Return to Play for Overhead Athletes Following Superior Labral Repair

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Faculty Disclosure

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Why Superior Labral Injury?

- Clinical data 2006-2013 for patients under the age of 30 y/o

Year	Total Labral and Capsular Repairs	% Increase
2006	99	--------
2007	121	22%
2008	133	10%
2009	174	31%
2010	201	15%
2011	182	-9%
2012	179	-2%
2013	208	16%

Question

- **What are you currently telling your athletes about RTP possibility following shoulder surgery?**
  - What level of return?
    - Pre-injured level
    - Any level
    - No return

Focus

- What do we know about RTP and overhead athletes after superior labral repair?
- What does the literature say?
- What has clinical experience revealed?
- What suggestions can I provide to you?

Return to pre-injured levels of play following arthroscopic labral repair in overhead athletes

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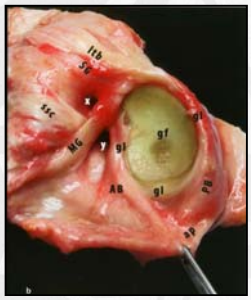
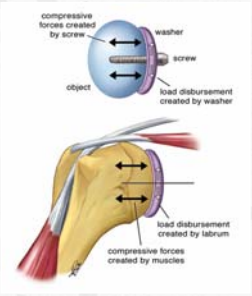
Sciascia et al JAT 2015

Labral Roles: Function

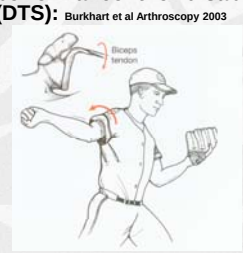
Washer/Bearing for Shoulder Joint → **Distributes load**

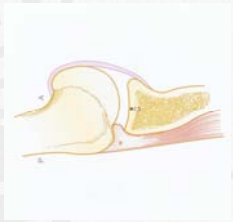




Background

- **Shoulder pain common in overhead athletes**
  - **Loss of arm function affecting athletic performance: the "disabled throwing shoulder" (DTS):** Burkhart et al Arthroscopy 2003



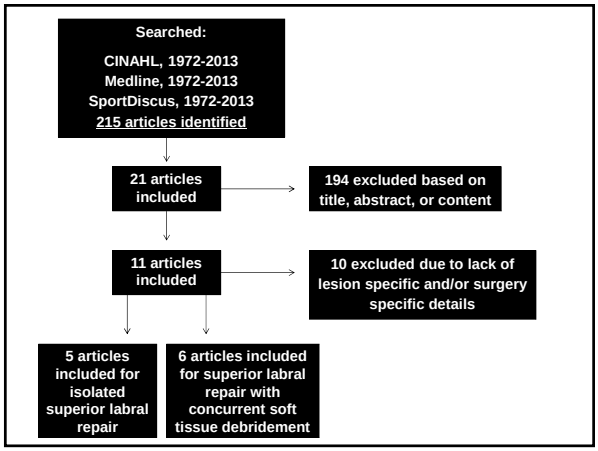


Background

- Surgery attempts to restore the functional loss
- Return to athletic function following arthroscopic SLAP/Int. Imp. repair is a concern of both the patient and clinician
- Unclear as to what extent overhead athletes return to pre-injury play following the procedure

Search Limits

- Databases
  - CINAHL, Medline, SportDiscus
- Limits
  - English, Human Studies, 1972-2013
- Inclusion
  - Articles reporting surgical repair of an isolated superior labral injury or a labral injury with soft tissue debridement
  - Overhead athletes with a mean age ≤40 years
  - Record of assessment of return to pre-injury level of play
- Exclusion
  - Articles not identifying the type of labral lesion repaired
  - Articles which did not describe surgical technique/procedure
  - Articles determined to be literature reviews (non-systematic reviews) or current concepts/opinion papers



Odds of RTP

	Full Return	Limited Return	Odds
Overhead	4	14	4/14=.3
Non-overhead	10	6	10/6=1.7

1.7/.3 = 5.8

Kim et al JBJS 2002

Non-overhead athletes have 5.8x greater chance to return in full after isolated superior labral repair compared to overhead athletes

Critical Appraisal

- Intervention study appraisal score sheet described by MacDermid
  - MacDermid J. J Hand Therapy 2004
  - 24 questions divided amongst 7 subsections
  - Score from 0 to 2 (48 points max)
- Scoring sheet was modified to a binary ("yes" or "no") scoring system
- Risk of bias determined
  - Agency for Healthcare Research and Quality

