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Original Research Article

COMPARISON OF 3 STRETCHING PROTOCOLS FOR POSTERIOR SHOULDER TIGHTNESS IN THROWERS

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ABSTRACT

Background and Purpose: Posterior shoulder tightness (PST) can result due to abnormal humeral head motion which decreases subacromial space during overhead activities leading to compression of tissues causing limited shoulder flexion, internal rotation and horizontal adduction. Recently, some authors have expressed belief about cross body stretch and sleeper stretch. The need of this study is to know the effectiveness between three stretching protocols in PST.

Materials and Methods: 45 PST throwers were randomly selected into three groups, A Modified cross-body stretch (MCBS; n=15), B Modified sleeper stretch (MSS; n=15), and C Horizontal adduction stretch (HAS; n=15) and three stretching's were given in respective groups for 4 weeks, 5 repetitions once daily. Pre and post-treatment values of Range of motion (ROM) with goniometry and actively moving the thumb up the back(TUB), shoulder disability with PENN Shoulder score were noted and statistically analyzed.

Results: The difference between three groups was significant. ROM (0.0003), TUB (0.0085), PENN Shoulder score (P<0.0001) which is considered significant in Modified cross-body stretch.

Conclusion: Results concluded that Modified cross-body stretch was beneficial in increasing Range of motion (ROM), decreasing pain, improving functional ability, and satisfaction levels.

KEY WORDS: Modified cross-body stretch, Modified sleeper stretch, Horizontal adduction stretch, Range of motion, Posterior shoulder tightness.

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INTRODUCTION

Throwing is a high dynamic movement which requires balance of strength, flexibility and coordination of all body segments for optimal performance. Overhead throwing athletes commonly demonstrates adaptive changes in glenohumeral range of motion (ROM) [1]. One of the literature has documented that increased capsular and muscular tightness of the dominant posterior shoulder in throwing athletes has been associated with the development of altered shoulder rotational motion [2,3].

Throwers have a decrease in internal rotation (IR) ROM with a subsequent increase in external rotation (ER) ROM in their throwing arm. Contracture of the posterior shoulder occurs in response to the loads that are placed upon it during the deceleration phase. Common bony adaptation that is present in habitual throwers is humeral retroversion[4-9]. Even though the components of total ROM in the throwing shoulder may be altered, the total arc of motion (ER + IR) is equal bilaterally [10].

Posterior shoulder tightness (PST) is thought to be a possible cause of lost IR and is predominately found in the throwing athlete due to the previously stated repetitive overhead motions [11-13].

This has been reported, in previous studies, to allow greater degrees of ER and decrease the degrees of IR in the throwing athlete [14].

The reason for this altered arc of motion has been hypothesized to be the result of a physiologic adaptation of the dominant shoulder through repetitive microtrauma that leads to selective stretching of the anterior capsule [15] and tightening of the posterior capsule during the cocking phase of throwing [16].

Loss of posterior shoulder mobility and dynamic control in the throwers is a major contributing factor to pathologic shoulder dysfunction [17] and decreased level of performance in athletes [18]. It has been shown that increasing IR and decreasing Posterior shoulder tightness enhances the ability of the overhead athletes to perform [19] and may decrease the risk of injury. Many overhead athletes simply want to maximize their performance and have the most efficient and functional shoulder possible, which makes a posterior shoulder stretching program important for the overhead athlete [20].

Stretching during the warm-up has become a traditional practice in preparing for exercise or athletic activity [21]. Static stretching is one of the safest and most commonly performed stretching methods used to increase muscle length [22]. The literature supports that a static stretch of 30 seconds at a frequency of 3 repeated stretches per single session is sufficient to increase muscle length [23].

Throwers repeatedly perform posterior shoulder stretches prior to activity for reasons of increasing flexibility [24-26], preventing injuries [27], and improving muscular performance [28]. Stretching of the posterior shoulder is proposed as a fundamental component of treatment for overhead athletes.

These facts should be used to mandate a posterior shoulder stretching program for throwers as an injury prevention tool to be performed among all age players. A recent study had validated three non-assisted stretches (ie; standing sleeper stretch at 90^0, sleeper stretch at 45^0 and horizontal cross arm stretch) that can be performed on the field prior to competition. Another study revealed about cross-body stretch in individuals with limited shoulder internal rotation ROM appears to be more effective than sleeper stretch. A study by Kevin E. Wilk [29] based on the inability to stabilize the scapula and control glenohumeral joint rotation with the cross-body stretch and the potential for subacromial impingement with the sleeper stretch, modifications to both of these commonly performed stretches were recommended.

