

Recent Advances

2016

Rehabilitation of Shoulder in the Overhead Thrower

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Physiotherapy Associates

CSMA CHAMPIONS SPORTS MEDICINE

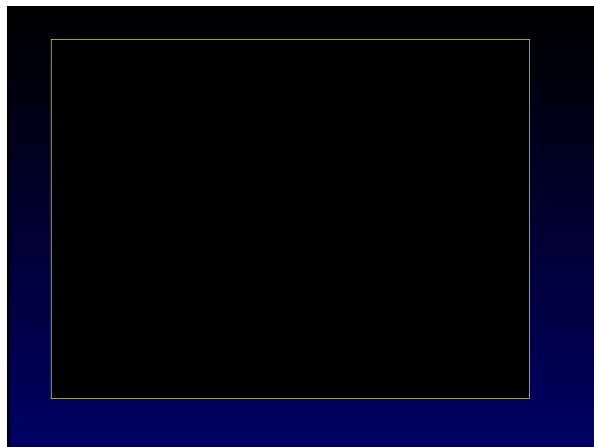
ASMI

RAY'S

Kevin E Wilk, PT, DPT, FAPTA
2016 Baseball Sports Medicine Conference
Faculty Disclosure:

- Theralase Laser – Medical Advisory Board
- LiteCure Laser – Consultant
- AlterG – Medical Advisory Board
- Intelliskin USA – Medical Advisory Board
- Zetroz Medical – Medical Advisory Brd
- Throw Like A Pro – Co-Owner
- Dr PRP – Rehab Advisor
- Educational Grants:
 - » Performance Health
 - » Joint Active System
 - » ERMI
 - » Bauerfeind Brace
- Book Royalties:
 - » CV Mosby, Lippincott, Human Kinetics










The Overhead Thrower

Introduction

- Goals of presentation:
 - Discuss rehabilitation concepts of the overhead thrower
HIT the HIGH POINTS
 - Describe several treatment strategies for the shoulder & elbow:
 - ✓ Specific rehab concepts
 - ✓ Pathology specific
 - ✓ Multi-phased approach to rehab
 - ✓ New exercises – insights
 - ✓ Return to throwing

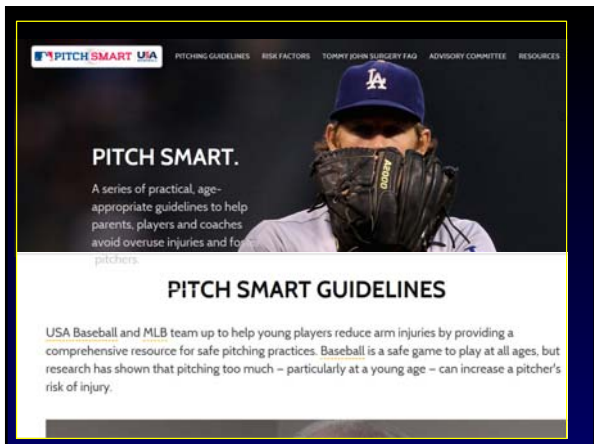


Recent advances in the treatment of the overhead athlete

Wilk - GIRD, TROM and Injuries to the Thrower 2016







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

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




The Overhead Thrower

Introduction

- Overhead throwing motion
- Extraordinary demands on shoulder & elbow joint
 - Fastest human movement – 7,230 o/s
 - Late cocking to ball release 0.03sec
- 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



The Overhead Thrower




Introduction

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

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





The Overhead Thrower

Introduction - Injuries

- ✓ Shoulder & elbow injuries are common in baseball – and appear to be increasing
- ✓ In MLB big league level:
 - ✓ 67% of all injuries to pitchers are to the upper extremity
 - ✓ Pitchers are 2.5x more likely to injure their UE than position players
 - ✓ Shoulder most commonly injured joint in pitchers
 - ✓ Shoulder joint 31% of all injuries to pitchers
 - ✓ Elbow joint 26% of all injuries to pitchers

Posner et al: AJSM '12
Wilk et al: AJSM '11
Conte et al: AJSM '01



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



 **Injuries in Baseball Players**
Incidence of Injury

- ✓ Major League Baseball Injuries 1998-2012
- ✓ 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: 1.8:1 elbow to shoulder DL days
- ✓ 61% of all DL days are pitchers
 - ✓ relievers account for 31.5 % of DL days
 - ✓ starters account for 29.7% of DL days


Elbow Injuries in Baseball
UCL Surgeries – Conte, Wilk, et al: AJSM '15

- ✓ Surveyed all **Minor** League Baseball Players
- ✓ 4,052 respondents (2,145 pitchers)
- ✓ 29/30 teams responded
- ✓ 100% responses in 29 teams
- ✓ 331 players had UCLr (8%)
- ✓ **Pitchers: 300/2145 (14%)**
- ✓ **Position players: 31/1907 (2%)**
- ✓ **Avg age at time of surgery 21**



Elbow Injuries in Baseball
UCL Surgeries: Conte, Wilk et al: AJSM '15

- ✓ Surveyed all **Major** League Baseball Players
- ✓ 1,036 respondents
- ✓ 30/30 teams responded
- ✓ 100% responses in 30 teams
- ✓ 166 players had UCLr (16%)
- ✓ **Pitchers: 25%**
- ✓ **Position players: 5%**
- ✓ **49% UCLr received concomitant surgery**



Rehabilitation Overhead Thrower

Rehabilitation Overview:

- ✓ Rehabilitation strategies for the overhead throwing athlete:
- ✓ Stretching & flexibility
- ✓ Activation drills
- ✓ Restoring balance
- ✓ Restore scapular position
- ✓ Plyometrics
- ✓ Endurance
- ✓ Gradual return to throwing



Evaluate – Strategize – Implement – Assess – Adjustments

Specific Rehabilitation Concepts



New Rehabilitation Concepts









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

Motion Imbalance Program

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

Capsular Restriction ← → *Musculotendinous*

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

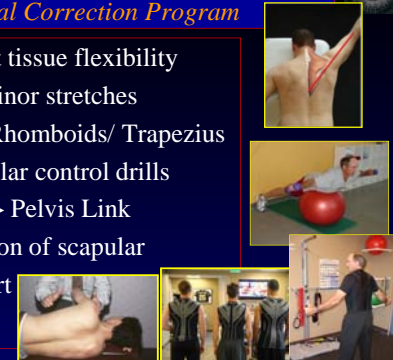
Treatment based on assessment



Rehabilitation of Overhead Athlete

Postural Correction Program

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



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



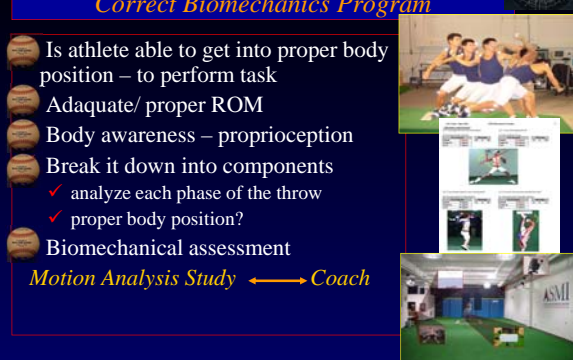
The slide includes a diagram of the kinetic chain showing the path from the feet to the hand. It also features three photographs: one of an athlete on a red ball, one of an athlete standing with a weight, and one of an athlete performing a core exercise.

