International Journal of Science and Healthcare Research
Vol. 8; Issue: 4; Oct.-Dec. 2023
Website: ijshr.com
Original Research Article *ISSN: 2455-7587*

Effect of Scapular Stabilization Exercises with and without Thoracic Mobilization on Neck Pain and Range of Motion in Upper Cross Syndrome

Minal Ganvir[1], Dr. Sonali Kadam[2]

[1]Intern, DPO's Nett College of Physiotherapy, Thane, Maharashtra, India
[2]Assistant Professor, DPO's Nett College of Physiotherapy, Thane, Maharashtra, India

Corresponding Author: Minal Ganvir

DOI: https://doi.org/10.52403/ijshr.20230409

ABSTRACT

Background: Neck pain is a common musculoskeletal disorder occurring in Upper Cross Syndrome which involves pain and discomfort around the neck region, which causes limitation in activities of daily living and impact the health of an individual and can also be a risk factor for reduced general productivity. Few studies have shown higher evidence in younger adults as a result of sustained exposure to abnormal posture, which increases the risk of musculoskeletal disorders.
This intervention aims on the restoration of the muscle imbalance and to reduce pain and increase range of motion.
Objective: To study the effect of Scapular Stabilization Exercises with and without Thoracic Mobilization on neck pain and range of motion in Upper Cross Syndrome in young adults.
Method: This is a comparative study where 70 subjects were selected as per inclusion and exclusion criteria and assigned to group A (n=35; Exercise group) and group B (n=35; Exercise with Mobilization group) respectively. Scapular stabilization exercises were given to both the groups. The intervention was given for 4 days/week for 4 weeks. Pain and Range of Motion was assessed pre and post intervention using VAS and Goniometer. The data was collected and statistically analysed.
Results: Both groups showed ($p<0.001$) differences in all outcome measures between pre-test and post-test values of Group A and Group B. Results of this study indicated that after 4 weeks of upper thoracic mobilization in addition to scapular stabilization exercises, the Cervical ROM significantly increased in comparison to the scapular stabilization exercise group which in terms of flexion, extension, left and right lateral flexion, and left and right rotation.
Conclusion: The study concludes that Thoracic Mobilization along with Scapular Stabilization exercises had a significant effect in reducing pain, increasing flexion, extension, lateral flexion, and rotation range of motion as compared to Scapular stabilization exercises only.

Keywords: upper cross syndrome, neck pain, young adults, scapular stabilization exercises, thoracic mobilization, range of motion

INTRODUCTION

Upper cross syndrome (UCS) is defined as a muscular imbalance caused by tightness of the upper, middle, and lower trapezius fibres, levator scapulae, sub-occipital, and pectoralis major and minor muscles, as well as weakness of the cervical flexors, sternocleidomastoid, and serratus anterior muscles. The weakened and the shortened muscles connected in the upper body forms a cross. Hence, Dr. Janda named this syndrome as Upper Cross Syndrome. The patterns of dysfunction and postural changes that occur in Upper Cross Syndrome causes muscle imbalance at the shoulder, head, and neck region resulting in neck pain.[1]

When opposing muscles provide different direction of tension due to tightness and weakness of the muscles it leads to muscular imbalance, this muscular imbalance affects joint biomechanics, alters the movement pattern, uneven distribution on joint and pain which leads to the common features of Upper Cross Syndrome which are forward head posture, rounded upper back, elevated and protracted shoulder, winged scapula, increased cervical lordosis, thoracic kyphosis, and reduced thoracic spine mobility.[1]

The antagonistic muscular imbalance causes the postural disturbance in UCS.[2] The altered posture changes begins when the head and shoulder shifts anteriorly which creates a pattern of forward head and shoulder which later results into increased cervical lordosis and kyphosis. The forward head posture comprises of the extension of the upper cervical region and flexion of the lower cervical region, when this posture is accompanied by rounded shoulder there is generation of extensor torque around the upper cervical region due to reduced lengthening of the muscle fibers.[3] These comprehensive abnormalities cause the change in the pattern of the upper quarter body.[4] This altered posture causes tension around the soft tissues and reduces flexibility.[5]

Neck pain is the most common musculoskeletal disorder faced by young individuals, the common causes for neck pain are exposure to sustained abnormal posture, and neck strain. Mechanical dysfunction that triggers unusual joint motion is a known possibility for neck disorder since there is an altered mobility of cervical muscles which affects the cervical range of motion.[6]

Previous studies revealed that the prevalence rate of Upper Cross Syndrome in college-going students is 37.1% in which 48.7 % population of the students have neck pain while 66.8 % of the population was found to have poor studying posture.[7]

The young adult population with a sedentary lifestyle are at a higher risk of Upper Cross Syndrome as they have long hours of sitting posture while using the computer, studying in a slouch posture, watching television or using a smartphone, carrying heavy backpacks, and uncomfortable job posture. The exposure of this prolonged poor posture can often lead to neck and upper back pain.[4]

The cervical extensors constantly contract to take over the load of inactive deep flexors leading to the cervical extensors lengthening whereas weakness and shortening of deep neck flexors which in turn causes muscle imbalance and injury to the soft tissues. This ultimately leads to diffused pain in the neck, scapular, and head region as well as limitation in range of motion.[8]

