The Comprehensive Care of the Overhead Athlete

Presented by: Zach Kirkpatrick, PT, MPT, SCS
Introduction

- 7 years of clinical practice in sports medicine and orthopedics
- Graduated from Northern Illinois University in 2011 with a Master’s degree in Physical Therapy
- Began Sports Clinical Specialist residency with Evidence in Motion in July of 2015 – completed in March of 2017
Introduction

- Certifications and Training
  - Selective Functional Movement Assessment certified
  - Functional Movement Screen Level 1 & 2 certified
  - ASTYM certified
  - Functional Dry Needling Level 1 certified through Kinetacore
  - CrossFit Level 2 trainer
  - USAW Level 1 sports performance coach
  - Blood Flow Restriction trained through B Strong
My Family

My wife Tiffany
My son Knox (15 months old)
Another on the way due in January
Objectives

- Discuss the prevalence of injuries in overhead athletes, especially in baseball
- Provide an overview of the comprehensive evaluation of the overhead athlete
- Discuss the different treatments that can be provided to overhead athletes ranging from various manual therapies to exercise progressions
- Discuss the discharge measures for the overhead athlete
Injury Epidemiology

- Pitchers miss days at a rate 34 times higher than all other players due to elbow injuries\(^1\)

- In 1 season alone for an MLB team in 2010-2011
  - Long head of the biceps tendonitis resulted in 243 days missed\(^1\)
  - Shoulder SLAP and bicep tendon instability in another 88 days missed\(^1\)
Injury Epidemiology

- In Major League Baseball from 1998-2015\(^3\)
  - Shoulder injuries resulted in 26.2% of DL days
  - Arm/Elbow injuries resulted in 28.2% of DL days
  - This totaled 129,800 days missed and 120,739 days for elbows and shoulders respectively
    - Let’s puts some money on this
      - $6.7 billion paid to players on the DL
      - $886 million paid to replacement players
      - Totaling – 7.1 billion dollars
A study found that 5% of young baseball players (9-14 years old) had a “serious” shoulder or elbow injury within the first 10 years of playing baseball (serious is requiring surgery)\(^5\)
Injury Risk Factors

- 3x greater risk of injury if throwing more than 100 inning/year\(^4\)
- 4x greater risk of injury if you average more than 80 pitches/game\(^4\)
- 5x greater risk if pitching greater than 8 months/yr\(^4\)
- Overuse injuries
  - Pitch more months, games, and pitches/year
  - Pitch more inning, games and warm-ups
- Throwing a baseball is not good for your body
- Forces involved with throwing create forces at 1.5 times the athlete’s BW going through the anterior portion of the shoulder – BW going through shoulder with every pitch\(^2\)
- Most players are micro-injured at all times
Differential Diagnosis of Pain in Overhead Athletes

<table>
<thead>
<tr>
<th>Extrinsic</th>
<th>Intrinsic</th>
<th>Neurovascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotator cuff</td>
<td>Bone</td>
<td>Thoracic outlet syndrome</td>
</tr>
<tr>
<td>Tendinitis</td>
<td>Bony Bankart</td>
<td>Neurogenic, arterial, venous</td>
</tr>
<tr>
<td>Tear</td>
<td>OCD</td>
<td>Axillary artery</td>
</tr>
<tr>
<td>Subacromial impingement</td>
<td>Posttraumatic/ osteoarthritis</td>
<td>Thrombosis, aneurysm</td>
</tr>
<tr>
<td>Scapular dysfunction</td>
<td>Bennett’s lesion</td>
<td>Effort thrombosis</td>
</tr>
<tr>
<td>Scapular dyskinesis</td>
<td>Biceps tendon</td>
<td>Quadrilateral space syndrome</td>
</tr>
<tr>
<td>SICK scapula</td>
<td>Tendinitis/tendinopathy</td>
<td>Long thoracic nerve palsy</td>
</tr>
<tr>
<td>Snapping scapula</td>
<td>Soft tissue</td>
<td>Suprascapular nerve palsy</td>
</tr>
<tr>
<td>Scapulothoracic bursitis</td>
<td>SLAP</td>
<td>Brachial neuritis</td>
</tr>
<tr>
<td>Scapular winging</td>
<td>Bankart/anterior instability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Posterior labral tear/ posterior instability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HAGL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MDI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GIRD</td>
<td></td>
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</tbody>
</table>
Evaluation Process

