Managing Overuse Injuries in the Overhead Athlete: Strategies for Rehab and Injury Prevention

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Background

• Supervisor - EXOS @ Raleigh Orthopaedic
• Practiced since 1996 in outpatient sports/ortho clinics
• S & C coach for MLS - Columbus Crew 2002-2006
• Owned my own training facility 2000-2010
• FMS certified, board certified orthopaedic clinical specialist (OCS), credentiald in dry needling
• Write for PFP Magazine
• PT consultant for Carolina Hurricanes
Objectives

Recognize and assess common injuries in the overhead athlete
Design evidence-based rehab programs and implement corrective and preventive exercise strategies to reduce overuse injuries
Understand how to use screening and assessment tools to detect asymmetry
Summarize current research on throwing mechanics and the management of related overuse injuries
Learn how to integrate rehab and performance training for optimal health and future injury prevention
Common Injuries

- Rotator cuff tendinopathy
- Labral tears
- Instability
- Bicipital tendinopathy
- UCL sprain & valgus extension overload
- Medial/Lateral elbow pain
- Little League shoulder/elbow

Growth Plate Injuries

Type II SLAP

Morgan & Burkhart Arthroscopy 2003
Type II SLAP

Involves disruption of the proximal biceps anchor

First reported by Andrews and seen in overhead athletes ("peel back" injury)

Late cocking (max ABD & HER) is an at-risk position

Youth Baseball

Olsen et al. revealed that averaging more than 80 pitches per game nearly quadrupled injury risk and pitching more than 8 months out of the year raised it 4 times.

Olsen's study concluded pitching with a fatigued arm increased chances of having surgery 36x

Fleisig et al. showed that pitching more than 100 competition innings per year more than tripled the risk for serious shoulder or elbow injury. In addition, playing catcher as well as pitcher increased the odds ratio of injury 2.7 times.

Youth Baseball

Biomechanics - improper form leads to increased varus elbow torque. Common flaws include: hand under ball during stride phase, late arm rotation, excessive external rotation, excessive elbow flexion and improper abduction and trunk tilt.

Pitch type - concern about curveballs revolves around the thought that the elbow must be placed in a position of stress to create spin. Dun et al. studied 11-14 y/o who threw fastballs, change-ups and curves. There was greater supination with a curve, but more varus torque with a fastball. UNC and ASMI studies found no correlation w/curves before age 13 and an elbow injury.
Elbow Injuries in Youth Baseball Players Without Prior Elbow Pain

A 1-Year Prospective Study

449 players w/o prior elbow pain were observed prospectively for 1 season to study injury incidence in relation to specific risk factors

Average age was 10.1 years (range, 7–11 years). One year later, all players were examined by administering a questionnaire, physical examination, and radiographic examination

30% of youth baseball players have elbow pain each year, and nearly 60% of players w/elbow pain exhibit radiographic abnormalities

The age of 12 years, pitcher and catcher positions, and playing more than 100 games per year are risk factors for elbow pain

Matsuura et al AJSM 2013

Magnetic Resonance Imaging of the Throwing Elbow in the Uninjured, High School–Aged Baseball Pitcher

23 uninjured, asymptomatic male high school–aged baseball pitchers (mean age, 16 years) w/no history of elbow injury all had a minimum of 3 years’ experience w/pitching as their primary position (mean experience = 6 years)

Bilateral elbow MRI exam performed

Thickening of the anterior band of the ulnar collateral ligament and posteromedial subchondral sclerosis of the trochlea are common findings in the high school–aged pitcher and may be considered normal clinical findings in the absence of symptom complaints

Hurd et al AJSM 2011

Muscle Strength and Range of Motion in Adolescent Pitchers With Throwing-Related Pain

Implications for Injury Prevention

23 adolescent pitchers (age 15.7 ± 1.4 years) were tested

12 pitchers had throwing-related pain in the prior season and were currently symptom-free, while the remaining 11 pitchers had no such history of pain

