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Efficacy of Scapular Stabilization Exercises on Reduced Thoracic Expansion in Patients with Upper Crossed Syndrome

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ABSTRACT

Background: Upper-Crossed Syndrome (UCS) is also referred to as proximal or shoulder girdle crossed syndrome. In UCS, tightness of the upper trapezius and levator scapula on the dorsal side crosses with tightness of the pectoralis major and minor. Weakness of the deep cervical flexors ventrally crosses with weakness of the middle and lower trapezius. This imbalance leads to reduced thoracic expansion with difficulty in breathing and altered body posture. In the present study an attempt has been made to compare the efficacy of scapular stabilization exercises and conventional neck exercises in patients with UCS.
Materials and Method: A total of 30 purposively selected confirmed cases of UCS aged 18-50 years, collected from the OPD of DAV Institute of Physiotherapy and Rehabilitation Jalandhar, India, were considered for the present study. The subjects were further divided into two groups for intervention. Group-A consisted of 15 subjects who were treated with hot pack, TENS and scapular stabilization exercises for 5 times per week for 2 weeks. Group-B consisted of 15 subjects who were treated with hot pack, TENS and conventional exercises for 5 times per week for 2 weeks.
Results: The results of the present study revealed that within- group changes in NDI, thoracic expansions (Axillary, Midsternal and Xiphisternum), pectoral minor muscle lengthening were statistically significant in group-A. On the other hand, between Group-A and B, there was a statistically significant difference for the above-mentioned traits, showing the superior result in Group-A.
Conclusion: It could be concluded from the present study that, scapular stabilization were more effective for reduced thoracic expansion in patients with UCS. Thoracic expansion and pectoral minor flexibility were increased with the help of scapular stabilization exercises. Scapular stabilization exercises showed significantly positive effect on NDI scores.

Key Words: Upper Crossed Syndrome, Muscle activity, Scapular Stabilization exercises, Conventional neck exercises.

INTRODUCTION

Neck pain is defined as pain in the cervical spine. It is the one of the most common medical complications in developing world. Approximately, two thirds of the population is affected by mechanical neck pain in their lives. [1] Neck pain is most commonly associated with
upper crossed syndrome (UCS). [2] This syndrome expressed as a postural disorder presenting with over-active and under-active muscle groups of neck, chest and shoulder. It occurs when the neck, chest and shoulder

muscles are deformed. [3] There is an increase in the prevalence of upper crossed syndrome in past few years (ref.). In India, 56% males and 71 % females are suffering from it and prevalence was 63% [4] Shoulder dysfunction relate highly to the onset of UCS. [5]

In upper crossed syndrome most commonly, involved muscles are upper and lower trapezius, levator scapulae, deep neck flexors, rhomboids and pectoral group [6]. These all muscles have their different functions. Upper fibers of trapezius work with levator scapulae muscle to elevate the scapula and lower fibers of trapezius act with serratus anterior to rotate the scapula in forward direction. [6,7]

In this syndrome rhomboid also plays an important role which helps in retraction of the scapula. Longus capitis, rectus capitis anterior and lateralis are the deep neck flexors which helps in flexion of the neck. [7] Pectoral group are also involved in this syndrome. [6] Pectoral major are also helps in adduction and medial rotation of the shoulder joint and pectoral minor helps in draws the scapula forward and helps in forced inspiration. [7]

When the upper trapezius, levator scapulae and pectoral muscles are overactive then, the surrounding counter muscles (cervical flexors, rhomboids and lower trapezius) are under-used and become weak. When overlapping is occurred between these two muscle groups (over-active and under-active) then, it may lead to development of the X-shape pattern. [6]

Upper crossed syndrome occurs due to poor posture, specially sitting or standing with head forward for prolonged period of time. Computer and laptop use, driving, watching TV and reading, these activities promote the forward head posture. Trauma of the shoulder is also an important cause of upper crossed syndrome. [8]