- Outside of the referring diagnosis based on the physician’s evaluation with imaging I’m going to perform a detailed evaluation of the athlete.
- KISS method – I’m going to treat what I find, not dig too deep into it.
- After I find what I’m going to be addressing, I will then educate the athlete on how this can affect their throwing mechanics.
Pathomechanics of Pitching Motion

<table>
<thead>
<tr>
<th>Phase / Event</th>
<th>Proper Mechanics</th>
<th>Pathomechanics → Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windup</td>
<td>Lift front leg.</td>
<td></td>
</tr>
<tr>
<td>Maximum knee height</td>
<td>Pitcher is balanced.</td>
<td></td>
</tr>
<tr>
<td>Stride</td>
<td>Front leg goes down and forward.</td>
<td>↓ Push off rubber → ↓ Ball velocity</td>
</tr>
<tr>
<td>Foot contact</td>
<td>Front foot is planted slightly to third-base side (for a right-handed pitcher). Front foot is pointed slightly inward. Shoulder is abducted approximately 90°, with approximately 60° of external rotation.</td>
<td>↓ Stride length → ↓ Ball velocity Front foot open (position or angle) → ↑ Shoulder and elbow force Improper shoulder external rotation → ↑ Shoulder and elbow kinetics Excessive shoulder external rotation → ↓ Ball velocity ↓ Shoulder horizontal abduction → ↓ Ball velocity</td>
</tr>
</tbody>
</table>

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### Pathomechanics of Pitching Motion

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Description</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arm cocking</strong></td>
<td>Pelvis rotation, followed by upper trunk rotation. Shoulder externally rotates, and trunk arches.</td>
<td>Early pelvis rotation → ↓ Ball velocity&lt;sup&gt;25,40&lt;/sup&gt; Late pelvis rotation → ↑ Shoulder and elbow kinetics&lt;sup&gt;40&lt;/sup&gt; ↓ Pelvis rotation velocity → ↓ Ball velocity&lt;sup&gt;4,40&lt;/sup&gt; Poor timing between pelvis rotation and upper trunk rotation → ↓ Ball velocity&lt;sup&gt;23,35&lt;/sup&gt; Poor timing between pelvis rotation and upper trunk rotation → ↑ Shoulder internal rotation torque&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

| **Maximum external rotation** | Shoulder external rotation is approximately 180°. Elbow flexion is approximately 90°. | ↓ Shoulder external rotation → ↓ Ball velocity<sup>4,23,39</sup> Excessive shoulder horizontal adduction and elbow flexion → ↑ Shoulder kinetics<sup>12</sup> |

| **Arm acceleration** | Elbow extends, followed by shoulder internal rotation. Front knee extends. | |
Pathomechanics of Pitching Motion

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</table>
| Ball release        | The throwing shoulder is abducted approximately 90°                                | ↓ Knee extension velocity → ↓ Ball velocity⁷³  
|                     |                                                                                 | Improper shoulder abduction → ↓ Ball velocity⁷⁵  
|                     |                                                                                 | Improper shoulder abduction → ↑ Elbow varus torque⁷⁶  
|                     |                                                                                 | ↓ Forward trunk tilt → ↓ Ball velocity⁸³      |
| Arm deceleration    | Shoulder internal rotation and front knee extension continue.                     |                                                                                                 |
|                     | Trunk tilts forward.                                                             |                                                                                                 |
| Maximum internal rotation | Shoulder external rotation is approximately 0°.                               |                                                                                                 |
| Follow through      | Arm crosses in front of body.                                                    |                                                                                                 |
|                     | Trunk flexes forward.                                                            |                                                                                                 |
Cause of Pathomechanics

- In my experience these pathomechanics are caused from a multitude of factors
  - Lack of strength
  - Lack of ROM
  - Asymmetries
  - Poor coaching in pitching mechanics
Asymmetries in Pitchers

- A study in 2015 found the 75% of baseball players under the age of 12 had some form of scapular asymmetry.

