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FORWARD HEAD POSTURE CORRECTION VERSUS SHOULDER STABILIZATION EXERCISES EFFECT ON SCAPULAR DYSKINESIA AND SHOULDER PROPRIOCEPTION IN ATHLETES: AN EXPERIMENTAL STUDY

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ABSTRACT

Background: Forward head posture (FHP), the most common deviation from the normal curvature in cervical spine. Craniocervical flexor muscle strengthening is frequently used treatment for FHP. Scapular dyskinesia (SD) is the alteration in the normal static or dynamic motion of the scapula during coupled scapulohumeral movements. Shoulder stabilization exercises are an effective treatment for SD. As both FHP and SD are related to each other, the objective of the study was to find and compare the effect of FHP correction and shoulder stabilization exercises on SD and shoulder proprioception.

Methods: 40 athletes (18-30yrs) were recruited. Subjects were randomly allocated into two groups. Group A received deep neck flexor strengthening and anterior scalene stretch, group B received shoulder stabilizing exercises. Paired t test and chi-square test were used to judge the statistical significant difference. The level of significance was set at $p < 0.05$. All data was analyzed using SPSS program version 12.

Result: No statistical significant difference was found between the groups for the 4 outcome variables, but significant improvement was seen within the groups. Shoulder proprioception was found to be significant between the groups where group B ($p = <0.001$) showed better improvement than group A ($p = <0.017$).

Conclusion: Both FHP correction as well as shoulder stabilization exercises were equally effective in correction of scapular dyskinesia and shoulder proprioception. Shoulder stabilization exercises showed slightly better improvement than FHP correction group in reducing proprioception errors. Also neck strength values were found to be clinically significant for deep neck strengthening group.

Keywords: Posture, Shoulder Stabilization exercises, Scapula, Dyskinesia, Proprioception

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INTRODUCTION

Every activity of daily living needs certain pattern of posture to be maintained. Any deviations from the normal postural pattern, adversely affects the adjacent joint & muscles, leading to pathological conditions. Imbalance in the muscles leads to shortening or lengthening of the fibers further leading to postural alterations. Forward head posture (FHP) is the most common deviation from the normal curvature in cervical spine [1]. In FHP, flexion of lower cervical and upper thoracic vertebrae while extension of the upper cervical and extension of the occiput over C1 is observed [2]. In this posture, there is anterior protrusion of the head with increase in the lordotic curve of the cervical vertebrae [3]. There is an incidence of 66% for forward head posture among people in age group of 20 to 50yrs [4]. Cervical segments is supported by the muscular sleeve formed by the deep neck flexor muscles and the superficial flexors of neck. Deviation of cervical spine occurs if large superficial muscles of the neck (sternocleidomastoid and anterior scalene) contract without getting counterbalanced from the deep neck flexors [5]. Studies have proved, strengthening of deep neck flexors along with scalene muscle stretch, to be effective in correcting forward head posture [6,7]. Sphygmomanometer is been found to be reliable for training and assessing muscle strengths of neck muscles, abdominals, quadriceps and hamstrings [8-12].

Scapula plays a very important role in the smooth mobility of glenohumeral joint. It provides a stable base for the transfer of energy from legs and trunk to the arms and hand [13]. SD is defined as, alteration in the normal static or dynamic position or motion of the scapula during coupled scapulohumeral movements. SD is reported 68% with rotator cuff problems, 94% with glenoid labral lesions, and 100% with glenohumeral instability [14,15]. The coordination of the trapezius and serratus anterior muscles is important in controlling scapular orientation.

Individuals with forward head angle present with altered scapular kinematic [16]. Theory reports poor postural alignment in cervical and thoracic spine, alters the scapular kinematics. Due to alteration in the length-tension relationship of the muscles surrounding the scapula, leading to imbalance of the musculature [16]. Studies also prove that scapular dyskinesia leads to altered proprioception of the shoulder joint [17]. Few studies favor the results that proprioception is decreased specifically in overhead athletes [8].

Sherrington (1906) first defined proprioception as the sense of position, posture, and movement [18]. Forward head posture can cause impaired proprioception of the shoulder joint due to inhibition of muscle spindle and spinal reflexes [19,20,21].