The X- shape pattern leads to forward head tilt causing strain to the muscular attachments of the neck, chest and shoulder. [6] Scapular stabilization exercises brought about improvement in posture through activation of the neck muscles, lower trapezius and serratus anterior. Scapular stabilization exercises have a positive effect on neck alignment by reducing the compensatory movement of the muscles. The rounded shoulder posture eventually the compensatory alters the mechanical axis rotation of the glenoid fossa and these altered mechanics requires scapular stabilization exercises. [9]

People usually sit with position of head in different manners. It depends on various factors which includes musculoskeletal structures, body changes regarding ages, cultural, customs, motor performance and occupation. [10] Because of poor posture, the patients may develop forward head posture along with rounded shoulders due to increase the cervical lordosis and thoracic kyphosis. [11,12]

In addition to strengthening exercises targeting, this group of muscles are needed. [13] As patients with upper crossed syndrome have problems around the neck, around the neck-shoulder muscles, as well as abnormal postures such as rounded shoulders. In order to correct head and neck posture, it is important to improve the thoracic spine [14]. Therefore, scapular stabilization exercise is used as an effective way to recover the imbalance in posture and the muscles. [15]

A scapular stabilization exercises also helps to improve the head posture and neck pain. It also improves the quality of life of the patients. This exercise improves muscle activity of trapezius and serratus anterior. [16] The main scapular stabilizers muscles are the levator scapulae, rhomboids, serratus anterior and trapezius. When the scapular muscles are weak and tight then position of the scapula may become altered which results abnormal stress to the capsular structure and rotator cuff compression. Due to weakness or tightness of theses muscles, scapular functions are reduced. [17] In the present study an attempt has been made to compare the efficacy of Scapular stabilization Exercises and Conventional Neck Exercises in patients with UCS.

MATERIALS AND METHODS

Subjects

The present study was based on purposively selected 30 confirmed cases of UCS (both males and females), aged 18-50 years, collected from the OPD of DAV Institute of physiotherapy and rehabilitation, Jalandhar, India. The subjects meeting the inclusion criteria were included with no history of radiculopathy, chronic neck pain and forward head posture, were included in the study.

The subjects were further divided into two groups for intervention. Group-A consisted of 15 subjects who were treated with hot pack, TENS and Scapular stabilization exercises. Group-B consisted of 15 subjects who were treated with hot pack, TENS and conventional neck exercises. A written informed consent was taken from each participating subject. A prior explanation regarding the treatment was given to the subjects who were enrolled in the study. The study was approved by institutional ethical committee.

Intervention given to the subjects

The total duration of the study was 2 months; Both groups had treated for 5 times per week for 2 weeks. Patients with UPS in both the groups were assessed for Neck Disability Index (NDI) scale, thoracic expansion and pectoral minor length test.

Hot pack: The hot pack was applied in supine position for 10-15 minutes to relax the tight muscles of the neck.

Transcutaneous Electrical Nerve Stimulation (TENS): Low Transcutaneous electrical nerve stimulation with frequency 2 Hz was applied to the patient in supine position for 15 minutes to decrease pain.

Scapular stabilization exercises: Scapular stabilization exercises have a positive effect on neck alignment by reducing the compensatory movement of the muscles. A scapular stabilization exercises also helps to improve the head posture and neck pain.

Conventional neck exercises: Exercises for neck flexors, Extensors, Rotators and Side flexors in conventional manner.

STATISTICAL ANALYSIS

Standard descriptive statistics (mean ± standard deviation) were determined for directly measured variables. One way ANOVA was used for between -group differences followed by post hoc Bonferroni. The independent t-test was used for the comparison of selected variables between patients with Group-A and B as well as within the treated with. Data were analyzed using SPSS (Statistical Package for Social Science) version 20. A 5% level of probability was used to indicate statistical significance.

RESULTS

Table 1 exhibits the Analysis of variance for selected variables between Group-A and B in various conditions. In Group-A, statistically significant between-group differences ($p<0.$ 003-0.000) were found in NDI, ACE and PMMLT, whereas, statistically significant differences ($p<0.000$) were noted only in NDI in Group-B.