23 pitchers had a loss of internal rotation ROM (13° ± 10°, P < .001) and gain in external rotation ROM (11° ± 10°, P < .001) on the dominant versus non-dominant arm, with no effect on total ROM (2° ± 7° loss, P = .14)

Throwing-related pain in this population may be due to the inability of weakened posterior shoulder musculature to tolerate stress imparted on it by adaptively strengthened propulsive muscles

Trakis et al AJSM 2008
Pitch Counts

Age Pitches/Game
7–8   = 50
9–10  = 75
11–12 = 85
13–16 = 95
17–18 = 105

Source: Little League Baseball

Rest Periods Required

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Days of Rest</th>
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<td>14 &amp; under</td>
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<tr>
<td>1-30</td>
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Source: Little League Baseball

Pitch Smart Resource

https://www.mlb.com/pitch-smart
**Pitch Types & Recommended Age**

- Fastball: 8 +/- 2
- Change up: 10 +/- 3
- Slider: 16 +/- 2
- Curveball: 14 +/- 2
- Forkball: 16 +/- 2
- Knuckleball: 15 +/- 3
- Screwball: 17 +/- 2

*Source: Little League Baseball*

**Weighted Ball Training**

38 healthy baseball pitchers were randomized into a control group and an experimental group.

- Pitch velocity, shoulder and elbow PROM, shoulder strength, elbow varus torque, and shoulder internal rotation velocity were measured in both groups.
- Experimental group performed a 6-week weighted ball throwing program 3 times per week using balls ranging from 2 to 32 oz. while the control group only used a 5 oz. regulation baseball.
- Statistically significant increase of 4.3° of shoulder external rotation in the experimental group while overall injury rate was 24% (4 elbow injuries) in the experimental group.

**Instability**

- Acquired laxity > anterior micro instability
- MDI
- Secondary RC, bicipital and labral stress
- Caution with loading (snatch, jerks, flies, pressing, dips, etc.)
Rhythmic Stabilization

May be done in multiple planes and functional positions
Encourages co-contraction, joint position sense and stability
Challenge the patient in OCK & CKC

Rhythmic Stabilization
Video

PT Evaluation

Observe posture
A/PROM
MMT
Joint mobility
Palpation (TrP's)
Special tests
The Scapula

Resting alignment
Dynamic mechanics
SICK scapula
- Inferior border prominence
- Medial border prominence
- Superior border prominence

Scapular Positioning

The dominant-side scapula of overhead athletes was more internally rotated and anteriorly tilted than the non-dominant side scapula.
The dominant-side scapula of the tennis players was more protracted than that on the non-dominant side.
Scapular posture asymmetry in unilateral overhead athletes may be normal.

Oyam et al. J Athl Train. 2008

Scapular Dyskinesia - MLB Pitcher
ERD and GIRD

ERD (ext. rot. deficiency) - 5 deg or less w/PROM increases injury risk in throwers 2.3x (unpublished data)

Anatomical GIRD - normal loss of IR (18-20 deg), with adequate ER gain and TROM within 5 deg of the uninvolved side

Pathologic GIRD - A shoulder that has GIRD more than 18-20 deg and a concomitant loss of TROM > 5 deg (= 2.5x injury risk)

More on GIRD

Burkhart reports that an acceptable level of GIRD is defined as:

1) less than 20 deg loss of shoulder IR comparing shoulders bilaterally or

2) no greater than 10% loss of the total rotation seen in the non-throwing shoulder (Non dominant shoulder IR + ER ROM) x 10%

3) Ratio of GIRD to ERG needs to be 1 or less
GHJ PROM Deficits Increase Risk of Elbow Injury in Prof. Baseball Players
Prospective study 2005 - 2012
505 exams on 296 pitchers
Assess PROM for HER, HIR & shoulder flexion for throwing & non-throwing side
Bilateral differences greater than or equal to 5 deg in total shoulder rotation and flexion increase risk for elbow injuries 2.6 and 2.8x respectively