- Of these players, 24% of them had experience some sort of shoulder pain during the season.

<table>
<thead>
<tr>
<th>Scapular position of the throwing side compared with non-throwing side</th>
<th>number of subjects</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>anterior tilt</td>
<td>70</td>
<td>31.4</td>
</tr>
<tr>
<td>posterior tilt</td>
<td>63</td>
<td>28.3</td>
</tr>
<tr>
<td>superior deviation</td>
<td>60</td>
<td>26.9</td>
</tr>
<tr>
<td>inferior deviation</td>
<td>87</td>
<td>39.0</td>
</tr>
<tr>
<td>abduction</td>
<td>31</td>
<td>13.9</td>
</tr>
<tr>
<td>adduction</td>
<td>52</td>
<td>23.3</td>
</tr>
<tr>
<td>upward rotation</td>
<td>50</td>
<td>22.4</td>
</tr>
<tr>
<td>downward rotation</td>
<td>72</td>
<td>32.3</td>
</tr>
</tbody>
</table>
Asymmetries in Pitchers

- In a 2014 study, it was found that pitchers had more internal rotation of the stance hip as well as having more external rotation of the stride hip\(^9\)

- Loss of IR of the shoulder was the ROM deficit that had the highest relationship with injury risk
  - Pitchers that had a greater than 20 degree decrease in shoulder IR were more likely to sustain an injury\(^{11}\)
  - Other findings: a gain in ER ROM, posterior shoulder tightness and loss of total ROM were unrelated to injury risk\(^{11}\)
Strength Asymmetries in Pitchers

- Youth pitchers also demonstrate excessive contralateral trunk lean which may be associated with an imbalance between oblique muscles on the dominant and nondominant side which can also lead to increased joint loading
  - Youth pitchers typically develop this strategy in order to achieve high velocity\(^{10}\)

- Strength deficits in dominant and nondominant supraspinatus strength tended to have a increased injury risk\(^{11}\)
Evaluation of the Overhead Athlete

- Detailed history
  - How many seasons played? What positions?
  - How many innings or pitches throw/game?
  - Factors leading up to the injury?

- Neurological screening
  - Chance to catch TOS

- Breathing

- Strength testing

- Selective Functional Movement Assessment
  - ROM measurements are then taken at this point

- Special Testing
  - Although I track special testing, it does not really change treatment
Selective Functional Movement Assessment

- A comprehensive assessment used to classify movement patterns and discover local biomechanical dysfunctions during the examination which ultimately will direct manual therapy and exercise prescription.

- Takes 7 top tier movements and classifies them as functional or dysfunctional and painful or not-painful.

Scoring

- Functional & Nonpainful
- Functional & Painful
- Dysfunctional & Painful
- Dysfunctional & Nonpainful
Selective Functional Movement Assessment

- Movements that are functional and nonpainful are not broken down
  - There’s nothing wrong

- Movements that are dysfunctional and nonpainful are broken down further
  - Something is going on to make movement this way

- Movements that are dysfunctional/painful and functional/painful are broken down lastly and with caution
  - Maybe leading to what is wrong but with SFMA we avoid pain

- By breaking down patterns you find local dysfunctions

- The beauty of SFMA is you can make change by attacking movements that are painful by movement into nonpainful patterns
SFMA Findings