The scapular bone connects the neck and shoulder and plays a significant role in neck stability and shoulder complex. The scapula and the neck have same muscle attachments; hence the altered scapular function and stability causes cervical spine loading which may lead to neck pain.[9]

Since the cervical and scapular regions are closely correlated the altered dysfunction in one of these two regions can affect the other region. The altered orientation and stability of the scapula also contributes to the dysfunction in the cervical spine. The poor neuromuscular pattern or altered activity in scapular stabilizers -serratus anterior and trapezius and altered

activity and extensibility of scapular mobilizers- pectoralis minor, rhomboids, and levator scapulae often lead to altered scapular orientation.[10]

The Scapular Stabilization Exercises work on the principle of developing awareness of muscle contraction and spinal position which is acquired by learning motor control. Scapular Stabilizer Exercises helps in reducing neck as well as shoulder pain. These exercises have also shown a particular effect in reducing neck pain and improving cervical functioning.[11]

The pain caused by poor postures also involves the upper thoracic spine which is involved in the physiologic motion of the neck like cervical flexion, cervical extension, cervical rotation, and cervical

lateral flexion.[12] The altered biomechanics of the thoracic vertebra serves as a connection between the disturbances in cervical function and mobility.[13] The manual therapy had shown effects in temporary biomechanical changes, local and neurophysiological effects in individuals with mechanical neck pain.[14]

Upper thoracic mobilization decreases mechanical stress and increases the distribution of joint forces in the cervical spine and restores normal biomechanics and enhances thoracic mobility, The Upper thoracic mobilization has proven in providing immediate improvement in cervical range of motion, pain and neck function.[15] Previous studies revealed that when manual therapy is combined with exercises the effects are improved, which also helps in reducing pain and disability.[16]

Therefore, this study will be carried out to find the effect of thoracic mobilization along with scapular stabilization exercises on neck pain and range of motion in patients with upper cross syndrome having neck pain.

MATERIALS & METHODS

Materials: Consent form, Stationary material, Data collection sheet, Goniometer, Theraband of different colors, Visual Analog Scale (VAS)

Methodology:

Study Design: Study type – Experimental study

Study design – Pretest and Post test

Study setting – Metropolitan city

Study duration – 18 months.

Sample Design: Sampling method – Simple Random Sampling followed by Convenient Sampling. Sample size - 70 subjects diagnosed with upper cross syndrome having neck pain will be selected (35 in each group)

Sample population – Young Adults (18 to 25 years of age)

Treatment Duration: 30 minutes per session, 4 days/week for 4 weeks

PROCEDURE

Ethical clearance was taken from institutional ethical committee. Permission from concerned authorities to conduct study was taken. Written consent was obtained from subjects prior to participation. All participants were screened according to inclusion and exclusion criteria.

The inclusion criteria were: Age: 18 to 25 years, Both Male and Female, Subjects diagnosed with Upper Cross Syndrome having neck pain, Pain duration for at least 3 months. The Exclusion criteria were Neurological deficit, Pain in scapular and thoracic region, Any shoulder pathology/ trauma, Previous history of cervical and thoracic and shoulder surgery, Whiplash injury, History of Vertebral fractures and surgical spinal fixation, Any inflammatory or osteometabolic and history of neurological diseases, Congenital / Rheumatic Disorder.

Purpose of study and procedure was explained to subject prior to study. Demographic data was collected. A brief summary relating to the project was given to the subjects.

•Assessment of participants for upper cross syndrome was done by

-Pectoralis Major Contracture Test: Asking the subject to lie supine and clasp both the hand behind the head. Then the subject will lower the arm until the elbow touches the couch. Test is positive if elbow does not touch the table

-Middle and Lower Trapezius Weakness: For testing Middle trapezius, subject is positioned in prone lying. Arm is then abducted in 90^0 flexion and laterally rotated. The examiner resists the horizontal extension of arm looking for scapular retraction to occur. If there is protraction of scapula, then test its suggestive of weakened middle fibers of trapezius.

For testing Lower Trapezius, subject lies prone with arm abducting to 120^0 and shoulder rotated laterally. Therapist applies

resistance towards diagonal extension and observe scapular retraction which occurs normally. If scapular protraction occurs, then test is positive revealing weakness of lower trapezius

- Screening for neck pain was done in participants who have upper cross syndrome

Before beginning the intervention Pain, Range of Motion was assessed and documented using VAS, Goniometer and in both the groups.

- **Group 1**: Thoracic Mobilization with Scapular Stabilization Exercises - Thoracic mobilization- Posteroanterior Mobilization was given in two sets of 30 oscillations for approximately 3 minutes.
- **Group 2**: Scapular Stabilization Exercises -3 sets of 10 repetitions were given later was progressed to 15 repetitions along with the progression of theraband.

Hot moist pack was given for 10 minutes as a baseline treatment for both groups. Warm-up and Cool down exercises were given in both groups:

-Warm-up Exercises: Neck movements, Shoulder bracing, Shoulder shrug, Trapezius stretching, Pectoralis stretching.
-Cool-down Exercises: Neck movements, Shoulder bracing, Shoulder shrug.
Treatment was given for 4 days in a week for 4 consecutive weeks. Later statistical analysis was done.