Results: Isolated Labral Repair

- Mean age: 24-34 years
- Average # overhead athletes: 16/study
- Follow-up: minimum 2 years (24-97 months)
- Return to play assessed at follow-up only
  - 22-92% full return
  - Odds ratio: Non-overhead athletes 2-6x more likely to return to full activity
- All retrospective case series
- Critical appraisal
  - 10-15 points (42-62%)

Results: Labral Repair with Debridement

- Mean age: 24-36 years
- Average # overhead athletes: 29/study
- Follow-up: minimum 1 year (12-120 months)
- Return to play assessed at follow-up only
  - 41-84% full return
  - Odds ratio: Non-overhead athletes 2-4x more likely to return to full activity
- All retrospective case series
- Critical appraisal
  - 11-17 points (42-70%)

Study	Odds of Non-Overhead RTP
Kim et al 2002	6
Cohen et al 2006	2
Yung et al 2008	N/A
Maier et al 2013	2
Park et al 2013	5
Morgan et al 1998	N/A
Ide et al 2005	4
Brockmeier et al 2009	2
Friel et al 2010	2
Park and Glousman 2011	N/A
Neri et al 2011	28

Superior Labral Repair with Concurrent Debridement

- Both groups had positive chance of success
  - Odds for both groups all greater than 1
    - Non-overhead groups superior to overhead groups
- But why???
  - 13 more overhead patients in concurrent procedure groups
  - Superior labral injury not occurring in isolation
  - Optimum method to treat labral pathology not fully understood

Study	Number of Anchors Reported	Anchor Location Described
Kim et al 2002	At least 1	Base of biceps
Cohen et al 2006	1-4	Where indicated
Yung et al 2008	2-4	2 o'clock to 10 o'clock
Maier et al 2013	1-2	Where indicated
Park et al 2013	At least 1	12 o'clock for double loaded anchor, 11 o'clock and 1 o'clock for single loaded anchor
Morgan et al 1998	No	Articular margin
Ide et al 2005	At least 2	11 o'clock to 1 o'clock
Brockmeier et al 2009	At least 1	Articular margin not beyond 10 o'clock
Friel et al 2010	At least 1	Base of biceps to 11 o'clock
Park and Glousman 2011	No	No
Neri et al 2011	Mean 2.3	On either side of biceps

Limitations

- Inconsistent definition of overhead/throwing athlete
- Wide range of age and follow-up time
  - Mean age 24-36 across all studies
- No determination of sample size
  - Lack of a thorough statistical analysis
  - Confounding variables not accounted for
- Rehabilitation details not reported
- **Evident biases exist**
  - **Recall (100%)**
  - **No prospective assessment of pre-injured ability**

Conclusions

- Use of odds reduces noise in literature showing consistent trend of non-overhead athletes having greater success with superior labral surgery
- Limitations within studies and variations between studies limits strength of findings
- Labral surgery should not be abandoned
  - Treat based on functional deficit and demands

Recommendations

- Be comfortable stating:
  - Overhead athletes can return to activity following superior labral repair
  - We cannot guarantee return to pre-injured activity level not because the surgery is bad, but solid information doesn't exist
  - Non-overhead athletes do have better odds of returning to full activity (at least 2x better)

What about non-operative treatment?

Give Rehabilitation a Chance?

- 68 MLB players with verified SLAP lesions
  - Pitchers
    - 21 no surgery: RTP=40%, Pre-injured return=22%
    - 24 surgical: RTP=48%, Pre-injured return=7%

    Rehab Better
  - Position Players
    - 10 no surgery: RTP=39%, Pre-injured return=26%
    - 13 surgical: RTP=85%, Pre-injured return=54%
      - Fedoriw et al AJSM 2014

    Surgery Better

Give Rehabilitation a Chance?

- 19 patients with SLAP treated non-operatively
  - ASES pain and function improved
    - Pain decreased from 4.5 to 2 (p=.04)
    - Function increased from 31/50 to 45/50 (p<.001)
  - All athletes pre-injured return=71%
  - Overhead athlete pre-injured return=66%
    - Edwards et al AJSM 2010

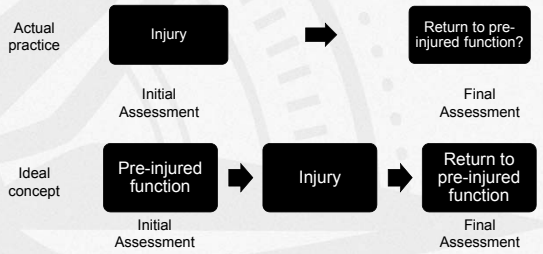
Give Rehabilitation a Chance?

