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EFFECTIVENESS OF SLEEPER'S STRETCHING ON RANGE OF MOTION IN OVERHEAD ATHLETES WITH GLENOHUMERAL INTERNAL ROTATION DEFICIT

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Abstract

Background -*This study aimed to evaluate the effectiveness of sleeper' stretching exercise on range of motion and proprioception in overhead athletes with glenohumeral internal rotation deficit.* ***Study design-****Pre and Post, intervention, using a within subjects and between subjects comparison of a convenience sample.* ***Methods-****Glen humeral internal rotation, external rotation and total rotational motion of the dominant and non-dominant shoulders of overhead athletes were measured using a universal goniometer. Determinations were made as to the degree of Glenohumeral Internal Rotation Deficit (GIRD) in the dominant shoulder. A daily (5 days per week), 4-week posterior capsule stretching program was administered. Post-stretching internal rotation, external rotation and total rotational motion measures were again obtained.* ***Results-*** *The result showed significant improvement in IR in both groups i.e. dominant and non-dominant arm, from the descriptive data analysis it has been seen that the effect of sleeper's stretch was more in group 1 (dominant arm) than the group 2 (non-dominant arm) with a P value of F (1) =144.94, p<0.05 and F (1) =20.196, p<0.05 respectively. No statistically significant improvement in range of motion was found for external rotation, non-dominant arm external rotation, and non-dominant arm total motion.* ***Conclusions****-Main findings of this study demonstrated that the sleeper's stretching protocol was significantly effective for increasing internal rotation and total rotational motion of dominant arm and.*

Keywords: *sleeper's stretching, range of motion, glenohumeral internal rotation deficit*

INTRODUCTION

The shoulder joint is a complex joint with a great mobility its static and dynamic stability depends on the rotator cuff muscles and shoulder joint capsule and ligaments (Kiber et al; 2003). The demands on static and dynamic stabilizers are higher during the sporting activity like throwing, swimming, volleyball, badminton, tennis etc. the all sports have different characteristics. These all sports show similar movement pattern of the shoulder complex as overhead movement (Kibler et al; 1995).

There are several definitions but one common finding present during the overhead athlete's evaluation is the continuous finding of enhanced internal motion of the dominant arm and reduced internal rotation deficit of the dominant arm Gleno humeral (Matsenet et al; 1990, Ellenbecker et al; 2002). These processes include posterior capsule tightness, rotator cuff and humeral retroversion changes (Reagan et al; 2002). To place an athlete in a category of GIRD, internal rotation difference between non-dominant and dominant arm must be greater than 20 degree (GIRD). The difference between internal rotation of dominant shoulder and non-dominant shoulder must be greater than 10% of the total rotation of nondominant shoulder (GIRD) (Tokish et al; 2008). The relationship between the loss of internal rotation ROM (tightness in the shoulder's posterior capsule and enhanced translation of the anterior humeral head was recognized (Gerber et al; 2003).

In overhead athletes there are side to side difference in dominant arm shoulder joint range of motion that show increased external rotation and decreased internal rotation and it reflects soft tissue adaptations i.e. posterior shoulder capsule and bone adaptation to glenoid and humeral. This increased in external rotation and decreased in internal rotation resulting in equivalent total rotational motion to non-dominant arm in overhead athlete because of humeral retroversion. Some studies showed that humeral retroversion has large influence on internal rotation and external rotation. These studies suggested that shoulder range of motion should consider the influence of humeral torsion (Shanley et al; 2012). A study in past showed the posterior capsule tightness of shoulder result in anterior and superior humeral head translation when

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passively flexing the shoulder. This abnormal movement of the humeral head during overhead activities can lead to a reduction in subacromial space. This decrease subacromial space can result in approximation of humeral head and acromion that leads to compression of tissues around the shoulder and can be associated with linked shoulder flexion, internal rotation and horizontal adduction (Harryman et al; 2008).

Objectives - To find out the role of sleeper's stretching exercise on range of motion in overhead athlete with glen humeral internal rotation deficit.

MATERIALS AND METHODS

Design

A pre-post, intervention, using a within subjects and between subjects comparison was used. This study was approved by the Ethics Committee of the University (approval number: 31/10/186/JMI/IEC/2018).

