

Unconventional Baseball Pitching Styles, Part 2: Upper Extremity Injury Rehabilitation

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A comprehensive assessment and treatment plan for an injured baseball pitcher should include consideration of throwing mechanics. The athletic trainer or therapist should always consider the uniqueness of a patient's injury, his or her performance deficits, and sport-specific demands. Pitching style affects the forces imposed on

the involved anatomic structures, which should be considered for rehabilitation program design.¹⁻³ Part 1 of this two-part series presented information relating to the biomechanics and injury pathology associated with unconventional pitching styles. Part 2 presents information relating to the treatment and rehabilitation of pitchers who utilize unconventional styles.

Hypomobility of the posterior shoulder complex (i.e., posterior capsule and rotator cuff musculature) and tightness of the pectoralis minor muscle can be problematic for baseball pitchers.^{3,4} Unconventional throwing styles are associated with a predisposition for poor coordination of the serratus anterior and lower trapezius muscles.⁴ We present

specific exercises that address performance deficiencies in key muscles, which are particularly relevant for pitchers who utilize the submarine throwing style.

Treatment Considerations for Unconventional Throwing Styles

The physical examination should be focused on assessment of flexibility and neuromuscular coordination of scapulo-humeral function. Improvements in strength and flexibility of the shoulder, elbow, and trunk can improve a pitcher's transfer of energy through the kinetic chain, thereby decreasing stress on the shoulder and elbow joints.⁵

Flexibility Emphasis

Tension in the pectoralis minor muscle can limit scapular motion during elevation of the arm, which can be manifested as limitation of posterior tilt, upward rotation, and external rotation (ER) of the scapula.⁶ Stretching to improve (or maintain) pectoralis minor flexibility should be emphasized for patients diagnosed with scapular malposition, inferior medial border prominence, coracoid pain and malposition, and dyskinesia of the scapula (i.e., a "SICK" scapula).⁴ Stretching the pectoralis minor can be achieved by placing a rolled towel or a foam roll between the scapulae of a supine patient, and then

KEY POINTS

▶ Treatment and rehabilitation must address biomechanical differences between throwing styles.

▶ Pectoralis minor flexibility, maintenance of internal rotation of the glenohumeral joint, and strengthening of scapula muscles should be emphasized.

▶ Functional exercises for the submarine style pitcher include the sitting diagonal exercise, kneeling deceleration, and cable retraction with external rotation.

applying posteriorly-directed manual pressure to the shoulders (Figure 1).⁴

Although the throwing shoulder will display greater ER and a lesser amount of internal rotation (IR) at the glenohumeral (GH) joint, the total range of motion (ROM) should be maintained at a level equal to that of the nondominant shoulder through frequent performance of gentle IR stretching.³ The “sleeper stretch” has been widely recommended for the posterior capsule and rotator cuff tightness (Figure 2),^{3,4,6-11} which has been reported to produce a short-term increase in posterior GH joint ROM by 2.3° and an increase in IR by 3.1°.¹² Regular performance of the sleeper stretch may prevent or limit tightness, thereby limiting the amount of ROM loss that can progressively occur over the course of a competitive season.¹²

Another effective technique for development and maintenance of GH joint mobility is the “modified internal rotation stretch” (Figure 3).¹³ This stretch minimizes scapulo-thoracic motion, thereby imposing an IR force on the posterior rotator cuff muscles (infraspinatus and teres minor) and the posterior GH joint capsule. To perform this flexibility exercise, the patient lies in a prone position with the forearm pronated, the elbow flexed at 90°, and shoulder abducted at 90°. The AT manually reduces the protruding inferior angle of the scapula by pressing it down on the thorax. Increased IR can be achieved by using towels (or other supportive material) to elevate the hand above the surface of the treatment table.¹³ The AT increases the stretch by manually stabilizing the inferior angle of the scapula, and applying a downward pressure on the distal portion of the upper arm.



Figure 2 Sleeper stretch.



Figure 3 Modified internal rotation stretch.