The comparison of selected variables between group A and B in various conditions. In Group-A and B is shown in Table 2. Statistically significant between-group differences ($p<0.000$) were found in NDI at post treatment session after 15 days whereas ACE, MSCE, XSCE and PMLLT, statistically significant difference ($p<0.04$-0.000) was noted at post-treatment sessions after 7days and 15 days.

Table 1. Analysis of variance (ANOVA) for selected variables between Group-A and B in various conditions

Variables	Group-A (n=15)		Group-B (n=15)	
	F	P	F	P
NDI	59.6	.000(S)	33.3	.000(S)
ACE (cm)	43.6	.000(S)	.012	.988(NS)
MSCE (cm)	2.5	.094 (NS)	.002	.998(NS)
XSCE (cm)	.282	.756 (NS)	.003	.997(NS)
PMMLT (cm)	6.9	.003 (S)	.001	.999(NS)

NDI = Neck disability index ACE = Axial chest expansion, MSCE = Midsternal chest expansion, XSCE=Xiphysternum chest exapansion PMMLT= Pectoral minor muscle test

Table 2. Comparison of selected variables between Group-A and B in various conditions

Variables	Conditions	Group-A N=15 Mean+ S. D	Group-B N=15 Mean+S.D	t-value	p-value
NDI	Pre-treatment	34+4.1	32.3+4.15	1.144	0.262 (NS)
	Post treatment after 7 days	24.0+3.9	25.4+3.4	-.988	0.332 (NS)
	Post treatment after 15 days	17.4+4.5	20.6+4.1	-2.058	0.04 (S)
ACE	Pre-treatment	1.24+3.1	1.22+.27	.123	0.903(NS)
	Post treatment after 7 days	1.96+.36	1.24+.26	6.11	0.000(S)
	Post treatment after 15 days	2.5+.42	1.2+.26	9.78	0.000(S)
MSCE	Pre-treatment	2.11+.24	1.8+.31	.213	0.913 (NS)
	Post treatment after 7 days	2.2+3.1	1.89+.31	2.7	.012(S)
	Post treatment after 15 days	2.3+.27	1.90+.33	4.06	.000(S)
XSCE	Pre-treatment	2.16+.29	1.9+.28	1.82	.079(NS)
	Post treatment after 7 days	2.2+.34	1.96+.28	2.24	.033(S)
	Post treatment after 15 days	2.2+.4	1.9+.29	2.16	.039(S)
PMMLT	Pre-treatment	4.1+.81	4.4+.87	-1.06	.298 (NS)
	Post treatment after 7 days	3.7+.76	4.4+.88	-2.41	0.02(S)
	Post treatment after 15 days	3.0+.75	4.4+_.89	-4.5	.000(S)

Table 3 describes the application of post hoc Bonferroni for selected variables within the Group-A & B in various conditions. Statistically significant within-group differences ($p<0.000$) were found in NDI both in Group-A & B, and in ACE ($p<0.000$) at 1 vs 2 and 1 vs 3 and 2 vs 3 conditions in Group-A only. In rest of the combinations, statistically no significant between-group differences were found.

Table 3. Intra-group comparison of selected variables in Group-A and B in various conditions

Variables	**Group-A**			**Group-B**		
	1 vs 2	**1 vs3**	**2 vs 3**	**1vs 2**	**1 vs 3**	**2vs 3**
NDI	.000(S)	.000(S)	.000(S)	.000(S)	.000(S)	.000(S)
ACE (cm)	.000(S)	.000(S)	.000(S)	1.000(NS)	1.000(NS)	1.000(NS)
MSCE (cm)	1.000 (NS)	1.000(NS)	.096 (NS)	1.000(NS)	1.000(NS)	1.000(NS)
XSCE (cm)	1.000 (NS)	1.000(NS)	1.000(NS)	1.000(NS)	1.000(NS)	1.000(NS)
PMMLT (cm)	.500 (NS)	.500(NS)	.002(NS)	1.000(NS)	1.000(NS)	1.000(NS)

1= Pre-treatment, 2 = Post treatment after 7 days, 3 = Post treatment after 15 days

DISCUSSION

The objective of this study was to explore the efficacy of scapular stabilization exercises on reduced thoracic expansion in patients with UCS. In this study, 30 participants were taken and subjects were divided into two groups - Group A and B. Then, pre and post assessment were taken in both groups. In this assessment of pectoral flexibility, thoracic expansion and NDI score were involved. Scapular stabilization exercises were given to Group-A and conventional neck exercises were given to Group-B.