Rehabilitation of Overhead Athlete

Correct Biomechanics Program

- Is athlete able to get into proper body position – to perform task
- Adequate/ 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*




The slide features a diagram of a thrower's body in various positions, a photo of athletes in a motion analysis lab, and a photo of a coach observing an athlete.

Rehabilitation of Overhead Athlete

Reduce Inflammation Program

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

Determine cause of onset



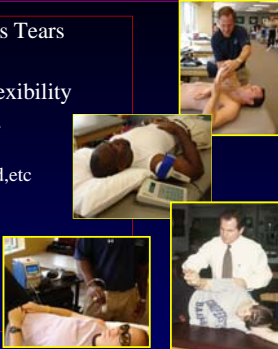
The slide includes a photo of an athlete's shoulder, a close-up of a shoulder with a brace, and a photo of an athlete performing a strengthening exercise.

Rehabilitation of Overhead Athlete


Tissue Regeneration Program

- Rotator Cuff Partial Thickness Tears
- *Tendonosis - Tendinopathy*
- Restore musculotendinous flexibility
- Promote collagen synthesis & organization:
 - ✓ ↑ blood flow – heat, ultrasound, etc
 - ✓ Cold laser
 - ✓ Eccentric loading of muscle
 - ✓ Higher loads
 - ✓ Nutrition , PRP, Stem Cell

Tissue Regeneration



The Thrower's Shoulder



Hypomobility

Hyperlaxity

Scapular - Anterior Tilted & Protracted

Poor Posture Weak Core


Usually Presents with numerous contributing factors

Internal Impingement

Introduction



- ✓ Occurs during abduction & excessive external rotation
- ✓ Late cocking during pitching
- ✓ Supraspinatus / Infraspinatus rubs on the posterosuperior glenoid rim & labrum
- ✓ Results in fraying of cuff and glenoid labrum – inflammation

Andrews: *Tech Orthop* '88
Walch: *JSES* '91
Jobe et al: *JSES* '93






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
Rehabilitation – 4 Phases Program

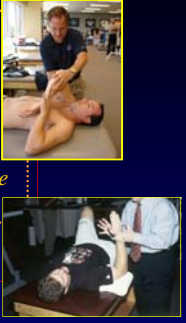
- **Phase III: Advanced Phase:**
 - ✓ Advanced isotonic program
 - ✓ Strength, power, & endurance
 - ✓ *Advanced thrower's ten program*
 - ✓ Plyometrics
 - ✓ Continue stretching & ROM program
- **Phase IV: Return to Activity Phase:**
 - ✓ Advanced thrower's ten program
 - ✓ Adjust the program when throwing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



Rehabilitation of the Thrower

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



Rehabilitation of Overhead Athlete

Rehabilitation Programs

- Diminish inflammation & pain
- Improve dynamic stabilization
- Re-establish proper ROM & flexibility
- Correct posture & scapulae position
- Promote core control
- Correct throwing mechanics
- Tissue regeneration



Rehabilitation of Overhead Athlete

Rehabilitation Programs

- **Diminish inflammation & pain**
- Improve dynamic stabilization
- Re-establish proper ROM & flexibility
- Correct posture & scapulae position
- Promote core control
- Correct throwing mechanics
- Tissue regeneration



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's Shoulder

Diminish Pain & Inflammation

The Action-Patch

Area under electrode: highest blood flow in areas of red/orange/yellow/green

Untreated area next to electrode: normal blood flow of blue/purple

Method	Area of Drug Delivery (cm²)
IontoPatch	18.4 ± 0.2
High-current iontophoresis	8.2 ± 1.8

Method	Area of Drug Delivery (cm²)
IontoPatch	18.4 ± 0.2
Buffered Electrode (average 50 mA-sec)	8.45 ± 0.26

Longer localized effect of drug when delivered using IontoPatch than red electrodes*

Anderson et al : Physical Therapy 83(2) 2003

Rehabilitation of the Thrower's Shoulder
Diminish Pain & Inflammation - Laser



The first photograph shows a physical therapist in a black shirt using a laser device on a patient's shoulder. The second photograph shows the same therapist using the laser on another patient's shoulder. Both patients are wearing black athletic shirts.

Rehabilitation of the Thrower's Shoulder
Diminish Pain & Inflammation



The first photograph shows a patient sitting on a chair, wearing a black athletic top, with a laser device being applied to their shoulder. The second photograph shows a close-up of the laser device being applied to a patient's shoulder.

Low Intensity Therapeutic UltraSound (SAM)

treatment 3MHZ
on treatment 1MHZ
based on graph for comparison



The first image shows a woman in a green tank top with a SAM device on her shoulder. The second image shows a SAM device with a red and white flower-shaped applicator. The third image shows a close-up of the SAM device being applied to a patient's shoulder.

Rehabilitation of the Thrower's Shoulder *Soft Tissue Mobilization Techniques*

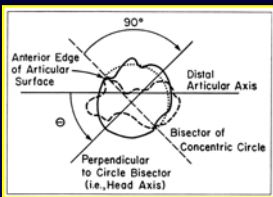
Loss of IR Due to Several Factors:

1. *Osseous adaptations* 1° Cause of the IR loss
- superimposed other factors:*
2. *Scapular posture - anterior tilt*
 3. *Posterior muscular tightness*
 4. *Shoulder fatigue*
 5. *Posterior capsular thickness/thickness*
- 2° Contributing Factors

Osseous Adaptation and Range of Motion at the Glenohumeral Joint in Professional Baseball Pitchers*

Heber C. Crockett,†† MD, Lyndon B. Gross,§ MD, PhD, Kevin E. Wilk,§ PT, Martin L. Schwartz,§ MD, Jamie Reed,|| ATC, Jay O'Mara,§ MD, Michael T. Fleilly,|| MD, Jeffery R. Dugas,§ MD, Keith Meister,* MD, Stephen Lyman,|| PhD, and James R. Andrews,§ MD

From †Trailwest Sportsmedicine, Kearney, Nebraska, §American Sports Medicine Institute, Birmingham, Alabama, ||Tampa Bay Devil Rays Baseball Club, Tampa Bay, Florida, and *University of Florida Shands Clinic, Gainesville, Florida



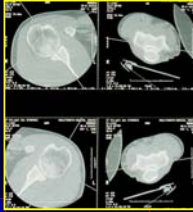
Crockett, Gross, Wilk, et al: AJSM '02

- 25 professional baseball pitchers
 - Compared to 25 subjects (never played baseball)
 - Assessed laxity, ROM and CT scan
 - Average ROM
 - Throwers: ER 129°, IR 61°
 - Non-throwers: ER 119°, IR 7°
 - Total motion: NS side-to-side
 - Laxity: NS side-to-side
- ✓ **CT scan: humeral retroversion:**