Strengthening Emphasis

Upward rotation and posterior tilting of the scapula are critical movements that elevate the acromion process and prevent impingement of the soft tissues within the subacromial space during humeral elevation.¹⁴ The importance of the role of serratus anterior in producing upward rotation, medial rotation, and posterior tilting of the scapula has been stressed by multiple authors,^{6,14,15} and strengthening the serratus anterior muscle has been widely advocated.^{6,7,15-18} Exercises recommended for strengthening the serratus anterior include the low row, scapular clock, seated press-up, and forearm wall slide exercises.^{14,15} A high level of electromyographic activity in the serratus anterior has been documented during performance of the dynamic hug, scaption, serratus anterior punch, push-up plus, forearm wall slide, and the sitting diagonal exercises.^{16,17,19-21}



Figure 1 Pectoralis minor stretch.

After a patient has developed adequate strength to statically control the scapula, a progression may be made from isolated scapular strengthening exercises to more dynamic multi-joint exercises. All exercises included in a rehabilitation program should be selected on the basis of the patient's pathology and performance deficiencies. There is no "one-size-fits-all" formula for rehabilitation of injuries caused by baseball pitching.

The sitting diagonal exercise is an open kinetic chain exercise that replicates the upward follow-through motion used by a submarine style pitcher (Figure 4). The patient starts with the throwing arm at the side and then elevates the arm with a combination of shoulder flexion, horizontal adduction, and ER. This exercise utilizes serratus anterior for upward rotation of the scapula while deemphasizing activation of the trapezius.^{17,22} Electromyographic activity recorded during performance of the diagonal exercise has documented an average activation level of the serratus anterior muscle that corresponds to $100 \pm 24\%$ of that associated with a patient's maximum voluntary isometric contraction.¹⁷

Weakness of the lower trapezius also may contribute to improper mechanics and scapular positioning that is associated with subacromial impingement.¹⁸ The lower trapezius has also been identified as an important scapular stabilizer that facilitates upward rotation of the scapula,⁶ and it is believed to assist in posterior tilting and ER of the scapula.¹⁵ A high level of electromyographic activity in the lower trapezius has been observed during arm elevation from a prone position with the arm in ER and approximately 120 degrees of abduction; this is a movement pattern that



Figure 4 Sitting diagonal exercise.

is aligned with the orientation of the fibers of the lower trapezius.¹⁷ Other exercises that elicit a high level of lower trapezius electromyographic activity are prone shoulder ER at 90 degrees of abduction and prone shoulder horizontal abduction in a position of arm ER.^{17,21}

Dynamic Exercise For the Submarine Style Pitcher

The kneeling deceleration exercise is a rehabilitation exercise that is often advocated for baseball pitchers.^{3,23,24} A version of this exercise that is tailored for a submarine pitcher involves ipsilateral trunk flexion and an upward follow-through movement pattern (Figure 5). The clinician stands at an oblique angle behind the patient and tosses a weighted ball from a position that is approximately 10 to 30 degrees offset from the sagittal plane. The ball is bounced off the ground, and the patient must time the exercise motion in order to catch the ball at the start of the follow-through phase. Catching the ball while still in the arm acceleration phase will generate undesirable stress on the anterior capsule of the shoulder and the ulnar collateral ligament of the elbow. A concentric muscle action can be elicited by going through the same motion in the opposite direction and throwing the ball back to the clinician. As the control of scapular movement improves, the magnitude of loading can be progressed to increase the demand placed on the scapular musculature.²¹

The cable retraction with ER exercise is similar to one depicted by previous authors (Figure 6).²⁵ Our version has been adapted for a submarine pitcher to incorporate ipsilateral trunk flexion and an upward follow-through motion. The patient stands parallel to the cable line of pull with a wide base of support. The starting position for this exercise corresponds to that which exists at the instant of ball release (i.e., arm horizontally adducted and extended). The patient retracts the scapula while extending the trunk to an erect posture and maintains the scapula in a retracted position. The patient then externally rotates the arm in approximately 30 degrees of abduction. The patient then tilts the trunk laterally and maintains eccentric muscle tension to slowly return to the starting position. This dynamic stability exercise is an important component of the rehabilitation process for an injured pitcher and should be included as a component of an ongoing sport-specific conditioning program.^{3,25}