THORACIC MOBILIZATION (POSTERO-ANTERIOR):

As described by Maitland, the Patient will be in the prone lying position. The therapist's caudal hand, the second and third digits are used as "dummy" fingers, with pads of the second and third fingers placed on the transverse processes of the targeted vertebra. Cranial hand the Palmar aspect of the fifth metacarpal is placed over the dummy finger. The therapist takes up the slack and induces posteroanterior force at the specified segment. The depth and frequency of the forces can be modified to perform graded oscillations III and IV. This process will continue sequentially in a causal direction to T6, for an overall intervention time of approximately 3 minutes.

Fig.1. Therapist performing Thoracic Mobilization on Subject

Figure 2: Subject performing Scapular Stabilization Exercise

SCAPULAR STABILIZATION EXERCISES: [12]

1. Scapular Retraction: Stand erect grasp the band between your hands and arms lifted out to the sides with elbows at 90° and slow pull arms backwards and squeeze the shoulder blades together. Hold it for 6-10 seconds and slowly return to the starting position

2. Eccentric Scapular Retraction: Stand erect by holding the end of band in each hand. Pull back until elbows are even with trunk and keep elbows out from sides at 45°, thumbs up. Hold it for 6-10 seconds and slowly release and get back to starting position.
3. Combined Scapular Retraction with Shoulder External Rotation: Stand erect with band looped around your hands about shoulder-width apart, elbows 90° flexed. Squeeze your shoulder blades together, gently stretching the band between your hands. Hold it for 6-10 seconds and slowly return to a starting position.
4. Forward Punch: Stand erect with band wrapped around your mid back. Grasp the ends of the band in front of you with your elbows bent at your side. Extend your elbows forward and push the band away from your trunk. Hold it for 6-10 seconds and slowly return to starting position.
5. Dynamic Hug: Stand erect, place the band around your upper back and adjust your hands as an open-handed grip and palms are prone. Abduct your shoulders about 60° and bend your elbows about 45°. Keeping your arms raised and in position, push your arms forward and inward when your hands cross each other. Hold for 6-10 seconds and slowly return to starting position.

Weekly Progression of the Exercises:

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
SCAPULAR STABILIZATION EXERCISES	Begin using yellow or red theraband 1 set of 10 repetitions 1 session/day	With same color theraband 1 set of 15 repetitions 1 session/day	Progress to next color theraband 1 set of 10 repetitions 1 session/day	With same color theraband 1 set of 15 repetitions 1 session/day

STATISTICAL ANALYSIS

A total of 70 subjects (young adults between the age group of 18 to 25 years) were enrolled in the study. Data was collected on a data sheet. Tables were made using Microsoft Word and figures were plotted using Microsoft Excel Windows 10. The significant difference between the two groups was investigated with the unpaired t-test and within the group with paired t-test.

RESULT

Table 1: Age Distribution Chart

Variable	Group	N	Mean	Std. Deviation	Unpaired t statistic	p value
Age	Mobilization + Exercises	35	22.14	1.93	0.36	0.72
	Exercises	35	21.97	2.11		

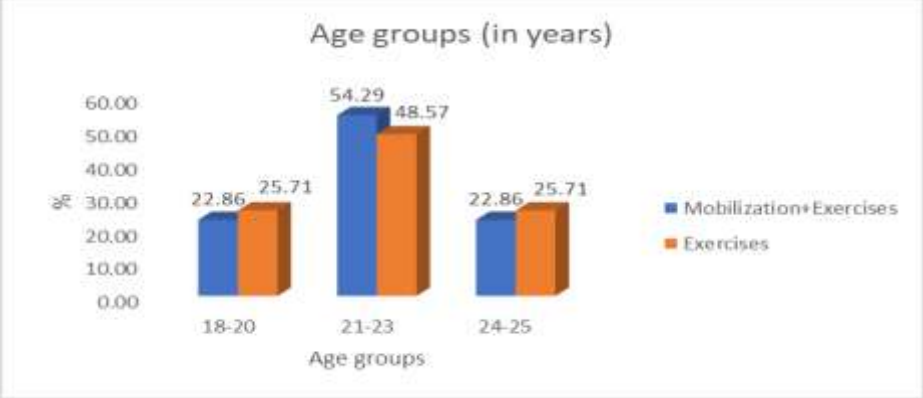

Figure 3: Age Distribution Graph

INTERPRETATION:

The above tabular data and bar graph chart depicts that 70 young adults with upper cross syndrome between the age group 18 to 25 years were studied.

- In Group A, Thoracic Mobilization with scapular stabilization exercises group, there were 8(22.86%) young adults between 18-20 years of age, 19(54.29%) young adults between 21-23 years of age, and 8(22.86%) in 24-25 years of age.
- In Group B, the Scapular stabilization exercises group, there were 9(25.71%) young adults between 18-20 years of age, 17(48.57%) young adults between 21-23 years of age, and 9(25.71%) in 24-25 years of age.
- Mean age of patients from Group A was 22.14 years and mean age of patients from Group B was 21.97 years.

Table 2: Gender Wise Distribution Of Subjects.

