Addendum: For Rehab Professionals

1a. **Form/Throwing/Mechanics-** Use a mirror, videotape or some form of visual aide to assist in achieving proper mechanics. Form throwing is performed without throwing any objects and can be utilized at various speeds.

Catcher: Pop up, stride step, and release from ear

Outfield: CROW HOP: Hop, skip, and throw
(*Crow hop is an excellent drill for any thrower if they are having difficulty involving the rest of the body i.e. trunk, legs, and hips)

Pitching:
Windup: Trunk rotates 90 degrees
Stride leg elevated and flexed, so lateral side of body is facing target
Maintain proper balance

Stride: Begins at the top of the leg kick
Lead leg starts descending to the target; trunk stays rotated storing energy
Stride length slightly less than throwers body length
Stride foot placement is straight or slightly closed to the target

Cocking: Pelvis internally rotated (trunk rotation)
Shoulder abduction 90
ER 110-160 (greater in avid throwers)
Traction on anterior capsule and rotators
Elbow 90 (start of valgus stress)
Only the arm is cocked the legs, hips, and trunk have accelerated
(Late phase)

Acceleration: Increased valgus stress on elbow
Internal rotators forceful
Phase ends with release of the ball

Deceleration/Release: Humerus internally rotated
Elbow extension
Forearm pronation
Eccentric loading of cuff
Ipsilateral hip IR

Follow Through: At End of phase, arm is at opposite knee
Contralateral hip IR

(21 and 4)

Reviewed 12/2014

6. **Muscles Active During Throwing**:
Early Cocking: Upper trap, supraspinatus (sup. & post. cuff muscles activated), deltoid
Late Cocking: Serratus anterior (stabilize the scapula), (concentric) subscapularis, teres minor, supraspinatus, and infraspinatus; bicep
Acceleration: Subscapularis (concentric), lat. dorsi/pectoralis, lower trap and middle trap
Deceleration/follow through: Teres minor/infraspinatus (post. cuff eccentrically), lower trap, and posterior/middle deltoids
(Avid throwers use the RTC muscles less as power muscles, and more as stabilizers)
(23, 18, 16, and 6)

2a. **Dynamic Exercises**:

Plyometrics:
Single arm shot putt toss
Trunk rotation pass
Scoop and roll
Side to side trunk rotation toss
2-hand overhead throw
Wall baseball throw
Sit-up toss
Supine plyometric punch toss
Supine eccentric load plyometric toss
Short arm toss (use weighted ball increase strength and endurance)
Double arm eccentrics (self toss)
Single arm toss- eccentric loading, and ER/IR toss at 0 degrees
Double arm-assist toss- eccentric loading

Endurance Drills:
Wall dribble
UBE
Isokinetic (speed)
Acceleration/deceleration training (short arc's)
1. Eccentric
2. Concentric

Sitting push-up for rep's

Rhythmic Stabilization's(RS's):
Single arm standing (wall)
Supine ball or single arm
Prone ball
Athletic stance position (in-fielding)
ER/IR in stance or supine position
@ 90-90, to 90-0
@ 0 to 90 ER
@ 0 to 70 IR

Neuromuscular Drills:
PNF eyes open/closed (D2 FLEX/EXT)
90/90 drills standing on one leg
RS's eyes closed
PNF on ball supine
Short/long toss standing on 1 leg
Reciprocal isometrics
Closed chain and kinetic chain exercises (body-arm)**see below section
prone on elbows
Quadruped
Triped(fitter)
Hand on tilt board/baps
Single and double arm stairmaster (endurance)
Shoulder flexion with ipsilateral step-up
Lateral stride of ipsilateral leg with punch at shoulder level
(19)

Core training (all planes)- trunk, hips, and back
aa. Start early in the rehab process, as the shoulder recovers from injury/surgery
bb. Use closed kinetic chain, standing one leg utilizing hip and trunk rotation
Clock exercise with hand on wall, ball, or table
1. Start below 90 degrees of elevation until acute pain resolves
2. Also begin with scapular retraction/protraction and elevation/depression
cc. Emphasize diagonal patterns and incorporate plyometrics (use later if surgical)
1. Example-Lawnmower exercise
dd. Focus on trunk extension, hip extension and scapular retraction as used in the cocking phase (be aware for excessive lumbar lordosis)