Currently there was no study on modified cross-body stretch, modified sleeper stretch and horizontal adduction stretch for posterior shoulder tightness. So present study is to know the effectiveness of these three stretchings on posterior shoulder tightness in throwers

MATERIAL AND METHODS

The present study was done on 45 individuals. All the individuals were randomly divided into three groups. Group A (n=15) received Modified cross-body stretch. Group B (n=15) received Modified sleeper stretch. Group C (n=15) received Horizontal adduction stretch by coin toss method. Written consent is taken from the subjects in prior starting of the study.

Procedure:

Modified Cross-Body Stretch: Group A-Subject is positioned in sidelying on the involved side and trunk rolled posteriorly 20^0-30^0 and shoulder is elevated to 90^0 and semi flex both the knees up to stable position is achieved. Therapist stands behind the patient and support the back of the patient to prevent further trunk rotation. Ask the athlete to align the forearm that to be stretched with the opposite forearm on the top, thus external rotation is restricted via counter pressure of the opposite forearm and hold the distal end of humerus of the hand to be stretched with the top hand. Now ask the patient to passively pull the humerus across the body into horizontal adduction with the opposite hand. Ask the subject to hold the stretch for 30 seconds and 3-5 repetitions once daily for 4 weeks.

Fig. 1: Showing modified cross body stretch.

Modified Sleeper Stretch: Group B-Subject is in sidelying position on the involved side, trunk rolled posteriorly 20^0-30^0 and shoulder is elevated to 90^0 and elbow is flexed to 90^0 and semiflex both the knees up to stable lying is achieved. Ask the athlete to hold the effected hand just below the wrist with the opposite hand and slowly push the forearm down towards the couch ie; athlete performs internal rotation passively using the opposite arm. Therapist stands behind the patient and support the back of the patient to prevent further trunk rotation. This stretch is performed once daily 3-5 repetitions, holding each stretch for 30 seconds for 4 weeks.

Fig. 2: Showing modified sleeper stretch

Horizontal Adduction Stretch: Group C-

Subject will be in standing position and flex the involved shoulder up to 90^0 and flex the elbow and place the hand on opposite shoulder. Now ask him/her to grasp the involved arm with opposite hand and gently pull the involved arm across front of the chest just below the chin. This stretch is performed once daily 3-5 repetitions, holding each stretch for 30 seconds for 4 weeks.

Fig. 3: Showing horizontal adduction stretch.

Outcome Measures: Outcome measures obtained on 2 occasions, pre- intervention and post-intervention measurement. The measurements were taken by Universal goniometer, TUB and PENN shoulder score.

Measurement by Universal Goniometer: Universal goniometer was used to measure ROM of joints. In this study shoulder IR ROM is measured by using universal goniometer, before examination procedure is thoroughly explained to the throwers. Then subjects were positioned in supine lying with shoulder abducted to 90^0 and elbow flexed to 90^0. Olecranon process of the ulna is taken as the axis. Movable arm is placed over the midline of the forearm, Stable arm is placed straight line to the movable arm, kept in air without contact with the athlete's body and is holded by another hand. Subject is asked to do internal rotation. Movable arm is moved along with the moving hand of the athlete. Thus, pre and post interventions were taken by goniometry during the study [30].

Measurement by TUB: TUB (Thumb-up-the-back-measurement) is used to measure the ability to actively move the thumb up the back with the help of inch tape. Before examination procedure is thoroughly explained to the throwers. First, measure the length of the spine from the first thoracic spinous process (T1) to the level of the iliac crests (IC) at midline, which were determined by palpation and marked. Now ask the athlete to move the thumb up the back. Now measure the distance from thumb to T1. The TUB mea-sure was expressed as a percentage of spine length based on the

following formula [31].

TUB = (distance from T1 to IC – distance from thumb to T1)/dis-tance from T1 to IC.

Measurement by Penn Shoulder Score: Penn score is used to measure disability of shoulder conditions which consists of 3 categories i.e.; pain, satisfaction and functional ability. Pain consists of 3 questionnaires that consists of 10 scores each (total 30) and then satisfaction, it consists of 1 questionnaire consists of 10 scores, functional ability consists of 20 questionnaires with 10 scores each for the questionnaire (total 60). Procedure is explained to the subjects. Then subjects were asked to circle the numbers which were given in the form then pre and post interventions are taken [32].

