SHOULDER REHABILITATION INVOLVING LABRAL REPAIR AND INSTABILITY
REHAB SUMMITT 2009

Michael P. Reiman, PT, DPT, OCS, ATC, CSCS
Assistant Professor
Wichita State University Physical Therapy
Objectives

• Understand the major limitations regarding post-operative rehabilitation post labral repair and shoulder instability repair procedures

• Be able to list 3-4 exercises that demonstrate the greatest benefit with such post surgical procedures

• Understand the exercise progression concept related to these surgical procedures
Glenoid Anatomy

• Shoulder intrinsically unstable
• Large humeral head/small glenoid
• Rowe and Zarins compared this relationship to seal balancing ball

Stability

• Enhanced by glenoid labrum

• Labrum a fibrous ring attached to the rim of the glenoid
Stability

- Expands the size and depth of the glenoid
- ↑ the superior inferior diameter 75%
- ↑ the anterior posterior diameter by 50%


Labrum

- Also serves as primary attachment of capsule and GH ligaments
- Superior aspect serves as attachment site for the long head of the biceps muscle
**LHB Tendon**

- Blends with the superior portion of the labrum
- Inserts into the supraglenoid tubercle of the scapula, approximately 5 mm medial to the superior edge of the glenoid rim

• Fibers of biceps consistently intermingled with collagen fibers of the labrum
• At the twelve o’clock position the hyaline articular cartilage extends for a short distance over the edge of the rim and creates a small recess beneath the biceps tendon and the superior part of the labrum
Labrum

• Biceps tendon important for anterior stability of GH joint
• Tension applied to intact long-head tendon in cadavers significantly decreased anterior, superior and inferior translation of humeral head


Labrum

- With increased loads to LHB the amount of humeral head translation decreased in response to a 1.5 kg anterior force as compared to no load applied to the LHB.

- Effect of biceps loading on anterior humeral head displacement was even more remarkable after creating Bankart lesion.

GH Joint Instability

- **Laxity** - asymptomatic passive translation of the humeral head on the glenoid
- It is required for normal shoulder motion

- **Instability** - pathologic condition manifesting as pain due to excessive translation of the humeral head on the glenoid during active shoulder motion - unwanted translation

- **Subluxation** - partial loss of GH jt. articulation - symptoms produced
- **Dislocation** - complete separation of articular surface, due to direct or indirect forces
- **Dead arm syndrome** - recurrent anterior subluxation
• Matsen & Arntz- two different extremes of instability
  *AMBRI
  *TUBS

• **AMBRI** - atraumatic, multidirectional, bilateral, responsive to rehabilitation, or failing that, inferior capsular shift

• **TUBS** – traumatic, unidirectional, with Bankart lesion, responding to surgery

• These variants represent the ends of a continuum of mixed pathology associated with instability
Shoulder Static Stabilizers
Stability

Ligaments/capsule

• Labrum (variable)

NEW CONCEPTS

• Shoulder is a circle concept
• Structure dependent on position/specificity of ligament function
Circle Concept of Shoulder Stability

• Excessive translation in one direction may require damage to restraints on the same and opposite sides of the joint.

Circle Concept

• Circle concept – need to check both sides of the joint
• Contra-coup concept (injury can occur opposite to the side of the obvious injury)


Capsular/Ligamentous Constraint Mechanism

Dependent on position of arm
Laxity is NOT the same as instability.
Stabilization Against Anterior Dislocation

• 0° of ABD: Subscapularis
• 45° of ABD: Subscap, Middle GHL, Anterosuperior fibers of IGHL
• 90° of ABD: IGHL

PSEUDOLAXITY ASSOCIATED WITH SLAP LESIONS HAS LED TO ERRONEOUS DIAGNOSIS OF MICRO-INSTABILITY IN MANY CASES, PROMPTING ILL-ADVISED INSTABILITY SURGERY IN PATIENTS WHO HAD UNRECOGNIZED SLAP LESIONS THAT WENT UNREPAIRED

SLAP LESIONS ARE THE MOST COMMON PATHOLOGIC ENTITIES ASSOCIATED WITH “DEAD ARM”

SLAP Lesions

- First described labral injuries in throwers
- Postulated that tensile failure at the biceps root was the MOI
- Biceps contracting eccentrically to decelerate the extending elbow during follow-through phase of pitching

SLAP Lesions

• Term coined by Snyder in 1990
• The disruption of the superior labrum-biceps complex involving tearing or separation or both of the superior labrum beginning posterior to the biceps tendon insertion and extending anteriorly

This area is functionally important because it serves as an anchor for the insertion of the long head of the biceps tendon onto the glenoid.
SLAP Lesions

