Physical Therapy for the Athlete

THE SHOULDER

Special Considerations, Examination, Theory, Exercise Prescription and Progression

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Outline

- Shoulder Injuries in Sport
- Functional Anatomy
- Shoulder Examination
- Shoulder Testing
- Shoulder Treatment Theory
- Shoulder Exercise Prescription and Progression
- Special Considerations, Return to Play

Shoulder Injuries in Sport

- Most common involved sports;
  - Baseball, softball, tennis, volleyball and swimming
  - Repetitive overhead components
  - Stress of sport (volume and load)
  - Adaptive changes vs. Pathologic Changes
    - Retroversion of humeral head of dominant arm is normal adaptation

Shoulder: Functional Anatomy

- GH joint has more mobility than any other joint in body
- “Static” Stabilizers
  - Labrum, GH ligaments, Glenoid Socket (concavity)
- “Dynamic” Stabilizers
  - RTC mms, deltoid, parascapular mm’s
  - Posture
  - Attempt to centralize humeral head in glenoid

Shoulder: Functional Anatomy

- Other considerations
  - Thoracolumbar spine, soft tissue length (LE and UE), Shortened RTC mm’s, fascia
  - Mm spindles and mechanoreceptors

- Fascial stability; deep fascia of neck and back can provide scapula stability (must consider all structures since only bony attachment to rest of body is clavicle
- 120deg of GH joint motion in full flex/abd
  - To achieve full flex and abd, must have enough ER to allow greater tuberosity to pass under coracoacromial arch
  - 60deg scapulothoracic, but WHEN does it occur is key

Shoulder: Functional Anatomy

- GH jth as
  - Posture structures since only bony attachment to rest
Shoulder: EXAMINATION

• Do not rely on physician dx: ie. “Frozen shoulder”
• Subjective: Ask the right questions!
  – When releasing ball, cocking phase, release phase? Only when throwing 100%, after how many throws, swim strokes, serves, etc.? 
  – Sensations of instability or stiffness?
  – Athletes are very “in tune” with their body, they can tell you extremely valuable information
  – In season, out of season, weight lifting and practice schedules
  – Decreased velocity/accuracy?
  – Soreness, fatigue?

Shoulder: Examination

• Hyper vs. Hypo
  – Born loose or torn loose?
• Scapula Position: influence of rest of kinetic chain
  – Wing, tilt, rotation, etc.
  – Protracted scapula loads the labrum
• “You can see a lot by watching” Yogi Berra

Posture

• Posture: unique, wide variation of “normal”
  – We are not symmetrical: Heart on one side, lungs have more lobes on one side
• Adaptive shortening (sport specific necessary vs. dysfunctional)
• Posture is NOT STATIC!
  – Dynamic posture exam vs. plumb line static exam
  – Looking for posture that influences the position of the shoulder girdle DURING ACTIVITY
• Postural Timing: if one segment is out of sync = performance error, predisposed to injury if repeated enough

Posture: Result/Adaptations

• I.e. anterior pelvic tilt = knee recurvatum
• I.e. Thrower – loss of balance, lack of hip flexion, ankle ROM, stance leg bent vs. straight, thoracic spine curve and why, etc.
  • Multiple considerations that can change G-H and scapular position

Dynamic Posture: Overhead Athlete

• Critical points during overhead motions;
  – Balance Point: at end of “wind up” phase
    • If solid balance point is not achieved, the legs and trunk will not be in sync with UE
    – Increase stress on shoulder and elbow to achieve velocity
  – Early cocking: keep hand on top of ball
    • Keep arm from moving behind body in late cocking will minimize anterior capsule stress
  – Adequate stride length: ensure LE and trunk in sync with the arm
    • Athlete can take advantage of explosiveness of body with least amt of stress to shoulder – “serape effect”

Shoulder: Testing

• “Functional” Testing
  – 5/5 MMT? What does that mean?
  – Does test translate into useful info?
    • Throwing performance index
    • Closed Kinetic Chain UE test
Shoulder Testing

- Don’t forget to test in position they perform
  - 90deg Abd, overhead, full ER, end ROM
- Check provocative tests and motions in “normal” posture and corrected posture
- Generalized laxity inspection:
  - Hyperext of elbow, MCP Jts, hyperflexion of 1st CMC and wrist joint
  - Stabilize scapula to better assess true G-H motion

“Normal” scapulohumeral rhythm:
- 1st 25deg = 4:1, then 5:4 ratio (20deg GH to 5deg Sc, then 92deg GH to 73deg Sc)
- TROM (Total Range of Motion) concept:
  - 185deg acceptable, 200deg caution, 200+ monitor closely
  - TROM should be within 5deg of other shoulder
  - GIRD (Glenohumeral Internal Rotation Deficit)
- Assessing Hor. Add: Normal is 45-55deg

Firing patterns of muscles

Unstable shoulder – deltoid/pec activated 1st (downward rot of scapula instead of lifting humerus)
- Normal shoulder – RTC and biceps activate 1st
- BODY CHOOSES STABILITY OVER MOBILITY!
  - Serratus anterior always rotates scapula
  - Mid trap always stabilizes
  - Rhomboids always stabilize above 60deg of motion
- Muscle firing is POSITION SPECIFIC
- Shoulder problem vs. TIMING problem

Muscle spindle firing after immobilization
- Elongates post RTC, shortened pec minor
  - Delayed RTC response
  - Reset the mm spindle bias at rest to a lengthened position
- Length-tension relationship
  - Optimal length = optimal force production
  - Pain inhibits mm firing