Group A received Modified cross-body stretch (MCBS), GROUP B Modified Sleeper Stretch (MSS) and GROUP C Horizontal Adduction Stretch (HAS). Each stretching was given for 30 seconds hold for 5 repetitions for 4 weeks (once daily). Data were analyzed statistically.

RESULTS

Results were analyzed statistically by using students t-test for pre-post treatment values, ANOVA test for post-post treatment values in between groups. Results revealed that all the three stretching methods showed significant improvement in shoulder range of motion and decreasing shoulder disability. Out of three stretching types modified cross body stretch showed extreme significant improvement with P value <0.0001.

Graph 1: Comparison of Rom Post-Treatment Values of Group A, B and C.

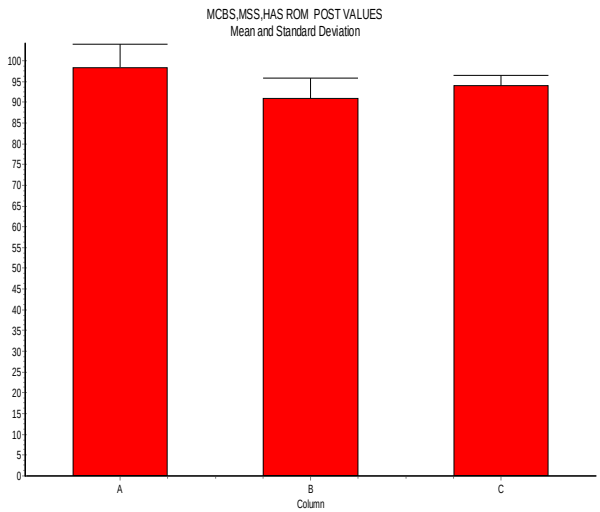

Table 1: One-way Analysis of Variance (ANOVA), P value is 0.0003, considered extremely significant.

ROM POST-TREATMENT VALUES			
GROUPS	MEAN	STANDARD DEVIATION (SD)	P-VALUE
A (MCBS)	98.33	5.627	0.0003
B (MSS)	91.66	4.499	
C (HAS)	94	2.535	

Graph 2: Comparison of Tub Post-Treatment Values of Group A, B and C.

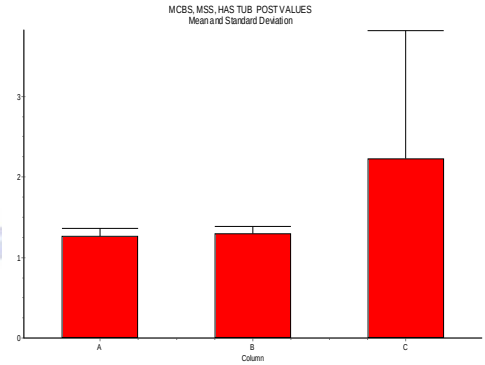

Table 2: One-way Analysis of Variance (ANOVA), P value is 0.0085, considered very significant.

TUB POST-TREATMENT VALUES			
GROUPS	MEAN	STANDARD DEVIATION (SD)	P VALUE
A (MCBS)	1.266	0.09759	0.0085
B (MSS)	1.3	0.08452	
C (HAS)	2.23	1.586	

Graph 3: Comparison of Penn Score Post-Treatment Values Of Group A, B and C.

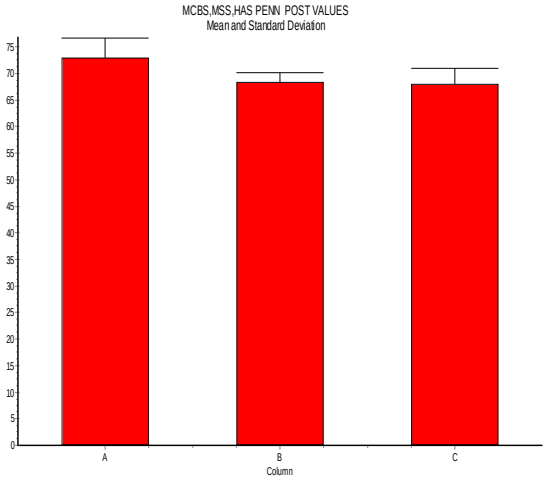

Table 3: One-way Analysis of Variance (ANOVA), P value is < 0.0001, considered extremely significant.