 - Throwing side : 40°
 - Non-throwing side: 23°

17° deg diff

✓ Control group (NT): 22° = bilateral



Humeral Retroversion Throwers

Bilateral Differences – 34 studies

Crockett, Gross, Wilk, Andrews, et al: AJSM '02 (17°)
 Reagan, Meister, Horodyski, Wilk, et al: AJSM '02 (10°)
 Osbahr, Cannon, Speer: AJSM '02 (10°)
 Chart, Litchfield, et al: JOSPT '07 (10.6°)
 Pieper: AJSM '98 (9.4°, up to 29°, painful grp less retrov)
 Wyland, Pill, Shanley, et al: AJSM '12 (13°)
 Whiteley et al: JOSPT '09 (Ultrasound 11.9°)
 Hibberd et al: AJSM '14 (Ultrasound - age dependent)
 Myers et al: AJSM '12 (validation study – ultrasound)
 Myers et al: Sports Health '11 (injury related – college age)
 Tokish et al: J Spts Sci Med '08 (radiographs) (11.2°)

Humeral Retroversion Throwers

Bilateral Differences – 34 studies

Nakase, et al: AJSM '16 (Ultrasound) (14°)
 Itami, et al: AJSM '16 (CT scan) (16°)
 Noonan : AJSM '16 (Ultrasound) (15°)
 Saka et al: OJSM '15 (CT scan) (10°)
 Hibberd et al: AJSM '14 (Ultrasound) (16°)
 Oyama et al: Clin Biomech '13 (US) (12-14°)
 Whiteley et al: Sci Spts Med '10 (Ultrasound) (11°)
 Wyland et al: AJSM '12 (Ultrasound) (13°)
 Myers et al: AJSM '12 (ultrasound) (13°)
 Myers et al: Sports Health '11 (US) (15°)
 Polster et al: AJSM '13 (CT scan) (10.9°)

Increase in Humeral Retrotorsion Accounts for Age-Related Increase in Glenohumeral Internal Rotation Deficit in Youth and Adolescent Baseball Players **AJSM '14**

Elizabeth E. Hibbert,¹ MA, ATC, Sakiho Ogawa,¹ PhD, ATC, and Joseph B. Myers,¹ PhD, ATC, Investigation performed at the University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA.

- Influence of age on GIRD, humeral retrotorsion, retrotorsion adjusted GIRD & TROM on healthy baseball players
 - ✓ 52 youth aged (6-10 yrs of age)
 - ✓ 52 junior high school (11-13 yrs)
 - ✓ 70 junior varsity (14-15 yrs)
 - ✓ 113 Varsity (16-18 yrs)
- ✓ *GIRD & retrotorsion increased with age while retrotorsion adjusted GIRD & TROM remained unchanged –*
- ✓ *GIRD is primarily attributed to retrotorsion & not due to soft tissue tightness*

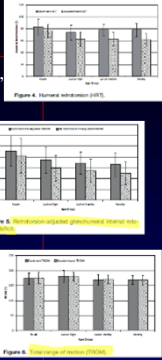


Figure 4. Humeral retrotorsion (2013)


Figure 5. Retrotorsion adjusted glenohumeral internal rotation deficit

Figure 6. TROM (degrees) (2013)

Noonan, Shanley, Bailey, et al: AJSM '16

- Humeral torsion risk factor for shoulder/elbow injuries in professional baseball pitchers
- **Relationship between GIRD & retortorsion**
- 222 pitchers assessed in spring training
- IR, ER & TROM, retrotorsion assessment (US)
- GIRD = 15° ≥, TROM 10° ≥
- ✓ *60 pitchers exhibited GIRD (27%)*
- ✓ *GIRD pitchers exhibited greater retrotorsion (19°) compared to Non-GIRD (12°)*
- ✓ *IR was affected retrotorsion but not ER*

Ultrasound Retroversion Corrected ROM



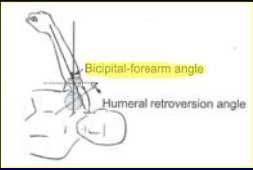
Wilk - GIRD, TROM and Injuries to the Thrower 2016

Why is the humeral retroversion of throwing athletes greater in dominant shoulders than in nondominant shoulders?

JSES '06

Nobuyuki Yamamoto, MD,* Eiji Ito, MD,* Hiashi Minogawa, MD,* Masakazu Urayama, MD,* Hirotomo Saito, MD,* Nobuhiko Seki, MD,* Takarobu Iwase, MD,* Shinji Kashiwaguchi, MD,* and Tetsuya Mitsuura, MD* Aika and Tokushima, Japan

groove and a line parallel to the axis of the forearm. We called this angle the **bicipital-forearm angle**. The relationship between the bicipital-forearm angle and humeral head retroversion is as follows: **the smaller the bicipital-forearm angle is, the larger the humeral head retroversion is. The reason is that, as the angle formed by a line from the bottom of the groove to a central point on the humeral head is constant, the sum of these two angles is constant.** We used the method of ultrasonographic measurement described by Ito et al.¹³ The bicipital-forearm angle was measured with a portable ultrasound device (SonoSite 180i; SonoSite Inc, Bothell, WA) with the subject lying supine on a table in a horizontal plane. When the bicipital groove was located exactly anterior to the humeral head, a line passing through the center of the bicipital groove was perpendicular to a line tangential to the anterior and posterior margins of the greater and lesser tuberosities forming the groove. Measurement was done at the entrance to the bicipital groove because it was the easiest portion of the groove to detect by use of ultrasonography, and good reproducibility of the measurement was expected. Therefore, with the arm in this position, the angle of internal rotation of the forearm relative to the vertical line indicated the bicipital-forearm angle.



Bicipital-forearm angle
Humeral retroversion angle

ASSESS DON'T ASSUME !!





Treat the clinical findings'

ASSESS DON'T ASSUME !!

DON'T GUESS ASSESS !!



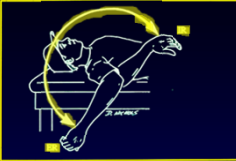
Treat the clinical finding

Total Rotational Motion Concept (TRM)

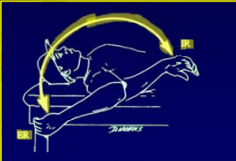
$ER + IR = \text{Total Motion}$

“Envelope of Motion”

Wilk AJSM '02
Total Rotational Motion is equal bilaterally (within +5 degrees)