- SFMA Findings are listed at either Mobility Dysfunctions (MD) or Stability Motor Control Dysfunctions (SMCD)
- SMCD’s are not just strength issues but also timing and control issues with movement
- Typical findings, in a pitcher
  - Thoracic spine extension/rotation MD
  - Shoulder flexion, IR, ER MD’s or SMCD’s
  - Hip ER/IR MD’s or SMCD’s
SFMA Top Tier Movements
Trigger Points and Dry Needling

- Trigger points are thought to be caused by dysfunctional motor endplates\textsuperscript{12}

- Leads to a release in acetylcholine at neuromuscular junction resulting in shortened muscle fibers\textsuperscript{12}
  - This results in tissue hypoxia – primary cause of increased pain\textsuperscript{12}

- Proposed mechanics of DN effectiveness\textsuperscript{12}
  - Mechanical stretch due to local twitch response
  - Opens gate of afferent neurons
  - Possible release of opioid-like peptides
  - Change in chemical state following twitch response
  - Improved blood flow to area resulting in improved muscle recovery
Dry Needling

- Trigger point dry needling has been found to be an effective tool at improving not only joint ROM but muscle fiber recruitment as well.

- In a case study in the management of elite volleyball players with anterior shoulder pain, DN was found to be an effective tool.
  - All athletes in the study had immediate decrease in pain as well as improved shoulder ROM\textsuperscript{12}
  - Primary muscles that were treated were teres minor and infraspinatus given the eccentric and concentric action with overhead activity
    - Although this study was on volleyball players this can be carried over to baseball
Dry Needling

- Dry needling also appears to improve neuromuscular recruitment of motor units
  - Can be performed on lower trapezius, deltoids

- Can also be used to reduce tension throughout muscles and help to reduce over-recruitment
  - Pectoralis Major
  - Upper Trapezius
Upper Extremity Dry Needling
UE Patterns 1 & 2 after Dry Needling
Instrument Assisted Soft Tissue Mobilization

- I am an ASTYM certified clinician and I have had great success with ASTYM in treating overuse injuries.

- A study in 2014 found that IASTM had acute improvement in glenohumeral horizontal abduction and internal rotation ROM following treatment\textsuperscript{22}.
Joint Mobilizations

- Joint mobilizations are also an effective tool at providing improved mobility in the glenohumeral joint
  - Patients with primary shoulder impingement had better functional outcomes, AROM and decreased pain scores with GH mobilization in anterior, posterior, inferior and LAD compared to the control group who underwent same exercises, stretches and modalities\textsuperscript{23}

- Thoracic spine manipulation also has been a valuable tool at reducing shoulder impingement pain
  - Also a study has shown it can result in improved lower trapezius strength following thoracic spine manipulation\textsuperscript{24}
Eccentric Strengthening in Injury Prevention

- Eccentric strength training of the external rotators resulted in no loss of strength in internal rotation concentric strength, but also helped reduce injury in female collegiate tennis players\textsuperscript{13}

- Focusing on eccentrics can help muscles by changing to optimal muscle length\textsuperscript{14}

- Eccentric help to strengthen the muscle-tendon system which helps to dissipate energy used in muscles\textsuperscript{14}

- Most importantly helped to decelerate the forces through the shoulder at ball release\textsuperscript{14}
Exercises After Mobilizations

- After performing manipulations or mobilizations I then prescribe exercise to reinforce this new found motion
- First with movement based exercises
- Followed by loaded exercises
Sidelying Thoracic Rotation
Downward Dog
Barbell Overhead Opener
Quadruped Thoracic Rotation with Assistance and with Resistance
Kettlebell Arm Bars
Double Kettlebell Front Rack Walk
Waiter’s Carry
Waiter’s/Farmer’s Carry
Exercises to Focus on for Overhead Athletes\textsuperscript{15,16}

- Based on the information for the study performed by Mike Reinold, PT, ATC and Kevin Wilk, PT in 2009