Gender	Mobilization + Exercises		Exercises	
	F	%	F	%
Females	17	48.57	12	34.29
Males	18	51.43	23	65.71
Total	35	100.00	35	100.00

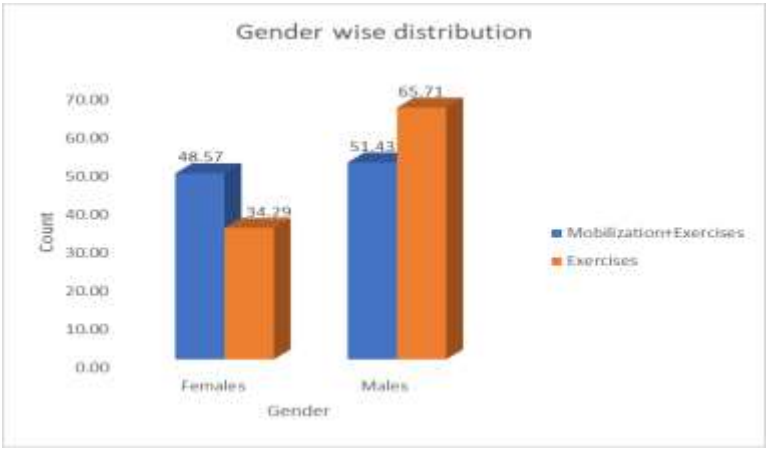

Figure 4: Gender Wise Distribution Of Subjects.

INTERPRETATION:

- The above tabular data and graph chart depicts gender wise distribution of subjects.
- In Group A, Thoracic Mobilization with scapular stabilization exercises group, there were 17(48.57%) female young adults and 18(51.43%) male young adults.
- In Group B, Scapular Stabilization Exercises group, there were 12(34.29%) female young adults and 23(65.71%) male young adults.

Table 3: Comparison Between Group A: Thoracic Mobilization With Scapular Stabilization Exercises And Group B: Scapular Stabilization Exercises

Variables	Group	N	Mean	Std. Deviation	Unpaired t statistic	p value
Age	Mobilization + Exercises	35	22.14	1.93	0.36	0.72
	Exercises	35	21.97	2.11		
Pain on activity Pre	Mobilization + Exercises	35	6.94	1.00	0.52	0.61
	Exercises	35	7.06	0.84		
Pain on activity Post	Mobilization + Exercises	35	3.11	1.11	9.30	<0.001
	Exercises	35	5.40	0.95		
Pain on rest Pre	Mobilization + Exercises	35	2.71	1.10	0.28	0.78
	Exercises	35	2.80	1.45		
Pain on rest Post	Mobilization + Exercises	35	0.43	0.61	5.42	<0.001
	Exercises	35	1.49	0.98		
Flexion Pre	Mobilization + Exercises	35	39.51	1.72	0.22	0.83
	Exercises	35	39.43	1.52		
Flexion Post	Mobilization + Exercises	35	43.49	1.36	6.20	<0.001
	Exercises	35	41.29	1.60		
Extension Pre	Mobilization + Exercises	35	39.77	1.59	1.95	0.06
	Exercises	35	38.89	2.17		

Extension Post	Mobilization + Exercises	35	44.17	1.27	7.92	<0.001
	Exercises	35	41.00	2.00		
Right Lateral flexion Pre	Mobilization + Exercises	35	42.00	1.61	1.55	0.13
	Exercises	35	41.43	1.48		
Right Lateral flexion Post	Mobilization + Exercises	35	44.43	0.85	5.14	<0.001
	Exercises	35	42.97	1.44		
Left Lateral flexion Pre	Mobilization + Exercises	35	42.17	1.72	0.15	0.89
	Exercises	35	42.11	1.57		
Left Lateral flexion Post	Mobilization + Exercises	35	44.40	0.85	4.09	<0.001
	Exercises	35	43.31	1.32		
Right Lateral rotation Pre	Mobilization + Exercises	35	54.89	2.15	2.96	<0.001
	Exercises	35	53.43	1.96		
Right Lateral rotation Post	Mobilization + Exercises	35	58.17	1.65	8.53	<0.001
	Exercises	35	54.77	1.68		
Left Lateral rotation Pre	Mobilization + Exercises	35	55.11	2.18	1.42	0.16
	Exercises	35	54.43	1.85		
Left Lateral rotation Post	Mobilization + Exercises	35	58.37	1.68	6.49	<0.001