Our study showed that the scapular stabilization exercises were more effective than the conventional neck exercises. The present study supported the alternative hypothesis that was, statistically significant difference existed between Group-A and B. Above mentioned tables showed that the scapular stabilization exercises also helped in increasing thoracic expansion, pectoral flexibility and decreases the NDI scores.

Koseki et al. (2019) reported on the effect of UCS on thoracic shape and respiratory function and concluded that upper crossed syndrome caused expansion of the upper thorax and contraction of lower thorax, and due to these changes, the decreased respiratory function was found. [18]

Ito et al. (2007) conducted a study on investigation of respiratory function and breathing pattern in elderly people with kyphosis posture. They found in their study that UCS did lead to restrict the chest expansion during expiration. Conversely, UCS restricted the expansion of the lower

expansion during inspiration. The findings of the present study also showed the effect on reduced thoracic expansion. Axial thoracic expansion was increased after the scapular stabilization exercises. But, there was no effect observed on the midsternal and Xiphisternal, as these exercises worked on the scapular muscles. [19]

Im et al. (2016) conducted a study on effect of scapular stabilization exercises on neck posture and muscle activation in individuals with neck pain and forward head posture. They conducted the study on 15 subjects with forward head posture. Pre and post assessment were taken. Scapular stabilization exercises were given to patients for 4 weeks. After treatment the study showed the effect on muscle activity and NDI score. The score was decreased after the treatment. [20]

Han et al. (2016) conducted a study on effects of forward head posture on forced vital capacity and respiratory muscle activity. They had done the study on twenty six subjects and divided the study into two groups (normal and forward head posture). They found that forced vital capacity and accessory muscle activity were reduced in patients with UCS. Our study showed that pectoral minor flexibility was reduced in case of forward head posture. After the intervention, the scapular stabilization exercises reduced the tightness of the muscle. [21]

Dimitrides et al. (2016) conducted a study on the respiratory weakness in patients with chronic neck pain. They reported that weakness of the neck muscles and accessory respiratory muscles in patients with neck pain resulted the decline on the thoracic mobility. The findings of the reported that the activity of sternocleidomastoid, upper trapezius and pectoral minor were reduced due to neck pain. Similarly, the findings of the present study also showed the activity was reduced in all these muscles. Forward head posture caused the shortening and weakening of the accessory respiratory muscles. Due to this shortening and weakening of the muscles, thoracic expansion was reduced. [22]

Jung and Moon (2015) conducted a study on the effect of thoracic region self stabilization on chest expansion and pulmonary function. They concluded that when interventions were applied, the major effect occurred on axillary region, there was no effect found on Xiphisternum. Similar effect was also found in the findings of the present study. After intervention (scapular stabilization exercises) thoracic expansion was also increased at the axial level. But, there was no effect on the midsternal and xiphisternal. Because of all the thoracic muscles showed attachment with first 10 ribs. So, the effects at Xiphisternum were negligible that area comprising with floating ribs. [23]

Yip et al. (2008) reported that effects of forward head posture and neck pain on craniovertebral angle and cervical range of motion. The findings of the study showed the craniovertebral angle and cervical range of motion were decreased due to forward head posture. Because in forward head posture, the muscles became shorten and tighten. Our study also showed that the cervical range of motion was reduced due to forward head posture. Due to weakness of deep cervical flexors which led to reduce the cervical range of motion, scapular stabilization exercises helped to strengthen the weak muscles and increase the flexibility of tight muscles. The scapular stabilization exercises also played a very important role in decreasing pain and curing the patients with UCS. [24]

Declaration by Authors

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