Throwing Shoulder



Non- Throwing Shoulder

Rehabilitation of Overhead Athlete

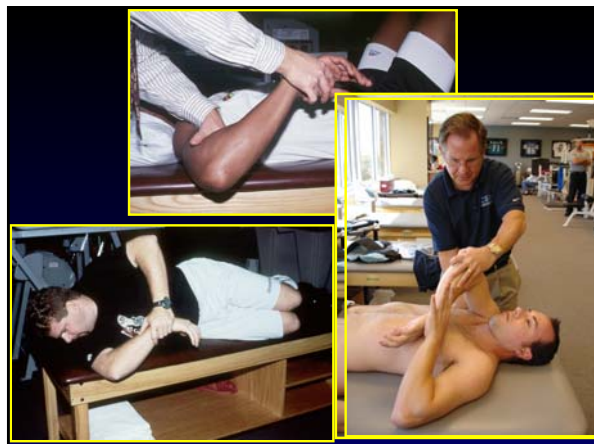
Rehabilitation Programs

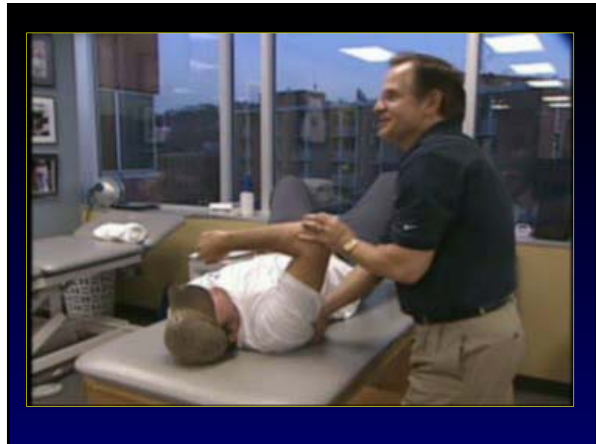
- Diminish inflammation & pain
- Improve dynamic stabilization
- Re-establish proper ROM & flexibility
- Correct posture & scapulae position
- Promote core control
- Correct throwing mechanics
- Tissue regeneration









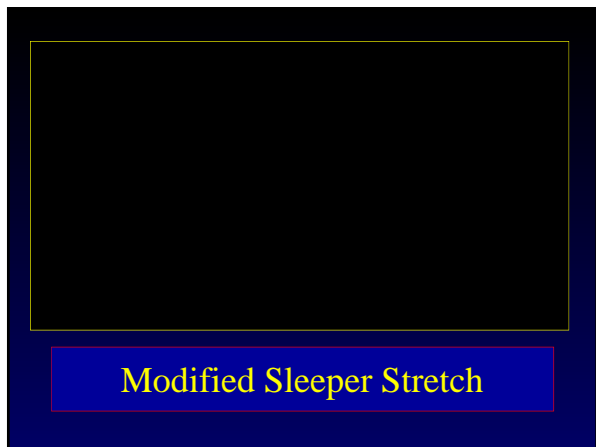






Sleeper's Stretch







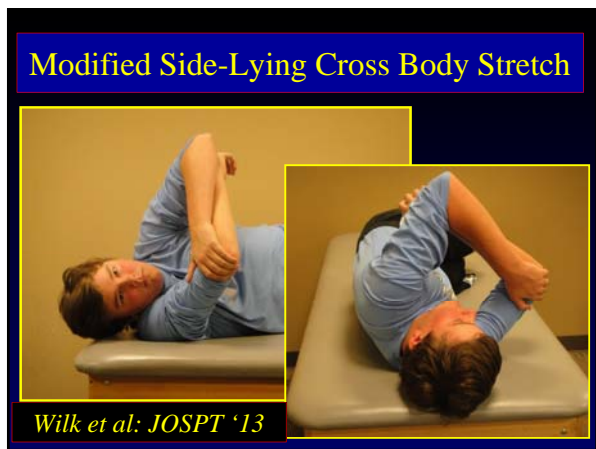










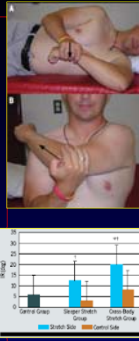


Modified Sidelying Cross Body Stretch



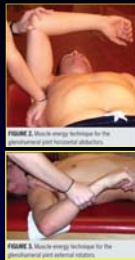
McClure et al: JOSPT '07

- 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=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



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



Group	Pre-treatment	Post-treatment	Difference	95% Confidence Interval	Within-Group Effect Size
IR for HZA	83.3 ± 9.1	87.5 ± 8.7	4.2 ± 5.3	-10.2, 1.6	0.40
IR for ER	80.9 ± 8.6	84.7 ± 8.6	3.8 ± 4.3	-10.4, 3.1	0.08
Control	82.7 ± 11.3	80.5 ± 12.1	-2.2 ± 6.9	-11.7, 7.3	0.02

*Difference in IR, horizontal abduction (HZA), and external rotation (ER) post-treatment compared to pre-treatment. IR = internal rotation; HZA = horizontal abduction; ER = external rotation.

†Within-group effect size = 0.05 degrees.

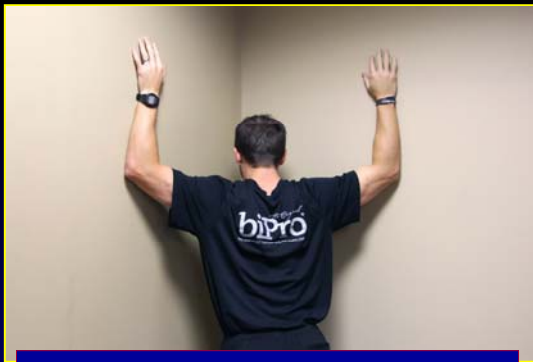
Laudner, Sipes, Wilson: J Athl Trn '08

- 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*



Lintner, Mayol, Uzodinma, Jones, Labossiere: AJSM '07

- 85 professional pitchers enrolled in study
- Divided into 2 groups:
 - » Group I: pitchers in stretch program 3 yrs or >
 - » Group II: pitchers with < 3yrs in stretch program
- ✓ *Pitchers with 3 yrs or more in stretch program exhibited greater IR ROM (74 vs 54 degrees) & greater TROM 217 vs 194 degrees*






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,...)



Rehabilitation of Overhead Athlete

Rehabilitation Programs

- Diminish inflammation & pain
- **Improve dynamic stabilization**
- Re-establish proper ROM & flexibility
- Correct posture & scapulae position
- Promote core control
- Correct throwing mechanics
- Tissue regeneration



Rehabilitation of Overhead Athlete

Re-establish Static/Dynamic Stability

- ✓ *Static stabilization*
 - Hold stationary position
 - Low level control drill
- ✓ *Dynamic stabilization*
 - Ability to move through space
 - Then stabilize
 - Moderate level control drill

It's all about capturing/controlling HH



Rhythmic Stabilization ER/IR




Rehabilitation Overhead Athlete

Restoration of Proprioception

- ✓ Awareness of joint position
- ✓ Eyes open & closed
- ✓ Performed static/dynamically
- ✓ Levels of proprioception
 - Progression through stages

Apprehension to Controlled Apprehension ★



Wilk - GIRD, TROM and Injuries to the
Thrower 2016











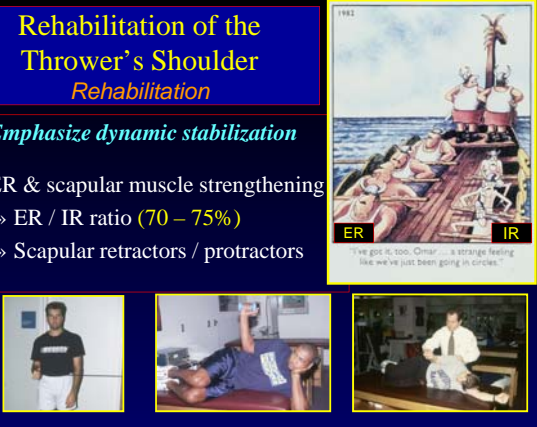
Rehabilitation of Overhead Athlete
Rehabilitation Programs