Shoulder stabilization training strengthens the scapular muscles, thereby resolving the SD. But as FHP can lead to SD, can the correction of FHP correct SD also. There is also paucity of literature available on effect of training neck flexor strengthening on shoulder proprioception which

is affected due to SD or forward head posture. Hence this study aims to compare the effect of neck flexor strengthening and shoulder stabilization exercises on correction of SD and shoulder proprioception.

METHOD

After receiving the approval from the ethical committee, 40 subjects were recruited from various grounds in Belgium city representing different sports. Inclusion criteria's were, individuals in the age group of 18-30 years, both male and female subjects, individuals positive for SD (1-1.5 cm difference), individuals having forward head posture (54 ± 6.6) [22]. Subjects who met the inclusion criteria were allocated into two groups using non probability convenient sampling. Each group had 20 subjects. Baseline data of all the subjects were recorded before commencing the respective training. Group A was given deep neck flexor strength training using sphygmomanometer, 12 repetitions in supine lying position, with subjects chin tuck and without holding the breath. Started with a pressure of 20mmhg of cuff inflation and the participants had to hold it for 10 seconds. As the subjects were able to hold it for 10secs, the pressure of the cuff was increased gradually with 2mmhg increase till 30mmhg. Scalene muscle stretch was given post neck muscle training, during which participants were in sitting, with hands resting on the side of the table. Pressure was applied against the temporal region of the head in an obliquely posterior direction till the point which does not cause discomfort. The stretch was maintained for 30secs each with 4 reps/3 times a week for 2weeks.

GROUP A: Deep neck flexor strength training using sphygmomanometer



(PRE)

Figure 1: Deep neck strengthening pre positioning



(POST)

Figure 2 : Deep neck strengthening post positioning with chin tuck in

Lateral Scapular Slide Distance Test



Figure 3: Measuring scapular inferior angle distance from adjacent spinous process to diagnose scapular dyskinesia

Group B was given D2 PNF stretching using green theraband with 30secs hold, 4 reps/3 times a week for 2 weeks, Sleeper stretch 3days/week with hold for 30secs, repeated 4 times, stabilization for 12 reps, 3times/week for 2 weeks using green theraband, low row exercise for 12 reps, 3 times/week for 2 weeks. SD was measured using inch tape while CVA was measure using computer software MB ruler.

GROUP B: D2 PNF Pattern



Figure 4: Shoulder stabilization exercise using theraband performing D2 PNF.



Figure 5: Rhythmic stabilization with theraband for shoulder stabilization



Figure 6: Low row exercise for shoulder strengthening



Figure 7: Sleeper stretch post shoulder stabilization exercises

Statistical Analysis

Paired t test and chi-square test were used to judge the statistical significant difference. The level of significance was set at $p < 0.05$. All data was analyzed using SPSS program version 12. Paired t test was used for the analysis of neck strength, craniovertebral angle, scapular slide distance, and proprioception.

RESULTS

A total of 40 subjects participated in the study. The mean value for the age in group A was 21.95 ± 43.68 while for group B it was 21.45 ± 2.60 . The statistical analysis of baseline values is shown in TABLE 1-3. None of the baseline values showed significant difference; hence the groups were homogenous in the study. All the pre-post values of all the variables showed statistically significant improvement within the group but not between the groups (TABLES 4-8).

GENDER	GROUP A	%	GROUP B	%	P	Df	X ²
MALE	13	65	15	75	0.490	1	0.476
FEMALE	7	35	5	25			
TOTAL	20		20				

Table 1: Distribution of subjects by gender in the two groups. $P = < 0.05$

GROUP	AGE IN YEARS		BMI IN Kg/m ²	
	MEAN	D	MEAN	SD
A	21.95	.89	22	3.93
B	21.45	.60	22.4	3.16
P	0.636		0.755	
Df	38			
T	0.477		0.314	

Table 2: Mean and SD of age in years and BMI in Kg/m² scores of the two groups. P=<0.05

