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COMPARATIVE EFFECTS OF SCAPULAR STABILIZATION VERSUS SCAPULAR FUNCTIONAL EXERCISES ON CHRONIC NECK PAIN

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ABSTRACT

Objective: To determine the effects of scapular stabilization versus scapular functional exercises on pain severity, neck function and cervical range of motions in patients with chronic neck pain.

Study design: It was a randomized clinical experiment.

Place and duration of study: The study setting was Amina Physical therapy and Rehab Centre Lahore The study completed in a period of eight months, from July 2023 to december 2024.

Methods: Data collected from the Amina Physical therapy and Rehab Centre Lahore, after inclusion exclusion criteria 42 participants by the process of randomization 21 participants included in Group A and 21 participants were included in Group B. Both Males and females between 18 to 35 years were selected for study. After selection group A received scapular stabilization exercises along with the conventional treatment of hot pack and ultrasound and Group B received Scapular functional exercises along conventional physical therapy. The participants were examined at the beginning of treatment, then at 4th week and again at 8th week for 3 sessions per week for eight weeks for visual analogue scale, neck disability index and cervical range of motions.

Results: In this study 42 participants included by randomization, after criteria and drop off 39 participants were analyzed in two groups 20 in A and 19 in B group with the mean age and standard deviation(25.20 ±4.62) and mean age and standard deviation(25.26± 3.76) respectively. For normality used Shapiro-wilk test, after this applied parametric test for analysis. Across the group comparison determined by independent t-test they showed statistical non-significance with p-value>0.05 for pain and disability. Within the group analysis showed statistical significance between group A and Group B cervical range of motions as p-value<0.001.

Conclusion: The study concluded both groups were effective on pain, neck function and cervical range of motions but scapular functional exercises were more effective in improving cervical range of motions as compared to scapular stabilization exercises.

INTRODUCTION:

Neck pain is a significant medical issue among overall community (1). Currently, neck pain and stiffness are common although major musculoskeletal impairments with a prevalence of 16.7% to 75.1% in the total population in one year (2). Neck pain is a leading cause of the musculoskeletal impairment but most people don't take it into account because most people usually have a propensity to cure from the neck pain (3). Pain is a significant medical, economic and social issue in most communities across the globe. Moreover, pain related problems which place a negative effect on your quality of life in comparison to other health problems which contributes to most disabilities all over the world (4).

Some studies have shown that neck ache that arises during the movement of the upper extremities can occur due to changes in the biomechanics of the trapezius muscle which changes the axio-scapular orientation (5). Scapular stability exercises have been considered as the central component in most of the performance training exercise programs in the last ten years. While, most of the scapular exercises focus on the core stabilization of spine and the scapula. For this reason, most of the health practitioners and physical trainers have promoted these exercises programs and incorporated them in their treatment regimens (6).

Scapular exercise consists of a series of strengthening exercise meant to improve the stability of muscles which assists in maintaining a normal posture while running, or performing other daily life activities and sports. Balance training exercise helps in improving the flexibility, alleviate muscle soreness and prevent the risk of re-injury (7). Scapular exercises consist of push up plus and lateral pull down exercise and patients can perform the lateral pull down exercise using a resistive elastic band. While the push up plus exercise is performed in an oblique position using a table to support your body. When individuals with cervical pain perform these exercises properly, their neck pain improves. Moreover, functional restoration of the scapula can be promoted with a treatment plan which includes progressive resistive exercises to restore the specific muscle groups of the cervical and scapular region. Some of the studies focuses specifically on the serratus anterior and trapezius muscles but these primarily emerge from the literature of the shoulder (8).

Exercises that focus on the scapula have been incorporated to the treatment regimen of the patients with cervical pain shows muscular imbalances inside the upper and lower trapezius muscles and associated altered posture of the scapular orientation due to dysfunction of the scapular muscles due to energy deficit. Because of dysfunction of the scapula can lead to problems in the neuromuscular coordination of the neck and shoulder regions, which results in the neck pain and muscular impairments. When scapular specific exercises are incorporated in the treatment plan, it can help in alleviating the pain and improves the mobility (9) (10).

We have assumed that including the scapular stabilization and other functional activities can promote the speedy recovery of the patients with NP, neck disability, poor life quality, sleep quality, strength of the scapular muscles and the proprioception in the patients with chronic neck ache. There is enough scientific research present to show how effective the scapular stabilization protocols are (11).