- Factors associated with failure of non-operative treatment of SLAP lesions
  - History of trauma OR=10
  - Overhead activity OR=19
  - + Compression Rotation OR=9
    - Jang et al JSES 2016

How Do We Overcome The Issues?

Clinical Decision Making

Clinical Decision Making



Establishing Pre-Season Self-Reported Functional Outcomes Scores for Overhead Athletes

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Jean Lucas, PT, DPT
Tim Uhl, PhD, ATC, PT, FNATA

Information from larger data from Sciascia et al JAT 2015

Paradigm Shift?

- Biopsychosocial Model
  - Let the individual be the guide by appreciating individual factors that could affect outcome
    - Chassany et al Value Health 2006
    - Chen et al JSES 2007
    - Barratt Patient Educ Couns 2008
    - Michener and Snyder Clin Sports Med 2008
    - Deutscher et al APMR 2009

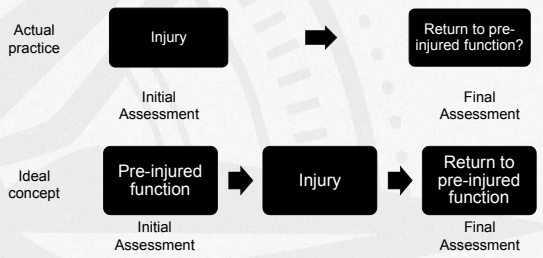
EKU

"It is more important to know what sort of person has a disease than to know what sort of disease a person has"

EKU **Hippocrates**

"It is more important to know what sort of person has a disease than to know what sort of disease a person has"

EKU Clinical Decision Making



EKU Background

- The goal of rehabilitation is to return the athlete to pre-injured levels; however:
  - Prospective pre-injured levels of function are not routinely documented and thus not utilized
- Outcomes collection begins at a time of dysfunction

How difficult is it for you to get loose or warm prior to competition or practice?	
Never feel loose during games or practice	Normal warm-up
How much pain do you experience in your shoulder or elbow?	
Pain at rest	No pain with competition
How much weakness and/or fatigue (i.e. loss of strength) do you experience in your shoulder or elbow?	
Weakness or fatigue preventing any competition	No weakness, normal competition fatigue
How unstable does your shoulder or elbow feel during competition?	
"Popping out" routinely	No instability
How much have arm problems affected your relationship with your coaches?	
Left team, cut, or lost scholarship	Not at all

How much have you had to change your throwing motion, serve, stroke, etc. due to your arm?	
Completely changed, don't perform motion anymore	No change in motion
How much has your velocity and/or power suffered due to your arm?	
Lost all power, became finesse or distance athlete	No change in velocity/power
What limitation do you have in endurance in competition due to your arm?	
Significant limitation (became relief pitcher, switched to short races for example)	No endurance limitation in competition
How much has your control (of pitches, serves, strokes, etc.) suffered due to your arm?	
Unpredictable control on all pitches, serves, strokes, etc.	No loss of control
How much do you feel your arm affects your current level of competition in your sport (i.e. is your arm holding you back from being at your full potential)?	
Cannot compete, Had to switch sports	Desired level of competition

EKU Background

- Pre-season assessment of arm capability has been conducted in professional baseball players
  - Asymptomatic players: ≥90/100
    - Kraeutler et al JSES 2013
    - Franz et al AJSM 2013
  - No history of injury: 97/100
  - History of injury: 84-87
    - Franz et al AJSM 2013
    - Fronek et al JSES 2014

EKU Background

- Assessment of arm capability in swimmers during fall practice
  - Not currently injured: 84/100
  - Currently injured: 54/100
  - Years competing
    - ≤10 years: 86
    - ≥11 years: 72
      - Wymore and Fronek AJSM 2015

EKU Questions

- What are the average KJOC values of subjective functional scores at the beginning of a competitive season for collegiate overhead athletes?
- Is there a difference in subjective scores between athletes with and without a history of injury?
- Is there a difference either within or between sexes?