- The classic description of a patient with a labral tear is one whose shoulder has pain with throwing activities and palpable clicking
- Rarely are labral tears seen without the presence of instability
SLAP Lesions

• Mechanism of injury:
  – Shoulder is forcefully ABD, extended and externally rotated
  – Posterior damage with force applied to humerus in direction of longitudinal axis with shoulder in 90° forward flexion
  – Superior labrum with biceps tendon/traction mechanism or fall onto outstretched, ABD and forward flexed arm
SLAP Lesions

• SLAP Lesion Symptoms
  – Pain
  – Pain greater with OH activity
  – Painful “catching”
  – Painful “popping”
Type I SLAP Lesions

- Type I Lesion
  - SLAP degenerated
  - Marked fraying with degenerative appearance
  - Periphery attached
  - Biceps firmly attached

Type II SLAP Lesions

- Type II Lesion
  - Degenerated and fraying
  - Superior labrum and biceps tendon stripped off the underlying glenoid

Type II SLAP Lesions

• Type II Lesion
  – Results in labral-biceps anchor unstable and pulled away from glenoid

Type III SLAP Lesions

- Type III lesion
  - Bucket handle type tear
  - Central portion displaced into the joint while periphery firmly attached to glenoid

Type IV SLAP Lesions

- Type IV lesion
  - Bucket handle tear with extension into biceps
  - Labral flap tends to displace into joint

### Occurrence per Snyder et al.

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>3</td>
<td>11%</td>
</tr>
<tr>
<td>Type II</td>
<td>11</td>
<td>41%</td>
</tr>
<tr>
<td>Type III</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>Type IV</td>
<td>4</td>
<td>15%</td>
</tr>
</tbody>
</table>

Treatment of SLAP Lesions

- Type I
- Torn and frayed labrum is debrided back to intact labrum
- Careful preservation of attachment of labrum and biceps tendon to the glenoid
Treatment of SLAP Lesions

- Type III
- Treated with excision of the bucket-handle portion of the tear
Treatment of SLAP Lesions

- Type IV
- Treated with excision of the bucket-handle portion of the tear, with resection continuing into the split portion of the biceps tendon
- In some instances the split in the biceps tendon and the labrum can be repaired with sutures placed arthroscopically
Treatment of SLAP Lesions

- Type II
- Different from other treatments
- Attention directed not only to torn labrum and biceps tendon tissue, but also to re-attachment of the biceps anchor to superior glenoid neck.
Type II

- Superior glenoid neck is abraded to promote healing of detached labrum
- Done to create a bleeding bone surface
Type II

- Drill hole made on the superior glenoid at the junction of the articular cartilage directed $45^\circ$ to the glenoid articular surface

- Mitek anchor can then be placed with #2 nonabsorbable suture
Type II

- Suture hook is passed through the anteroinferior portal and is used to grab one limb of the Mitek suture, which is passed through the operating cannula
Type II

- Curved epidural needle passed through portal into the superior labral tissue
Type II

- Suture Shuttle used to pull suture back into the joint and through the superior labral tissues
Type II

- Slip knot tied down to secure the superior labrum back onto the glenoid

- Arthroscopic knot-pusher used to ensure adequate attachment
Drill in corner of glenoid after preparing rim
Anchor insertion
Grasping suture
Tying suture
POST-OPERATIVE TREATMENT
Type I: Superior Labral Fraying

- ROM
  - As tolerated, no restrictions
- Protection
  - Biceps (7-10 Days)
- Return to Sport
  - Dependent on strength and biomechanics of shoulder, but usually 2-4 weeks
Type II: Week 1

- Sling immobilization at all times for 4 weeks
- Gentle PROM only. Full ROM by 6 weeks with combined external rotation and abduction achieved last
- Protection
  - Avoid Biceps resistance exercises for 10-12 weeks, no external rotation beyond 40 degrees for 6 weeks
Type II : Week 1

- Gentle elbow wrist and hand exercises started the day after surgery and continued throughout rehab period
- After 7-10 days, formal therapy focusing on gentle PROM within pain free range avoiding ER beyond neutral and extension of arm behind body for 4 weeks
Weeks 2-3

- Codman circumduction
- PROM: 0-90° flexion, abduction and external rotation in adduction only
- No ER in abduction due to peel-back
- Sling immobilization when not performing PROM
Weeks 3-6

- Discontinue sling
- Progressive PROM to full as tolerated in all planes (ER not passed neutral until week 4)
Weeks 3-6

- Begin passive posterior capsular stretches and IR stretches
- Begin passive and manual scapulothoracic mobility program
Weeks 3-6

• Begin gentle ER in abduction (not past neutral until minimum 4 weeks)
• Allow use of the operative extremity for light ADL’s
Weeks 3-6

