Recent Advances

2017

Rehabilitation of Shoulder in the Overhead Thrower

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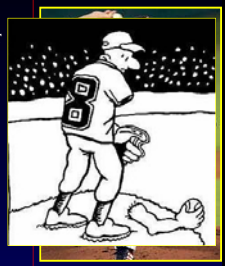
ANDREWS
Sports Medicine and Orthopaedic Center

CSM CHAMPION SPORTS MEDICINE

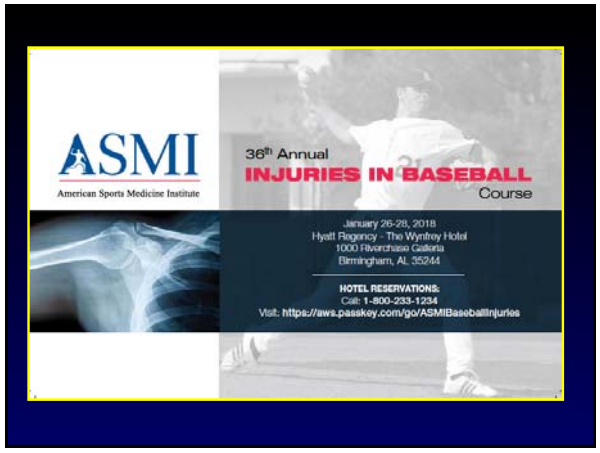
ASMI

The Overhead Thrower
Introduction

- Goals of presentation:
  - Discuss rehab concepts in the thrower *HIT the* ***HIGH POINTS***
  - Describe several treatment strategies for the shoulder & elbow:
    - ✓ *Post-Op Rehab Guidelines*
    - ✓ *Non-Op Rehab Approaches*
    - ✓ ROM in the thrower
    - ✓ GIRD & TROM
    - ✓ Multi-phased approach to rehab
    - ✓ New exercises – insights
    - ✓ Return to throwing – different throwing plan



Recent advances in the treatment of the overhead athlete



The Thrower's Shoulder
Treatment

- ✓ Non-operative rehabilitation is the first line of treatment
  - *Mainstay of treatment !!*
- Plays a key role in outcome
- Failed non-op treatment → adjust your rehab program
- Common diagnosis:
  - ✓ *Tendonitis*
  - ✓ *Biceps Pain*
  - ✓ *Internal impingement*
  - ✓ *Instability – SLAP lesions*

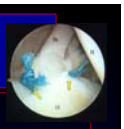
Evaluate – Strategize – Implement – Assess – Adjustments

Elbow Injuries – Overhead Thrower

- Tremendous forces & stress
  - ✓ *Acceleration phase: 64 NM valgus stress*
- Increase stress with specific
- pitches (*slider, split-finger)*
- Pitchers are bigger & stronger & able to generate
- Tremendous torques generated

Better recognition of injuries

Glenoid Labral Lesions
Clinical Outcomes



Fedoriw, Linter et al: AJSM '14

- Return to play after Rx of SLAP on professional baseball players:
- ✓ Non-Op compared to Surgery
- 119 consecutive patients retrospective review
- ✓ *40% Pitchers return to play & 22% return to previous play with non –operative Rx*
- ✓ *48% Pitchers return to play & 7% return to previous level after SLAP repair*
- ✓ *Position players: non-op (39% & 26%)*
  SLAP repair (85% & 54%)

Rehabilitation Overhead Thrower
Rehabilitation Overview:

- ✓ Rehabilitation strategies for the overhead throwing athlete:
- ✓ Stretching & flexibility
- ✓ Activation drills
- ✓ Restoring balance
- ✓ Restore scapular position (posture)
- ✓ Body restoration (core, hips & legs
- ✓ Plyometrics
- ✓ Endurance
- ✓ Gradual return to throwing

Evaluate – Strategize – Implement – Assess – Adjustments

UCL Pathomechanics

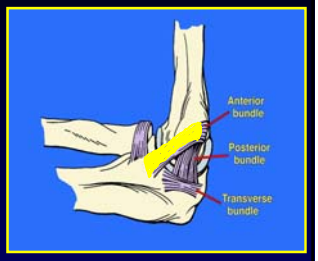
Maximum External Rotation

Elbow Varus Torque = 64 Nm (40#)

Fleisig GS: AJSM '07

Medial Elbow Pathologies
UCL Sprains

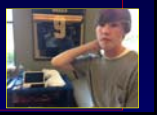
- UCL is the main medial stabilizer of the elbow
- Anterior bundle is the primary structure involved in throwing



Rehab UCL Repair Internal Brace

- ✓ *Week 1:* Elbow brace at 90° locked 5-7 days
  - ✓ Shoulder PROM & isometric exercises
  - ✓ Scapular exercises, wrist PROM
- ✓ *Week 2:* ROM Brace (30-110°)
  - ✓ Continue shoulder exercises isotonics
  - ✓ Initiate elbow & wrist exercises
- ✓ *Week 3-4:*
  - ✓ Thrower's Ten Program
  - ✓ Week 4-5 full PROM
- ✓ *Week 5-6:*
  - ✓ Advanced Thrower's Ten Program

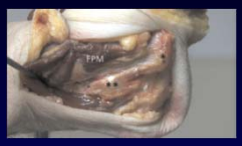
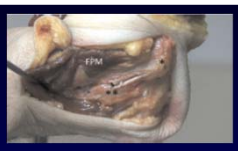




Biomechanical Comparison of Ulnar Collateral Ligament Repair With Internal Bracing Versus Modified Jobe Reconstruction

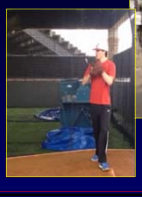
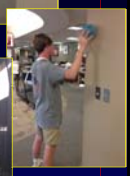
AJSM 2016

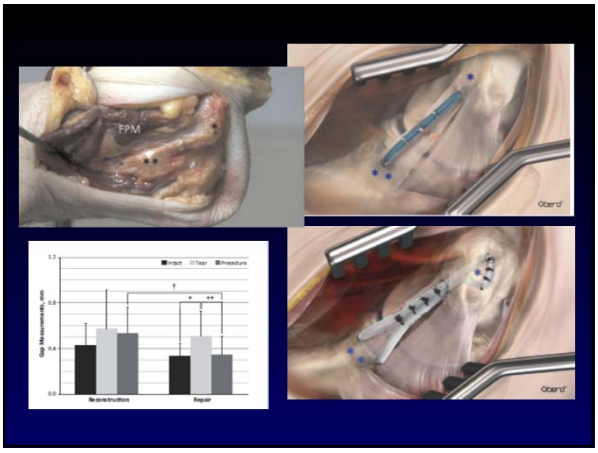
Jeffrey R. Dugas,* MD, Brian L. Walters,* MD, David P. Beason,*† MS, Glenn S. Fleisig,* PhD, and Justin E. Chronister,* MD
Investigation conducted at the American Sports Medicine Institute, Birmingham, Alabama, USA

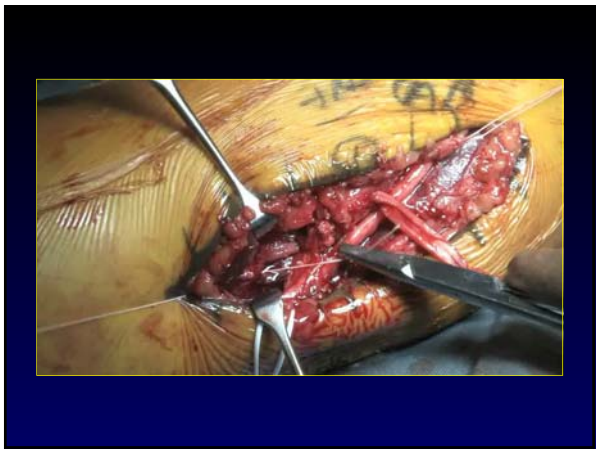
Rehab UCL Repair Internal Brace

- ✓ *Week 6:*
  - ✓ Advanced Thrower's Ten Program
  - ✓ Plyometrics 2 hand drills
- ✓ *Week 8:*
  - ✓ Plyo 1 hand drills
  - ✓ hitting week 10
- ✓ *Week 11-16:*
  - ✓ ITP Phase I (week 10-11)
  - ✓ ITP Phase II (wk 14-15)
- ✓ *Week 16>:*
  - ✓ Return to play



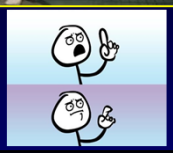
UCL Reconstruction



UCL RECONSTRUCTION REHAB

Return to Activity

- ✓ITP (I): long toss – week 16
- ✓ITP (II): mound - week 26
- ✓Competitive throwing – 8-9 mos *(simulated game)*
- ✓*RTP: 12-16 mos*
- ✓*"Thrower's Ten" program*
  - » Strengthening & Stretching



Rehab UCL Reconstruction

Overview – Rehab Phases

- ✓Week 1: Posterior splint 90°
- ✓Week 2: ROM brace 30-90°
- ✓Week 3>: gradually increase elbow
  - ✓Week 4: 10-125°
  - ✓Week 5-6: 0- 135°>
- ✓Perform shoulder PROM immediately post-op
- ✓Wrist PROM immediately post-op