- Performed EMG studies on common glenohumeral and scapulothoracic muscles based on anatomical, biomechanics and clinical implications
<table>
<thead>
<tr>
<th>Muscle</th>
<th>Exercise</th>
<th>Anatomical Implications</th>
<th>Biomechanical Implications</th>
<th>Clinical Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supraspinatus</td>
<td>1. Full can</td>
<td>1. Enhances scapular position and subacromial space</td>
<td>1. Decreased deltoid involvement compared to empty can</td>
<td>1. Minimizes chance of superior humeral head migration by deltoid overpowering supraspinatus</td>
</tr>
<tr>
<td></td>
<td>2. Prone full can</td>
<td>2. Enhances scapular position and subacromial space</td>
<td>2. High posterior deltoid activity with similar supraspinatus activity</td>
<td>2. High supraspinatus activity and also good exercise for lower trapezius</td>
</tr>
<tr>
<td>Infraspinatus and teres minor</td>
<td>1. Side-lying ER</td>
<td>1. Position of shoulder stability, minimal capsular strain</td>
<td>1. Increased moment arm of muscle at 0° abduction. Greatest EMG activity</td>
<td>1. Most effective exercise in recruiting infraspinatus activity. Good when cautious with static stability</td>
</tr>
<tr>
<td></td>
<td>2. Prone ER at 90° abduction</td>
<td>2. Challenging position for stability, higher capsular strain</td>
<td>2. High EMG activity</td>
<td>2. Strengthens in a challenging position for shoulder stability. Also good exercise for lower trapezius</td>
</tr>
<tr>
<td></td>
<td>3. ER with towel roll</td>
<td>3. Allows for proper form without compensation</td>
<td>3. Increased EMG activity with addition of towel, also incorporates adductors</td>
<td>3. Enhances muscle recruitment and synergy with adductors</td>
</tr>
<tr>
<td>Subscapularis</td>
<td>1. IR at 0° abduction</td>
<td>1. Position of shoulder stability</td>
<td>1. Similar subscapularis activity between 0° and 90° abduction</td>
<td>1. Effective exercise, good when cautious with static stability</td>
</tr>
<tr>
<td></td>
<td>2. IR at 90° abduction</td>
<td>2. Position of shoulder instability</td>
<td>2. Enhances scapular position and subacromial space. Less pectoralis activity</td>
<td>2. Strengthens in a challenging position for shoulder stability</td>
</tr>
<tr>
<td>Serratus anterior</td>
<td>1. Push-up with plus</td>
<td>1. Easy position to produce resistance against protraction</td>
<td>1. High EMG activity</td>
<td>1. Effective exercise to provide resistance against protraction, also good exercise for subscapularis</td>
</tr>
<tr>
<td></td>
<td>2. Dynamic hug</td>
<td>2. Performed below 90° abduction</td>
<td>2. High EMG activity</td>
<td>2. Easily perform in patients with difficulty elevating arms or performing push-up. Also good exercise for subscapularis</td>
</tr>
<tr>
<td>Muscle Group</td>
<td>Exercise 1</td>
<td>Exercise 2</td>
<td>Exercise 3</td>
<td>Exercise 4</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Lower trapezius</td>
<td>1. Prone full can</td>
<td>1. Can properly align exercise with muscle fibers</td>
<td>1. High EMG activity</td>
<td>1. Effective exercise, also good exercise for supraspinatus</td>
</tr>
<tr>
<td></td>
<td>2. Prone ER at 90° abduction</td>
<td>2. Prone exercise below 90° abduction</td>
<td>2. High EMG activity</td>
<td>2. Effective exercise, also good exercise for infraspinatus and teres minor</td>
</tr>
<tr>
<td></td>
<td>3. Prone abduction at 90° abduction with ER</td>
<td>3. Prone exercise below 90° abduction</td>
<td>3. Good ratio of lower to upper trapezius activity</td>
<td>3. Effective exercise, also good exercise for middle trapezius</td>
</tr>
<tr>
<td></td>
<td>4. Bilateral ER</td>
<td>4. Scapular control without arm elevation</td>
<td>4. Good ratio of lower to upper trapezius activity</td>
<td>4. Effective exercise, also good for infraspinatus and teres minor</td>
</tr>
<tr>
<td>Middle trapezius</td>
<td>1. Prone row</td>
<td>1. Prone exercise below 90° abduction</td>
<td>1. High EMG activity</td>
<td>1. Effective exercise, good ratios of upper, middle, and lower trapezius activity</td>
</tr>
<tr>
<td></td>
<td>2. Prone horizontal abduction at 90° abduction with ER</td>
<td>2. Prone exercise below 90° abduction</td>
<td>2. High EMG activity</td>
<td>2. Effective exercise, also good exercise for lower trapezius</td>
</tr>
<tr>
<td></td>
<td>3. Prone horizontal abduction at 90° abduction with ER</td>
<td>3. Prone exercise below 90° abduction</td>
<td>3. High EMG activity</td>
<td>3. Effective exercise, also good exercise for lower trapezius</td>
</tr>
<tr>
<td></td>
<td>3. Prone horizontal abduction at 90° abduction with ER</td>
<td>3. Prone exercise below 90° abduction</td>
<td>3. High EMG activity</td>
<td>3. Effective exercise, also good exercise for lower trapezius</td>
</tr>
<tr>
<td>Rhomboids and levator scapulae</td>
<td>1. Prone row</td>
<td>1. Prone exercise below 90° abduction</td>
<td>1. High EMG activity</td>
<td>1. Effective exercise, good ratios of upper, middle, and lower trapezius activity</td>
</tr>
<tr>
<td></td>
<td>2. Prone horizontal abduction at 90° abduction with ER</td>
<td>2. Prone exercise below 90° abduction</td>
<td>2. High EMG activity</td>
<td>2. Effective exercise, also good for lower and middle trapezius</td>
</tr>
</tbody>
</table>
Progressions of Common Shoulder Exercises

