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THE IMMEDIATE EFFECTS OF SLEEPER STRETCHESON SHOULDER RANGE OF MOTION IN VOLLEYBALL PLAYERS

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ABSTRACT

The purpose of this study was to find out the immediate effect of sleeper stretches on shoulder internal rotational and horizontal adduction range of motion in volleyball players with posterior shoulder tightness. **Subjects: 60** university level Volleyball players, showing posterior shoulder tightness of dominant hand were participated in this study. **Method:** Subjects who fulfill the inclusion criteria were assigned into 2 groups. Group 'A' (n=30) performed sleeper stretch. Group 'B' (n=30) performed formal cross -body stretching. The stretch was repeated for 3 times with a rest period of 30 sec in between each stretches for both the groups. Outcome measures included the evaluation of shoulder internal rotation& horizontal adduction ROM using digital inclinometer. **Result:** Both the groups showed significant improvement in variable however group A showed greater improvements in of internal rotation and horizontal adduction ROM than Group B. (p=.000). **Discussion and conclusion:** sleeper stretches resulted in significant improvements in Group A, which could be due to the enhanced scapular stabilization leading to effective stretching of the posterior soft tissues of GH joint. This being an easy to apply and a specific stretching technique, can be used, to ensure proper shoulder ROM, kinematics, kinetics and for rehabilitating athletic shoulder for athletes involved in overhead activities like Volley Ball, tennis & Basketball.

INTRODUCTION

Volleyball is a complex discipline with high technical, tactical, and athletic demands on the players, because of this there is a need for the players to specialize early in certain tasks in the game, such as spiking or setting. Setting is the way in which the ball is hit with the fingertips, the wrist being radially deviated, and hyper extended. In spiking, the player hits the ball at the maximum height of a vertical jump, directing the hit downwards on the ball so that the ball cannot be returned. Because of the repetitive load due to overhead motions, a range of pathologies can cause shoulder pain in the volleyball players [1].

Shoulder injuries accounts for 8-20% of all volleyball injuries [2]. According to **Reeser** , 2006, an elite athlete performs more than 40,000 spikes in a season. This results in a higher risk for developing shoulder pain for the attacker, also seen in other overhead sports including baseball or tennis, as reported by many investigators[1,2]

It is imperative to understand normal and abnormal mobility adaptations in the healthy throwing shoulder in order to help to interpret findings on the clinical examination identify the shoulder at risk for injury and develop appropriate preventive & rehabilitative strategies for the throwing athlete [4]. One area among researchers that has received particular attention in volleyball players is the flexibility of posterior shoulder joint capsule and musculature [1- 6].

The posterior shoulder tightness may contribute to alteration in ROM such as reduced internal rotation, horizontal adduction and increased external rotation [7-13]. These alterations have been linked empirically to bony [14-18] and soft tissue[19,20] adaptations that result from the large rotational and distractive forces acting on the GH joint during the throwing motion.

Bony adaptations among throwing athletes often appear as increased humeral retroversion[6], this increase has been reported to decrease shoulder internal rotation and increase external rotation, leaving the total arc of motion same (sum of total internal and external rotation)[14-18]. The deceleration phase of the throwing motion is a major contributor to the development of posterior shoulder soft tissue tightness[21,22], as the humerus internally rotates during the follow-through phase of throwing motion; the posterior inferior capsule may be placed in a primary location to resist the deceleration phase, becoming direct restraints against these loads. Accumulation of such forces may result in tightness of the posterior capsule and other dynamic restrains like posterior deltoid, teres minor, and latissmusdorsi, which causes altered range of motion [21,22].

Posterior shoulder tightness of the shoulder have been suggested as a causative or perpetuating factor in shoulder impingement syndrome, labral lesions &cuff pathology[22,23].

The abnormal humeral head motion can result in a decrease in the subacromial space during overhead activities leading to compression of tissues in that region, ultimately manifested as a SICK scapula(scapular malposition, inferio -medial angle scapular winging ,coracoid tenderness &scapular dyskinesis)[24]. Furthermore, Burkhart, suggest that contracture of the posterior-inferior glenohumeral capsule, evidenced by a lack of internal rotation with the arm abducted to 90°, is an essential cause of superior labral lesions[23,24].