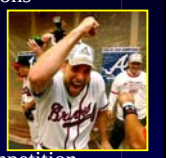
Outcome of Ulnar Collateral Ligament Reconstruction of the Elbow in 1281 Athletes

AJSM 2010

Results in 743 Athletes With Minimum 2-Year Follow-Up

E. Lyle Cain Jr.,*† MD, James R. Andrews,† MD, Jeffrey R. Dugas,† MD, Kevin E. Wilk,† PT, DPT, Christopher S. McMichael,† James C. Walter II,§ MD, Reneé S. Riley,† MD, and Scott T. Arthur,† MD
Investigation performed at the American Sports Medicine Institute, Birmingham, Alabama

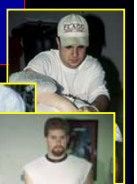
- 1281 UCL procedures, 1265 reconstructions
- Follow-up on 79% (743 patients)
- *95% baseball players (89% pitchers)*
- Average follow-up: 49.1 months
- ✓*83% returned to same level (recon)*
- 63% of repairs returned to same level competition
- ✓Return to competition: ***11.6 months***
- ✓ITP initiated – 4.4 months

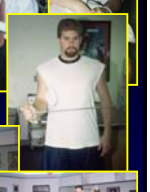


UCL RECONSTRUCTION REHAB

Muscular Strength Training

- Wrist & hand isometrics day 1
- Isometrics UE week 1-2
- Active ROM week 2-3
- Isotonics program week 3-4
- Thrower's Ten program week 4/5
- Weight lifting week 10-12
- Sports (golf) week 11
- Plyometrics
  - » Two hand drills week 12
  - » One hand drills week 14





Rehabilitation Biceps Pain

The Painful Long Head of the Biceps Brachii

Nonoperative Treatment Approaches

Clin Spts Med '16

Kevin E. Wilk, PT, DPT[a,b,c,*]
Todd R. Hooks, PT, ATC, OCS, SCS, NREMT-I, CSCS, CMTPT[d,e]

KEYWORDS

• Rehabilitation • Shoulder • Elbow • Biceps

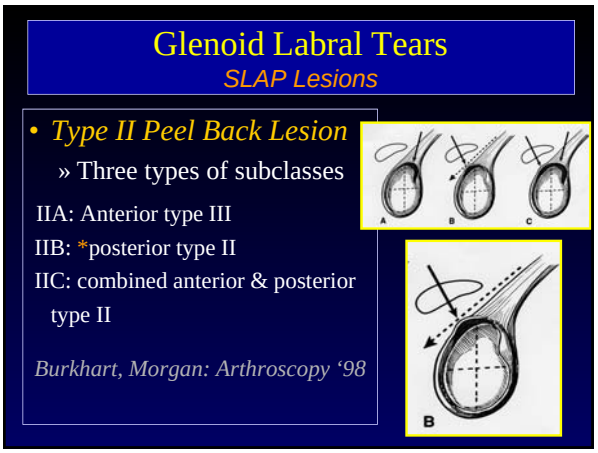
KEY POINTS

• Abnormality involving the long head of the biceps has a w
affecting either the tendon or the supporting tissues.
• The long head of the biceps tendon can be a primary source o
of pain as a result of shoulder dysfunction.

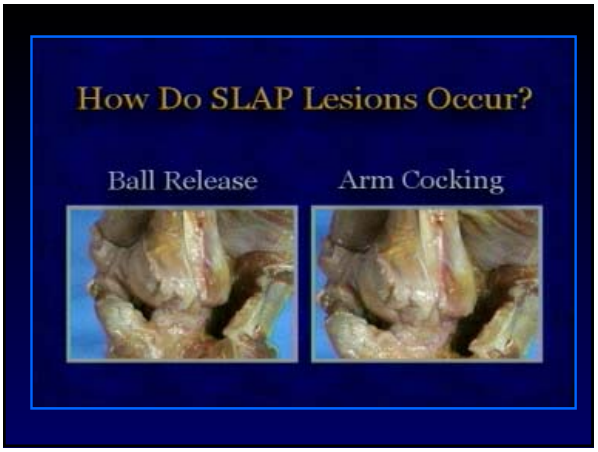
Box 1
Classification of long head biceps brachii pain

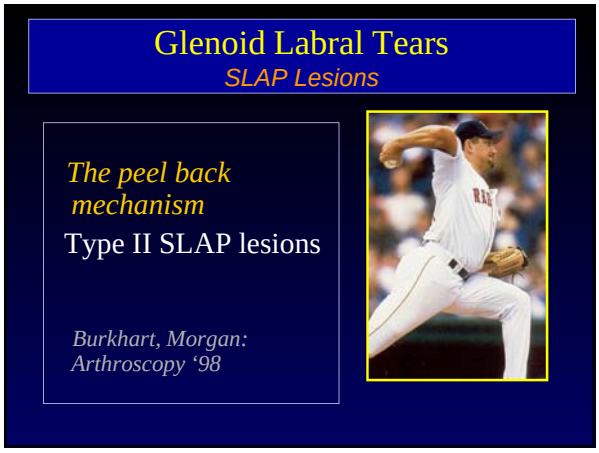
Traumatic injuries
Instability
Tendinopathies
Tendonitis
Tendinosis
Biomechanical dysfunction
Scapular dysfunction
Glenohumeral joint hypermobility
Capsular involvement
SLAP lesions

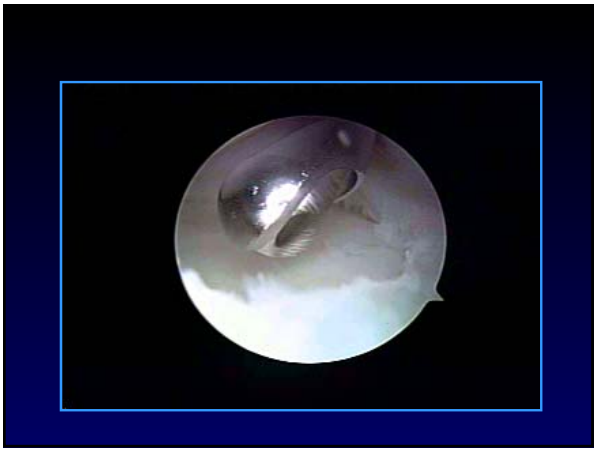

SLAP Lesion – Arthroscopic View
Overhead Throwing Athlete
Partial Undersurface Infraspinatus Tear
Posterior Labral Detachment With "Peel-Back"


Glenoid Labral Tears
SLAP Lesions
• Type II Peel Back Lesion
» Three types of subclasses
IIA: Anterior type III
IIB: *posterior type II
IIC: combined anterior & posterior type II
Burkhart, Morgan: Arthroscopy '98
A
B
C
B


Rehabilitation Following SLAP Surgery

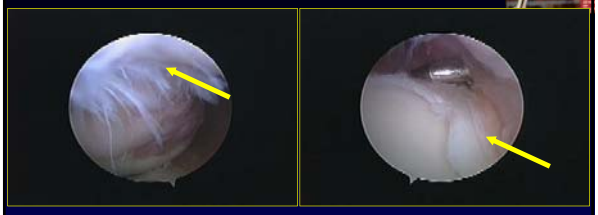

How Do SLAP Lesions Occur?
Ball Release
Arm Cocking


Glenoid Labral Tears
SLAP Lesions
The peel back mechanism
Type II SLAP lesions
Burkhart, Morgan: Arthroscopy '98



SLAP Lesion – Arthroscopic View

Overhead Throwing Athlete

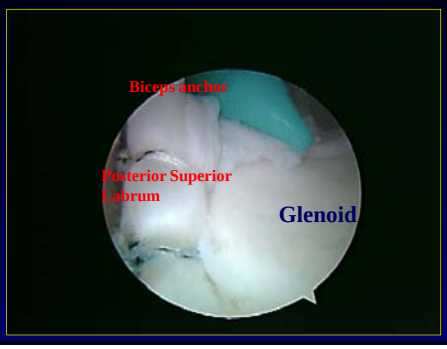


Partial Undersurface Infraspinatus Tear

Posterior Labral Detachment With "Peel-Back"

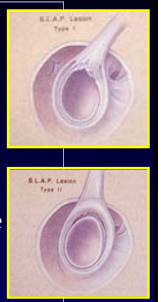
SLAP Repair
1999

SLAP Repair
2014

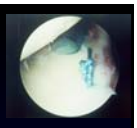


SLAP Lesion Repair
Rehab Guidelines

- Rehabilitation must match the surgery
  - » *Repair vs. Debridement*
- Based on type of lesion
  - » SLAP classification I thru IV (VIII)
- Based on severity of SLAP lesion
- Consider patient's age
- Emphasis on dynamic stabilization
- Do not overstress healing tissue (excessive
- Minimize biceps activity (II, IV) Repairs
- Microtrauma injury -
  *think dynamic stabilization !!!