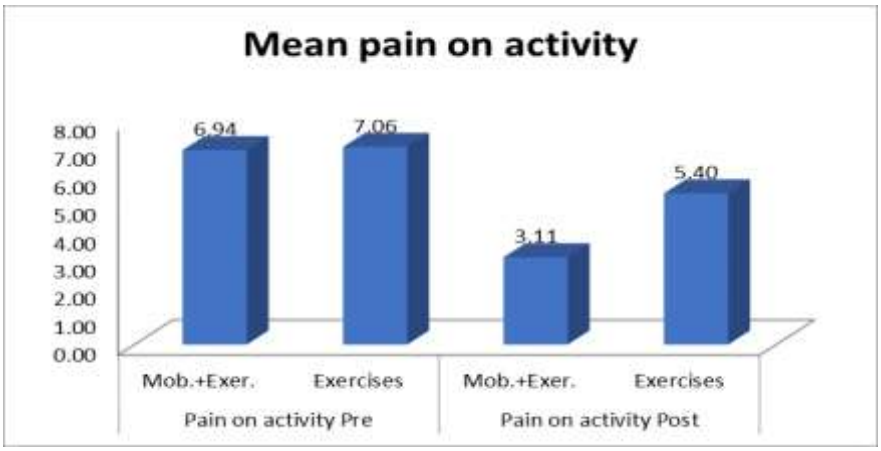

Figure 5: Comparison Between Group A And Group B For Pain (Vas) On Activity

INTERPRETATION:

Mean pain on activity after intervention in subjects receiving mobilization with exercises 3.11 was significantly lower than mean pain on activity in subjects receiving only exercises 5.40 ($p<0.001$).

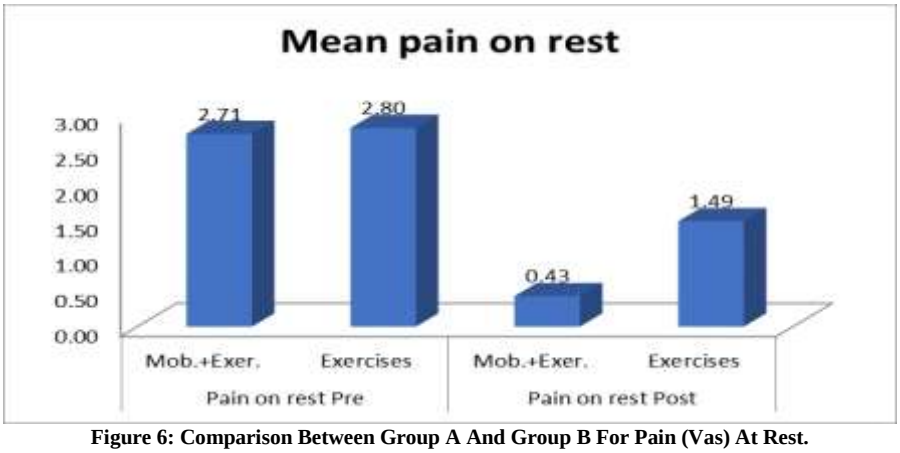

Figure 6: Comparison Between Group A And Group B For Pain (Vas) At Rest.

INTERPRETATION:

Mean pain on rest after intervention in subjects receiving mobilization with exercises 0.43 was significantly lower than mean pain on rest in subjects receiving only exercises 1.49 ($p<0.001$).

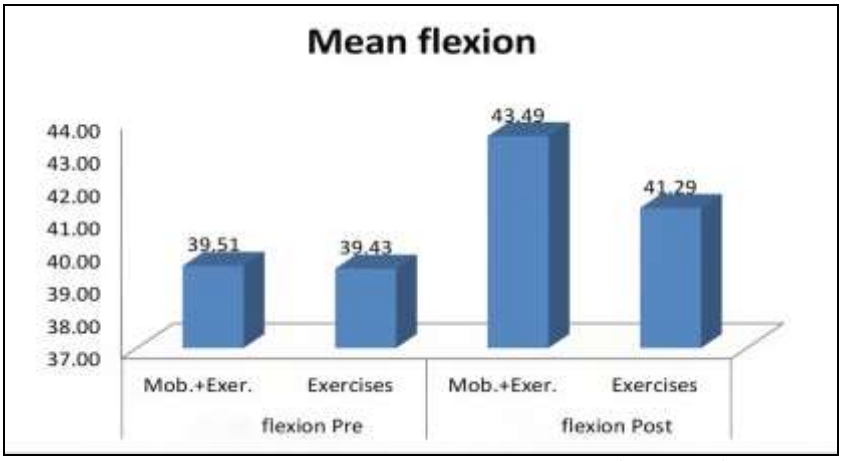

Figure 7: Comparison Between Group A And Group B For Flexion Rom Before And After The Intervention.

INTERPRETATION:

Mean flexion after intervention in subjects receiving mobilization with exercises 43.49 was significantly higher than mean flexion in subjects receiving only exercises 41.29 ($p<0.001$).

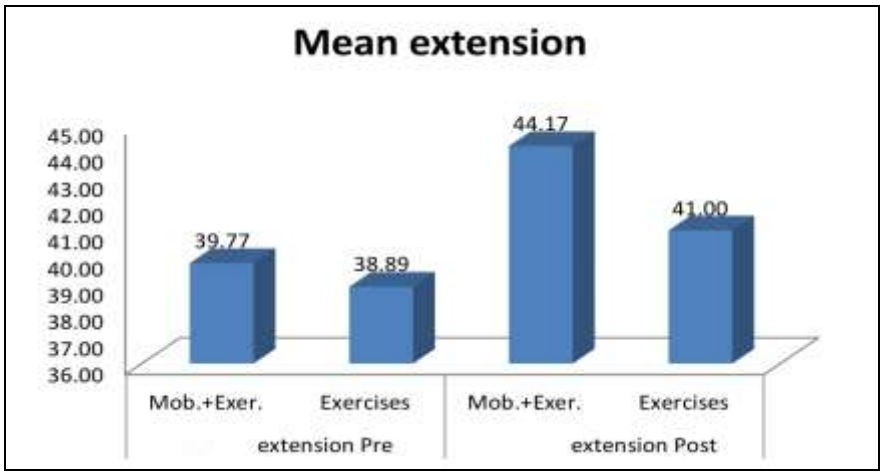

Figure 8: Comparison Between Group A And Group B For Extension Rom Before And After The Intervention.