Rehabilitation exercises that are designed to restore the scapular muscle functioning are essential to gain successful outcomes in CNP. The motive of this research was to explore the relationship between scapula and neck, also emphasize importance of scapular rehabilitation in the treatment of CNP. In this research, we compared the effects of scapular stabilization and scapular functional exercises on the rehabilitation of pain, ROMs and Functions of neck and also determined which treatment was more beneficial between scapular stabilization and scapular functional exercises so that, in future Physiotherapist also include scapular rehabilitation in the neck pain treatment.

MATERIALS AND METHODS

The clinical study was randomized. Recruitment was done by employing a Non probability convenient sampling approach and assigned at random to one of two groups by using sealed opaque enveloped labeled method. The study setting was Amina Physical therapy and Rehab Centre Lahore. After receiving clearance from the research ethics council at Riphah International University, Lahore, the study

completed in a period of eight months, from July 2023 to december 2024. This completed study was reported in accordance with the requirements of Consolidated Standards of reporting trials (CONSORT) statement. Sample size was calculated through Epitool software using primary variable pain calculating through VAS. Sample size of 38 (19 in each group) is calculated by attrition rate = 10%. By adding the attrition rate of 10% we got the sample size equal to 42.

The inclusion criteria included both male and female participants with 18-35 years of age, restricted cervical movements, VAS equals to or greater than 4 (12) and NDI score equal to or greater than 10 and patients suffered from chronic neck pain with greater than 3 months (13). Exclusion Criteria comprises of any accidental history (14), cervical Spine and injuries relayed to shoulder, cervical radiculopathy, pregnancy, history of cancer and cases which was related to spinal degeneration, prolapse or related to stenosis and patients who used any medication currently.

Scapular Stabilization Exercises were applied to **Group A**. Scapular stabilization exercise protocol was included. Patient was asked to take a deep breath while in supine position, for the body relaxation. Bending knee at 90 degree patient was sitting on the chair, placed both feet on the floor. After this patient performed scapular retraction along with elbow extension and also raised his hand overhead with 90 degree flexion (ten seconds hold with ten repetitions and twenty seconds break). The patient was asked to lift his hands while inn quadruped pose with shoulder abduction and 120 degree flexion. (ten seconds hold with ten repetitions and twenty seconds break) (15).

TYI exercises were performed.

T shape: We asked the patient to place both arms horizontally with thumbs up. The patients was told to perform this exercise in 3 sets (10 repetitions each with 5 seconds hold)

Y-shape: Then in prone lying, the patients was asked to assume the Y-shaped position with both arms at 45 degrees in 3 sets (10 repetitions each with 5 sec hold)

I-shape: In prone lying, patient was told to place both his arms overhead to assume the I-shaped positions in 3 sets. (10 repetitions each with 5 sec hold) (16).

Eight weeks were spent performing the aforementioned workouts three times a week.

Scapular Functional Exercises selected for **Group B**. Scapular functional exercises protocol was performed. With the help of a table grade 1, press-up (in a chair) (17), push-up plus, in incline pose were executed. For further advancement this exercise also performed in transverse plane. Oblique pulls down, even pull apart. Prone flexion done in prone position on examination table with two arms put above head, and then lift both arms in the direction of

ceiling. Prone rows include bending the elbows while gently raising the arms towards the ceiling while maintaining a prone posture.

For eight weeks, the aforementioned exercises were done three times a week, three sets, and with dumbbells in the hands (20RM in the first weeks and 10RM in the last weeks).

Conventional Treatment: As conventional treatment, firstly given both groups 20 minutes hot pack, 8 minutes ultrasounds for pain as a conventional treatment.

VAS is use for measuring the pain severity, measures pain on a horizontal 100 mm scale, which is designed as on the right side shows no or minimum pain while it's left end shows high intensity pain. It is us to measure pain progression or any change in pain before or after treatment. It has high reliability (0.97) and validity (between 0.71 to 0.78) (18).

This is used to measure any disability related to neck or any disturbance in neck function. It is a self-reported examination through which approach the disability of neck. It includ 10 parts, each part having 5 scores so, total scores of it is 50. 0 score shows no disability, 50 shows high disability in patients due to chronic neck pain. Neck disability index having good reliability ICC=0.88, (0.63 to 0.95) (19).