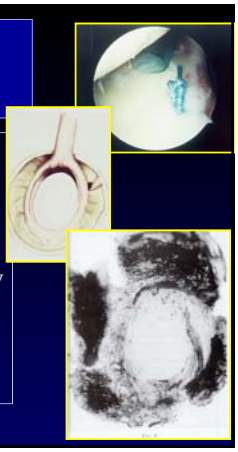
Rehabilitation Following SLAP Repair
Overview



- *Concern is to control forces/loads on repaired labrum
- ER/IR motion usually *Not* a problem *no excessive motion for 12 wks**
- Restoration of full arm elevation (flexion) sometimes difficult
- *Determine extent of lesion**
  - » *Number of suture anchors used*
  - » *Location of lesion*
- Ensure dynamic stability is present

Rehabilitation Following SLAP Repair
Precautions

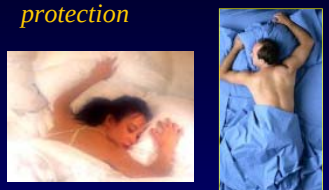
- Control forces for 6-8 weeks
- No overhead movements (above 90) for 3-4 weeks
- Need stable glenohumeral joint
- Emphasize dynamic joint stability
  - » Minimize GH translation
- No isolated biceps 8 weeks
  - » No heavy lifting

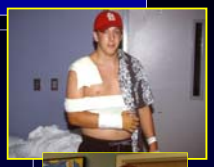


Rehabilitation Following SLAP Repair
Range of Motion Progression

- Sling for 3-4 weeks
  - » Sleep immobilizer 4 weeks

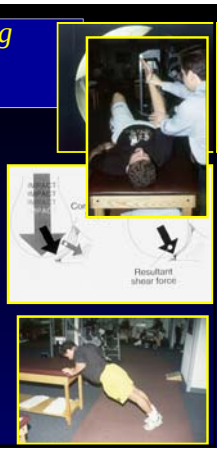
Shoulder immobilizer for protection





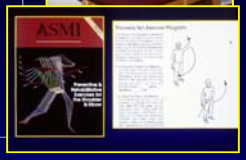

Rehabilitation Following SLAP Repair
Precautions

- No CKC exercise drills till 8 weeks post-operative
- No resisted movements above 90 degrees elevation for 8 weeks
- No heavy bench press, heavy lifting overhead till 3 months post-operative



Rehabilitation Following SLAP Repair
Weeks 3-4

- Remove ROM restrictions
- Gradually increase ROM
  - » Flexion to tolerance
  - ✓ER/IR at 90^0 ABD
- Full ROM @ week 7-8
  - » ER @90 abd to 95-105
  - » in overhead athletes
- Progress isotonics
  - » *"thrower's ten program"*

Rehabilitation Following SLAP Repair
Range of Motion Progression

- Sling for 3-4 weeks
  - » Sleep immobilizer 4 weeks
- Immediate *"limited motion"*
  - » AAROM / PROM flexion to 70^0
  - » Weeks 2-4: flexion to 90
- Motion above 90 begins week 4-5
- ER/IR @ 90 deg abd. Week 5
- Full *"normal"* ROM week 8
- Week 8-12: return to *throwers' motion* – ER to 115 deg

Rehabilitation Following SLAP Repair

- Full ROM by week 6-9
  - ✓ER to 90^0 by week 6-7
  - ✓ER to 105^0 by week 7-8
  - ✓ER to 115 at week 10-12
- Plyometrics week 8
  - » 2 hand plyos week 8-10
  - » 1 hand plyos week 12
- No CKC drills for 8-10 weeks
- Isolated biceps: initiate week 8
  - » Light & progress





Rehabilitation Following SLAP Repair
Muscular Training

- Isometrics immediately – *sub program!!*
- Active ROM week 3
- *Light* isotonics week 4-6
- No isolated biceps for 8 weeks
- No CKC exercises for 8 weeks
- Advanced strengthening wk 10-12
- Plyometrics week 12-14
- Interval throwing week 16 (toss)
- Interval mound throwing program 5-6mos
- Interval hitting program week 12-14


The Overhead Thrower
Introduction

- *Highly skilled athlete*
- *Requires flexibility, muscle strength, coordination, synchronicity & NM efficiency*
- Proper throwing mechanics
- Proper training program

Injuries Are Common to the Throwers Shoulder & Elbow

Tremendous stresses & velocities

Rehabilitation Following SLAP Repair
Functional Activities

- *Initiate throwing program* week 16
  - » ITP long toss: week 16
  - » ITP mound program week 22-26
  - » Competitive throwing: 7-9 months
  - » Interval Golf week 14
- Athletes must continue ROM & strengthening program
- Return to sports:
  - » *Overhead sports: 6-9 months*

The Overhead Thrower
Introduction - Injuries

- Shoulder & elbow injuries are common in baseball – and appear to be increasing
- In professional baseball:
- ✓ 28 % of all injuries occur to the shoulder joint
- 22 % of all injuries occur to elbow joint
- Length of injury time is increasing – days on the disabled list days

Conte et al: Am J Spts Med '01

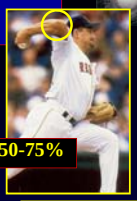
- ✓ In youth baseball – 50 % of players (9-14) complained of elbow or shoulder pain

Lyman et al: Am J Spts Med '02

- ✓ UE 75% time lost college baseball players

McFarland et al: Clin J Spts Med '98

50-75%




What's New Thrower's Shoulder
New Rehab Concepts

- ✓ GIRD assessment
- ✓ Assessment of humeral retrotorsion
- ✓ ROM & association with injuries
- ✓ Stretching techniques
- ✓ Thrower's Ten Program
- ✓ Advanced Thrower's Ten Program
- ✓ Lower Trapezius activation
- ✓ Serratus anterior activation
- ✓ Planking
- ✓ Shoulder & Hips/Core activation
- ✓ Endurance
- ✓ Weighted Ball Throwing
- ✓ BFR

Thrower's Shoulder
Key Points

FACT

- ✓ Pitchers sustain injuries at the highest rate
  - ✓ *64% of all team injuries pitchers compared position players*
  - ✓ *>73% of all pitchers injuries are to their shoulder/elbow*
- ✓ Specific risk factors increases injuries
  - ✓ *Pitching when fatigued, or pitch too much (volume), improper throwing mechanics, or max effort - all increase injury risk*
- ✓ GIRD & GERI is predominantly due to boney adaptations
  - ✓ *~83% boney & ~17% due to soft tissue*
- ✓ Maintaining motion in throwing shoulder when healthy isn't difficult
- ✓ Specific exercises & stretches are important – maintain !

The Overhead Thrower
Introduction

- Overhead throwing motion
- Extraordinary demands on shoulder & elbow joint
  - *Fastest human movement – 7,230 o/s*
  - *Youth:6382°/s High School:6545°/s*
  - *Late cocking to ball release 0.03 sec.*
- Tremendous forces generated
  - *Anterior displacement 0.5 x BW*
  - *Distraction forces 1 x BW at ball release*

Fleisig et al: Am J Spts Med '95
Fleisig et al: J Biomech '99

Injuries in Baseball Players
Incidence of Injury

- ✓ Major League Baseball Injuries 1998-2015
- ✓ DL Days:
  - ✓ 72% of all DL days are due to shoulder &/or elbow injuries
  - ✓ 1998-2007: 2:1 shoulder to elbow DL days
  - ✓ 2007 to now: 1.9:1 elbow to shoulder DL days
- ✓ 61% of all DL days are pitchers
  - ✓ relievers account for 32.5 % of DL days
  - ✓ starters account for 30.7% of DL days

The Overhead Thrower
Introduction

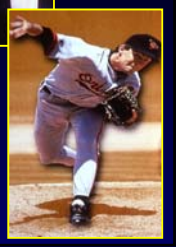
- Overhead throwing motion
  - Moderate to high levels of muscular activity
    - » *80-120 % of MVIC during acceleration phase ofpitch*

DiGiovine et al: JSES'92

- Effective transfer of kinetic energy
  - » *Over 60% of kinetic energy during pitch generated by legs*

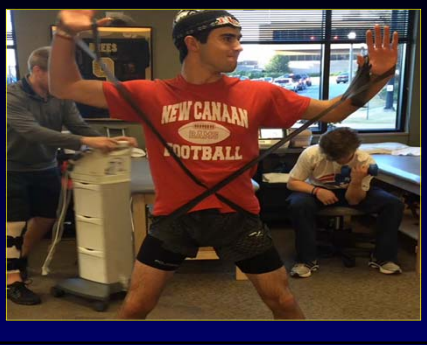
Toyoshima et al: Biomech '86

Specific Rehabilitation Concepts



REHAB THROWER'S ARM
Lower Extremity Strengthening

REHAB THROWER'S ARM
Linking The UE & LE



REHAB THROWER'S ARM
Lower Extremity Strengthening

REHAB THROWER'S ARM
Linking The UE & LE

Linking UE & LE

Rehabilitation of Overhead Athlete

Motion Imbalance Program

- ✓Improve IR ROM
- ✓Restore total rotational ROM balance

Capsular Restriction ⟷ *Musculotendinous*

- Supine Horizontal Adduct Stretch
- Sleeper's stretch
- Joint mobilization

Treatment based on assessment




Rehabilitation Programs for Throwers

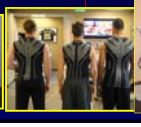
- ROM/Flexibility Improvement ⟶ IR/Horz Add
- Laxity ⟶ Stabilization
- Tendinitis ⟶ Reduce Pain/Inflammation
- Partial Thickness ⟶ Tissue Regeneration/Strength
- Postural Adaptations ⟶ Posture/Core
- Biomechanical Faults ⟶ Correct Throw