- Diminish inflammation & pain
- Improve dynamic stabilization
- Re-establish proper ROM & flexibility
- **Strengthening program**
- **Promote core control**
- Correct throwing mechanics
- Tissue regeneration

Rehabilitation of the Thrower's Shoulder

Rehabilitation

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




Enhancing Activation of Posterior Cuff



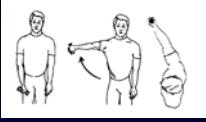
Thrower's Ten Program



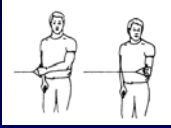
Thrower's Ten Program




D2 PNF Flexion



Standing Full Can



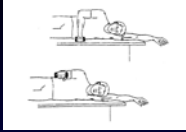
Tubing ER/IR



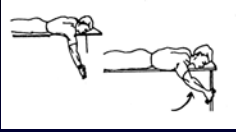
Lateral Raises

www.asmi.org

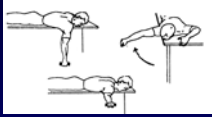
Thrower's Ten Program




Sidelying ER



Prone Full Can



Prone Horz Abduct




Prone Row into ER

Thrower's Ten Program



Prone rowing



Elbow Flex/Ext



Push-Ups



Sup/Pron & Wrist Flex/Ext

www.asmi.org


Rehabilitation of the Thrower's Shoulder

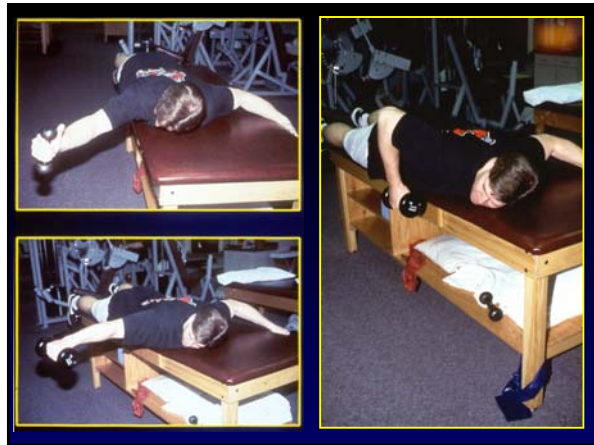
Rehabilitation Concepts

- 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





Scapular Muscle Training

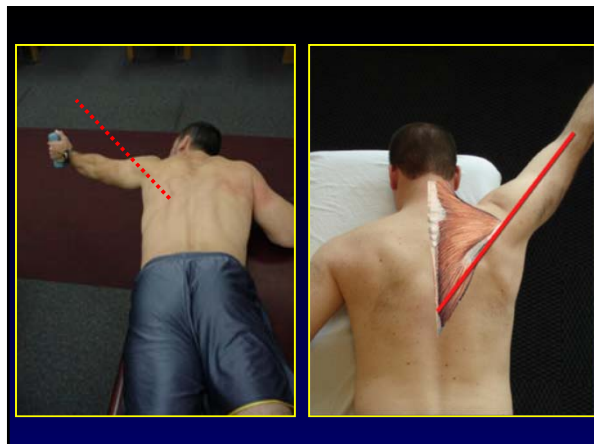
- *Alternating day schedule:*
 - ✓ *Isotonic table exercises days-*
 - Goal: strengthen/hypertrophy
 - traditional exercises
 - progress with dumbbells
 - neuromuscular drills
 - ✓ *Stability Ball days-*
 - Goal: NM control & dynamic stab
 - Isotonic exercises on stability ball
 - NM control drills
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



Scapular Muscle Training

Alternating day schedule:

- Isotonic table exercises days- strength
- Stability ball – NM benefits, core, legs, bilateral