Methods

- Pre-participation physical examinations at physician offices and athletic facilities
- Athletes 17-32 years old
  - Baseline measure all overhead athletes
- Demographics, KJOC
  - KJOC scale 0-100 (low to high function)
    - Alberta et al AJSM 2010

Statistical Analysis

- Summary statistics
  - Demographic variables
  - Overall score medians
- Non-parametric statistics
  - Differences between history and no history of injury within and between sexes
  - Mann-Whitney U
- Significance set at $p<.05$
  - Removed athletes with elbow injury

Results

- 168 overhead athletes completed surveys
  - Age: 19±2 (94 F, 74 M)
  - 5 colleges
  - 5 sports
    - Baseball (51)
    - Volleyball (45)
    - Swimming (35)
    - Softball (27)
    - Tennis (10)
  - Years playing: 11±4
- History of injury
  - No injury ever: 114 (68%)
  - Injury ever: 54 (32%)
    - 25 of 54 injured in past year
- Overall KJOC Score: 97/100

Results: Shoulder Injury

	N	Mean (SD)	95% CI	Median	P-Value
Injury	54	78 (21)	72-83	81	P<.001
No Injury	114	96 (7)	95-98	98	

Results: Sex

	N	Mean (SD)	95% CI	Median	P-Value
Female					
Shoulder Injury	25	74 (22)	65-84	80	P<.001
No Injury	68	97 (4)	95-98	98	

Results: Sex

	N	Mean (SD)	95% CI	Median	P-Value
Female					
Shoulder Injury	25	74 (22)	65-84	80	P<.001
No Injury	68	97 (4)	95-98	98	
Male					
Shoulder Injury	29	81 (19)	73-88	88	P<.001
No Injury	45	96 (9)	93-99	99	

Results: Injury Time

	N	Mean (SD)	95% CI	Median	P-Value
Injury ≤1 year	25	68 (23)	58-77	70	P<.001
Injury ever	29	86 (14)	81-92	92	

Key Points

- History/current injury affects perceived physical capability in overhead athletes
  - Franz et al Am J Sports Med 2013
  - Fronek et al J Shoulder Elbow Surg 2014
  - Wymore and Fronek Am J Sports Med 2015
- Reported in other joints as well
  - Cameron et al Am J Sports Med 2013
  - Sciascia et al J Ath Train 2015
- Females perceived lower physical capability than males
  - Ageberg et al Am J Sports Med 2010
  - Naylor and McBeath Percep Psycho 2008
  - John and Ebbeck Sex Roles 2008
  - Bekker et al Pers Ind Diff 2002

Conclusions

- Medically qualified overhead athletes with previous injury have perceived lower physical capability prior to a competitive season.
- This self-assessment of joint specific capability may supplement pre-season physicals and indicate a need for further monitoring or care for individual athletes.

What About Functional Testing?

- The literature is limited in identifying a "best" test for the upper extremity
- Suggestion to change terminology to Physical Performance Measure
  - Reiman and Manske J Man Manip Ther 2011
- Let's look at what is out there and what information we have

Physical Performance Measures (UE)

- Push-ups
- Y-balance test
- Closed kinetic chain upper extremity stability test
- Softball throw for distance
- Seated shot-put for distance (2 arm)
- Posterior shoulder endurance test (PSET)
- Seated shot-put for distance (1 arm)
- 1-RM estimate
- 1-arm hop test
- Sitting throw test
- Modified pull-up

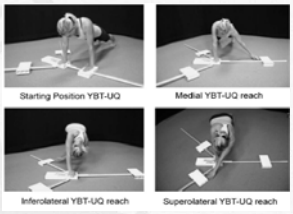
Push-Ups

- Excellent test/re-test reliability
  - Baumgartner et al Measure Phys Ed Ex Sci 2002
  - Negrete et al J Strength Cond Res 2010
- Reference data
  - Baumgartner et al Measure Phys Ed Ex Sci 2002
  - Negrete et al J Strength Cond Res 2010
- Correlated with bench press
  - Baumgartner et al Measure Phys Ed Ex Sci 2002

Negrete et al J Strength Cond Res 2010

Y-Balance Test

- Excellent test/re-test reliability
  - Gorman et al J Strength Cond Res 2012
  - Westrick et al Int J Sport Phys Ther 2012
- Correlated with push-ups and CKCUEST
  - Westrick et al Int J Sport Phys Ther 2012
- No difference between sexes
  - Gorman et al J Strength Cond Res 2012
- Differences between sexes and sports
  - Butler et al J Ath Train 2014
  - Taylor et al J Sport Rehabil 2016



Gorman et al J Strength Cond Res 2012

Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)