Rehabilitation of Overhead Athlete

Postural Correction Program

- Improve soft tissue flexibility
- Pectoralis minor/maj stretches
- Strengthen Rhomboids/ Trapezius
- Neuromuscular control drills
- Scapular ⟷ T spine -Pelvis Link
- Proprioception of scapular
- Scapular shirt




Rehabilitation of Overhead Athlete

Stabilization Program

- Emphasize dynamic stabilization drills
  - » Neuromuscular control
  - » Rhythmic stabilization
  - » Proprioception drills
  - » Perturbation activities
- Muscular balance
  - » ER/IR
  - » ER/Deltoid
  - » Scapular ratios
- Entire body awareness (core, hips)
- Core stabilization drills - tone

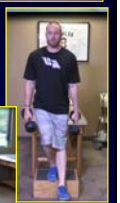




Rehabilitation of Overhead Athlete

Kinetic Chain Effect

- Assess & treat deficiencies in the entire kinetic chain
- GH, ST, Core, Hips, Legs
- Pelvic girdle ⟷ Shoulder girdle
- Hip abduction, ER, Extension
- ND & D Hip PROM
- Core position & stabilization

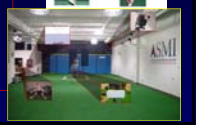



Rehabilitation of Overhead Athlete
Correct Biomechanics Program

- Is athlete able to get into proper body position – to perform task
- Adaquate/ proper ROM
- Body awareness – proprioception
- Break it down into components
  - ✓ analyze each phase of the throw
  - ✓ proper body position?
- Biomechanical assessment

Motion Analysis Study ⟷ *Coach*





Thrower's Shoulder


Hypomobility

Hyperlaxity

Scapular – Anterior Tilted & Protracted

Poor Posture Weak Core

Usually Presents with numerous contributing factors

Rehabilitation of Overhead Athlete
Reduce Inflammation Program

- Reduce Pain &/or Inflammation
- ✓ *Tendinitis program*
- ✓ Anti-inflammatory treatment
  - ✓ NSAIDs , Laser, Iontophoresis
- ✓ Restore tendon health
- ✓ Flexibility (light program)
- ✓ Strengthening program

Determine cause of onset



The Thrower's Shoulder
Overview

- *Excessive Motion especially External Rotation*
- Requires stability
- Inherent hyper-laxity
- *Allows tremendous mobility*

Fine line:
Too loose & just right !!!

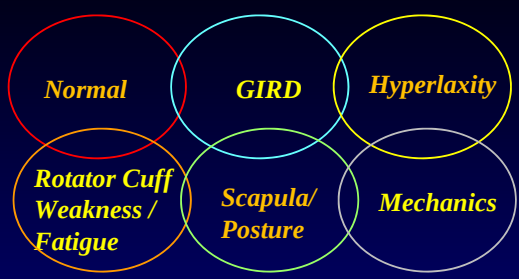
Rehabilitation of Overhead Athlete
Tissue Regeneration Program

- Rotator Cuff Partial Thickness Tears
- *Tendonosis - Tendinopathy*
- Restore musculotendinous flexibility
- Promote collagen synthesis & organization:
  - ✓ ↑ blood flow – laser, heat, etc
  - ✓ Eccentric loading of muscle
  - ✓ Higher reps (15/20 reps)
  - ✓ BFR
  - ✓ Nutrition - protein

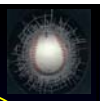
Tissue Regeneration

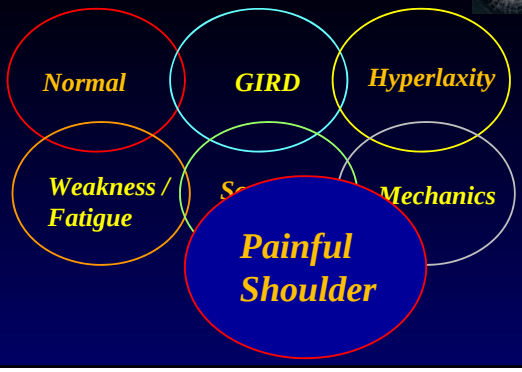



Internal Impingement
Proposed Mechanism



Internal Impingement





Rehabilitation of the Overhead Thrower

Rehabilitation Guidelines

- **Youth – Adolescent**
  - ✓ Weak hips/core
  - ✓ Posterior chain weakness
  - ✓ Scapular weakness
  - ✓ ER weakness
  - ✓ Fatigue easily-endurance
  - ✓ Pitching biomechanics
- **Elite Professional**
  - ✓ Fine tune the shoulder
  - ✓ Calm inflamed tissue
  - ✓ Correct imbalances
  - ✓ Small corrections = big
  - ✓ Find the "issue/lesion"
  - ✓ Train power transfer




Andrews, Wilk, Reed et al: Spring Trn '00

- 31 *asymptomatic* professional baseball pitchers tested at onset spring training
- MRI of glenohumeral joint
- ✓ 28/31 (90 %) abnormal glenoid labrum
- ✓ 27/31 (87 %) abnormal rotator cuff appearance
- 12/31 (39%) humeral head changes
- *All pitchers were pain-free at time of study*
- *All MRI scans assessed by radiologist*

Thrower's Shoulders Are Not Normal on MRI

2 Baseball Players

16 yrs old

23 yrs old

Shoulder Imaging & Clinical Rx

- ✓ ***BARF***
  Blind Application of Radiographic Findings
- ✓ ***VOMIT***
  Victim of Modern Imaging Technology

Rx the Patient - Not the MRI

16 yrs old

Prevention of Arm Injuries
5 Specific Categories

- ✓Pitch Counts:
  -
- ✓Rest:
  -
- ✓Endurance:
  -
- ✓Conditioning:
  -
- ✓NM control & Coordination

Prevention of Arm Injuries
5 Specific Categories

- ✓Pitch Counts:
  - Innings, Games, Year, …
- ✓Rest:
  - Per week, end of year rest, no year round pitch
- ✓Endurance:
  - Prevent fatigue, don't pitch when tired
- ✓Conditioning:
  - Proper ROM, strength, dynamic stability
- ✓NM control & Coordination
  - Proprioception & neuromuscular drills

MLB Pitchers ≥ 200 Wins

Youth Baseball Player
Risk Factors for Injury

Rehabilitation of the Thrower
Rehabilitation – 4 Phases Program

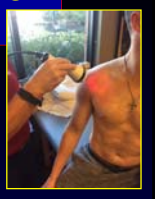
- **Phase I: Acute Phase:**
- **Phase II: Subacute Phase:**
- **Phase III: Advanced Phase:**
- **Phase IV: Return to Activity Phase:**

Rehabilitation of the Thrower
Rehabilitation – 4 Phases Program

- **Phase I: Acute Phase:**
  - ✓ Normalize motion
  - ✓ Decrease inflammation & pain
  - ✓ Normalize muscular ratios
  - ✓ Activation of specific muscles
  - ✓ Establish Scapular base (posture)
- **Phase II: Subacute Phase:**
  - ✓ Continue stretching program
  - ✓ Isotonic strengthening program
    - ✓ Scapular & Glenohumeral joint
    - ✓ *Thrower's Ten Program*
  - ✓ Core & Leg program

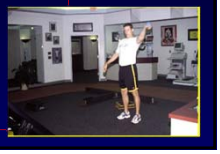

Rehabilitation of the Thrower
Diminish Pain & Inflammation

- Rest – from throwing
- Stretch /motion - tolerance
- Exercise at tolerance level
- Modalities
  - ✓ *Laser*
  - ✓ *Iontophoresis*
  - ✓ *Injection*
  - ✓ *Hybresis*
  - ✓ *Heat or ice ???*

Rehabilitation of the Thrower
Rehabilitation – 4 Phases Program

- **Phase III: Advanced Phase:**
  - ✓ Advanced isotonic program
    - ✓ Strength, power, & endurance
  - ✓ *Advanced thrower's ten program*
  - ✓ Plyometrics
  - ✓ Continue stretching & ROM program
- **Phase IV: Return to Activity Phase:**
  - ✓ Advanced thrower's ten program
    - ✓ Adjust the program when throwing
  - ✓ Plyometrics
  - ✓ Interval throwing program (ITP)
  - ✓ Light stretching program (maintain)

