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Effects of scapular stabilization program on pain, range of motion, and disability in patients with chronic non-specific neck pain

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ABSTRACT

Objectives: The objective of this study was to analyze the impacts of the scapular stabilization program (SSP) on pain, range of motion (ROM), and disability in chronic non-specific neck pain (NNP).

Methods: It was a randomized clinical trial. The study was conducted at University Medical Centre, Lahore. According to eligibility criteria, 28 participants were randomly allocated to the experimental and control groups through the lottery method. While the control group received only relaxation exercises, the experimental group received SSP exercises along with the relaxation exercises on the cervicoscapular region. Three sessions of 45 min each, three times/week, on alternating days for three weeks were given. The outcome measures for pain, ROM, and disability were the numeric pain rating scale (NPRS), goniometer, and neck disability index (NDI), respectively. These were assessed before the intervention and at the end of the third week.

Results: The mean age of Groups A and B was 24.76 ± 4.53 and 27.76 ± 4.62, respectively. Within-group analysis of NPRS, NDI, and cervical flexion and extension ROM showed significant improvement in both groups. Between-group analysis showed post-treatment NPRS ($P = 0.000$), NDI ($P = 0.000$), cervical flexion ($P = 0.004$), and extension ($P = 0.000$). A significant improvement ($P < 0.05$) in pain, disability, and flexion and extension was observed in the experimental group.

Conclusion: Both groups showed improved outcomes, but a significant difference was found in the control and experiment groups. The trial concluded that in treating NNP, the SSP effectively alleviates pain and improves disability and mobility.

Keywords: Chronic neck pain, Functional disability, Non-specific neck pain, Quality of life, Relaxation therapy, Scapular stabilization program

INTRODUCTION

Non-specific neck pain (NNP) is a multi-factorial ailment. Various ergonomically and bio-psychosocial factors such as age, distress, job environment, work-related postural imbalance,

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behavioral attitude, and societal pressures play a major role in developing neck pain.[1] Cervical region disability does not remain localized but affects its surrounding areas and muscles. The scapula is the most prone region for muscle imbalances, altered neuromuscular control, and spasms due to NNP.[2] Any traumatic history, sedentary lifestyle, and cervical biomechanical anomalies draw the attention of scapular muscles resulting in asymmetrical scapular motions. This is followed by scapular destabilization due to tightness of the rhomboid muscle group and trapezius. Ultimately whole physiological process leads to scapular dysfunction. This exacerbates neck pain to radiating pain in the upper extremities.[3]

Rehabilitation of chronic NNP is highly supported by physical therapy with evidence-based interventions. Stabilization exercises have proved to be the gold standard treatment for the activation of superficial muscles of the cervical and scapula. Massage and ischemic compression target the surrounding muscles. These techniques decrease tension build-up, which directly improves spasticity and hyper-tonicity.[4] Muscle strengthening along with scapular stabilization exercises proved to be very advantageous in rectification of mal-alignment of the neck. The stabilization program helps to correct muscular imbalances and gives early insight for activating superficial cervical muscles to perform a normal range of motion (ROM).[5] Pre-scapular muscles are subjected to stretching and strengthening protocol. Exercises include raising the arms upward and against a wall as well as shoulder abduction in the scapular plane. This stabilization restores clavicular retraction and normal symmetry of the cervical-scapular region.[6]

Fatima *et al.* conducted a single-blinded randomized controlled trial (RCT) in 2022 to determine the effectiveness of cervical stability exercises with scapular stabilization and upper extremity proprioception exercises in participants with persistent neck pain. The study indicated that combining the two therapies improved pain, functions, and muscular strength more effectively.[7]

In 2022, Kang *et al.* carried out an RCT to check whether scapular stabilization and thoracic extension exercises, as opposed to neck exercises, were more effective in treating individuals with neck pain. Pulmonary functions, cardiovascular accidents, and C-ROM measurements taken at baseline and after six weeks were the outcome measures. According to the findings, the combination of scapular stabilization and thoracic extension exercises enhanced respiratory capacity in the experimental group. In addition, the experiment and control groups working together successfully alleviated pain and enhanced the outcomes.[8]

This study fills a critical gap in the existing literature by examining the combined effects of a scapular stabilization program (SSP) and baseline therapies like relaxation exercises and hot packs on people with persistent NNP. The need for this research stems from the current complexity of NNP management, which frequently necessitates diverse approaches. Our study intends to provide complete insights into the practical effectiveness of these interventions by analyzing the cumulative effects of various interventions on pain, ROM, and disability. Such discoveries have significant clinical implications providing healthcare practitioners and patients suffering from chronic NNP with vital information in optimizing treatment regimens for enhanced quality of life.

MATERIALS AND METHODS

The study design was an RCT. It was registered in the NIH Clinical Trial Library U.S. and has reference #NCT05392023. The study was conducted at University Medical Centre, Lahore. The duration of the study was 10 months. A total sample size of 28 was calculated from Epitool using baseline values of variable pain. Data was gathered using a non-probability purposive sampling technique. The study's inclusion criteria comprised both female and male patients aged 18–35, as well as those who had NNP for longer than three months and shoulder flexion of at least 130° or more. Patients with structural issues such as fractures and spondylosis were eliminated. Patients with any known psychological disease, history of musculoskeletal or neurological disorder, and history of any thoracic or cervical surgery were also excluded from the study.