Subjects

Subjects with GIRD who were diagnosed by researcher were included based upon the inclusion and exclusion criteria:

Inclusion criteria were: male overhead athletes; age between 18-35 year; overhead athlete with GIRD; previously, athlete did not participate in stretching protocol. **Exclusion criteria were:** Any surgical intervention around shoulder within last 1 year; history of traumatic injury; neurological symptom or radiculopathy upper quadrant since last 1 year; history of systemic or inflammatory disease.

Written informed consent was obtained from all subjects before being allocated before their baseline assessment.

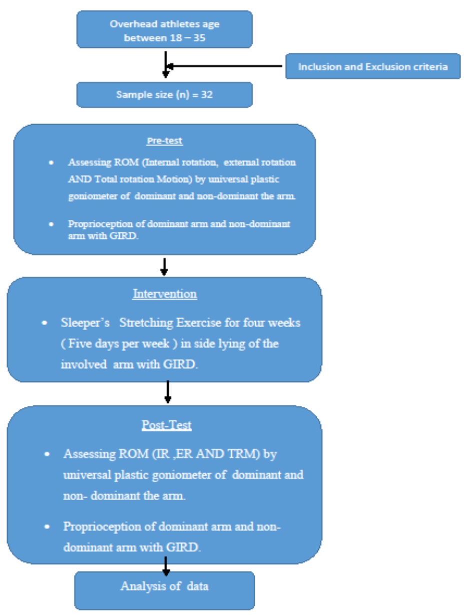
Intervention

The sleeper stretching exercise is performed in sidelying position of subject on dominant side. The position of the subject's shoulder and elbow 90 degree of flexion with lateral border of scapula fix on the treatment table. The examiner internally rotates the shoulder by grasping the distal forearm and move towards the treatment table. The stretch was held at the end range of motion for 30 seconds and the stretching exercise performed 3 times. The 30 seconds rest was given in between the stretching episodes (Laudner et al; 2008). Subjects were treated for 5 days in a week for 4 weeks.

Outcome measures

Demographic characteristics, age, gender, weight, height, body mass index and history were recorded. Before and after the treatment programs, evaluations related to shoulder internal, external rotation and total rotational motion range of motion and proprioception in eye closed of dominant and non-dominant arm were taken. All evaluations were conducted by the same researcher.

Design of the study: Pre-test and post-test intervention study.



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Statistical analysis
The number of subjects were determined by using software G POWER 3.15 for this study. The SPSS version 17.0 software program was used for data analysis. The general linear model multivariate analysis of variance (MANOVA) has been done to analyse data that involves dominant and non-dominant arm range of motion, proprioception in eye close at a time within-subject and between-subject. Significance level was set at $p \leq 0.05$.

Table 1. Demographic characteristics of subjects
Descriptive Analysis

	N	Minimum	Maximum	Mean	Std. deviation
AGE(YR)	32	18	25	19.00	1.459
HEIGHT(CM)	32	155.0	204.0	173.82	9.84
WEIGHT(KG)	32	29.7	85.0	63.05	12.04
BMI	32	16.6	29.7	21.33	2.68
N	32				

YR= year; CM=centimetre; KG=kilogram; BMI=body mass index; N= no. of subject.

Table 2. Comparison of pre and post ROM in dominant arm

ROM Test *p*-value			
IR **Pre-treatment** **Post-treatment**	56.40±11.37 79.68±5.22	144.947	***p*<0.05**
ER **Pre-treatment** **Post-treatment**	117±7.92 100±6.05	123.86	***p*<0.05**
TRM **Pre-treatment** **Post-treatment**	173.59±11.72 180±3.81	3.06	*p*=0.085

Table 3. Comparison of pre and post ROM in non-dominant arm

ROM Test *p*-value			
IR **Pre-treatment** **Post-treatment**	77.03±13.96 87.65±4.39	144.947	***p*<0.05**
ER **Pre-treatment** **Post-treatment**	104.06±13.96 93.12±5.64	123.86	***p*<0.05**
TRM **Pre-treatment** **Post-treatment**	180±4.4 181.40±11.16	3.06	*p*=0.085