- Shoulder exercise began around 4 weeks
- No biceps until 10-12 weeks
Week 6-16

- Continue all stretching and flexibility programs as above
- Begin progressive strengthening of the RTC, scapular stabilizers, and biceps
Moseley Core Scapular Exercises
Month 4

- Begin interval throwing program on level surface
- Continue stretching and strengthening regime, with particular emphasis on posterior capsular stretches
- Can begin more aggressive biceps resistance after 4 months
Month 6

- Begin throwing from mound.
Month 7

- Allow full-velocity throwing from the mound
- Continue strengthening and posterior capsular stretching long-term (indefinitely)
- Remember an occult tight posterior capsule caused the SLAP to begin with and recurrence of the tightness can be expected to place the repair at risk in a throwing athlete
Type III: Bucket Handle Labral Tear

- ROM: Similar to Type I, but 1-2 weeks slower
- Protection: Same as Type II
- Return to activity: Same as Type II
Type IV: Bucket-Handle with Extension into Biceps

- ROM
  - Dependent on technique: Repaired see Type II, Excision sling for 3 weeks, Full ROM by 6 weeks

- Protection
  - Avoid biceps resistance for 6 weeks if tenodesis or 10 weeks if repaired

- Return to sport: 8-10 weeks with excision and tenodesis; Return to throwing 3-4 months.

- If repaired see Type II
General Instructions

- Placed in sling which may be removed only for passive full extension/flexion of elbow
- Avoid external rotation of the shoulder past neutral and extension of the arm behind the body with the elbow extended for first 4 weeks
## Arthroscopic Bankart Rehabilitation Protocol

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Forward Flexion</th>
<th>External Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>90°</td>
<td>10°</td>
</tr>
<tr>
<td>2-4</td>
<td>110°</td>
<td>20°</td>
</tr>
<tr>
<td>4-6</td>
<td>130°</td>
<td>30°</td>
</tr>
<tr>
<td>6-8</td>
<td>160°</td>
<td>45°</td>
</tr>
<tr>
<td>8-12</td>
<td>“Full”</td>
<td>“Full”</td>
</tr>
</tbody>
</table>

"Prefer 5° less than normal side."
• No pull-ups until 4 months post-op
• Throwing Activity - start 4 months post-op. Follow function progression per IAM program.
• Return to sport at 4 months post-op if PT goals have been met.
• No Dips - until 4 months
• Full return to throwing at 6-8 months
General Principles

• Emergency care – check for distal N-V triad integrity
  - immobilization with a towel roll under axilla
  - swing and swathe
• Address signs of inflammation/pain – take into account stage of healing (acute, sub-acute, chronic)
• Normalize the quality of motion at the glenohumeral joint
• Normalize the quantity of motion at surrounding joints
• Strengthen the shoulder girdle and related musculature
• Consider relationship between shoulder instability and RTC impingent (secondary impingement)
General Principles

• Rehab for dislocation/subluxation/labral injury will vary in length depending on factors:
  1. degree of instability/laxity
  2. acute vs. chronic
  3. length of time immobilized
  4. strength/ROM status
  5. performance/activity demands
• Rehab program outlined in 3 phases
• Phase I and II – caution to avoid undue stress on capsule as dynamic joint stability is restored
• Phase III – progressive rehab in preparation for return to prior activity level
Progression Principles

- Simple-------------------------- complex
- Proximal------------------------ distal
- Single plane exercises--------- multiplane exercises
- Isometric stability------------ isometric mobility
- Stability----------------------- mobility
- Controlled mobility------------ skilled mobility
- Controlled environment-------- uncontrolled environment
- Horizontal movements--------- vertical movements
- Unidirectional movements------ multidirectional movements
- Posterior dominant shoulder
- Create stability-contractile, noncontractile, neuromuscular (kinesthetic)
Rehab Considerations

• Weak rotator cuff muscles results in poor glenohumeral articulation

• Weak scapular stabilizers prevents appropriate positioning for glenohumeral contact

• Strengthening of these areas is essential for stabilization of the humeral head in the glenoid (keeping humeral head posterior with contraction)
Rehab Considerations

- Neuromuscular (kinesthetic) training
- Functional patterns of movement
- “the motor cortex is organized in such a way as to optimize the selection on muscle synergies and not for the selection of a single muscle. Thus….the motor cortex thinks in terms of movements and not muscles” (Noth, *Strength and Power in Sport*, 1992)
- Isolation-------------Integration
• Scapulo-thoracic muscles
  -protraction/retraction
  -elevation/depression

• Create stable base from which glenohumeral joint can function
Rehab Considerations

• Moseley Four Core Scapular Exercises (Moseley, AJSM, 1992)
  - scaption (scapular plane elevation)
  - rowing
  - push-up with a plus
  - press-up

