Contraction and/or stretching of biceps

Yergason Test
SP-95; SN-13  +LR-2.5;-LR-.91

Compression-Rotation Test
SP-78; SN-25  +LR-2.8;-LR-.87

What do you suspect? **ACJ Separation**

In an AP View the normal joint space is 0.3-0.8 cm and the normal coracoclavicular distance is 1.0-1.3 cm
ACJ Grading

<table>
<thead>
<tr>
<th>Type</th>
<th>Deformity</th>
<th>Ligaments</th>
<th>Instability</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Minor</td>
<td>Incomplete AC</td>
<td>none</td>
<td>no</td>
</tr>
<tr>
<td>Type II</td>
<td>Minor step deformity</td>
<td>Complete AC, Incomplete CC</td>
<td>Palpable gapping</td>
<td>no</td>
</tr>
<tr>
<td>Type III</td>
<td>Piano key deformity</td>
<td>Complete AC/CC</td>
<td>Visible gapping</td>
<td>possible</td>
</tr>
<tr>
<td>Type IV</td>
<td>Clavicle displaced posteriorly into trapezius</td>
<td>Complete AC/CC; trap/deltoid tear</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Type V</td>
<td>CC space ↑ 100-300%</td>
<td>Complete AC/CC; significant trap/deltoid tearing</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Type VI</td>
<td>inferior dislocation of clavicle - frequently locked under conjoined tendon</td>
<td></td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>
Confirmation of ACJ Arthrosis

- Symptom reproduction with:
  - direct palpation
  - cross body adduction
  - pain at end range elevation
  - superficial pain with O’Brien’s (Active Compression) test
  - + Paxinos test
No clear method to diagnosis degenerative ACJ pain

- Negative response to palpation and Paxinos test to rule out and O’Brien test to rule in ACJ as symptom generator

---

<table>
<thead>
<tr>
<th>Test</th>
<th>SN</th>
<th>SP</th>
<th>Accuracy</th>
<th>+ LR</th>
<th>- LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paxinos Test</td>
<td>79</td>
<td>50</td>
<td>65</td>
<td>1.6</td>
<td>0.42</td>
</tr>
<tr>
<td>ACJ Palpation Tenderness</td>
<td>96</td>
<td>10</td>
<td>53</td>
<td>1.1</td>
<td>0.40</td>
</tr>
<tr>
<td>O'Brien Test</td>
<td>16</td>
<td>90</td>
<td>53</td>
<td>1.6</td>
<td>0.93</td>
</tr>
<tr>
<td>X-ray</td>
<td>41</td>
<td>90</td>
<td>66</td>
<td>4.1</td>
<td>0.66</td>
</tr>
<tr>
<td>Bone Scan</td>
<td>82</td>
<td>70</td>
<td>76</td>
<td>2.7</td>
<td>0.26</td>
</tr>
<tr>
<td>MRI</td>
<td>85</td>
<td>50</td>
<td>68</td>
<td>1.7</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Shoulder Imaging Chapter

Shoulder imaging chapter available in your references

Imaging may reveal pathology but musculoskeletal exam and patient history provides relevance.
Screen for referral appropriateness: red/yellow flags

Non-op

Imaging

Abnormal

GHJ OA
Calcific Tendinitis
Fractures
Tumors

Normal or Contributive

Post-op

Chief Complaint

Instability
GHJ Instability
Labral Defects
ACJ Instability

Rule In
< 40
+ Laxity-Provocation
Mechanical

Rule Out
Apprehension
Absence

Stiffness
Adhesive Capsulitis
Stiff Shoulder

Rule In
Coracoid Tender
Capsular Patern
Motion Loss

Rule Out
< 40

Weakness/Roughness
RC Pathology
Contractile Lesions
Impingement Syndrome
Scapular Dyskinesis

Rule In
IR Loss
Painful Arc
ER Weakness
+/Lag/Drop Signs

Rule Out
Palpation
- Impingement Signs

Paraesthesia
TOS
Cervical Radiculopathy
Neural Entrapment
Myofascial Strain

Other
Myofascial
Fibromyalgia

Pathoanatomy's
Tissue Irritability

UT SOUTHWESTERN
MEDICAL CENTER
# Tissue Irritability

guides intensity of physical stress

<table>
<thead>
<tr>
<th></th>
<th>HIGH</th>
<th>MODERATE</th>
<th>LOW</th>
</tr>
</thead>
</table>
| History/Exam | • Pain > 7/10  
• Consistent rest or nocturnal pain  
• Empty End feel  
• AROM < PROM  
• High Disability (Outcome Score)  | • Pain = 4-6/10  
• Intermittent rest or nocturnal pain  
• Pain at EROM  
• AROM ~ PROM  
• Moderate Disability (Outcome Score)  | • Pain ≤ 3/10  
• Minimal rest or nocturnal pain  
• Pain with OP  
• AROM = PROM  
• Low Disability (Outcome Score)  |
| Intervention Focus | • Minimize Physical Stress  
• Activity Modifications  
• Monitor Impairments  | • Mild to Moderate Physical Stress  
• Basic Functional Activities  
• Address Impairments  | • Moderate to High Physical Stress  
• High Demand Activities  
• Restore Impairments  |
Impairment Level guides intensity of intervention tactics

<table>
<thead>
<tr>
<th>Impairment</th>
<th>HIGH Irritability</th>
<th>MODERATE Irritability</th>
<th>LOW Irritability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited Mobility</td>
<td>• Painfree, within range</td>
<td>• Comfortable, to end range</td>
<td>• Longer duration and increased frequency to tolerance</td>
</tr>
<tr>
<td>Muscle – Joint - Neural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypermobility</td>
<td>• Joint protection</td>
<td>• Stabilization training</td>
<td>• Dynamic stabilization</td>
</tr>
<tr>
<td>Neuromuscular Weakness</td>
<td>• AROM within pain-free range</td>
<td>• NM retraining</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• BF or E. Stim to facilitate</td>
<td>• Light to moderate resistance</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Education on Activity Modifications and Contraindications</td>
<td>• Self-care strategies</td>
<td>• Return to Activity Progressions</td>
</tr>
</tbody>
</table>
My Prejudice on Common Impairments

- Trapezius and Serratus Weakness or poor motor awareness
- Tightness in pec minor and posterior capsule
- Hypomobile thoracic spine
  - Stuck in flexion; unable to reverse with arm elevation
Let’s go to lab and practice