- Excellent test/re-test reliability
  - Goldbeck and Davies JSR 2000
  - Tucci et al BMC Musculoskel Dis 2014
  - Sciascia and Uhl Int J Sports Phys Ther 2015
  - Lee and Kim J Phys Ther Sci 2015
  - Tarara et al Br J Sports Med 2016
  - De Oliveira et al Int J Sports Phys Ther 2017
- Reference data
  - Ellenbecker et al Orthop Phys Ther Clin North Am 2000
  - Roush et al N Am J Sport Phys Ther 2007
- Injury prediction
  - Pontillo et al Sports Health 2014
- Difference between groups
  - Tucci et al BMC Musculoskel Dis 2014
  - Taylor et al J Sport Rehabil 2016

Discrepancy

- CKCUEST discriminates between individuals with and without impingement
  - Tucci et al BMC Musculoskel Dis 2014
- No difference in CKCUEST performance between individuals with and without shoulder symptoms
  - Sciascia and Uhl Int J Sport Phys Ther 2015
- 24 year age difference between impingement group and healthy group
- Heterogeneous diagnoses

Test Battery?

- Many different aspects of physiology that go into RTP decision making
  - Strength
  - Flexibility
  - Endurance
  - Power
- If a test is not “one size fits all”, then maybe testing battery is warranted?

Functional Impairment Test: Hand and Neck/Shoulder/Arm (Fit-HaNSA)

- Endurance test
  - 3 tasks
  - 5 minutes for each
- 3 tasks
  - Waist-up
    - Move 3, 1kg weights between shelves from waist to 25cm above
  - Eye down
    - For 5 minutes, move 3, 1kg weights between shelves from eye level to 25cm below
  - Overhead work
    - Screw and unscrew bolts at and above eye level
- Excellent test/re-test reliability
  - MacDermid et al BMC Musculoskel Dis 2007
  - Kumta et al J Orthop Sports Phys Ther 2012
- High correlation with DASH and SPADI
- Moderate correlation with ROM and strength
  - Kumta et al J Orthop Sports Phys Ther 2012
- Discriminates between individuals with and without impingement
  - MacDermid et al BMC Musculoskel Dis 2007

Functional Impairment Test: Hand and Neck/Shoulder/Arm (Fit-HaNSA)

Waist up

Eye down

Overhead work

Davies Functional Testing Approach for UE

General Population	Recreational Athlete	Competitive Athlete
• MMT/Isokinetic testing • Proprioceptive testing • Impairment measures	• 1-arm seated shot put • Medicine ball power test • CKCUEST	• Sport-specific testing • Overhand softball throw for distance • Functional throwing performance index

Recommendations

- Still no “best” test
- Traditional strength tests (MMT, lifting tasks) may not be best choice for RTP decisions
- Understand the RTS model
  - Treatment doesn’t stop after discharge

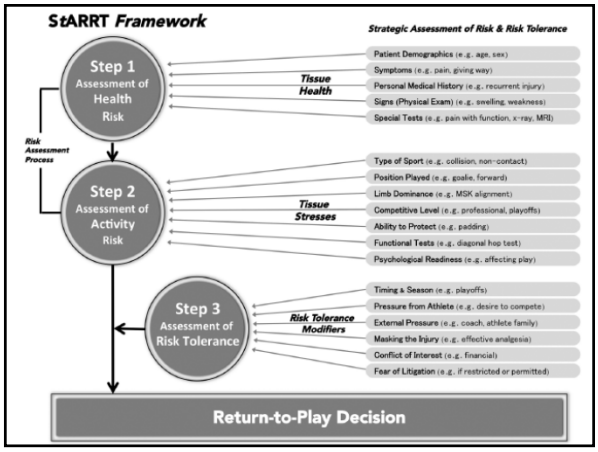
RTS Model

Return to participation	• Not ready to return to full participation for medical, physical, or psychological reasons • Could be in active rehab, modified activity, or with team
Return to sport	• Returned to team but not performing at desired level
Return to performance	• Returned to team and is performing at or above pre-injured level

Ardern et al Br J Sports Med 2016

STARRT

- Strategic Assessment of Risk and Risk Tolerance
  - Shrier et al Scand J Med Sci Sport 2015
  - Shrier Br J Sports Med 2017
- If the risk assessment is greater than the risk tolerance, the decision should not be to allow RTP