In many populations, the imbalance in flexibility might not impair day-to-day functioning, but for overhead athlete, like volleyball player, inflexibility poses major problems. Given the strong association between posterior shoulder tightness and various upper extremity injuries, many stretching techniques to improve posterior shoulder structures have been used among athletes using overhead throwing.

These include the "*towel stretch*," where the glenohumeral joint is adducted, internally rotated, and extended, while the hand now located behind the individual's back is pulled up by the opposite hand using a towel. Another popular stretch is the "*cross-body stretch*," where the shoulder is elevated to approximately 90° of flexion and pulled across the body into horizontal adduction with the opposite arm.

Disadvantage of these stretches are that when athletes perform these stretches independently on the field, as part of a warm-up or cool-down routine, the stretch will not be effective because the scapula is not stabilized and therefore the stretch is imparted to the scapulothoracic tissues as well as tissues crossing the glenohumeral joint [25]

More recently, researchers have described a "*sleeper stretch*" that is accomplished by lying on the side to be stretched. The side -lying position enables stabilization of the scapula against the upper body and the treatment surface, thereby enabling more isolation of the posterior glenohumeral joint. The stretch is typically performed while the participant is side lying with the stretching arm flexed to 90° and elbow flexed to 90°. Stretching occurs when the forearm is passively pushed into internal rotation. Shoulder flexion angle can be altered to target different portions of the posterior shoulder structure[25].

The sleeper stretches can be performed independently without the use of the treatment table. Specifically, these stretches can be performed while standing and having the athlete lean against a rigid wall (eg, a wall in a dugout or a bullpen, or a fence around the field). There are very few studies available where in the efficacy & superiority of "*sleeper stretch*" over routinely used techniques like cross body stretching & towel stretching have been established and moreover the amount of data on the immediate effect of sleeper stretches on shoulder ROM in volleyball players is very limited. Hence, this study was undertaken to evaluate the immediate effect of sleeper stretches on posterior shoulder tightness in volleyball players.

PROCEDURE

Both male and female Volleyball players between age the group of 18 to 30 years of age from Mysore, participating at the university level for the past 2 years were included in this study. 142 individuals who agreed to be a part of the study were evaluated and 60 subjects who fulfilled the inclusion criteria with a 10° (dominant versus non-dominant) of asymmetry in shoulder internal rotation measured at 90° abduction were identified and after stratification, randomly assigned to 1 of 2 intervention groups: **Group A**: The sleeper stretch group (n = 30) **Group B**: the cross-body stretch group (n = 30). Players with a history of previous shoulder surgery, injury in last 6 months, shoulder pain greater than 5 out of 10 using a numerical pain scale were excluded.

All subjects read and signed an informed consent document approved by University of Mysore, prior to participation in the study.

Subjects in both stretching groups were shown their assigned exercise. The examiner first demonstrated and explained the appropriate stretching technique, gave instructions to each participant & they were asked to demonstrate the same. The therapist answered any questions put forward by the participants & a sheet with written instructions and a picture of the stretch, was given to all the participants of the study. Study subjects were evaluated before they undertook their assigned stretching sessions for their shoulder internal rotation and horizontal adduction ROM using a Digital inclinometer. Prior to pre stretch range of motion testing, subjects were asked to warm up by performing 3 active, bilateral shoulder flexion stretches with hands clasped, holding each for 10 seconds. After the pretest measurements were completed, the participant immediately performed the shoulder stretches assigned to them.

Group A were asked to perform sleeper stretches and group B were asked to perform cross –body stretches .Each stretch was repeated 3 times and held for 30 seconds[34] with30 seconds of rest period in between trials, timed using a stopwatch. A valid stretch was determined by ensuring proper positioning by the examiners and verbal feedback from the participant indicating when a stretch was felt in the posterior shoulder.

Sleeper Stretches **(Figure1):** Group A subjects were instructed to perform sleeper stretches as demonstrated by therapist. The sleeper stretch was performed by lying on the side to be stretched, elevating the humerus to 90° on the support surface, with the lateral border of the scapula positioned firmly against the treatment table then passively internally rotating the humerus with the opposite arm.