- 3x10 with 10-30” hold at end of final rep
- Add rhythmic stabilization at varying rep schemes
  - Every 5 to 10 reps
  - Every other rep?
- Perform sidelying exercises in side plank position
- Remember our athlete’s do not live in a 3x10 world
  - Always change it up
  - Add holds, more reps
Shoulder Priming Exercises
Quadruped Reach, Rotate, Lift
Prone Swimmers
Sidelying Shoulder External Rotation in Side Plank
Sidelying Shoulder Abduction with Rhythmic Stabilization
(3x10-15 w/ RS every 5th rep)
Sidelying Shoulder Flexion with Hold
(3x10-15 w/ 10” hold every 5th)
Posterior Shoulder Trio (3xME)
90/90 Shoulder Raises
(3x20, maintain flat lumbar)
Half Turkish Get Up
(x10-15 each side)
Lower Extremity Strength in Overhead Throwing

- At this point it is clear how important it is to incorporate the lower extremities into throwing in order to transfer more power into the ball without injuring the rotator cuff.

- A study found that the gastrocnemius, vastus medialis, rectus femoris, gluteus maximus and biceps femoris EMG activity increases throughout the throwing motion$^{17}$.

- Moderate to high EMG activity was noted in the trail leg at maximum stride leg knee height to stride foot contact (SFC) and in the stride leg at max stride knee height through ball release$^{17}$. 
Lower Extremity Strength in Overhead Throwing

- This high level of EMG activity is due to the shear force created while throwing a baseball\textsuperscript{18}
  - Shear forces at .35 body weight is created in the direction of the pitch on the push off leg
  - Shear forces at .72 body weight is created on the stride leg
Cross Training

- This is how I get my overhead athletes to learn how to transfer power from their legs through their torso.