It is an instrument use to measure the ranges of joints with the help of gravity. It is a protractor type scale which filled with a fluid, through which ranges of neck flexion, extension or side bending rotation is

measure. It show very good reliability and Intraclass correlation coefficient which is about >0.81 . It also had good level validity (20).

Statistical Analysis

Version 25 of the SPSS program was used to analyse the study's data. The Shapiro-Wilk test was performed to determine if the data had a normal distribution at $n < 50$.

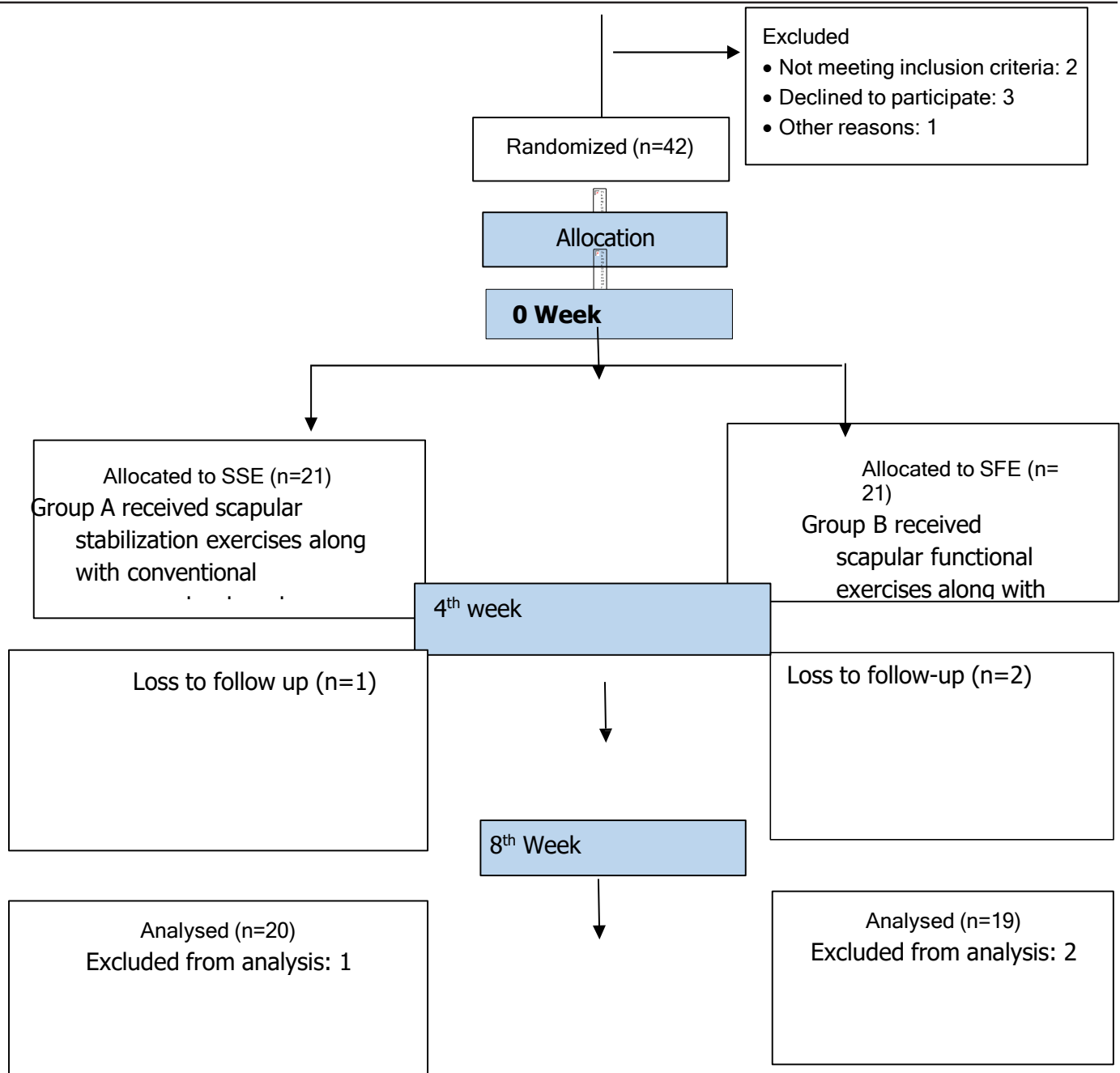
Descriptive Statistics: To present an overview of the group measures taken throughout time, frequency, tables, pie charts, and bar charts were employed.