GROUP	YEARS OF PLAY	
	MEAN	SD
A	5.8	2.51
B	5.6	3.86
P	0.819	
T	0.230	

Tables 3: Distribution of subjects by Years of play. P=<0.05

AFFECTED SIDE	GROUP A	GROUP B	P	X ²
L	1	2	1	0
R	19	18		
TOTAL	20	20		

Tables 4: Distribution of subjects by Affected side. P=<0.05

GROUP	PRE		POST		Df	t	P		
	MEAN	D	MEAN	D					
A	43.5	6.94	98.5	3.68	55	8.59	55±38.59	6.373	<0.001*
B	39.5	7.61	82.3	6.58	40.6	8.01	40.6±28.01	5.850	<0.001*
T	0.732		1.380		1.270				
Df	38		35		35				
P	0.469		0.177		0.212				

Table 5: Intra group comparison of Deep neck flexor strength in mmhg. P =<0.05

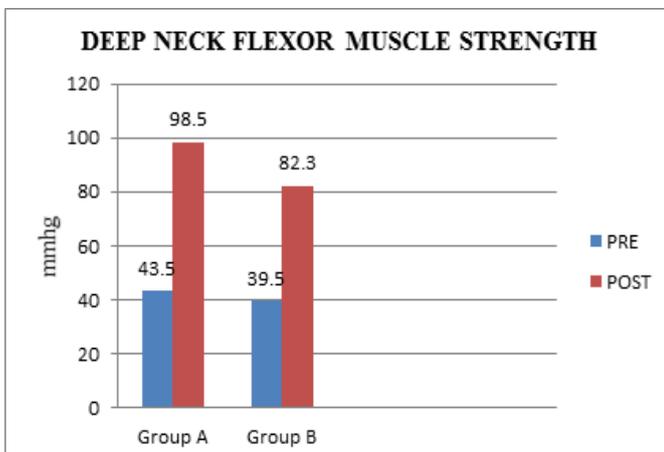


Figure 8: COMPARISON OF DEEP NECK FLEXOR STRENGTH BETWEEN GROUP A AND GROUP B: both group showed drastic improvement in the pre-post values. Group A neck flexor strength was 43.5 and SD of

16.94 while the post values were 98.5 with SD of 43.68. Group B was 39.5 with SD of 17.61 while post intervention values were found to be 82.3 with SD of 26.58.

GROUP	PRE		POST		MEAN	D	T	df	P
	MEAN	D	MEAN	D					
A	43.35	4.75	47.7	6	4.35	.90	6.713	4.35±2.90	<0.001*
B	42.72	4.73	46.25	5.57	3.81	.77	5.669	3.81±2.77	<0.001*
T	0.424		0.762		0.582				
Df	38		35		35				
P	0.674		0.451		0.564				

Table 6: Intra group comparison of Craniovertebral angle in degrees. P=<0.05

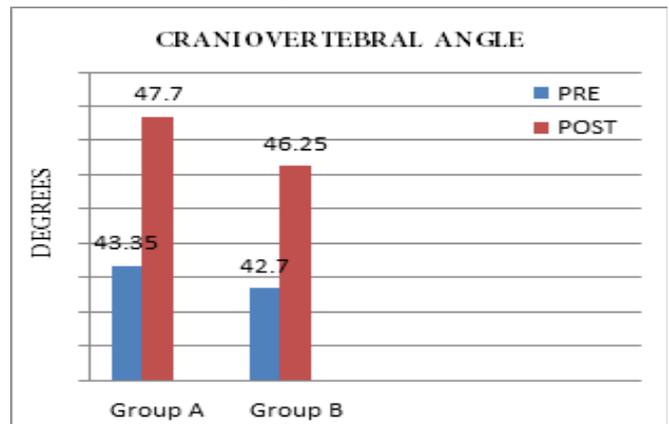


Figure 9: Difference observed in craniovertebral angle between the two groups: the pre mean values for craniovertebral angle for group a was 43.35 with sd of 4.75, while the post mean values were improved to 47.7 with sd of 6. group b mean craniovertebral angle was 42.72 and sd of 4.73 before the intervention while post mean value was calculated as 46.26 with sd of 5.57