***Cross – Body stretching(figure2)*:** Group B was instructed to perform Cross-body stretches as demonstrated by therapist. The cross-body stretch was performed with the subject standing with shoulder flexed to 90^0, by passively pulling the humerus across the body into horizontal adduction with the opposite arm .

Posttest measurements of shoulder IR and HA were done immediately by the same therapist following the stretching sessions. We used the ASL-160 Digital Inclinometer to measure GH horizontal adduction motion and internal rotation motion. This device provides a real-time digital reading of angles with respect to either a horizontal or vertical reference and is accurate up to 0.1°, as reported by the manufacturer. The digital inclinometer was modified with a reference line positioned along the midline of the device, which was used for proper alignment of anatomic landmarks [36,42].

Shoulder Internal- Rotation Measurement (Figure3): To measure internal shoulder rotation, the examiner positioned the participant supine with the shoulder and elbow in 90° of abduction and flexion and with the humerus supported to ensure a neutral horizontal position (humerus level with acromion process). With 1 hand, the examiner passively internally rotated the humerus, and, with the other hand, he stabilized the scapula by applying pressure to the anterior acromion until termination of humeral rotation.At this position, the digital inclinometer was aligned with the ulna (using the olecranon process and the ulnar styloid for reference) [25], providing an angle between the forearm and a perpendicular plane to the examination table.

Glenohumeral Horizontal Adduction Measurement (Figure 2)

To assess GH horizontal adduction, we placed participants in a supine position with both shoulders flush against a standard examination table. The tester stood at the head of the examination table toward the head of the participant and positioned the test shoulder and elbow into 90° of abduction and flexion, respectively. The tester stabilized the lateral border of the scapula by providing a posteriorly directed force (toward the examination table) to limit scapular protraction, rotation, and abduction motions. The tester's other hand then held the proximal portion of the participant's forearm slightly distal to the elbow and passively moved the humerus into horizontal adduction. At the end range of horizontal adduction, tester recorded the amount of motion present. To measure GH horizontal adduction, the digital inclinometer was aligned with the ventral midline of the humerus. The angle created by the end position of the humerus with respect to 0° of horizontal adduction (perpendicular plane to the examination table, as determined by the digital inclinometer) was recorded as the total amount of GH horizontal adduction motion [25]

DATA ANALYSIS

Statistical analysis carried out in this study using independent sample T test (Two tailed student t test) to find out the significance of parameters on continuous scale between groups & Paired sample T test for within group changes. The results of the study showed significant improvement in IR and HA for both the groups (p=0.000). Inter group comparison revealed that there was a significant change in variables between groups (p=0.000) with sleeper stretch group showing a mean improvement of 7.27 º± 3.61 in IR and 3.22º±1.75 of HA. The mean improvement in cross body stretch group was only 0.85º±0.69 and 0.58±0.56 for IR and HA respectively.