INTERPRETATION:

Mean extension after intervention in subjects receiving mobilization with exercises 44.17 was significantly higher than mean extension in subjects receiving only exercises 41 ($p<0.001$).

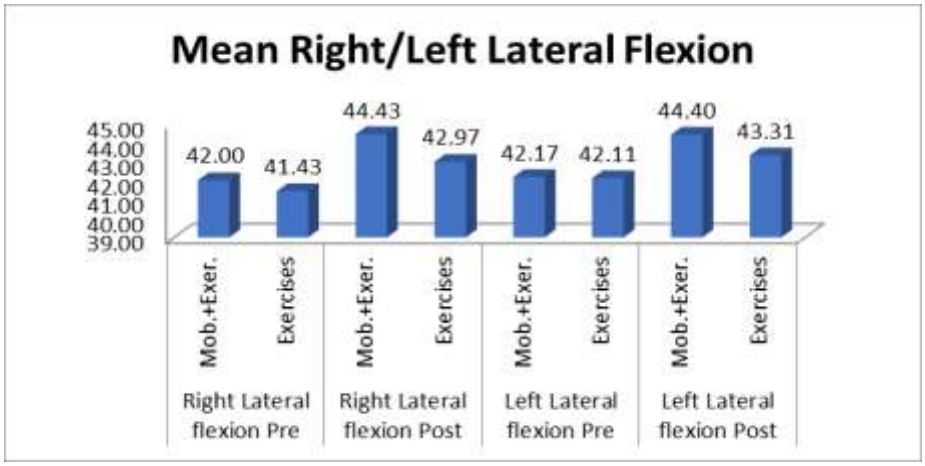

Figure 9: Comparison Between Group A And Group B For Lateral Flexion Rom Of Both The Sides Before And After The Intervention.

INTERPRETATION:

- Mean right lateral flexion after intervention in subjects receiving mobilization with exercises 44.43 was significantly higher than mean right lateral flexion in subjects receiving only exercises 42.97 ($p<0.001$).
- Mean left lateral flexion after intervention in subjects receiving mobilization with exercises 44.40 was significantly higher than mean left lateral flexion in subjects receiving only exercises 43.31 ($p<0.001$).

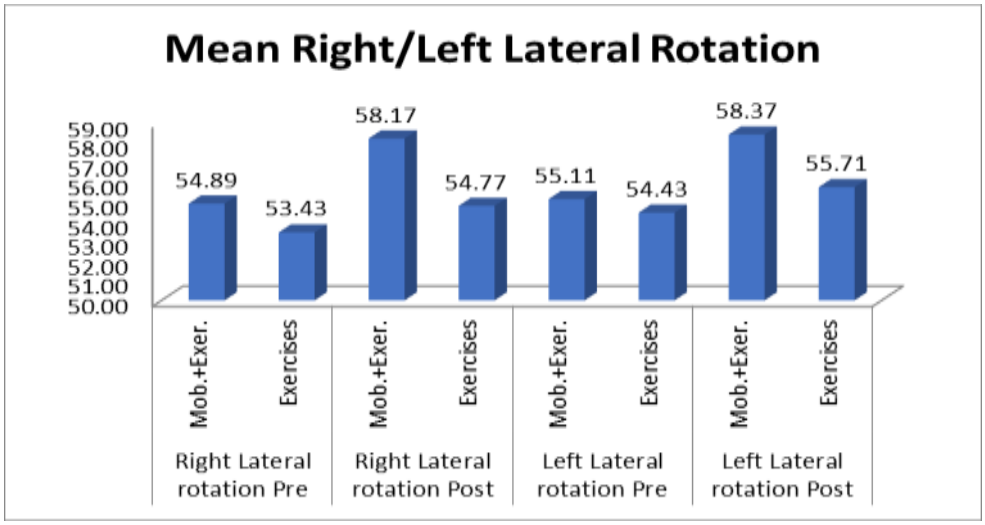

Figure 10: Comparison Between Group A And Group B For Lateral Rotation Rom Of Both The Sides Before And After The Intervention.