GROUP	PRE		POST		MEAN	D	Df	t	P
	MEAN	D	MEAN	D					
A	1.95	0.28	0.69	0.48	1.25	0.49	1.25±0.49	11.420	<0.001*
B	1.98	0.38	0.84	0.52	1.16	0.44	1.16±0.44	10.912	<0.001*
T	0.326		0.878		0.584				
Df	38		35		35				
P	0.746		0.386		0.563				

Table 7: Intra group comparison of Scapular slide distance in cms. P=<0.0

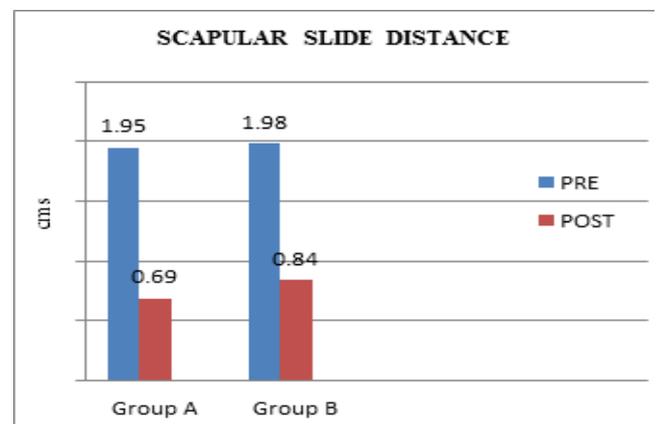


Figure10: Comparison between pre-post values of scapular slide distance between group a and group b: significant improvement observed between the groups. Group A pre mean value was calculated as 1.95 with SD of 0.28 while

the post mean values were 0.69 with SD of 0.48. Group B pre mean value =1.98 and SD of 0.38, while the post intervention value was found to be 0.84 and SD of 0.52. group b. the improvement seen between the two groups was found to be approximately same.

GROUP	PRE		POST				Df	T T	P
	MEAN	D	MEAN	D	MEAN	D			
A	5.5	1.35	3.7	3.16	1.8	3.07	1.8±3.07	2.621	0.017*
B	6.26	2.23	2.47	2.57	3.83	2.08	3.83±2.08	5.889	0.001*
T	1.302		1.281		2.127				
Df	38		35		35				
P	0.201		0.209		0.041				

Table 8: Intra group comparison of Proprioception in degrees. P=<0.05

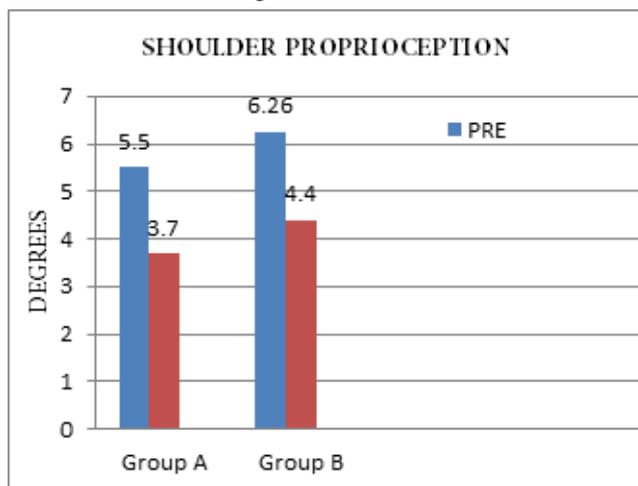


Figure 11: Comparison of shoulder proprioception for group a and group b: significant reduction observed in both group for shoulder proprioception error. Group A mean pre values of shoulder proprioception were found to be 5.5 with SD of 1.35 while the post mean values were calculated as 3.7 with SD of 3.16. Group A shoulder proprioception was also observed to be significantly improved with pre mean value of 6.26 and SD of 2.23 and post mean values were 4.47 with SD of 2.57.

DISCUSSION

The results of the present study accepted the alternate hypothesis i.e. both FHP and shoulder stabilizing exercises will be effective in correcting the scapular dyskinesia and shoulder proprioception. Baseline values suggested most of the subjects with decreased strength and endurance of the deep neck flexor muscles. These values were favored by Dean H Watson and Patricia et al, as they also found weak and reduced endurance of deep neck flexor muscles of the subjects, in their study on Natural Head Posture and Upper Cervical Flexor Muscle Performance.