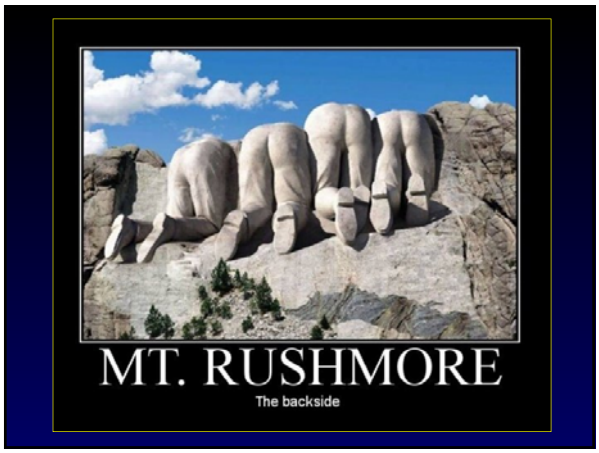



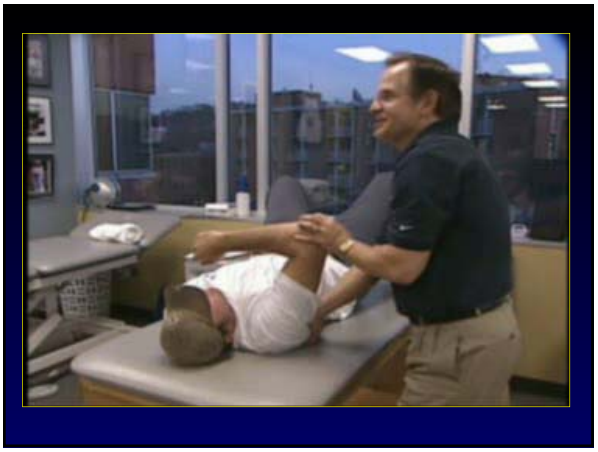
Rehabilitation of the Thrower's Shoulder
Diminish Pain & Inflammation & DOMS

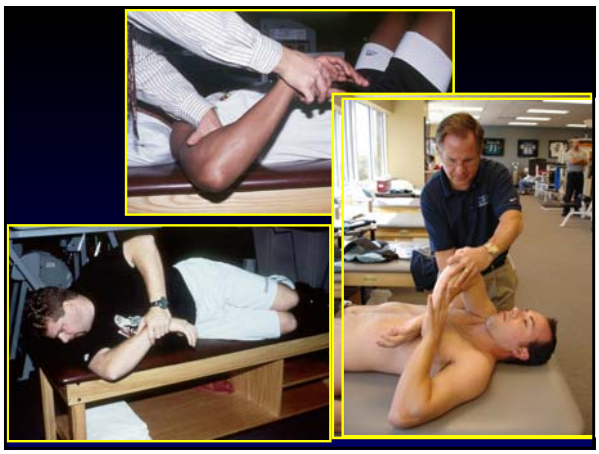

Rehabilitation of the Thrower
Rehabilitation – Keys to Treatment

- ✓ Active Rest – *not total rest*
  Abstain from throwing (2 – 8 weeks)
- ✓ Stretch – normalize motion (esp IR)
- ✓ Strengthen ER, scapular muscles
- ✓ Enhance dynamic stabilization
  mid-range progressing toward end-range
- ✓ Gradual return to throwing
- ✓ Return to competitive throwing


Stretching Techniques


MT. RUSHMORE
The backside






Sleeper's Stretch

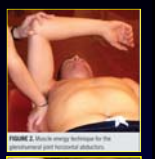
Modified Sleeper's Stretch

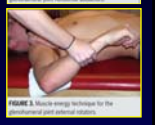
Wilk et al: JOSPT '13

Moore, Laudner, McLoda et al: JOSPT '11

- 61 Division I baseball players randomized into 1 of 3 groups:
  - » muscle energy technique for horz abd
  - » muscle energy technique for ER
  - » control

✓*A single application of MET for the shldr horz abd provided immediate gain in IR & horizontal adduction*





Modified Side-Lying Cross Body Stretch

Wilk et al: JOSPT '13

Laudner, Sipes, Wilson: J Athl Trn '08

- Effects of sleeper stretch during a season
- 33 Division I baseball players were evaluated (15 pitchers, 18 position players)
- ROM assessed pre & post season

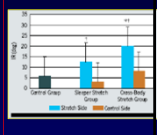
✓*3 stretches of 30 sec stretch*

✓*Stretching produced an increase in IR ROM – however not stat sign*

McClure et al: JOSPT '07

- Randomized controlled comparison for stretching posterior shoulder tightness
- 30 subjects with 10 deg loss of IR compared contralateral side
- Compared sleeper stretch (n=15) to cross body (n=15) to control group (n=24)
- Stretches 5 reps for 30 sec for 4 weeks

✓*Significant improvement in IR in cross body group (20°) compared to control (6°) – sleeper stretch(12°) no sign increase In IR compared to control*



Deficits in Glenohumeral Passive Range of Motion Increase Risk of Shoulder Injury in Professional Baseball Pitchers

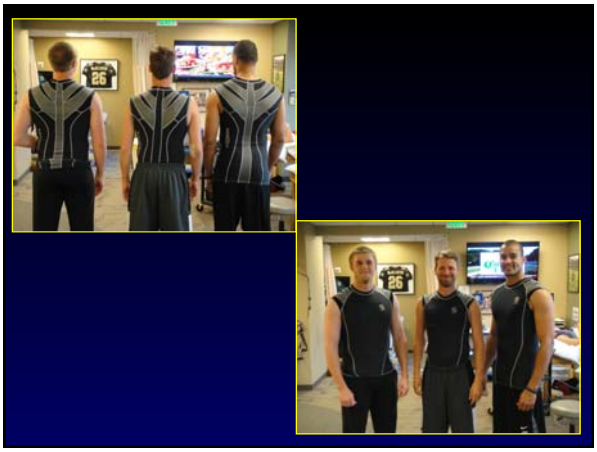
A Prospective Study

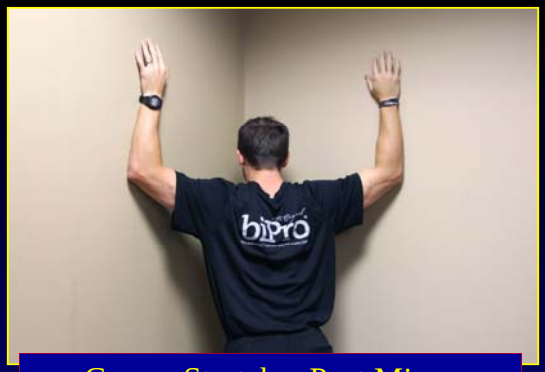
AJSM '15

Wilk, Macrina, Fleisig, et al: AJSM '15

- 8 year GIRD study – 1 professional team
- N=505 Pitcher/ Seasons (n=296 pitchers)
- Correlation of spring training shoulder ROM to DL days & surgery (shoulder)

✓ *GIRD did not correlate (p=0.862)*
✓ *TROM did correlate)p=<0.05)*
✓ *>ER was protective*
✓ *77 shoulder injuries*
✓ *Players who had surgery spent 3x more time on DL getting well, 208.5 days on DL*





Corner Stretch – Pect Minor

Rehabilitation of the Thrower's Shoulder

ROM & Stretching

- *Can you stretch too much ??*
  - ✓Stretch into ER ROM ?
  - ✓PROM vs Stretching
  - ✓Stretch into IR?
  - ✓Too much ??

What about the TROM concept ?

ROM & Stretching
My Thoughts:

- *Stretching & ROM on healthy players:*
  - ✓ Stretch to maintain healthy ROM
  - ✓ Hold stretch for 30 sec, 3-4 stretches to maintain
  - ✓ Dynamic stretching prior to throwing
- *Stretching & ROM on players with injury*
  - ✓ Stretch to improve motion to desired ROM
  - ✓ Consider TROM & GIRD
  - ✓ Balance the GH joint PROM
  - ✓ Stretch for 30 sec but more stretches, more times per day
  - ✓ Determine cause of loss of motion (capsule,muscle,…)

Enhancing Activation of Posterior Cuff

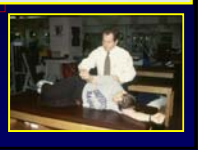
Rehabilitation of the Thrower
Rehabilitation – 4 Phases Program

- **Phase I: Acute Phase:**
  - ✓ Normalize motion
  - ✓ Decrease inflammation & pain
  - ✓ Normalize muscular ratios
  - ✓ Activation of specific muscles
  - ✓ Establish Scapular base
- **Phase II: Subacute Phase:**
  - ✓ Continue stretching program
  - ✓ Isotonic strengthening program
    - ✓ Scapular & Glenohumeral joint
    - ✓ Fine tune muscular ratios
  - ✓ Core & Leg program

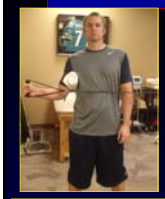
Dynamic Stabilization & Activation of Rotator Cuff

Rehabilitation of the Thrower's Shoulder
Rehabilitation

- ***Emphasize dynamic stabilization***
- ER & scapular muscle strengthening
  - » ER / IR ratio (70 – 75%)
  - » Scapular retractors / protractors