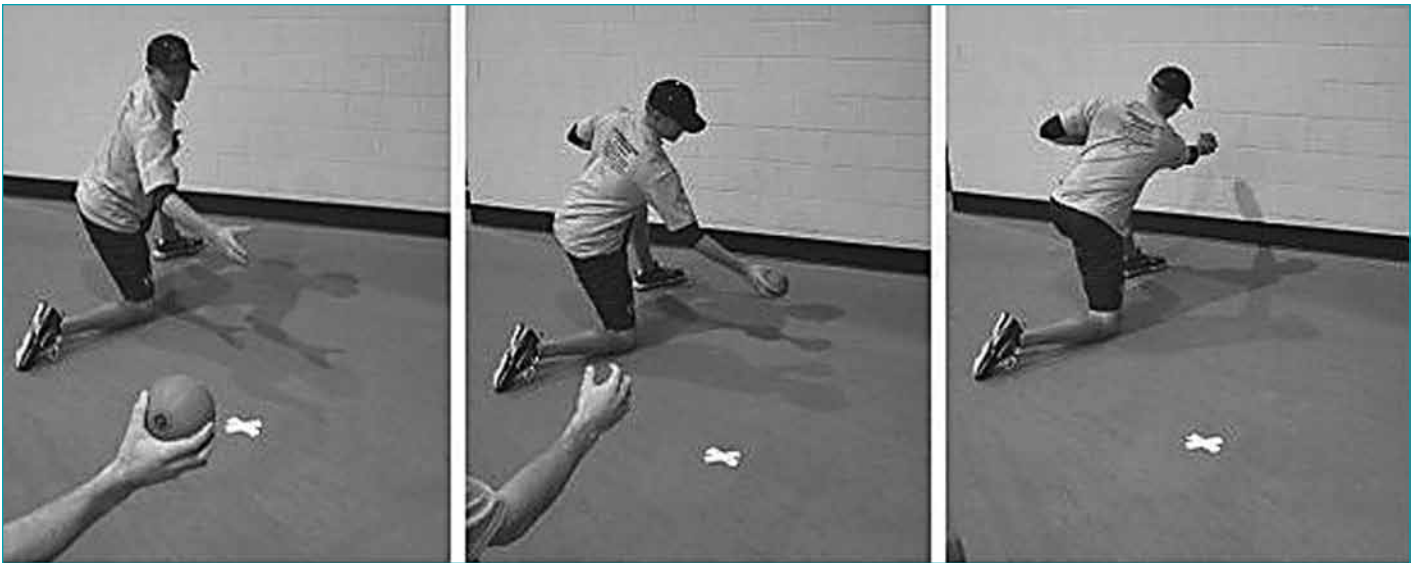


Figure 5 Kneeling deceleration.



Figure 6 Cable retraction with ER.

Summary

Rehabilitation of a baseball pitcher who uses an unconventional throwing style must address the unique muscle activation pattern that controls the sequential transfer of energy through the kinetic chain during the throwing motion. Treatment should address areas of restricted mobility, including emphasis on pectoralis minor flexibility and maintenance of IR of the GH joint. Strengthening exercises for the serratus anterior and lower trapezius musculature should also be incorporated. Pitching style-specific movement patterns for the submarine pitcher are replicated by the sitting diagonal exercise, kneeling deceleration, and cable retraction with ER exercise. ■

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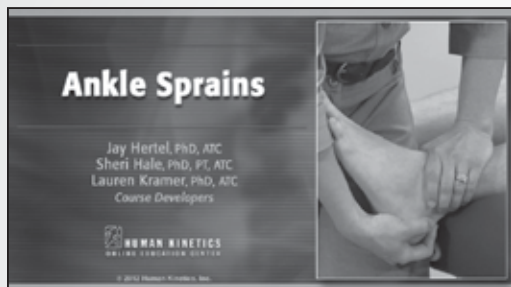
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