Shoulder: Treatment Theory

- If all you have is a hammer, everything looks like a nail
- If you can’t fix it with a hammer, you have an electrical problem
- CNS does not recognize individual mm’s – instead movement patterns
  - Repeated actions result in movement habit
  - Takes 3000-30,000 reps to changes a motor plan
- Train Movement, not muscles
  - Movement is gravity driven (Posture; equal and opposite reactions)
  - Less than optimal joint angle will result in altered mm firing and patterns
  - Body chooses stability over mobility

Rehab the athlete, not the injury
- Gravity does not discriminate, we can learn to cheat it for brief periods
- Practice makes permanent, NOT perfect
- Brain recognizes patterns of movement, not isolated muscles
Shoulder: Treatment Theory for the Athlete

• Train trunk and legs (Rotational stability)
• Flexibility of LE (Hip IR and Ext)
  – Stride length for pitcher (should be longer than height of athlete)
  • Ball velocity directly correlated with stride length
• Train multi-angle (prevents adaptation, builds neural memory)
• Work overhead (Scapular stabilizers work more above 90deg)
  – Short arc training in area of deficits (active lengthening)
  – Use hip and trunk changes to change G-H and scapula angle

Shoulder: Exercise Prescription

• Retrain mm’s to balance stability and mobility
  – Co-activation of mm spindles increased proprioception
  – Eccentric timing (angle specific to mm recruitment)
  – Emphasize scapular control
• Protect the anterior capsule
  • 30/30/30 concept
    – Protect RTC by avoiding wringing out effect, functional arc of motion, protects anti-in capsule, pre-stretches the infraspinatus and teres minor
  – Progress to 90/90 in overhead athlete – 45deg and above starts to limit posterior deltoid

Shoulder Hypo vs. Hyper Treatment

• Laxity is not synonymous with instability
  – Redundant joint capsule
• Hypo:
  – Joint mobilizations in end range, thoracic mobs
  – TERT – prolonged stretching decreases GTO response
  – Active warm up to increase collagen temp is more effective than modalities

Shoulder: “Bang for your buck” exercises

• Core strengthening when performing resistance ex’s for the limbs, especially if the ex’s are performed unilaterally
• Unstable bases
• ECCENTRICS!
  • Most injuries occur in eccentric rotation
• Exercise training variables;
  – Planes of motion, body positions, base of support, external resistance, balance, various ex modalities
  – Manipulate reps, sets, intensity, rest intervals, frequency, duration

Shoulder: Treatment Theory for the Athlete

• Address Rotational Strength deficits!!!!
  – Research demonstrated if only strengthen IR/ER, made gains in all planes
  – AROM: what element is evident with active Flex and Abd?: EXTERNAL ROTATION
• Serape Effect – transferring the internal forces generated in LE and pelvis to opposite UE (hip-shoulder relationship)
  – Train in rotational and diagonal
  – Throwing and kicking athletes

Strengthening: special considerations

• Weight and exercise selection involving the RTC
  – Endurance vs. strength
  – Throwers with large arm mass
### Functional Rehab Progression
- Slow to fast
- Known to unknown
- Stable to controlled to dynamic functional
- Low force to high force
- Correct execution to increased intensity
- Mid range to end range
- Constant under treatment does not stress tissue enough and increases potential injury when return to sport
- **Drills ≠ Skills**

### Return to Play
- **Gradual Re-Entry:**
  - Document # throws, swimming yards, tennis strokes, etc
  - Document pt’s response to these sessions
  - Pain before and during = More Rehab
  - Pain after that resolves in a few hours with ice = continue re-entry program
- Should pain be your only guide? Why?
- Quality vs. Quantity
- Looks like Tarzan, plays like Jane

### Shoulder: Special Considerations in Adolescents
- **Physeal closure**
  - Girls 14-16 y/o, Boys 16-12 y/o
  - Underdeveloped musculature, skeletally immature, joint laxity
  - Adolescents have more type III collagen that converts to Type I collagen as they mature
  - Discussion: RTC tears in youth?

### Shoulder: Special Considerations in Adolescents
- **Adolescent issues:**
  - Underdeveloped mm, decreased mm endurance, increased tissue laxity, decreased balance/coordination, decreased LE/trunk flexibility
  - Poor coaching, increased pressure to perform
  - Crazy ass parents
  - Physeal closure

### Athlete, Parent and Coach education
- **Weight training : modifications**
- **Year around conditioning**
  - Core strengthening
  - LE strength/flexibility
  - Dynamic posture training
  - Periods of rest from throwing
  - Normal mechanics in throwing – potentially damaging forces with every throw

### Youth Pitchers
- **Youth pitchers initiate trunk rotation early in movement – leads to shoulder hyperangulation**
- **Underdeveloped mm in RTC leads to difficulty controlling arm deceleration**
  - Increased hor. Add. Across the torso
- **“Thrower’s Paradox”**
  - Laxity to allow excessive ER, but stable enough to prevent subluxation
- The shoulder and hand follow the rest of the body!
Throwing Analysis

• Dynamic Posture
  ◦ Stance knee flexion
  ◦ Plant knee flexion
  ◦ Thoracolumbar flex/ext
  ◦ Spine rotation
  ◦ Pelvic position
  ◦ Head position
  ◦ Plant foot direction/position
  ◦ Hip position, flexion/rotation
  ◦ Hand position
  ◦ Shoulder position
  ◦ Elbow position

» The shoulder and hand follow the rest of the body!

Thank You
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