3a. **Symptom Guide for Throwers**:
A. Anterolateral/lateral arm pain is the common referral source for the RTC and shoulder complex pathology
B. Pain at full ER and Abd (cocking)- Check for ant. instability or internal impingement, SLAP lesions
C. Pain with follow-through and across chest- Post instability, MDI, and/or AC joint
D. Pain at acceleration - labral tear, retraction of biceps
E. Dead Arm Syndrome- recurrent instability (s/s: fatigue, pain, parathesias, and numbness of upper extremity)
F. Pain at posterior shoulder/arm with decreased internal rotation- (sharp pain usually during early acceleration phase) Posterior capsule tightness
(1,13, 11, 10, and19)

**If Overuse or injury occurs and/or pain is increased at any part of the program, return to the exercise or segment that will not elicit symptoms. Use modalities to inhibit inflammation and continue to train until pain or symptoms subside before progressing further.

Other Tips; and signs for recognizing and preventing overuse:

1. Palpable tenderness along the lateral 1/3 of the scapular border could indicate pathology of the conjoined tendon of the latissimus dorsi and teres major. These two muscles depress the humeral head in the glenoid fossa and internally rotate the arm in the acceleration component. Pain could be elicited with passive or active external rotation at 90 degrees abduction (late cocking). Palpation is the primary diagnostic tool (21).

2. The anterior capsule can be under excessive stress if there is improper foot placement towards the target, increased stride with delivery, early delivery, or improper trunk rotation. Anterior humeral subluxation encroaches on the subacromial space increasing the chance for impingement (5 and 13).

3. Posterior capsule tightness can also contribute to the anterior and superior migration of the humeral head against the AC joint. This migration is elicited by forward elevation of the shoulder. The loss of internal rotation, due to posterior capsule tightness, is primarily observed from the cocking to the follow-through phases (22). New research is looking at the possibility with the humeral head position to be posterior/superior.

4. The role of the scapula is multi-faceted. It provides a good foundation for the S.I.T.S muscles and creates a kinetic chain between the humerus and the rest of the body. Most importantly, in throwers, it elevates and rotates the acromion away from the cuff to minimize impingement (cocking and follow-through). When the scapula becomes overly protracted, they can cause shoulder impingement. Increased thoracic kyphosis and/or cervical lordosis can contribute to protracted scapula (17 and 18).

5. Rotator cuff fatigue/overload is the most common injury in avid throwers. Repetitive overload of the cuff muscles, primarily during follow through (deceleration), occurs as the cuff stretches secondary to the eccentric force (12).

6. A positive sulcus sign does not always indicate abnormal inferior laxity for the throwing athlete. It is important to differentiate between asymptomatic hyperlaxity and pathological instability. Always compare to the uninvolved shoulder and look for hyperlaxity in other joints (knees, elbows, and thumbs). The symptoms and their causes are the most important factors in determining a joints pathological instability. Asymptomatic laxity in throwers is very common especially in more competitive athletes (5).

7. Internal impingement is a relatively new concept that has not been researched as extensively as primary, secondary, or coracoid impingement. This type of impingement is unique to overhead throwers or individuals who repetitively abduct to 90 degrees and fully externally rotate, as in the late cocking phase. Internal impingement occurs when either the posterior aspect of the supraspinatus or the superior aspect of the infraspinatus insertion on the greater tuberosity encroaches on the posterior glenoid rim or labrum. This condition presents itself clinically with specific symptoms. Stage one is noted

primarily by stiffness. Stage two is indicated by posterior pain. Lastly, stage three includes stage two symptomatology and a positive relocation test (14).

Other associated terms: Little leaguer's shoulder, pitcher's elbow (medial epicondylitis), little leaguer's elbow (physis), ulnar neuritis, medial collateral instability (elbow), thrower's exostosis, suprascapular nerve entrapment, long thoracic nerve palsy, and axillary and musculocutaneous nerve palsy.

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