Changed over time: Difference between reading at baseline, at 4th week and again at 8th week was calculated by using repeated measure ANOVA for parametric data

Difference between Groups: Between groups difference was analyzed using independent t-test. Two populations are compared using this parametric test at baseline, then at 4th week of treatment and after 8th week of treatment.

Enrollment

Assessed for eligibility (n=48)



RESULTS

42 people were included in the study's sample after a 10% attrition rate. Forty-two of the 48 individuals split up into groups after being recruited for the research owing to exclusion criteria and other factors. Through a randomisation method using opaque, sealed envelopes with the labels 0 for Group A, Group B as 1 Twenty-one people made up Group A, while another twenty-one made up Group B. In this study, 39 patients who met the inclusion and exclusion criteria as well as followed the whole treatment plan were examined. Version 25 of the SPSS program was used to analyse the study's data. The Shapiro-Wilk test was used to determine if the data had a normal distribution. Over the course of eight weeks, a total of twenty-four therapy sessions were administered, three sessions each week.

Demographic statistics

With 20 participants in group A and 19 in group B, the table includes the basic demographics of both groups. Ten males and nine females made up Group B, and their mean ages were 25.26 ± 3.76 and 25.20 ± 4.62 , respectively, while twelve males and eight females made up Group A.

Table 1: Both groups' baseline demographics

Baseline characters		SSE group(A)	SFE group(B)
No. of participants		20	19
Gender	Male	12	10
	Female	8	9
Mean age		25.20 ± 4.62	25.26 ± 3.76

For the baseline demographic data, Table 1 summarises the differences between treatment groups A (scapular stabilisation exercises) and B (scapular functional exercises).

Inferential statistics

The p-value is higher than 0.05 based on the Shapiro-Wilk test, indicating that the data in this study was regularly distributed.

Table 11: Within the Group Analysis (ANOVA) Group A (Scapular Stabilization Exercises) and Group B (Scapular Functional Exercises)

Variables	Groups	Treatment values	Mean $\pm$ S.D	p-value
VAS	Group A	Pre treatment	6.31 ± 1.10	<0.01
		At 4 th week	4.42 ± 0.90	
		Post treatment	3.26 ± 0.99	
	Group B	Pre treatment	6.47 ± 1.02	<0.01
		At 4 th week	4.31 ± 1.15	
		Post treatment	3.15 ± 0.89	
NDI	Group A	Pre treatment	22.21 ± 1.87	<0.01
		At 4 th week	20.31 ± 2.05	
		Post treatment	17.57 ± 2.41	
	Group B	Pre treatment	22.10 ± 2.15	<0.01
		At 4 th week	19.94 ± 2.36	
		Post treatment	15.94 ± 3.13	
Cervical Flexion	Group A	Pre treatment	27.42 ± 5.16	<0.01
		At 4 th week	35.15 ± 5.08	
		Post Treatment	42.00 ± 6.03	
	Group B	Pre treatment	29.84 ± 3.54	<0.01
		At 4 th week	41.15 ± 4.32	
		Post Treatment	50.94 ± 6.86	
Cervical	Group A	Pre Treatment	40.68 ± 6.50	<0.01
		At 4 th week	45.68 ± 6.41	

Extension	Group B	Post Treatment	50.68±6.87	<0.01
		Pre Treatment	42.0±7.31	
		At 4 th week	50.52±5.68	
Cervical Right Side Bending	Group A	Post Treatment	57.15±6.08	<0.01
		Pre Treatment	26.42±4.18	
		At 4 th week	28.47±3.96	
Cervical Left Side Bending	Group B	Post Treatment	30.73±3.50	<0.01
		Pre Treatment	27.52±2.36	
		At 4 th week	31.05±1.98	
Cervical Left Side Bending	Group A	Post Treatment	34.73±2.82	<0.01
		Pre Treatment	25.73±3.29	
		At 4 th week	27.36±2.90	
Cervicle Right Side Rotation	Group B	Post Treatment	29.52±2.96	<0.01
		Pre Treatment	27.15±4.07	
		At 4 th week	30.57±2.65	
Cervicle Right Side Rotation	Group A	Post Treatment	34.26±2.74	<0.01
		Pre Treatment	32.42± 6.23	
		At 4 th week	41.52±6.58	
Cervical Left side Rotation	Group B	Post Treatment	51.68±7.94	<0.01
		Pre Treatment	34.31± 4.81	
		At 4 th week	50.47±6.95	
Cervical Left side Rotation	Group A	Post Treatment	65.94±10.35	<0.01
		Pre Treatment	34.57±8.09	
		At 4 th week	43.10±7.08	
Cervical Left side Rotation	Group B	Post Treatment	51.36±7.02	<0.01
		Pre Treatment	33.57±4.54	
		At 4 th week	47.68±5.82	
Cervical Left side Rotation	Group A	Post Treatment	66.00±9.05	<0.01
		Pre Treatment	33.57±4.54	
		At 4 th week	47.68±5.82	