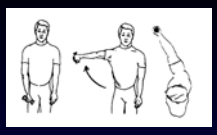


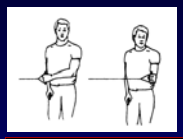
Thrower's Ten Program



Thrower's Ten Program


D2 PNF Flexion

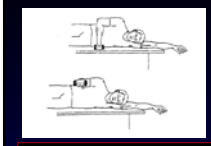

Standing Full Can

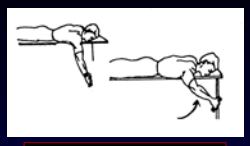

Tubing ER/IR

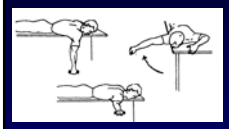

Lateral Raises

www.asmi.org

Thrower's Ten Program


Sidelying ER


Prone Full Can


Prone Horz Abduct


Prone Row into ER

Rehabilitation of the Thrower's Shoulder

Rehabilitation Concepts

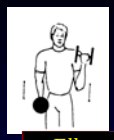
- Improve proprioception and Neuromuscular control

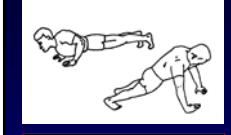
Mid-Range ⟷ End-Range

- *Progress gradually to fast speed movements*
- *Enhance end range dynamic stabilization*
  - » Improve proprioception
  - » Co-contraction rotator cuff
  - » Centralize humeral head

Thrower's Ten Program

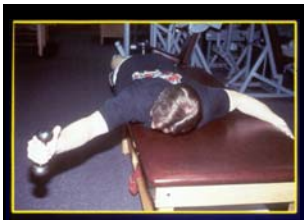

Prone rowing

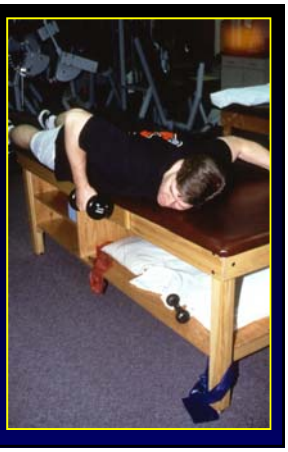

Elbow Flex/Ext


Push-Ups


Sup/Pron & Wrist Flex/Ext

www.asmi.org





Scapular Muscle Training

- *Alternating day schedule:*
  - ✓*Isotonic table exercises days-*
    - Goal: strengthen/hypertrophy
    - traditional exercises
    - progress with dumbbells
    - neuromuscular drills
  - ✓*Stability Ball days-*
    - Goal: NM control & dynamic stab
    - Isotonic exercises on stability ball
    - NM control drills
    - Core, hips & legs

Kibler et al: AJSM '08

TABLE 2
Average Amplitude EMG Activity All Subjects (N = 39) by Exercises[a]

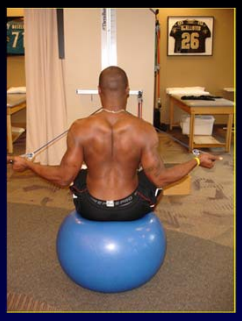
	Inferior Glide	Low Row	Lawnmower	Robbery
Upper trapezius	8.1 (5.9)	10.4 (8.1)	21.8 (15.7)	31.6 (16.7)
Lower trapezius	19.4 (26.6)	15.4 (11.6)	30.5 (19.2)	27.0 (20.8)
Serratus anterior	23.4 (19.6)	28.2 (20.8)	25.5 (21.4)	20.9 (16.8)
Anterior deltoid	4.6 (2.4)	16.6 (13.3)	5.5 (3.6)	7.4 (5.5)
Posterior deltoid	8.6 (6.0)	42.4 (23.2)	16.2 (10.6)	14.0 (9.2)
Differences between muscles	SA > UT, AD, PD LT = all others	PD > UT, LT, AD PD = SA SA > UT, LT	UT = LT = SA LT > AD, PD PD > AD	UT = LT = SA > AD UT = LT > PD

[a]Data are given in means (standard deviations). EMG, electromyography; RB, robbery; LM, lawnmower; SA, serratus anterior; UT, upper trapezius; AD, anterior deltoid; PD, posterior deltoid; LT, lower trapezius.

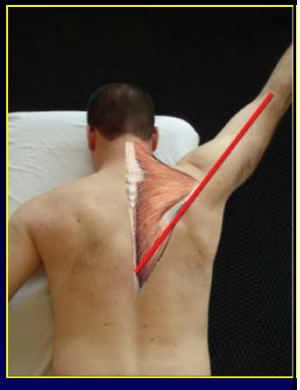
Scapular Muscle Training

Alternating day schedule:

- *Isotonic table exercises days- strength*
- *Physioball – NM benefits, core, legs, bilateral*



Lower Trapezius Exercises !!!



Kibler et al: AJSM '08

TABLE 2
Average Amplitude EMG Activity All Sub

	Inferior Glide	Low Row	Lawnmow
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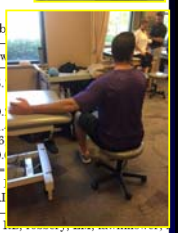
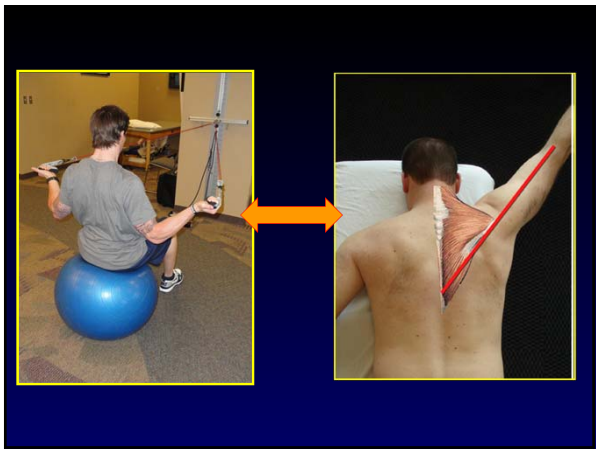
Posterior deltoid	8.6 (6.0)	42.4 (23.2)	16.2 (10.
Differences between muscles	SA > UT, AD, PD LT = all others	PD > UT, LT, AD PD = SA SA > UT, LT	UT = LT = LT > AD, PD > AI

[a]Data are given in means (standard deviations). EMG, electromyography;
SA, serratus anterior; UT, upper trapezius; AD, anterior deltoid; PD, posterior deltoid; LT, lower trapezius.






Reverse Wall Slides


Scapular neuromuscular control drills

Rehabilitation of the Thrower's Shoulder

Progress Strengthening Program

- Emphasize muscular balance
- Manual resistance drills
- Rhythmic stabilization drills *@ end range*
- Isotonic strengthening
- Trunk and leg training

Core tone & stabilization

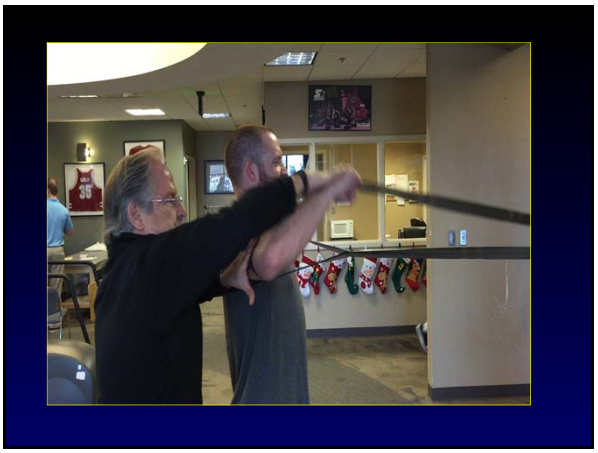
Bilateral Extremity Exercises

Hot Topics Shoulder Rehab

What You Need to Know

BFR Procedure:

- ✓ Blood Flow Restriction
- ✓ Designed to enhance muscle return
- ✓ Muscle hypertrophy
- ✓ Hypoxic environment
- ✓ Intramuscular anabolic signaling
- ✓ Proliferation stem cell release
- ✓ Results in greater muscle hypertrophy