Wilk - GIRD, TROM and Injuries to the Thrower 2016

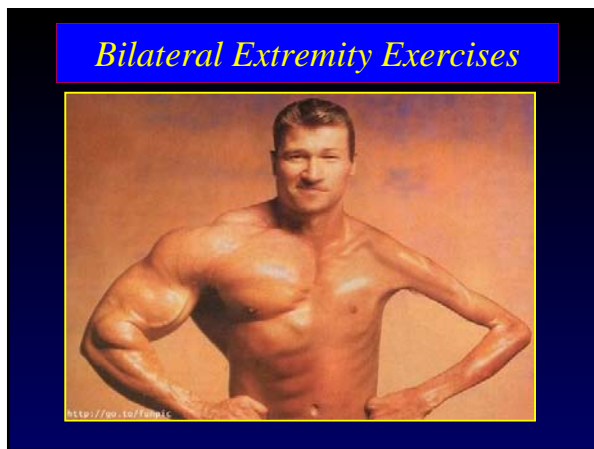












Rehabilitation of the Thrower's Shoulder
Progress Strengthening Program

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





NM Control - Eyes Closed



Wilk - GIRD, TROM and Injuries to the
Thrower 2016



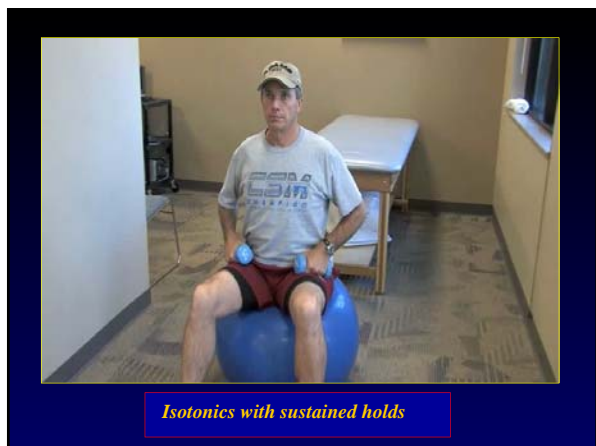




Wilk - GIRD, TROM and Injuries to the
Thrower 2016







Isotonics with sustained holds









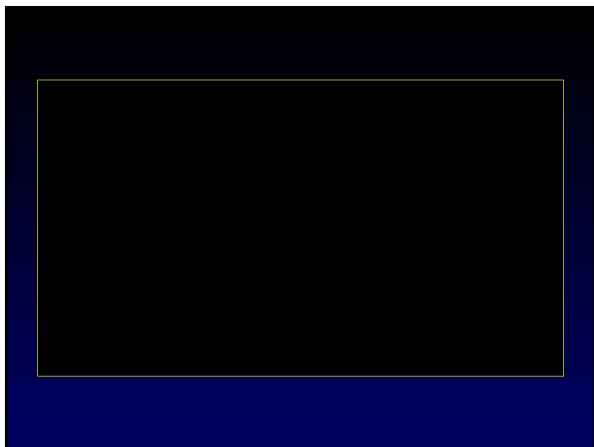


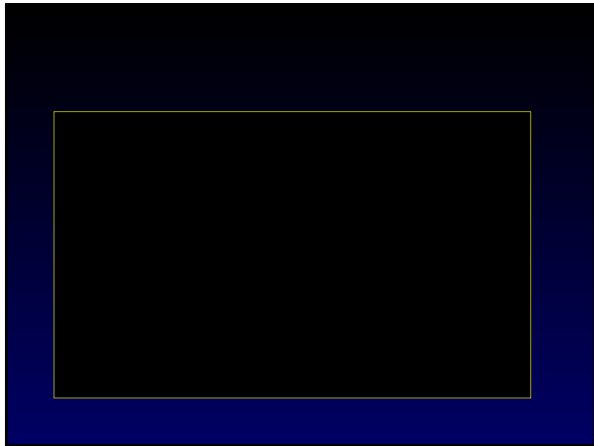


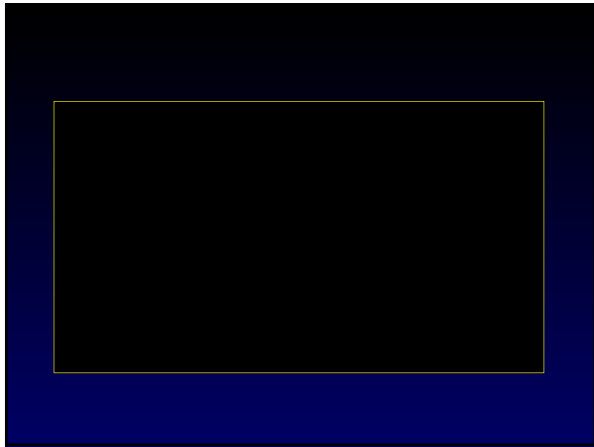
Wilk - GIRD, TROM and Injuries to the Thrower 2016

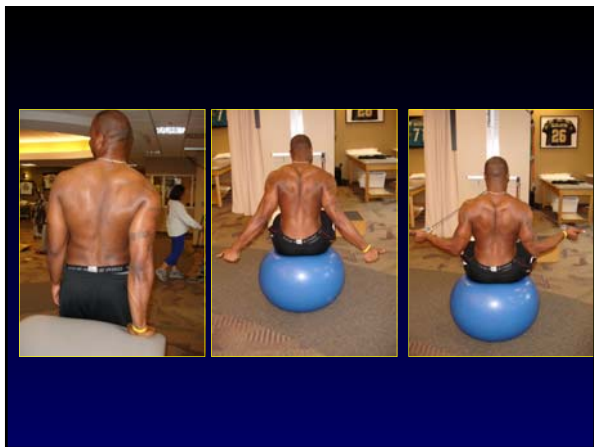








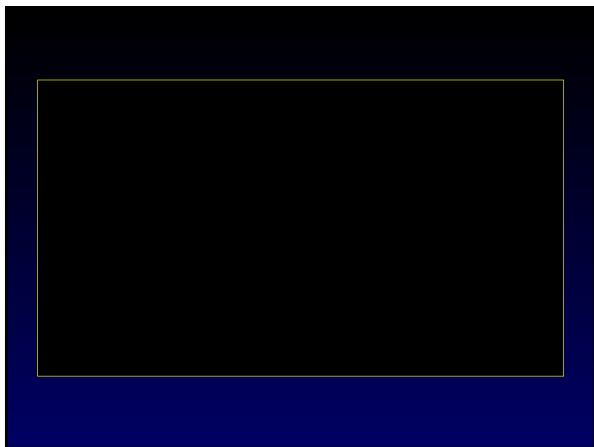




Wilk - GIRD, TROM and Injuries to the Thrower 2016



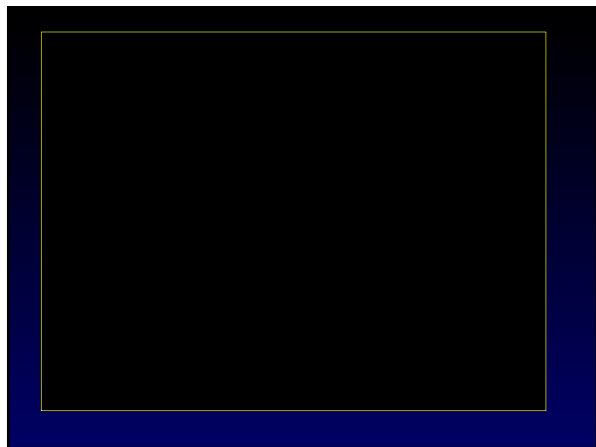


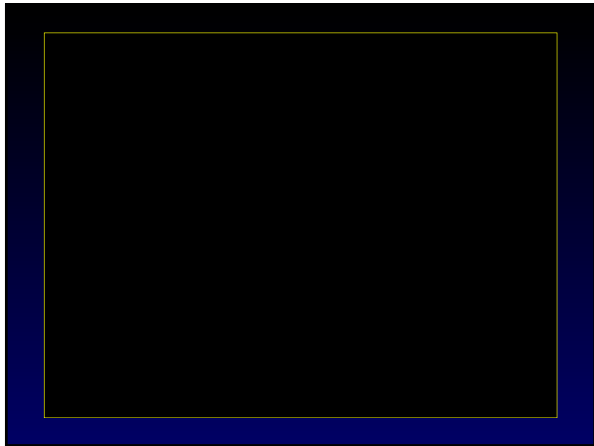


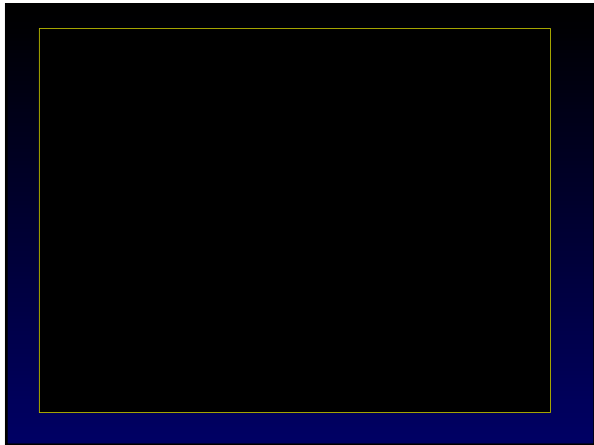
Wilk - GIRD, TROM and Injuries to the
Thrower 2016