INTERPRETATION:

- Mean right lateral rotation after intervention in subjects receiving mobilization with exercises 58.17 was significantly higher than mean right lateral rotation in subjects receiving only exercises 54.77 ($p<0.001$).
- Mean left lateral rotation after intervention in subjects receiving mobilization with exercises 58.37 was significantly higher than mean left lateral rotation in subjects receiving only exercises 55.71 ($p<0.001$)

DISCUSSION

An interventional study was carried out for a period of 18 months to study the effect of Scapular Stabilization Exercises with and without Thoracic Mobilization on neck pain and range of motion in patients with Upper Cross Syndrome.70 patients who had complaints of neck pain were selected for this study. The participants who satisfied the selection criteria were conveniently assigned into two groups, 35 subjects in each group. Baseline measurements were taken using the Visual Analogue Scale and Goniometer. The subjects in Group A were given Thoracic Mobilization with Scapular Stabilization exercises whereas the subjects in Group B received Scapular Stabilization Exercises. Hot moist pack (for 10 minutes), Warm up and Cool down exercises were given as a baseline treatment for both groups. At the end of 4 weeks, patients were re-assessed using the same outcome measures. Out of the total participants, the minimum age included in the study was 18 years and the maximum age was 25 years. The Mean age of subjects from Group A was 22.14 years and the mean age of subjects from Group B was 21.97 years. In Group A, there were 17(48.57%) female young adults and 18(51.43%) male young adults while in Group B, there were 12(34.29%) female young adults and 23(65.71%) male young adults.

Upper cross syndrome (UCS) is a muscular imbalance caused by tightness of the upper, middle, and lower trapezius fibers, levator scapulae, sub-occipital, and pectoralis major and minor muscles, as well as weakness of

the cervical flexors, sternocleidomastoid, and serratus anterior muscles1. A study reported that the prevalence rate of Upper Cross Syndrome in college-going students is 37.1% in which 48.7 % population of the students have neck pain.7 A previous study conducted by Priya concluded that Scapular Stabilization exercises have a particular effect in reducing neck pain and improving cervical functioning.[11] A study done by Al-Bassiouny HA et.al, showed a positive effect of upper thoracic mobilization on Cervical ROM and neck function when compared with routine physical therapy.[15]

Results of this study indicated that after 4 weeks of upper thoracic mobilization in addition to scapular stabilization exercises, the Cervical ROM significantly increased in comparison to the scapular stabilization exercise group which in terms of flexion, extension, left and right lateral flexion, and left and right rotation. The impact described here can be interpreted as small-amplitude oscillatory and distraction movements used in thoracic mobilization to stimulate mechanoreceptors, which inhibit the transmission of nociceptive stimuli at the spinal cord or brain stem levels. This reduces mechanical stress and increases the distribution of joint forces in the cervical spine, restoring the spine's normal biomechanics and enhancing thoracic mobility.[15] This study showed a significant improvement in pain levels in group A when comparing pre-and post-treatment to group B, which can be explained by the fact that all participants were lying on treatment tables with openings for the face, and the cervical spine was stabilized in a neutral position during treatment, mobilizing forces of the thoracic spine caused simultaneous inadvertent rotation of the cervical segments. Even without this stabilization, the direct movement of the cervical segments by thoracic mobilization would exceed the force used to correctly perform a Class IV mobilization.[18]

The study concluded that thoracic mobilization along with and without scapular stabilization exercises had an effect on cervical ranges of motion and pain, while Thoracic Mobilization with Scapular stabilization exercises had a significant impact on pain and cervical ROM as compared to another group

CONCLUSION

The study concludes that Thoracic Mobilization along with Scapular Stabilization exercises had a significant effect in reducing pain, increasing flexion, extension, lateral flexion, and rotation range of motion as compared to Scapular stabilization exercises only.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: I express my deep sense of gratitude and sincere thanks to our sir Dr Ajay Kumar and my guide Dr Sonali Kadam for their encouragement, guidance and constant supervision throughout the study. Also, my heartfelt thanks to all the subjects who willingly participated in the study and cooperated with me.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Mahmood T, Afzal MW, Waseem I, Arif MA, Mahmood W. Comparative Effectiveness of Routine Physical Therapy with and without Instrument Assisted Soft Tissue Mobilization for Improving Pain and Disability in Patients with Neck Pain Due to Upper Crossed Syndrome. Annals of Punjab Medical College (APMC). Journal of the Pakistan Medical Association,2022 Mar 31;16(1):45-50.
2. Weon JH, Oh JS, Cynn HS, Kim YW, Kwon OY, Yi CH. Influence of forward head posture on scapular upward rotators during isometric shoulder flexion. Journal of Bodywork and movement therapies. 2010 Oct 1;14(4):367-74.
3. Mubeen I, Malik S, Akhtar W, Iqbal M, Asif M, Arshad A, Zia S, Khalid S. Prevalence of upper cross syndrome among the medical students of University of Lahore. International Journal of Physiotherapy.2016 Jun 1;3(3):381-4.