Table 3: Across the Group Comparison Group A (Scapular Stabilization Exercises) and Group B (Scapular Functional Exercises)

Outcome measures	Time Points	Scapular Stabilization Exercises (Group A)	Scapular Functional Exercises (Group B)	p-value
VAS	Pre Treatment	6.4 ±1.14	6.3 ± 0.97	0.97
	At 4 th week	4.5 ± 0.94	4.2 ±1.11	0.41
	Post Treatment	3.3 ± 0.97	3.1 ± 0.90	0.54
NDI	Pre Treatment	22.2± 1.87	22.1± 2.15	0.87
	At 4 th week	20.3± 2.05	19.9±2.36	0.61
	Post Treatment	17.5± 2.41	15.9±3.13	0.08
Cervical Flexion	Pre Treatment	27.42±5.16	29.84± 3.54	0.10
	At 4 th week	35.15± 5.08	41.15±4.32	0.00
	Post Treatment	42.0± 6.03	50.9±6.86	0.00
Cervical Extension	Pre Treatment	40.68± 6.50	42.0±7.31	0.56
	At 4 th week	45.6±6.41	50.52±5.68	0.01
	Post Treatment	50.68± 6.87	57.15±6.08	0.005

Cervical	Pre Treatment	26.42±4.18	27.52± 2.36	0.32
Right Side	At 4 th week	28.47± 3.96	31.05±1.98	0.01
Bending	Post Treatment	30.73± 3.50	34.73±2.82	0.00
Cervical Left	Pre Treatment	25.73±3.29	27.15± 4.07	0.24
Side Bending	At 4 th week	27.36± 2.90	30.57±2.65	0.01
	Post Treatment	29.52± 2.96	34.26±2.74	0.00
Cervicle	Pre Treatment	32.42±6.23	34.31± 4.81	0.30
Right Side	At 4 th week	41.52± 6.58	50.47±6.95	0.00
Rotation	Post Treatment	51.68± 7.94	65.94±10.35	0.00
Cervicle Left	Pre Treatment	34.57±8.09	33.57± 4.54	0.64
Side Rotation	At 4 th week	43.10± 7.08	47.68±5.82	0.03
	Post Treatment	51.36± 7.02	66.0±9.05	0.00

DISCUSSION

Two interventional groups were evaluated in the current investigation. Group A received scapular stabilisation exercises, whereas Group B received scapular functional activities. After the process of randomization total of 42 participants recruited for study, 21 in each group but after drop off 3 participants, 39 participants were complete follow-up and analyzed in this study. As conventional treatment, firstly we have given both groups 20 minutes hot pack, 8 minutes ultrasounds for pain. Three sessions of treatment per week with a total of twenty four sessions were given in eight weeks; Pain, function and ROMs of cervical were evaluated before the first session then at fourth week and again in eighth week through VAS, NDI and inclinometer. In this study 20 participants included in Scapular stabilization exercises of Group A with mean age of (25.20 ±4.62) and 19 participants In Scapular functional exercises of Group B with mean age of (25.26± 3.76) as minimum age in inclusion criteria was 18 and maximum age was 35. In this study there were males with 56.41% and females with 43.59% were participated. After applied the treatment protocol there was a significant relationship <0.05 showed within the group analysis of SSE and SFE in which pain, disability decreases, Both had also improved cervical ROMs but there was marked improvement seen cervical range of movements among participants in Group B relative to those in Group A.