DISCUSSION

This study puts forward the following findings on the effect of sleeper's stretching on glenohumeral internal rotation deficit in dominant arm. It was seen in patients with GIRD that the diminished internal rotation range and strength is linked because of the osseous adaption, thickness, and contracture of posteroinferior capsule which results from repetitive microtrauma during throwing motion. (Moore et al; 2014). In throwing cocking phase, the shoulder passive

restraints are placed in high load that leads to slow stretching of capsular collagen resulting in increase external rotation range (Hibberd et al; 2014). The rotator cuff like supraspinatus, infraspinatus, teres minor work eccentrically during the throwing acceleration phase to provide humeral head stability and which results to avoid anterior translation of humeral head (Juneja et al; 2011). During the throwing motion the center of rotation shifts postero-superiorly on the glenoid and this changes the torsional forces interplay on the superior labrum and associated tendon and anchor biceps. This enables additional internal rotation by raising clearance for greater tuberosity and also prevents internal impingement of the postero-superior labrum or rotator cuff. If this biomechanics is changed the abduction would result in an anterior capsular laxity and reduction of internal glenohumeral rotation, leading in a "dead-arm" thrower (Ouellette et al;2007). Burkhart et al believed in a study that glenohumeral internal rotation deficit athletes showed posterosuperior shift in the late cocking phase of the throwing shoulder, increasing contact between the humeral head, labrum and rotator cuff (Manske et at; 2010). In our study it was seen that the resistance felt at the terminal range of motion had a rubbery end-feel which shows that the subject may had internal rotation deficit because of soft tissue tightness. The subjects in our study had asymptomatic shoulder or very little pain which was assess on numeric pain rating scale and had anatomical GIRD. In this study, the internal rotation ROM assessment was conducted in the side lying position. This position is reliable and comfortable for the subjects. Similarly, the side lying position provides scapular stability and thus reduced error during examination. In this study, it was seen that there was alteration in shoulder internal and external rotation, but total rotational motion was not changed, which suggests that the changes in joint biomechanics (osseous adaptation) and imbalance were due to changes in soft tissues such as contracture and thickening of the postero-inferior capsule of the overhead athlete. In particular, two anatomical entities may limit ROM: joint and muscles. Joint restrictions include joint anatomy and congruence as well as capsule ligamentous structure surrounding the joint. Muscle gives both passive and active tension: passive muscle tension depends on the muscle's structural characteristics and the adjacent fascia, while dynamic muscle contraction gives active tension (Phil et al; 2012). Stretching reduces the passive muscle tension at the length of the muscle. This decrease in passive muscle tension at a particular joint angle (force-length relationship is due to stress relaxation The reduction in stress because stress relaxation in a material which is stretched and held at a constant length Holding stretches for 20 to 30 seconds is a good standard because in the first 20 seconds most stress relaxation takes place in passive stretches (McNair et al; 2000). Our treatment protocol was 3 stretches with 30 seconds held in stretch position and 30 seconds rest in between the stretch. In one of the studies showed a sleeper’s stretching was effective in increasing the internal rotation range of the shoulder joint in overhead athletes (Bukhart et al; 2003). In one of the study, It was seen that sleeper’s stretching protocol has the capacity to improve the internal rotation of the arm and total rotational motion of the arm (Aldridge et al; 2012). Because of a myogenic sarcomer reaction and its clinical consequences, long-term muscle extensibility due to stretching or physical activity is believed to be comparatively well known (Gajdosiket al; 2001). Stretching also results in a substantial decrease in the passive tension (stress relaxation), but does not appear to influence its stiffness / elasticity. Stretch exercise considerably improves the range of motion, but also reduces the muscle’s passive tension and stiffness (Gajdosiket al; 2001), thus the sleeper’s stretching exercise was beneficial in order to increase the internal rotation.
This study showed that the sleeper’s stretching protocol improved the internal rotation range in patients with GIRD but it was not effective in increasing proprioception in patient with glenohumeral internal rotation deficit.

STRENGTH OF STUDY

- This study gives strong evidence that sleeper’s stretching program is beneficial in the management of glenohumeral internal rotation deficit in overhead athletes.
- It can also be used to prevent of injuries consequences from the glenohuhumeral internal rotation deficit.

CONCLUSION

Main findings of this study demonstrated that the sleeper’s stretching protocol was significantly effective for increasing internal rotation of dominant arm and there was non-significant effect for total rotation motion. The strength which was taken as an addition variable to see the effect of sleeper’s stretching, on shoulder internal and external rotators and found that there was slight increase in strength of internal rotator of shoulder in dominant arm and non-dominant arm. The external rotator strength was also increased. Sleeper’s stretching could be used as effective treatment of glen humeral internal rotation deficit. The effect of sleeper’s stretching exercise on proprioception of internal rotation and total rotational motion was insignificant and improvement in external rotation

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