PENN SHOULDER SCORE POST-TREATMENT VALUES			
GROUPS	MEAN	STANDARD DEVIATION (SD)	P-VALUE
A (MCBS)	73	3.684	<0.0001
B (MSS)	68.33	1.759	
C (HAS)	68	3.047	

DISCUSSION

The purpose of the study was to compare three different types of stretchings (modified cross-body stretch, modified sleeper stretch and horizontal adduction stretch) in posterior shoulder tightness whereas modified cross-body stretch with scapular stabilization is an eject to stretching of posterior capsule and increase in glenohumeral IR ROM, decrease posterior shoulder tightness and pain when compared to other two stretching's (modified sleeper stretch and horizontal adduction stretch).

However results of the study shows that modified cross-body stretch brought greater gains in ROM than compared to modified sleeper stretch and horizontal adduction stretch. The effects largely gained during 4 weeks of training period with p value < 0.0001 considered extremely significant

Throwers are known to have both osseous and soft tissue adaptations that result in an increase in ER ROM, a decrease in IR ROM, and an increase in PST. For throwers to maximize their performance and reduce the risk of injury, it may be beneficial to include posterior shoulder stretches into a warm-up program. Stretching the posterior shoulder resulted in significant increases in glenohumeral IR ROM and improvements in PST. Mechanism of pain reduction is unknown but is unlikely that stretchings preferably activate the internal rotators. Although the exact mechanism behind the acute effect of stretching on performance are not fully understood.

A study by Riemann et al. [33] categorized muscle stiffness into intrinsic and extrinsic (reflex) components. The intrinsic components consist of several noncontractile tissues that contain high amounts of collagen. The components therefore, exhibit the properties of elasticity and viscosity when stretched. Because biological tissues are viscoelastic, if the muscle-tendon unit is stretched and then held at a constant length, the passive force at that length gradually declines; the effect known as stress relaxation [34]. Similarly Takayuki Muraki, et al. [35], revealed that posteroinferior capsule tightness by horizontal adduction by placing a towel under the athletes humerus which is believed to be better to isolate the target tissues. The main physiological basis underline increase in ROM associated with modified cross-body stretch found that ROM increase could be attributed to acutely reducing the viscosity and/or stiffness of the muscle-tendon unit, which would be a factor to increase the joint ROM. Another study by Philip Mc Clure, et al [36], suggested improvement in internal rotation from the cross-body stretch was greater than for the sleeper stretch and of a magnitude that could be clinically significant even though sleeper stretch is modified to minimize pain that can occur with shoulder in a 90^0 flexed position. Though in modified cross-body stretch and modified sleeper stretch scapula is stabilized many subjects felt that sleeper stretch itself is painful and inconvenient.

P-value of modified cross-body stretch (P<0.0001) and sleeper stretch(P=0.0007) showed extremely significant but P-value of horizontal adduction stretch TUB measurement pre and post values are not significant. A study by John D. Borstad, Izumi T, et al [37], both revealed about trunk position orienting with humerus in scapular plane will increase strain on posterior capsule. This is because in modified cross-body stretch and in modified sleeper stretch scapula is stabilized but in horizontal adduction stretch scapula is not stabilized that may be the reason why modified cross body stretch and modified sleeper stretch is beneficial than horizontal adduction stretch.

After 4 weeks of treatment period Penn Shoulder Score showed marked changes in pain & disability with P value < 0.0001 considered extremely significant. All the three stretchings for Posterior shoulder tightness were effective in decreasing pain and improving function of shoulder. A study by Ann M. Cools, et al [38], said that stretching angular as well as non-angular techniques, increases internal rotation ROM in overhead athletes, and may decrease sport specific shoulder pain in overhead athletes with impingement symptoms. In this study also modified cross body stretch is applied in correlation with orientation of humerus, position of scapula which is effective than other stretching techniques.

Hence, in this study Modified cross body stretch

showed better improvement in Penn shoulder score than modified sleeper stretch and Horizontal adduction stretch.

CONCLUSION

The results of this study showed significant reduction in pain and increase in ROM and improvement in functional ability, when Modified cross-body stretch was administrated along with scapula stabilization over a 4 weeks of treatment time. Therefore, Modified cross-body stretch was found to be beneficial when compared with other two stretchings (Modified sleeper stretch and Horizontal adduction stretch) for throwers with Posterior shoulder tightness.

Conflicts of interest: **None**

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