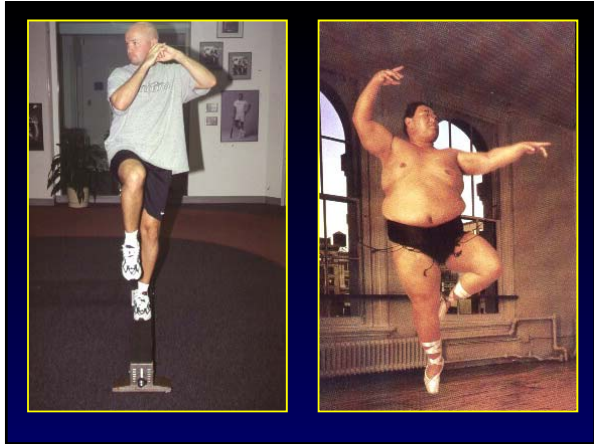
















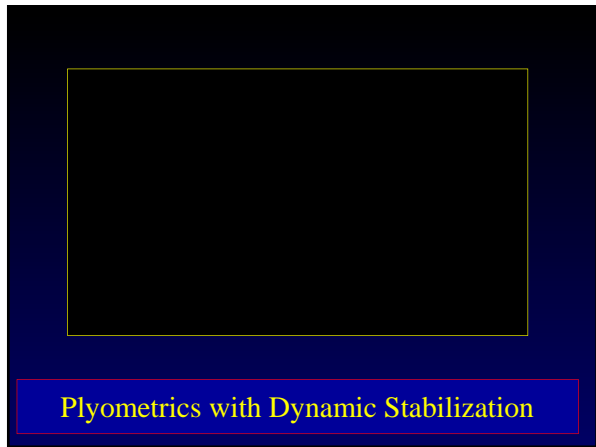


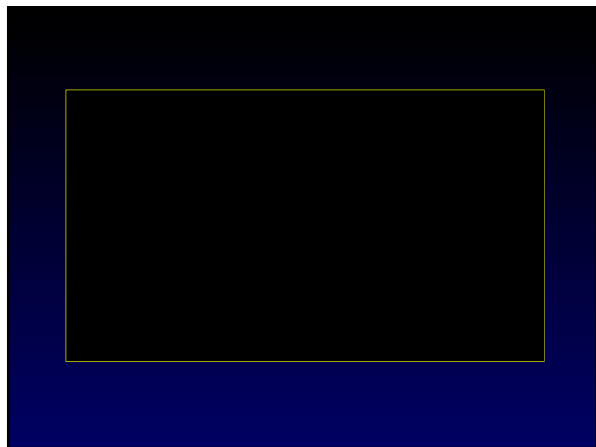
Rehabilitation of the Thrower's Shoulder Rehab- Advanced Phase

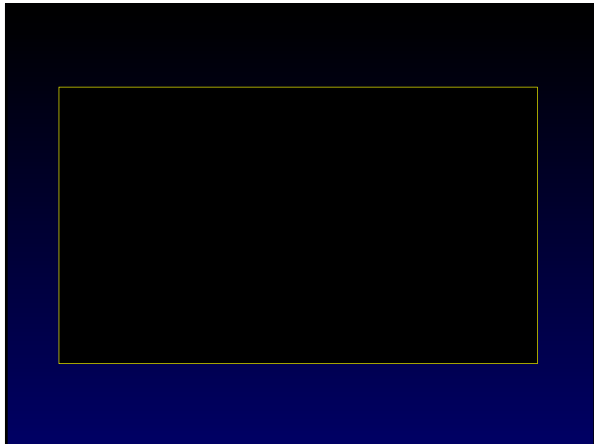
- Utilize plyometric training as transition
» Two hand drills → one hand drills
- Gradual return to throwing
- Monitor throwing mechanics

Plyometrics












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



Rehabilitation of the Thrower's Shoulder

Functional Drills

- ✓ Stretching & ROM
- ✓ Thrower's ten program
- ✓ Plyometric drills
- ✓ **Interval throwing program:**
 - » long toss
 - » interval mound throwing
 - » Gradual return to competition



Throwers' Shoulder

Daily Routine

Alternating Day Schedule

Heavy work days & light work days


Volume & intensity of exercise

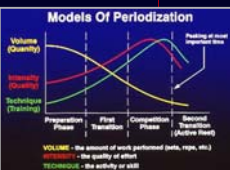
✓ Heavy Volume Days:

- ✓ Exercise
- ✓ Throw
- ✓ Exercise

✓ Light Volume Days:

Light exercise, neuromuscular drills, physioball, stretch, core, scapulae, & techniques to recovery





VOLUME - the amount of work performed (sets, reps, etc.)
INTENSITY - the quality of effort
TECHNIQUE - the ability or skill

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

Long Toss Program

- Suggested application
 - » Gradually increase distance
 - » 120 – 150 feet ???
- Advantages
 - » Arm strengthening
 - » Flexibility (get loose)
- Disadvantages:
 - » Ball release point
 - » Differences in mechanics

Is Throwing Longer Better ??





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

Interval Throwing Program
Mound Throwing

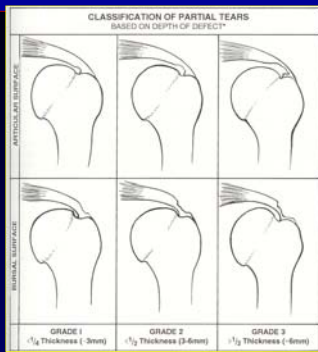
- Rate of progression
50% - 75% - 100%
- *What does that mean ?*
 - ✓ *50% is really 75%*
 - ✓ *75% is really 90%**Fleisig et al : ASMI '98*
- Fastballs → Breaking balls



Partial Tear Classification

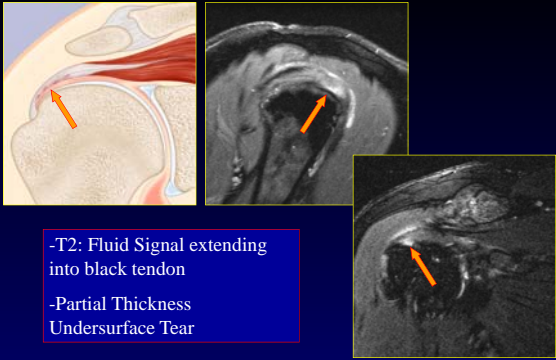
Articular

Bursal



Ellman 1987

Partial Thickness Tear (Articular)




-T2: Fluid Signal extending into black tendon
-Partial Thickness Undersurface Tear

Rehab of Partial Rotator Cuff Tears

Critical Factors

- Depth of cuff lesion:
 - » *Small: 15% or less*
 - » *Moderate: 15-40%*
 - » *Significant: 40% or greater*
- Location of lesion:
 - » *Involved muscles*
 - *supraspinatus, infraspinatus, ??*
 - » *PASTA &/or PAINT Lesions*

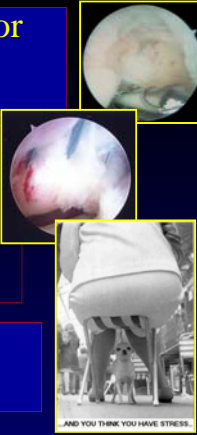


Rehab of Partial Rotator Cuff Tears

Classification

Partial Thickness tears
Small tears: 15% or less
Moderate size: 15 – 40%
Significant tears: 40% or greater
50% or greater