This study results aligned with the study conducted by Emine Atıcı and their colleagues in 2023 on patients with chronic neck pain in which therapeutic exercises and stabilization exercises were performed after performing manual techniques. After assessment group 1 who received stabilization exercises showed greater improvement in pain which was measured by using visual analogue scale while range of motion of neck and quality of life were measured by goniometer and neck disability index compared to other group who received therapeutic exercises which included isometric stretching exercises (21).

A study conducted by Mohamed h. El Gendy in 2021, in which to determine the effects of scapular scapular stabilization exercises and neck stabilization exercises in patients with neck pain 45 females recruited in study. Three groups formed, one was control group who only received conventional treatment, 2nd received SSE and third one received neck stabilization exercises. As current study they also used mixed ANOVA for assessment to determine the effects of interventions on pain through VAS, disability through NDI and CROM through goniometer. In analysis p-value was (<0.001) which showed there was a significant effect of treatment as same as in our study where p-value also <0.001. This study also supported the result of current study that scapular stabilization exercises had better effects in the improvement of neck pain (22).

In 2021, a study conducted by Na-Yeong Kang and by their colleagues to determine the effects of scapular stabilization exercises and thoracic extension exercises on patients suffered from neck pain. The 32 office workers included in this study with mean age of 36 to 63. They randomized in control and experimental group. Experimental group received SSE and Thoracic extension exercises which showed significant

relationship with p-value (<0.05) that also showed in our research (23). A previous study conducted by Yong Gon Seo and their colleague in 2019. This was a systematic study to assess either scapular focused exercise effective for treating patients who suffered from non-specific neck pain. For systematic review they gathered 227 studies, but according to inclusion criteria 4 were selected for study. After complete analysis they concluded that Scapular focused exercise should be considered as treatment protocol for treating neck pain as it showed better effect like our current study on pain and disability and also on quality of life of patients (24).

In a previous study conducted in 2013, In which they explained the effects of stabilization exercises on back pain. In that study stabilization exercises showed better results in decreasing back pain and also improved quality of life of patients which aligned with the result of our study in which there was a significant relationship showed with the p-value (<0.001). In previous a randomized controlled trial study was performed by Norollah Tadeusz and their colleagues. The motive of this study was to determine the effects of neck related exercises with or without scapular focused training on improving symptom in patients with chronic neck pain. After analysis the p-value (<0.05) showed significant relationship between them. As there was marked decrease in intensity of pain and also increase in cervical range of motions (25).

A study conducted by Christoffer and their colleagues in 2014 in which they wanted to determine the effects of scapular related functional exercise on neck and shoulder pain. This study analyzed two groups, one with SFE and other one was a control group. The SFE showed decrease in intensity 2.0 through VAS in neck and shoulder pain as same as current study and also p-value (less than 0.001) which showed there was a significant relationship between them (26).

In 2021 a quasi-experimental study was conducted by Filiz Ozdemir, Seyma Toy and by their colleagues to check the effectiveness of scapular stabilization exercises in patients who were suffered from chronic neck pain and also had scapular dyskinesia. Data showed that significant changes occur in pain intensity in pre and post assessment values in group 1 and group 2 in which pain was measured by VAS and also by NPQ (North Park neck Pain questionnaire) who received scapular stabilization exercises with the conventional treatment. But Group A showed more significant decrease in pain intensity score which was measured by using NPQ. This study also supported the results of current study (27).

Follow up evaluation were not carried out, so we were unable to find out any possible effects over time, this research didn't inquired the type of work and ergonomics of the participants at the time of the data collection which was an important determinant of the neck pain and psychological factors were not assessed in the current study that could affect the chronic pain in patients.

Researchers should collect their data from different populations to reduce the bias and make research more effective and accurate, for future researches, incorporate more functional exercises into the treatment plan of the patients with scapular functional exercises and it is advisable to do more research on follow up to look for long lasting results of interventions.

CONCLUSION

After comparing two groups of scapular stabilization and functional exercises, the study found that while there was statistical significance within the group analysis, there was statistical non-significance between the two groups' effects on pain and disability. This indicates that while both groups improved cervical range of movements, neck function, and discomfort, scapular functional activities were superior to scapular stabilization exercises in enhancing cervical range of motions.

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Competitive Interests: There is no competing interest.

Declaration of patient consent: Written consent was taken from all study participants.

Use of AI: None

Ethical approval: The study was accepted by Riphah Research and Ethics committee.

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