4. Asad A, Farooq N, Kafeel S, Hassan T, Zubair M. Association of upper crossed syndrome and posture among general population having neck pain in Islamabad. Journal of Rehman Medical Institute. 2021 Jul 11;7(2):07-11.
5. Pathan H, Phansopkar P, Naqvi WM. Screening for Upper Cross Syndrome in Asymptomatic Individuals. Indian Journal of Forensic Medicine & Toxicology. 2021;15(1):50-4.
6. Risaldar P, Phansopkar P, Chitale N, Wadhokar OC, Arora SP. Comprehensive rehabilitation of a patient with upper crossed syndrome. Journal of Medical Pharmaceutical and Allied Sciences. 2021;10(4):3179-81.
7. Chandarana P, Rathod S, Sorani D. Prevalence of Upper Crossed Syndrome in College Going Students-An Observational Study, International Journal of Health Sciences and Research, Vol.12; Issue: 3; March 2022
8. Deshpande V, Bathia K, Kanase S, Pawar A, Jain P, Patel G. Effect of McKenzie Approach and Neck Exercises on Forward Head Posture in Young Adults. Indian Journal of Public Health Research & Development. 2019 Jul 1;10(7).
9. Mawad An, Mohamed H, Yara S. Scapular stabilization exercise versus neck stabilization exercise in females with chronic mechanical neck pain. The Medical Journal of Cairo University. 2021 Dec 1;89(December):2729-34
10. Helgadottir H, Kristjansson E, Einarsson E, Karduna A, Jonsson Jr H. Altered activity of the serratus anterior during unilateral arm elevation in patients with cervical disorders. Journal of electromyography and kinesiology. 2011 Dec 1;21(6):947-53
11. Priya S. Efficacy of Scapular Stabilization Exercises in Patients with Mechanical Neck Pain (Doctoral dissertation, PSG College of Physiotherapy, Coimbatore).
12. Lee KS, Lee JH. Effect of Maitland mobilization in cervical and thoracic spine and therapeutic exercise on functional impairment in individuals with chronic neck pain. Journal of Physical Therapy Science. 2017;29(3):531-5.
13. Vicenzino B, Collins D, Wright A. The initial effects of a cervical spine manipulative physiotherapy treatment on the pain and dysfunction of lateral epicondylalgia. Pain. 1996, Volume 68, Issue 1, Nov 1;68(1):69-74.
14. Griswold D, Learman K, O'Halloran B, Cleland J. A preliminary study comparing the use of cervical/upper thoracic mobilization and manipulation for individuals with mechanical neck pain. Journal of Manual & Manipulative Therapy. 2015 May 1;23(2):75-83.
15. Salwa Shendy PD, El-Khozamy PD. Effect of Upper Thoracic Mobilization on Chronic Mechanical Neck Pain. The Medical Journal of Cairo University. 2019 Jun 10;87(June):1449-57.
16. Vincent K, Maigne JY, Fischhoff C, Lanlo O, Dagenais S. Systematic review of manual therapies for nonspecific neck pain. Joint Bone Spine. 2013 Oct 1;80(5):508-15.
17. Maitland GD. Vertebral manipulation. Elsevier Health Sciences; 1986 Mar 20,8th edition, Volume 1, page number 40
18. McGregor CI, Boyles R, Murahashi L, Sena T, Yarnall R. The immediate effects of thoracic transverse mobilization in patients with the primary complaint of mechanical neck pain: a pilot study. Journal of Manual & Manipulative Therapy. 2014 Nov 1;22(4):191-8
19. Suvarnnato T, Puntumetakul R, Kaber D, Boucaut R, Boonphakob Y, Arayawichanon P, Chatchawan U. The effects of thoracic manipulation versus mobilization for chronic neck pain: a randomized controlled trial pilot study. Journal of Physical Therapy Science. 2013;25(7):865-71
20. Cagnie B, Struyf F, Cools A, Castelein B, Danneels L, O'leary S. The relevance of scapular dysfunction in neck pain: a brief commentary. Journal of Orthopaedic & Sports Physical Therapy. 2014 Jun;44(6):435-9.
21. Ariens GA, Van Mechelen W, Bongers PM, Bouter LM, Van Der Wal G. Physical risk factors for neck pain. Scandinavian Journal of Work, Environment & Health. 2000 Feb 1:7-19.
22. Seo YG, Park WH, Lee CS, Kang KC, Min KB, Lee SM, Yoo JC. Is scapular stabilization exercise effective for managing nonspecific chronic neck pain? a systematic review. Asian Spine Journal. 2020 Feb;14(1):122.
23. Lluch E, Arguisuelas MD, Quesada OC, Noguera EM, Puchades MP, Rodríguez JA, Falla D. Immediate effects of active versus

passive scapular correction on pain and pressure pain threshold in patients with chronic neck pain. Journal of Manipulative and Physiological Therapeutics. 2014 Nov 1;37(9):660-6.
24. Norlander S, Nordgren B. Clinical symptoms related to musculoskeletal neck-shoulder pain and mobility in the cervico-thoracic spine. Scandinavian Journal of Rehabilitation Medicine. 1998 Dec 1;30(4):243-51.
25. Tsang SM, Szeto GP, Lee RY. Normal kinematics of the neck: the interplay between the cervical and thoracic spines. Manual Therapy. 2013 Oct 1;18(5):431-7.
26. Sillevis R, Cleland J, Hellman M, Beekhuizen K. Immediate effects of a thoracic spine thrust manipulation on the autonomic nervous system: a randomized clinical trial. Journal of Manual & Manipulative Therapy. 2010 Dec 1;18(4):181-90

How to cite this article: Minal Ganvir, Sonali Kadam. Effect of scapular stabilization exercises with and without thoracic mobilization on neck pain and range of motion in upper cross syndrome. *International Journal of Science & Healthcare Research.* 2023; 8(4): 55-66. DOI: *https://doi.org/10.52403/ijshr.20230409*

******