Key Special Tests
Hawkins, Neer impingement signs
O’Brien’s, pronated load, Biceps Load I & II, Speed’s for labrum
AC joint provocation
Sulcus sign, Apprehension, Jobe relocation
UCL stress testing

O’Brien Test Video
Sensitivity: O'Brien, Hawkins, Speed, Neer, Jobe
Specific: None
"There is no single maneuver that can accurately diagnosis SLAP lesions"

Pronated Load

Biceps Load 1 & 2
Speed's Test

Kinetic Assessment

- Thoracic spine mobility
- Core stability
- Hip mobility
- Hip stability
- SL stance
- Ankle mobility
- Integrated movement (FMS)

FMS
FMS Shoulder Mobility Video

FMS Trunk Stability Push-up Video

Key Recovery Principles

- Respect healing tissue
- Progressive, sequential & functional
- Embrace individual differences among clients
- Avoid loads to failure especially as they ease back into training
- Consistently assess and involve the client with threshold training
Threshold Training

Journal pain before, during and after activity
Mild soreness may be acceptable but should not have pain with throwing
24 hour rule = elevated soreness after a workout or training session must return to baseline level or less in 24 hours (or less)
Rehab/training progression is based 100% on pain response

Balance Prevents Overtraining

Non-operative Rehab

Resolve soft tissue restrictions
Resolve unwanted GIRD
Strengthen cuff and scap stabilizers
Emphasize stability
Incorporate entire kinetic chain
Rehab Approach

Visit #1 = HEP for cuff/scapular PREs, STM and stretching

Manual techniques

Limit and/or restrict throwing, hitting and OH training initially

Below shoulder height, then scapular plane and gradually move to overhead

Educate regarding pain and progression

Manual Therapy

GHJ mobilization

Dry Needling

IASTM

Stretching

Rehab Phases

Relative Rest, Mobility & Stabilization

Activation & Strengthening

Integrated CKC Strengthening & Power

Return to Play
Mobility Priorities

- Pec major/minor
- Lats
- Posterior rotator cuff/capsule
- Upper trap & levator (TPDN & IASTM)

90/90 Arm Sweep
Shoulder Mobility Exercises Video

Stretches

Posterior Shoulder Stretching

Low load long duration
30 seconds (8-10x)
Do not stretch into pain or impingement
Modified sleeper & cross body stretch can be used (roll posteriorly 20-30 deg)
Not encouraged prior to throwing or prior to tennis match

Wilk et al. JOSPT 2013
Scapular Activation

Scaption
Prone I, T, Y and Ws
HER and HIR
D2 exercises

RC Exercises

Side lying DB external rotation
Scaption
Prone I, T, Y and Ws
HER and HIR
D2 exercises
EMG Activity

Side lying ER produced the greatest amount of EMG activity for the infraspinatus (62% MVIC) and teres minor (67% MVIC)

The greatest amount of activity of the supraspinatus (82% MVIC), middle deltoid (87% MVIC), and posterior deltoid (88% MVIC) was observed during prone horizontal abduction at 100 degrees with full ER

Overhead Athletes
Strengthening Exercises
Video

Blood Flow Restriction (BFR) Training

Low-load BFR training increased muscle size and strength in limbs located proximal (chest, shoulders) and distal (biceps, triceps) to the restrictive stimulus

Reinold et al. JOSPT 2004

BFR Exercise Video

Body Blade Video

Integrated Closed Chain Shoulder Exercises Video
Benefits of unstable training surfaces include increased scapular activation. In a recent study published in the *J Phys Ther Sci 2013*, Seo et al revealed greater upper/middle trap and serratus activity while doing a push-up plus on a stability ball.