Treatment Based on Classification Determines Rate of Rehabilitation




Rehab of Partial Thickness Rotator Cuff Tears

Rehabilitation Concepts

- Restore musculotendinous flexibility
- Promote collagen synthesis & organization:
 - ↑ blood flow – heat, ultrasound, etc
 - Eccentric loading of muscle
 - Submax higher reps
 - Nutrition

Tissue Regeneration



Throwers' Shoulder Injuries

Fatigue

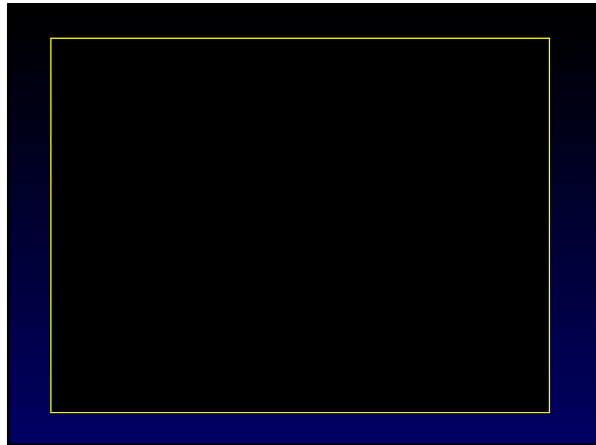
Effects of shoulder fatigue:

- ✓ 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

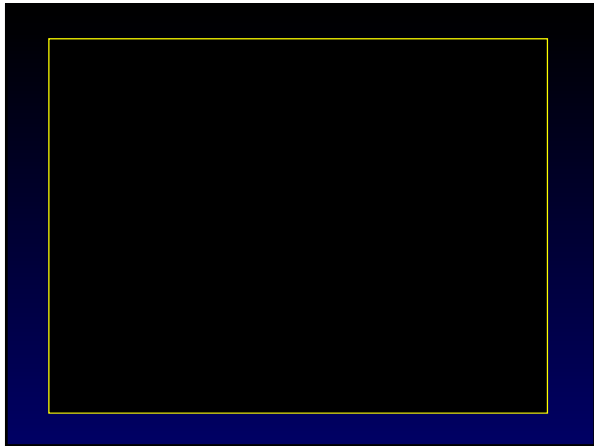


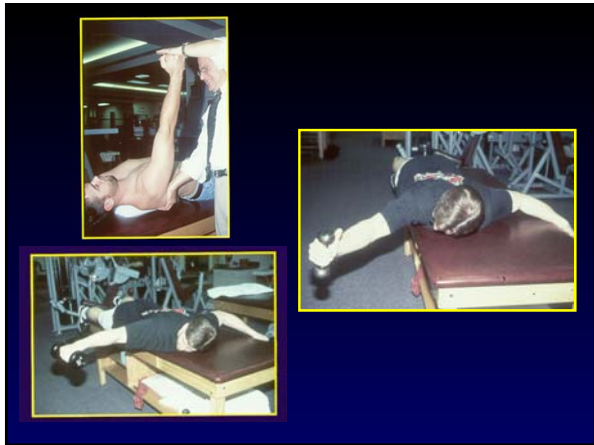












Rehab of Partial Rotator Cuff Tears

Throwing Progression

- *Interval Throwing Program*
- Progress gradually to ITP when appropriate
- Specific criteria
 - Small tears: week 12-14
 - Moderate tears: wk 16-18
 - Significant tears: wk 18-20

Variable timeframes

Gradually Progress to Mound Throwing

Rehab Overhead Athlete

Return to Play Criteria

- ✓ Full sport specific non painful ROM
- ✓ Strength which meets the criteria
- ✓ Excellent stability and no painful special tests
- ✓ Demonstrates proper throwing mechanics
- ✓ Successfully has completed rehab program
- ✓ Appropriate rehab progression completed
- ✓ Satisfactory functional scoring

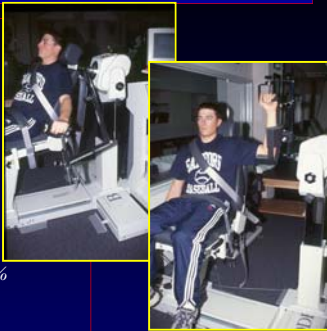
An Objective Criteria is Important

Assess Muscular Strength

Biodex -Isokinetics

- ER / IR ratios
 - ✓ 72 - 76%
- ER / ABD ratios
 - ✓ 68 - 73%
- Torque / BW ratios
 - ✓ ER 18 - 23%
 - ✓ IR 26 - 32%
- Bilateral comparison
 - ✓ ER 95-100%; IR 115%

Wilk et al: AJSM '93
Wilk et al: AJSM '95



Return to Play Criteria

Appropriate Rehab Progress


- ✓ Plyometrics
 - ✓ painfree 1 hand throwing
- ✓ Dynamic stabilization drills
 - ✓ RS drills at 90/90 (P/F)
 - ✓ prone ball drops



Return to Play Criteria

Ball Drop Test


- ✓ Dynamic stabilization tests
 - ✓ Prone ball drops
 - ✓ 30 sec test
 - ✓ prone on plinth
 - ✓ number of releases/catches
 - ✓ compare Dom to Non Dom
 - ✓ score: %
 - ✓ Goal: 90%>
 - ✓ Expectation; 110%>



Return to Play Criteria

Single Leg Squat

- ✓ Single leg squat test
 - ✓ Floor or 8 in step
 - ✓ 10 reps on each leg
 - ✓ assess depth
 - ✓ assess valgus/varus
 - ✓ assess lateral trunk movt.
 - ✓ assess trunk flexion
 - ✓ looking for symmetrical motion with no pain &/or dysfunction



Return to Play Criteria

Appropriate Rehab Progression

- ✓ Subjective Shoulder Questionnaire & Scoring System



Advanced Throwers Ten Program

Wilk et al: Phys SportsMed 2011



Rehab Thrower's


Key Points

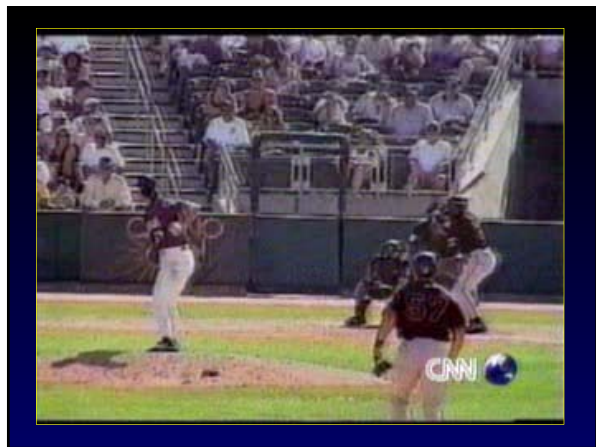
- ✓ Recognition of pathology
differential diagnosis
- ✓ Establish cause - treat cause
- ✓ Improve posterior flexibility *IR*
& *Horz Adduction (IR)**

STRETCH & Normalize

- ✓ Establish muscular balance
- ✓ Scapular muscular strength
- ✓ Enhance proprioception & NM

Gradual return to throwing





Wilk - GIRD, TROM and Injuries to the
Thrower 2016