NM Control - Eyes Closed

Advanced Throwers Ten Program

Wilk et al: Phys SportsMed 2011

Advanced Thrower's Ten Program

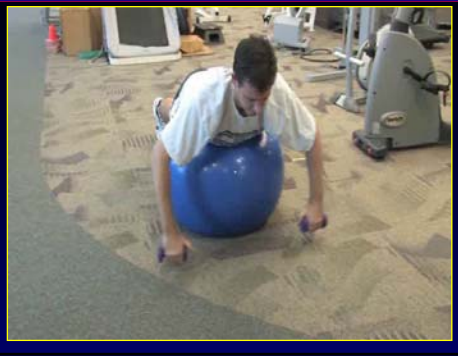
Advanced Throwers Ten Program

Wilk et al: Phys SportsMed 2011

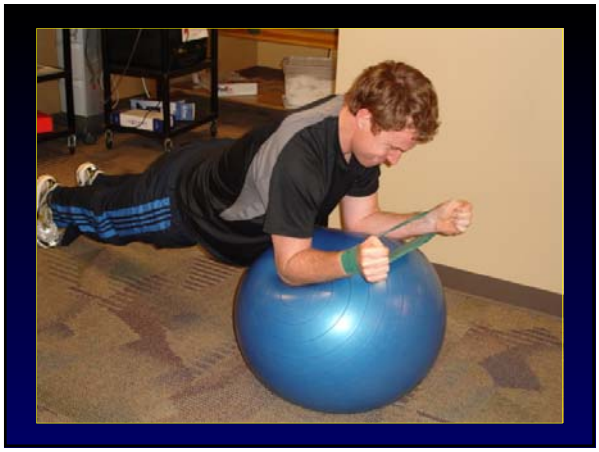
Advanced Thrower's Ten Program

Advanced Thrower's Ten Program

Advanced Thrower's Ten Program

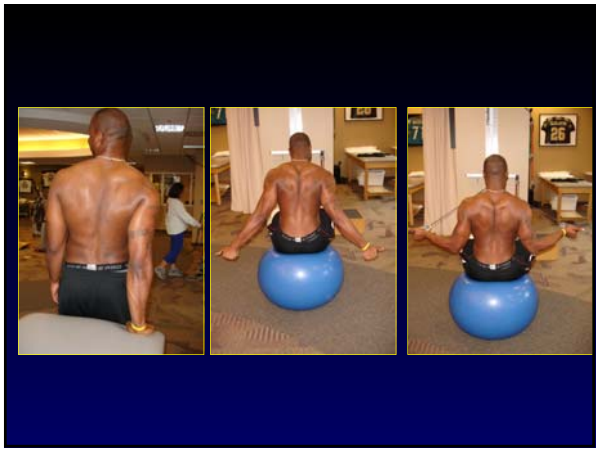


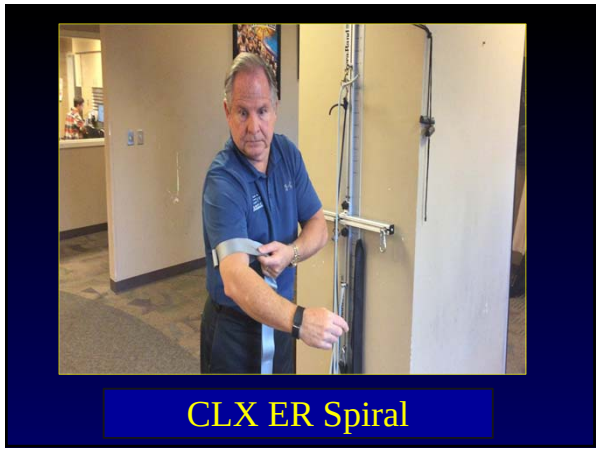
Advanced Thrower's Ten Program



Side Plank Shoulder ER

Serratus Anterior Drills/Exercises

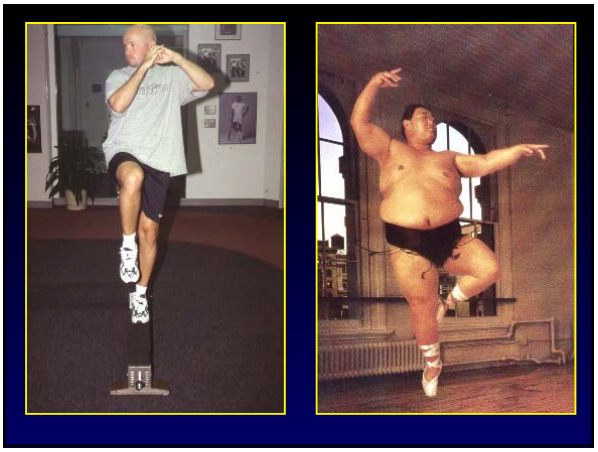




CLX ER Spiral

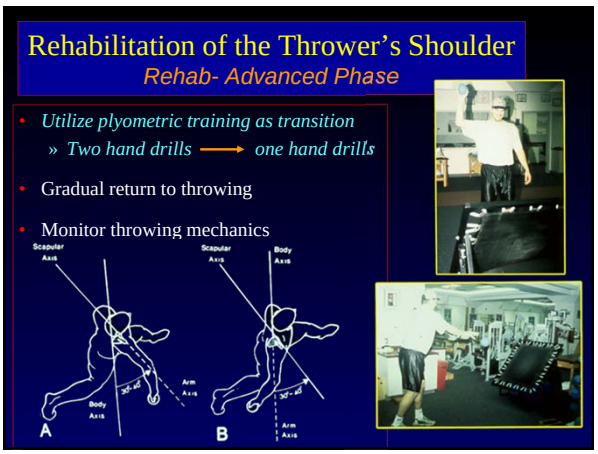
CLX ER Double Bands: ER & Retract

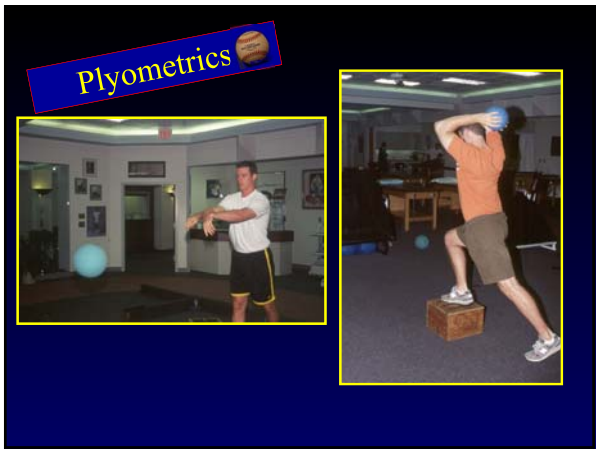
Ball on Wall Stabilization Drills

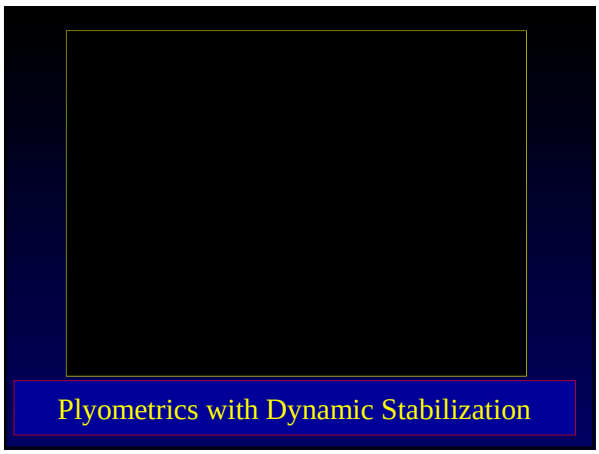


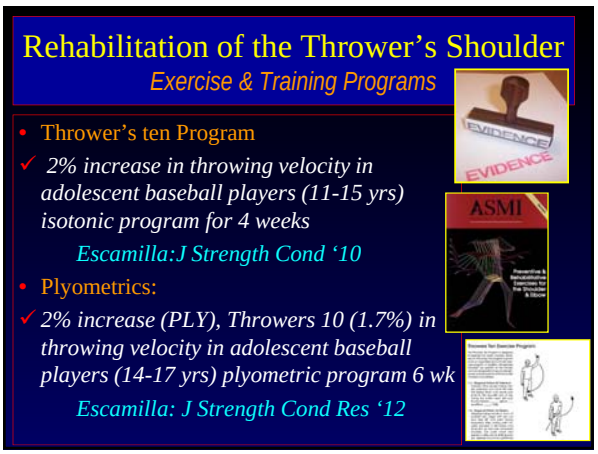

Core Strength &Stabilization


Push Ups on Rocker Board RS
Magnum


Rehabilitation of the Thrower's Shoulder
Rehab- Advanced Phase
Utilize plyometric training as transition
» Two hand drills → one hand drills
Gradual return to throwing
Monitor throwing mechanics
Scapular Axis
Body Axis
Arm Axis
A
B


Plyometrics


Plyometrics with Dynamic Stabilization


Rehabilitation of the Thrower's Shoulder
Exercise & Training Programs
• Thrower's ten Program
✓ 2% increase in throwing velocity in adolescent baseball players (11-15 yrs) isotonic program for 4 weeks
Escamilla:J Strength Cond '10
• Plyometrics:
✓ 2% increase (PLY), Throwers 10 (1.7%) in throwing velocity in adolescent baseball players (14-17 yrs) plyometric program 6 wk
Escamilla: J Strength Cond Res '12
EVIDENCE
ASMI

Rehab Overhead Thrower
Functional Drills

Interval Throwing Program

- *How far should a player throw ???*
- *Pitcher vs position player*
- ✓*Should pitchers throw further than 120 ft ???*
- ✓*From 120 feet – progress to off the mound program*
- ✓*Normalize biomechanics*

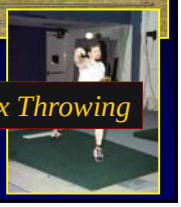
Interval Throwing Program
Mound Throwing

- Rate of progression
  50% - 75% - 100%
- *What does that mean ?*
  - ✓*50% is really 75%*
  - ✓*75% is really 90%*
  - *Fleisig et al : ASMI '98*
- Fastballs → Breaking balls

Interval Throwing Program
Long Toss Program

- Suggested ITP:
  - » Gradually increase distance
  - » 120 –150 feet ??? Or further ?
- Advantages
  - » Arm strengthening
  - » Flexibility (get loose)
  - » Strength it out "get long"
- Disadvantages:
  - » Ball release point
  - » Differences in mechanics
  - » Increased arm stress

Is Throwing Longer Better ??