Figure1: Sleeper stretch

Figure 2: Cross body stretch

Figure3: measuring IR with inclinometer

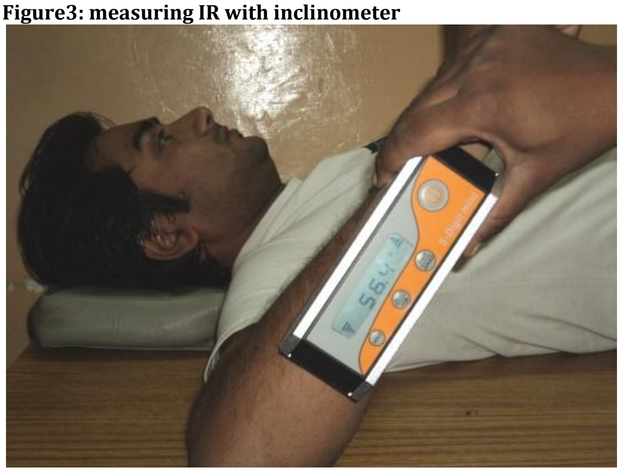


Figure 4: measuring HA wit inclinometer

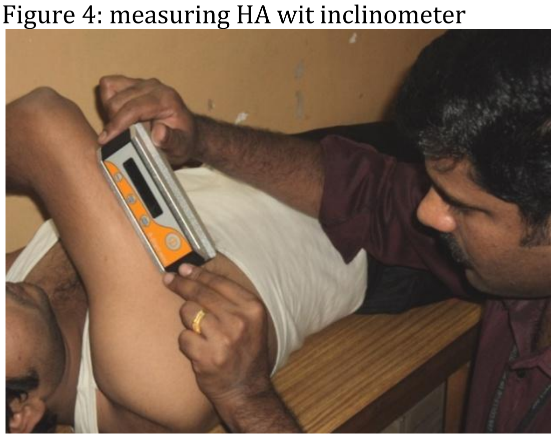


Table1: Age comparison

Group	No	Mean age
Experimental	30	21.4
Control	30	22.4

Table:2 Paired sample test for experimental group

		Mean	SD	Paired Diff.Mean	T	Sig
Pair 1	PRE_IR	60.2400	5.24520	7.2767	11.037	.000
	POST_IR	67.5167	6.01000			
Pair 2	PRE_HA	32.7500	2.66701	3.2200	10.077	.000
	POST_HA	35.9700	2.52575			

Table 3:Paired sample test for control group.

		Mean	SD	Paired Diff. Mean	T	Sig
Pair 1	PRE_IR	60.2400	5.24520	7.2767	11.037	.000
	POST_IR	67.5167	6.01000			
Pair 2	PRE_HA	32.7500	2.66701	3.2200	10.077	.000
	POST_HA	35.9700	2.52575			

Table 4:Mean difference comparison

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
IR DIFF	Experimental group	30	7.2767	3.61116	.65930
	Control	30	.8567	.69067	.12610
HA DIFF	Experimental group	30	3.2200	1.75015	.31953
	Control	30	.5800	.56715	.10355

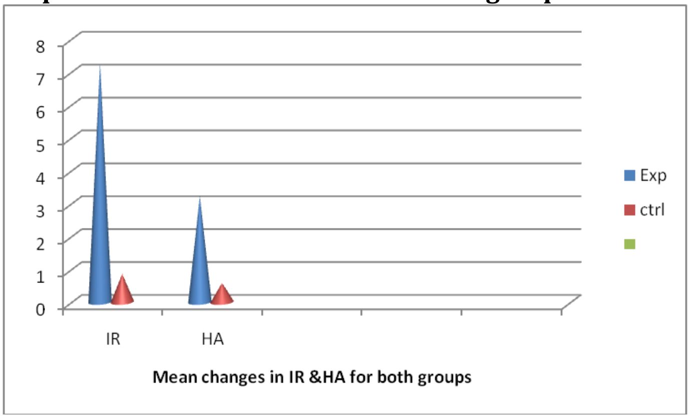
Table 5: Group Statistics for IR

Source	Type III Sum of Squares	Mean Square	F	Sig.
CHANGE	108.300	108.300	127.988	.000
CHANGE * GROUP	52.272	52.272	61.775	.000

Table.6: Group statistics for HA

Source	Type III Sum of Squares	Mean Square	F	Sig.
CHANGE	496.133	496.133	146.812	.000
CHANGE * GROUP	309.123	309.123	91.473	.000

Graph.8: Final Mean differences in both groups



DISCUSSION

The subjects for this study were recruited following the evaluation of 142 volleyball players for IR deficit (Dominant Vs Non-dominant hand). Among the 142 players, 95% of them showed IR deficit in their dominant shoulder with a wide range varying from 0.8º to 31º with 58% of them showing an IR deficit of more than 10º and 37% of them showed IR deficit less than 10º. Remaining 5% of them did not show any deficits. This clearly establishes the view point that there is a high prevalence of internal rotation deficit among over head athletes, like volleyball players. Our findings concur with that of Chan km [43], who conducted a survey on university students in Hongkong & reported a prevalence rate of 93% in 130 athletes.

Despite the subjects being trained players, playing at the university level for over 2 years and using one or the other form of stretching, they showed a ROM deficits, more so in the internal rotation. This could be because of varied stretching techniques used by them and there is very few data available, detailing the effectiveness of specific stretches that clinicians and athletes can use. Moreover, most of the stretching techniques routinely followed are not specific to the posterior capsule but target the musculoskeletal structures generally.