- A study found that strength training in combination with plyometrics resulted in the greatest percent change in 20, 40, 60 yard dash, vertical jump, standing broad jump and T-agility drill compared to heavy resistance or plyometric training.\(^1^9\)

- Whereas plyometric training only saw the greatest change in vertical jump compared to heavy resistance and cross training.\(^1^9\)

- Cross Training consisted of squats, lunges, split squats with plyometric exercise of box jumps, depth jumps and split squat jumps.
Plyometrics
Drop Jumps
Plyometrics
Lateral Drop Jumps
Plyometrics
Medicine Ball Slams
Plyometrics
Rotational Medicine Ball Slams
Plyometrics
Step Back MB Shot Put
Upper Extremity Plyometrics
BUE Overhead Dribble
Upper Extremity Plyometrics
Single Arm 90/90 ER Dribbles
Upper Extremity Plyometrics
Single Arm 90/90 IR Dribbles
Blood Flow Restriction Training

- Vascular affects of BFR
  - Restrict, impede, and make venous outflow more pulsatile
  - Engorge capillaries distal to BFR cuff
  - Maintain arterial inflow
  - Evidence of angiogenic stimulation from BFR – can make new/better blood vessels

- Easy exercise w/ BFR – Disturbance of Homeostasis
  - Decreased pO2, pH, PC/ATP
  - Increase Lactate
  - Together changes produce metabolic crisis
  - As early motor unit fatigue, faster and bigger units must take over the work

- Systemic Neuro-Immuno-Homoral anabolic response
  - The systemic response amplifies the local anabolic response
  - Because little damage was done, increases in strength and fitness come quickly
  - All tissues involved in the exercise, proximal and distal to the BFR enjoy the anabolic action
Benefits of Blood Flow Restriction Training

- Increase in cross sectional area and strength of the muscle proximal and distal to the BFR cuffs\textsuperscript{20}

- There is also research to show increase in intramuscular EMG in muscles both proximal and distal to the BFR cuffs\textsuperscript{21}

- In my practice I have used the B Strong BFR cuffs not only with conventional shoulder and leg exercises but also with all the previously mention plyometric exercises
Where do we go from here?

- Once we have addressed asymmetries by improving hypomobilities, neuromuscular control and overall strength, how do we truly know when the athlete is ready to return to sport?
- Are they progressing well through their return to throwing protocol?
- What other functional tests and measures can be used to determine readiness for return to sport?
Upper Extremity Y-Balance Test

- Similar testing to the LE-YBT however much more difficult
- Scoring is the same as the LE-YBT
  Medial+Inferolateral+Superolateral/Arm Length x3
- I prefer to have my athletes within 90% of the unaffected arm
- Research found there is a significant difference in positions however was found to be useful information for goals and functional discharge measure^{25}
Upper Extremity Y-Balance Test
Upper Extremity Y-Balance Test
One Arm Hop Test

- Good functional performance test to compare right arm vs. left arm

- Athlete begin in a single arm push up position next to a 10.2 cm box and perform 5 single arm hops from box to floor for time.

- Research on collegiate football players and wrestlers found this test was a reliable functional performance test to assess injured arm vs. unaffected contralateral arm\textsuperscript{26}
One Arm Hop Test
One Arm Hop Test
Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)²⁵

- Athlete is in a plank position with the hands on pieces of tape that are 36 inches apart.
- Athlete is then instructed to reach to the opposite side with one hand and repeat with the other.
- Number of touches in 15 seconds is counted and then is given 45 seconds of rest for 3 trials.
- In a study no significant difference was found in collegiate baseball players however was found to be a good measure of strength for goals.
Closed Kinetic Chain Upper Extremity Stability Test
(CKCUEST)\textsuperscript{25}
Final Remarks

- In my opinion, it is best practice to look at the athlete through the entire kinetic chain which can be performed by having the patient begin with functional movements.

- Based on what the movement screen shows, the best treatment plan can be developed.

- Once the athlete is demonstrating competence with exercises and progression, functional testing can be performed in order to assess readiness for return to sport.

- Don’t forget – athletes do not live in a 3x10 world, switch it up, add holds, rhythmic stabilization and place them in challenging positions.
THANK YOU!!
References


References