Group A showed significant improvement in the FHP which was increased post the training. This is supported in the study performed by Shaun O’Leary et al as they studied 50 females who were randomly allocated to either CCFEX (n=27) or CFEX (n=23) groups for a 6-week training program. Both the groups showed significant improvement in the craniocervical flexor muscle strength. The difference between this study and the present study was 6weeks and

2weeks training respectively. Sphygmomanometer was used in the present study for training deep neck flexor muscle. Helewa et al conducted a study to find the validity of modified sphygmomanometer on quadriceps and shoulder abductor muscle isometric strength. He concluded sphygmomanometer to be sensitive, simple, portable, inexpensive, comfortable and safe method for assessing or training muscles. Group A was found to be statistically significant for improvement of scapular slide distance. By training the deep neck flexors strength, inhibition of levator scapulae occurs, which further leads to increased CVA and correction of the FHP. Relaxation of levator scapulae causes correction of the downward rotation of the scapula; restoring its normal kinematics. This finding is consistent with Peter Thomas, John DeAngelis et al study where they researched the influence of scapular position on cervical range of motion and isometric strength. The results showed that deep neck flexor strengthening leads to reduction of levator scapulae tightness.FHP leads to levator scapulae and upper trapezius tightness. This was proved by Thomas Peter in his study. A study was conducted by Jonas Sandlund; Mats Djupsjo backa et al to find the effect of whiplash associated disorders on shoulder proprioception. They found significant lower acuity of shoulder proprioception. They suggested this occurs due to activation of certain nociceptive impulses leading to alteration of muscle spindle, that might impair the sensory pathway causing lower acuity of proprioception. In the present study as well, proprioceptive error was recorded to be high during the baseline recording. The reason could be the same as stated, in FHP, trapezius and levator scapulae goes for tightness which could have further inhibited the muscle spindles leading to alteration of shoulder proprioception. By strengthening the deep neck flexors, upper trapezius and levator scapulae is relaxed, leading to normal firing of the muscle spindle of these muscles, which further reduced the proprioceptive errors. Group B was trained with shoulder stabilization exercises. This group was found to be statistically significant for scapular dyskinesia, neck strength, CVA and shoulder proprioception. All these exercises were either open chain or closed chain, or PNF exercises. These exercises led to activation of shoulder muscles along with activation of muscle spindles which caused smooth flow of sensory afferents from the joint, leading to reduction of proprioceptive error post training and also improved SD. This result is consistent Ian M Rogel, Gregory Ernst et al. They performed a study on 39 healthy male military subjects with open chain, closed chain and control group exercises. They found significant improvement in the proprioception accuracy post training. The difference between the two studies was 6weeks and 2weeks of training respectively. These exercises leads to activation of upper and lower trapezius, causing activation of shoulder force couple i.e. serratus and trapezius. This was reported by Andrea Bernau and Sonja Münzebrock in the article, Optimization of Scapular Control by a Specific Exercise Program. In present study, stimulation and balanced activation of force couple during the

shoulder stabilization training exercises might have helped to improve SD. Group B showed better and significant improvement than group A for proprioception error reduction. This could be due to direct training of the shoulder stabilizing muscles in group B.

The study had few limitations also. First limitation of the study was inclusion of all types of athletes. Second limitation, subjects were not blinded about their group and treatment which would have led to bias of the study. Thirdly, thoracic spine kyphosis was not taken into consideration while assessing or forming the training protocol.

CONCLUSION

This demonstrated that both FHP correction as well as shoulder stabilization exercises are equally effective in correction of scapular dyskinesia and shoulder proprioception. Shoulder stabilization exercises showed slightly better improvement than FHP correction group in reducing proprioception errors. Also neck strength values were found to be clinically significant in group with deep neck flexor strengthening than shoulder stabilization group.

FUTURE SCOPE

Study can be performed taking only overhead athletes and comparing the effect of two training protocols. Study can be performed on the prevalence and training effect in male and female players separately. Correlation study can be conducted between competitive level of playing and prevalence of FHP & SD. Shoulder proprioception in subjects with FHP can be studied as it is been found only in subjects with whiplash associated disorders.

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