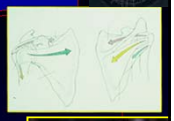


Sub-Max Throwing

Throwers' Shoulder Injuries
Fatigue

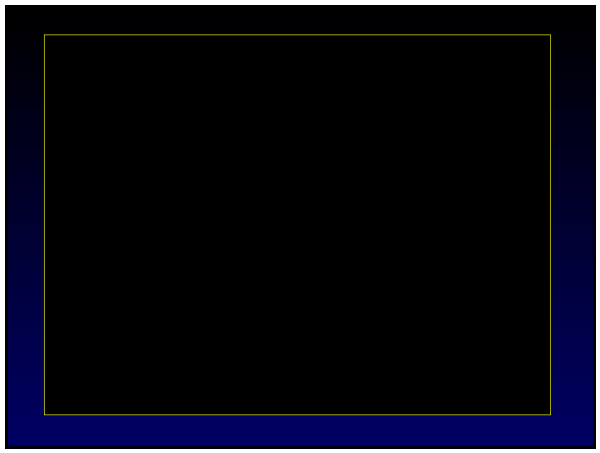
Effects of shoulder fatigue:

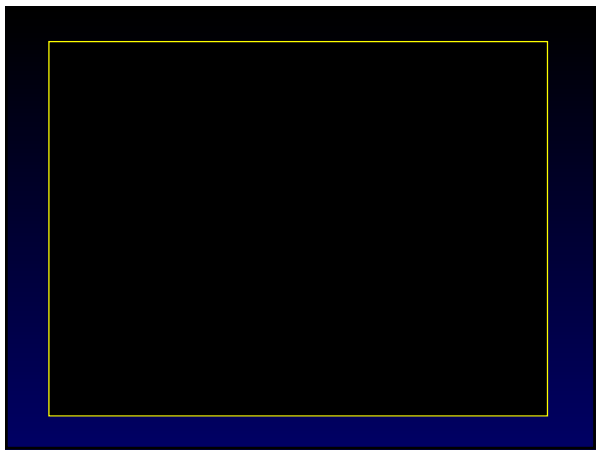
- ✓*Leads to injuries – little league pitchers*
  Lyman, Fleisig, Andrews: AJSM '02
  Olsen, Fleisig, Andrews: AJSM '06
- ✓*Increase superior migration humeral head*
  Wickiewicz, Otis, Warren: JSES '91
- ✓*Fatigue effects performance & mechanics*
  Murray, Cook, Werner, Hawkins: AJSM '01
- ✓*Proprioception diminishes by 78%*
  Carpenter : AJSM '98
- ✓*Scapular position changes*
  Macrina, Wilk, Reinold: APTA CSM '06

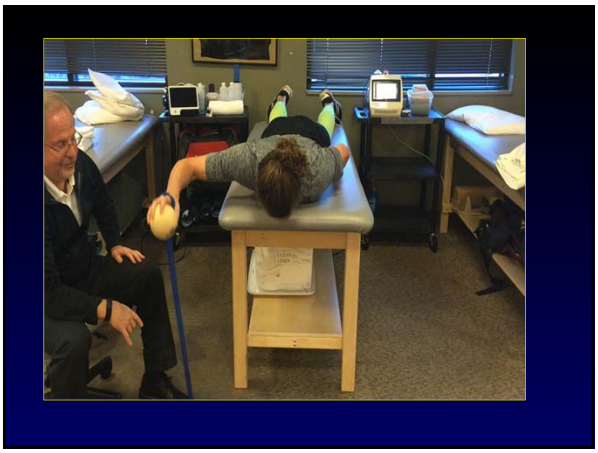


Fleisig, Bolt, Fortenbaugh, Wilk: JOSPT '11

- 17 healthy college pitchers
- Biomechanical analysis of long & short throwing
- Threw 18.4m , 37m, 55m & maximal distance on a line
- Shoulder line was horizontal for mound distance but gradually went uphill as distance increased
- ✓*Maximal throwing distance resulted in more ER, more Elb Flexion, more shoulder IR torque & more varus elbow torque*
- Trunk tilt gradually increased with distance







Rehab Overhead Throwing Athlete

Weighted Ball Programs

Rehab Overhead Throwing Athlete

Weighted Ball Programs

- Popular form of training
- Proposed to increase throwing velo
- Program utilizes weighted baseballs
- 4-8 week program prior season
- Been using plyoball throws since ’86
  - *Wilk, Gambetta, et al: JOSPT ‘93*
- Literature review:
  - *DeRenne: Athlet J ’85*
  - *DeRenne: J Appl Spt Sci R ‘90*
  - *Escamilla et al: Spts Health ‘00*
  - *Fleisig et al: JSH ‘16*

Rehab Overhead Throwing Athlete

Weighted Ball Programs

Rehab Overhead Throwing Athlete

Weighted Ball Programs

Table I. Effects of training with overweight and underweight baseballs on throwing velocity and accuracy.

Reference	Number of participants	Age level	Duration (w)	Number of throws per week	Baseball weights (oz)	Significant increase in throwing velocity?	Significant change in accuracy?
Overweight training							
Brose & Hanson[9]	7	College	6	75	10, 160*	Yes	No
Lthahner & Hamm[10]	5	College	12	165	7–12	Yes (5 m/s)	No
Logan et al.[11]	13	College	6	150	40*	Yes (6.5–11.6%)	NM
Straub[12]	24	High school	6	60	7–17	No	No
DeRenne et al.[13,14]	5	High school	10	NS	5-6	Yes (6.67 m/s)	NM
DeRenne et al.[14,15]	10	High school	10	150	5-6	Yes (5.3%)	NM
Underweight training							
DeRenne et al.[13,14]	5	High school	10	NS	4-5	Yes (1.34 m/s)	NM
DeRenne et al. [14,15]	10	High school	10	150	4-5	Yes (5.7%)	NM
DeRenne et al.[14]	17	High school	10	187	4	Yes (3.2%)	NM
Overweight and underweight integral training							
DeRenne et al.[14,15]	150	High school and college	10	198	4-6	Yes (4-6%)	NM

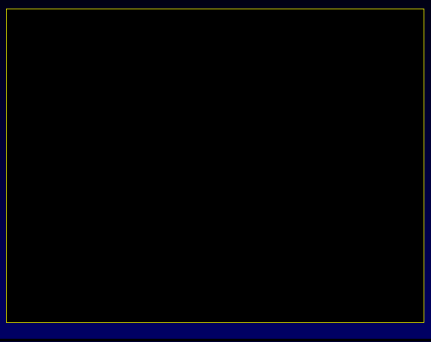
a Amount of resistance while throwing a baseball attached to a wall pulley.
NM = accuracy not measured in study; **NS** = number of throws not specified in study.

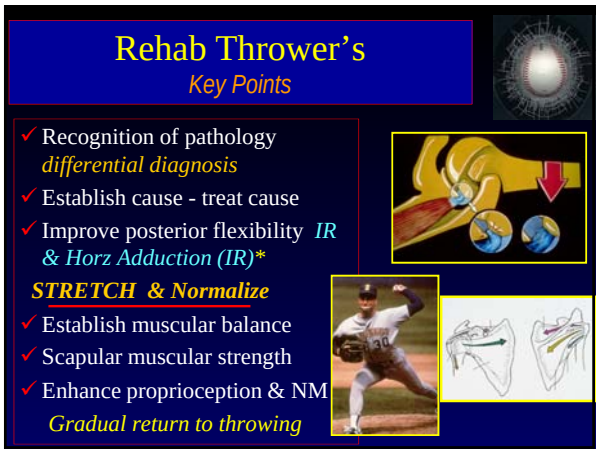
Review Article

Effects of Throwing Overweight and Underweight Baseballs on Throwing Velocity and Accuracy

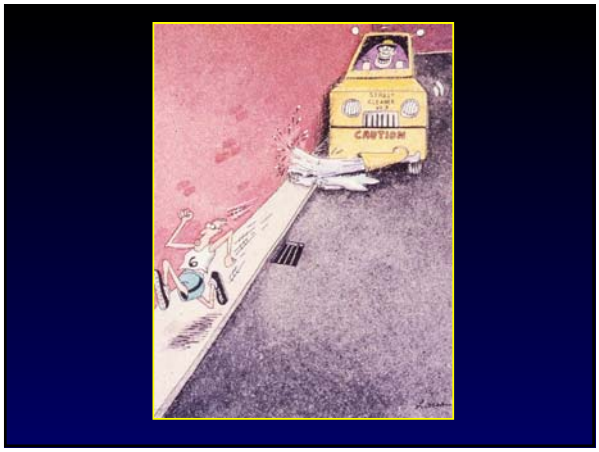
Rehab Overhead Throwing Athlete

Weighted Ball Programs – Plyoball 1#




Rehab Thrower's
Key Points
✓ Recognition of pathology
differential diagnosis
✓ Establish cause - treat cause
✓ Improve posterior flexibility IR
& Horz Adduction (IR)*
STRETCH & Normalize
✓ Establish muscular balance
✓ Scapular muscular strength
✓ Enhance proprioception & NM
Gradual return to throwing


Thank You!
405
ASMI
ANDREWS
INSTITUTE


CAUTION


Thank You