• EMG analysis of all 3 portions of trapezius, levator scapula, rhomboids, pec minor, and middle and lower serratus anterior
Rehab Considerations

• Townsend (AJSM, 1991) Four Core GH exercises
  - elevation in scapular plane with thumb down
  - flexion
  - horizontal abduction with arms externally rotated
  - press-up

• EMG analysis of GH/RTC muscles used during baseball rehabilitation
• Studied RTC muscles, pec major, latissimus, and all three portions of deltoid
Rehab Considerations

• Posterior dominant shoulder
  - the ability of the posterior RTC muscles (infraspinatus and teres minor) to decrease strain on the anterior structures in the GH joint is due to their ability to pull the humeral head posterior during external rotation of the humerus

• Cain (AJSM, 1987)
Rehab Considerations

• Increasing tone of the IR’s can also aid the humeral head in remaining posterior – limiting ER

• Subscapularis- may control anterior instability at the shoulder by passively acting as an anterior barrier to the humeral head, as well as a dynamic stabilizer to control ER (Donatelli & Wooden, Orthopedic Physical Therapy, 2001)

• Posterior capsular stretching/mobilization??

• Consider structures involved at time of trauma -subscapularis, capsule (what portion?), etc.
Rehab Considerations

- Prone
  - scapula is allowed to rotate
  - ER’s will be working against gravity
  - IR’s will be working with gravity (gravity assist)

- Standing
  - slight GH joint abduction – protect the supraspinatus blood flow (wringing out phenomenon)
  - ? scapula stabilized to prevent winging - ? supine position
<table>
<thead>
<tr>
<th>Exercise</th>
<th>Clinical Implication</th>
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<tbody>
<tr>
<td>Full can (supraspinatus)</td>
<td>Minimizes chance of superior humeral head migration by deltoid overpowering supraspinatus</td>
</tr>
<tr>
<td>Prone full can (supraspinatus)</td>
<td>High supraspinatus activity and also good exercise for lower trapezius</td>
</tr>
<tr>
<td>Side-lying ER (Infraspinatus and teres minor)</td>
<td>Most effective exercise in recruiting infraspinatus activity. Good when cautious with static stability</td>
</tr>
<tr>
<td>Prone ER at 90° abduction (Infraspinatus and teres minor)</td>
<td>Strengthens in a challenging position for shoulder stability. Also good exercise for lower trapezius</td>
</tr>
<tr>
<td>ER with towel roll (Infraspinatus and teres minor)</td>
<td>Enhances muscle recruitment and synergy with adductors</td>
</tr>
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</thead>
<tbody>
<tr>
<td>IR at 0° abduction (Subscapularis)</td>
<td>Effective exercise, good when cautious with static stability</td>
</tr>
<tr>
<td>IR at 90° abduction (Subscapularis)</td>
<td>Strengthens in a challenging position for shoulder stability</td>
</tr>
<tr>
<td>IR diagonal exercise (Subscapularis)</td>
<td>Effective strengthening in a functional movement pattern</td>
</tr>
<tr>
<td>Push-up with plus (Serratus anterior)</td>
<td>Effective exercise to provide resistance against protraction, also good exercise for subscapularis</td>
</tr>
<tr>
<td>Dynamic hug (Serratus anterior)</td>
<td>Easily perform in patients with difficulty elevating arms or performing push-up. Also good exercise for subscapularis</td>
</tr>
<tr>
<td>Serratus punch 120° (Serratus anterior)</td>
<td>Good dynamic activity to combine upward rotation and protraction function</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
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<th>Clinical Implication</th>
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</thead>
<tbody>
<tr>
<td>Prone horizontal abduction at 90° abduction with ER (Lower trapezius)</td>
<td>Effective exercise, also good exercise for middle trapezius</td>
</tr>
<tr>
<td>Bilateral ER (Lower trapezius)</td>
<td>Effective exercise, also good for infraspinatus and teres minor</td>
</tr>
<tr>
<td>Prone row (Middle trapezius)</td>
<td>Effective exercise, good ratios of upper, middle, and lower trapezius activity</td>
</tr>
<tr>
<td>Shrug (Upper trapezius)</td>
<td>Effective exercise</td>
</tr>
<tr>
<td>Prone extension with ER (Rhomboids and levator scapulae)</td>
<td>Effective exercise, unique movement to enhance scapular control</td>
</tr>
</tbody>
</table>

Conclusion

- Relationship between instability and labral tears
- SLAP vs. BANKART – precautions, etc.
- Exercises
  - Moseley
  - Townsend
  - Reinhold synopsis
- Systematic, Individualized program
Please fill out CE credit and evaluation forms for this session

Session number 106

Speaker – Michael P. Reiman
THANK YOU!!!