Unstable Closed Chain Shoulder Exercise Video

Rehab to Performance

Rehab exercises should include core and LE strengthening as well
Development pre-practice/game dynamic warm-up routines
Plyometric progressions (wall dribbles, chest pass, etc.)
Unilateral loading (sliders, pressing, pulling)
Exercise Prescription

Risk vs. reward

Kinetic chain mobility and stability define risk and ability

Recreational vs. elite

Individualized plan based on history, needs analysis and goals

Threatening Exercises

Full range chest press, flies and dips

Wide grip pull-ups

Heavy overhead lifts, hand stand push-ups

Burpees, bear crawls, undulating ropes

OH lifts and certain squat variations

Return to Play

Re-assess FMS (if needed)

Begin interval throwing, hitting or swimming training program (evidence-informed and graded dosage)

Maintain daily mobility work and essential scapular and RC exercises 2-3x/week

Use video analysis for feedback
Interval Throwing

Typical program in non-operative thrower lasts 4-6 weeks
Post-op throwing depends on procedure
Demands vary based on position
Pitchers must work up to 120 feet in long toss in most cases before mound throwing
Focus on fastball and change up initially
Long Toss Research

Hard, horizontal, flat-ground throws have biomechanical patterns similar to those of pitching and are, therefore, reasonable exercises for pitchers.
However, maximum-distance throws produce increased torques and changes in kinematics
Caution is advised in the use of these max distance throws for rehabilitation and training

Changes in Throwing Arm Mechanics at Increased Throwing Distances During Structured Long-Toss

Arm slot (P < .01), arm speed (P < .01), shoulder external rotation (P < .01), and elbow varus torque (P < .01) were significantly associated with long-toss throw distance
As throw distance increased, there was an increase in arm speed and shoulder external rotation and a decrease in arm slot for each distance.
Elbow varus torque increased with each distance up to 120’ m and then remained the same at 150’

SLAP Repairs

Arthroscopic repair of type II SLAP tears results in overall excellent results for individuals not involved in throwing or overhead sports
Results of type II SLAP repair in throwing or overhead athletes are much less predictable with rate of return for baseball players 22-64%

Elite Pitchers After Shoulder Surgery

287 elite male pitchers who underwent shoulder surgery with 99% on the dominant throwing shoulder
Most pitchers (276) were professional with a mean career length of 6.58 years. Post-operative clinical follow-up within these studies was 3.62 years
Primary diagnoses treated were RC tear = 120 (43%), Internal impingement = 82 (30%) and labral tear = 74 (27%)
Surgical procedures performed: Labral repair (157) or labral debridement (99), RC repair (29) or debridement (162), Thermal capsulorrhaphy (63) and subacromial decompression (42)

Return to Pitching & Performance in MLB Pitchers After Tommy John

A total of 179 pitchers with UCL tears who underwent reconstruction met the inclusion criteria and were analyzed
148 pitchers (83%) were able to RTP in the MLB, and 174 pitchers were able to RTP in the MLB and minor league combined (97.2%)
Only 5 pitchers (2.8%) were never able to RTP in either the MLB or minor league
Pitchers returned to the MLB at a mean 20.5 ± 9.72 months after UCL reconstruction
The length of career in the MLB after UCL reconstruction was 3.9 ± 2.84 years, although 56 of these patients were still currently actively pitching in the MLB at the start of the 2013 season
The revision rate was 3.9%

Elite Pitchers After Shoulder Surgery - Results

The overall rate of return to sport was low at 68%
Mean time to return to competitive pitching in a game situation was 12 months (range = 9 - 17)
22% of MLB pitchers never pitched again in MLB
Only 14% returned to competitive pitching in the same season as labral surgery
No one returned to competitive pitching in the same season after rotator cuff surgery
Reynolds et al reported a median of 2 seasons of pitching after debridement of partial thickness cuff tears
Mazoue and Andrews reported a mean of 0.7 seasons pitching (range 3 innings to 3 seasons) after mini-open RC repair

Harris et al Sports Health 2013

Erickson et al AJSM 2014
Questions?

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References


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