STARRT Steps

- Step 1: Tissue Health
  - Accounts for clinical measures
    - Strength, flexibility, special testing, etc.
    - Performed by clinician
- Step 2: Tissue Stress
  - Accounts for sport details, physical performance testing, and psychological readiness
    - Performed by clinician and/or coach
- Step 3: Risk Tolerance Modifiers
  - Accounts for acceptable rationales for allowing or not allowing RTP

Step 3 Example: Mid-Grade AC Injury

- Middle Linebacker
  - ↑ risk of contact
  - ↑ risk of re-injury
  - No RTP
- Kicker
  - ↓ risk of contact
  - ↓ risk of re-injury
  - RTP OK
- Let's add a caveat
  - Playoffs
  - Chance at higher draft position

Combining Experience with the Evidence

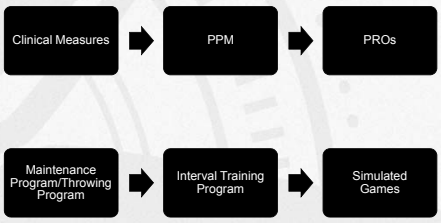
A Clinical Approach

Clinical Decision Making

Overhead Athletes

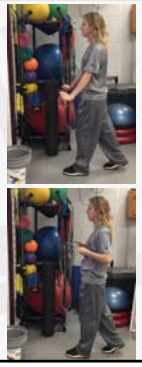
- Standard benchmarks to begin throwing or hitting programs
  - Minimum 100° external rotation at 90° abduction
  - Minimum 95° external rotation with pronation at 90° abduction
  - Dominant arm internal rotation ≤10° compared to non-dominant arm
  - No observable scapular dyskinesis
  - No observable single leg stability deficits
  - Performance of CKCUEST at least minimum # of touches for sex
    - 20-22 males
    - 18-20 for females
  - KJOC
    - 80-85

Clinical Decision Making



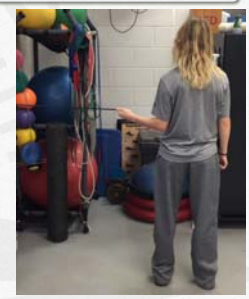
After Rehabilitation Program

- T-Band Low Row: 1 set 15 reps (build up to 3 sets 15 reps) (Blue Band)
- T-Band Mid. Row: 1 set 15 reps (build up to 3 sets 15 reps) (Blue Band)
- T-Band High Row: 1 set 15 reps (build up to 3 sets 15 reps) (Blue Band)



After Rehabilitation Program

- T-Band I/R Negatives: 1 set 15 reps (build up to 3 sets 15 reps) (Blue Band)
- T-Band E/R Negatives: 1 set 15 reps (build up to 3 sets 15 reps) (Blue Band)



After Rehabilitation Program

T-Band Power Position: 1 set 15 reps (build up to 3 sets 15 reps) (Blue Band)

Ball Drops: Flexion 3 sets 10 seconds 7 ounce ball

Rice Bucket: Both Hands 3 sets 30 seconds

After Rehabilitation Program

Rebounder: Standing I/R: 1 set 15 reps (build up to 3 sets 15 reps) (2 pound ball)

Rebounder: Power Position: 1 set 15 reps (build up to 3 sets 15 reps) (2 pound ball)

Rebounder: Standing Rotation: 1 set 15 reps (build up to 3 sets 15 reps) (2 pound ball)

After Rehabilitation Program

- Stepback Power Position: 3 x 8
- Overhead Reach: 3 x 10

After Rehabilitation Program

- Lateral Step: 3 Laps (40 Feet per lap)
- Lunge Matrix: 1 set of 6 reps (build up to 3 sets 10 reps)

Baseball/Softball

- Return to Throwing Program
  - Week 1: 20 feet, 20 throws
  - Week 2: 30 feet, 20 throws
  - Week 3: 40 feet, 20 throws
  - Week 4: 50 feet, 20 throws
  - Week 5: 60 feet, 20 throws
  - Week 6: 70 feet, 20 throws
  - Week 7: 90 feet, 20 throws
    - Warm-up should be at an intensity where you are only playing catch (no hard throwing) 15-30 throws
    - Cool down should be the same intensity as warm-up but no more than 15 throws

Data-Based Interval Training Programs

- Developed using volume as a guide

- Examples
  - Baseball
    - Axe et al Am J Sports Medicine 1996
    - Axe et al J Ath Train 2002
    - Axe et al Sports Health 2009
  - Tennis
    - Myers et al Sports Health 2016
  - Volleyball
    - Hurd et al Sports Health 2009

THANK YOU