Kibler and Chandler[41] reported improvement in both internal and external rotation ROM in elite tennis players who complied with a stretching program. Various other studies[45,47], also clearly demonstrate that a stretching program performed on a regular basis can improve or help maintain posterior shoulder flexibility in overhead-throwing athletes. The finding of the present study demonstrates that both the sleeper stretches as well as the cross- body stretches results in immediate improvement in shoulder IR and HA.

The stretches chosen for this study were based on their ability to isolate posterior shoulder structures and to be performed on the field without the help of a clinician to provide scapular stabilization.

The results of this study showed that both stretch groups showed statistically significant increase in internal rotation and horizontal adduction. Although when intergroup comparison was done, significant improvement were found in the sleeper stretch group (p=0.000).

The sleeper stretch produced a more effective and clinically significant stretch, with a mean improvement in IR of 7.27º± 3.61 and HA of 3.22º±1.75 whereas, cross-body stretches resulted in an increase of only 0.85º±0.69 and 0.58±0.56 respectively.

Therefore, in overhead athletes, significant gains in ROM, suggesting a universal, beneficial effect of the Sleeper Stretch.

The superior effect of sleeper stretches over cross body stretch could be due to enhanced scapular stabilization in sleeper stretches. The side lying position enables stabilization of the scapula against the upper body and the treatment surface, thereby enabling more isolation of the posterior glenohumeral joint. Therefore, the stretch force is limited to posterior soft tissues of GH joint result in separation between the posterior glenoid and the humerus, resulting in elongation of the posterior shoulder structures. The horizontal cross-arm stretch is considered to stretch the posterior musculature to a greater degree than the posterior capsule, moreover tissue stress is imparted to scapulothoracic tissues as well as tissues crossing the glenohumeral joint [27] .The freely moving scapula will often compensate and limit effectiveness of the stretch to isolate the posterior shoulder structures.

Johansen et al[38] described a stretching technique that was similar to the sleeper stretches used in our study and their findings are similar to the findings of our study. For this stretch, athletes lie prone with 90° of shoulder abduction and elbow flexion and full forearm pronation. The inferior angle of the scapula is stabilized against the thorax, while maintaining scapular retraction and an examiner applies a passive shoulder internal rotation motion. The authors believed that this stretch would assist in isolating the posterior GH capsule and rotator cuff because of the enhanced scapular stabilization.

McClure et al[39] reported that individuals who performed the cross-body stretch improved better than who performed the sleeper's stretch which is contradictory to our findings. This could be attributed to the fact that the study was conducted on a general population who normally not display the typical ROM characteristics of the overhead athletes i.e. deficits in internal rotation and horizontal adduction ROM on the dominant shoulder.

The high prevalence of shoulder ROM deficit (dominant side Vs non-dominant side) seen in volleyball players strongly indicate the importance of appropriate tissue specific stretching intervention as routine[1] , so that even minute ROM deficits which may lead to various shoulder pathologies can be prevented.

Although the therapist-aided stretching program may be appropriate in some settings, implementation of the program is not feasible in a setting where the clinician-to-athlete ratio is high. The results of this study demonstrated that the non-assisted sleeper stretches resulted in far greater immediate improvements in internal rotation and horizontal adduction ROM compared to that produced by the cross-body stretching exercises. This indicates that a large number of overhead athletes like volleyball players of all levels may be able to benefit from stretching by correctly performing the non-assisted posterior shoulder sleeper stretching. However, the long-term effect of the non-assisted stretch has not been evaluated in players.

The sleeper stretch also may be modified to enable increased horizontal adduction with internal rotation by elevating the humerus off the table with a folded towel placed under the posterior distal humerus or with the athlete's body rotated forward as reported by Johansen M[46]. This increase in horizontal adduction is hypothesized to increase the stress placed on the posterior shoulder structures, which may lead to greater improvement in ROM.

Future studies need to investigate the long-term effect of non-assisted sleeper stretches on internal rotation ROM and posterior shoulder flexibility and the effect of a stretching program on injury risk using a prospective cohort study design.

CONCLUSION

This study provides insight into the effectiveness of sleeper stretches for immediate increase in shoulder ROM. Therefore the sleeper stretches being a tissue specific stretching technique, & easy to apply should be used routinely to ensure proper shoulder ROM, kinematics, kinetics and also for rehabilitating an athletic shoulder especially in Athletes who participate in overhead activities like Volley Ball , tennis and Basketball.

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