Volunteers were invited to enroll in the screening process of the study through an advertisement in the University Medical Center, Lahore. The methodology and purpose of the research were explained to all the patients before their informed consent was obtained. A baseline assessment was done, and 28 participants were split into two groups at random, 14 in the control group and 14 in the experimental group, through lottery method. A Scapular Stabilization Program was given to the experimental group (three sets of 10 exercises each/day). This training regimen is for muscles that are impacted by persistent neck pain and scapular alignment. Unresisted scapular upward rotation, wall-facing arm lifts, backward rolling arm lifts, overhead arm raises, shoulder abduction in the scapular plane over 120°, shoulder shrugs, stretching of levator scapulae, and pectoralis minor are all part of a specialized program. Patients of both groups were also given a hot pack for 10 min before interventions and relaxation techniques for the cervicoscapular region such as neck stretches, scapular muscle stretches, and myofascial release. Three sessions of 45 min each, three times/week, on alternating days for three weeks were given. The control group underwent cervicoscapular relaxation activities such as neck stretches, scapular muscle stretches, and myofascial release. Figure 1 shows the consort flow diagram of patients allocation and followup.

Using a numeric pain rating scale, goniometry, and the neck disability index (NDI), the neck pain, cervical ROM, and disability were evaluated on day one and after the three weeks' intervention. The NPRS is a standard instrument to evaluate pain in numerous musculoskeletal conditions. It is a 10-point rating measure where 0 is no pain and 10 is the severity of pain or the worst pain imaginable.[9] The universal goniometer is reliable for measuring joint ranges and angles in every plane.[10] The NDI is a ten-item questionnaire focusing on affected activities targeted by chronic neck pain.[9]

Statistical analysis

To analyze the data, the Statistical Package for the Social Sciences version 25 was used. To determine whether the data was normal, the Shapiro–Wilk test was used. Shapiro–Wilk test showed significant >0.05 *P*-values for the numeric pain rating scale and NDI. Parametric tests were applied for the analysis of data. Within-group analysis was performed using the paired *t*-test. For analysis of differences across groups, an independent *t*-test was used.

RESULTS

Demographic statistics

Demographic statistics revealed that the mean age and body mass index of participants in the experimental group were 24.76 ± 4.53 and 19.94 ± 3.68, respectively. The mean age of participants in the control group was 27.76 ± 4.62, and the mean body mass index was 19.94 ± 3.68 [Table 1].

Within-group analysis

Table 2 illustrates the within-group analysis of NPRS, NDI, and cervical flexion and extension ROM. Pre-treatment NPRS for group A had a mean difference of 6.38 ± 1.04, and the post-treatment mean was 2.92 ± 0.75 with $P = 0.001$. Pre-treatment NPRS mean for Group B was 6.46 ± 1.12, and the post-treatment mean was 5.53 ± 1.05 with $P = 0.000$. Group A exhibited a 19.46 ± 2.78 mean difference in NDI before the intervention, which improved to 10.23 ± 1.64 after treatment with $P < 0.001$. Group B showed a pre-treatment difference in NDI of 19.07 ± 2.59 and post-treatment to be 15.38 ± 2.02 ($P < 0.001$). In Group A, pre-treatment flexion ROM showed a mean difference of 51.69 ± 5.02 and a post-treatment mean difference of 56.76 ± 5.08 with $P < 0.001$. In Group B, the mean difference for the pre-measure was 47.00 ± 5.67, and the post-treatment measure was 50.00 ± 5.67 with 0.000. In Group A, pre-treatment extension ROM showed a mean difference of 37.61 ± 1.19 and a post-treatment mean difference of 52.61 ± 1.19 with $P < 0.001$. In Group B, the mean difference for the pre-measure was 37.07 ± 1.25, and the post-treatment measure was 39.30 ± 1.75 with $P < 0.001$.

Table 1: Demographic statistics.

Study groups	Minimu m	Maximu m	Mean±SD
Group A (experimental)			
Age (years)	19	34	24.76±4.53
BMI	15.13	25.88	19.94±3.68
Group B (control)			
Age (years)	20	34	27.76±4.62
BMI	15.13	25.88	19.94±3.68

BMI: Body mass index, SD: Standard deviation

Table 2: Within-group comparison (paired *t*-test).

Study groups	Mean±SD	*P*-value
Group A		
Pre-treatment NPRS	6.38±1.04	0.000
Post-treatment NPRS	2.92±0.75	
Group B		
Pre-treatment NPRS	6.46±1.12	0.000
Post-treatment NPRS	5.53±1.05	
Group A		
Pre-treatment NDI	19.46±2.78	0.000
Post-treatment NDI	10.23±1.64	
Group B		
Pre-treatment NDI	19.07±2.59	0.000
Post-treatment NDI	15.38±2.02	
Group A		
Pre-treatment flexion ROM	51.69±5.02	0.000
Post-treatment flexion ROM	56.76±5.08	
Group B		
Pre-treatment flexion ROM	47.00±5.67	0.000
Post-treatment flexion ROM	50.00±5.67	
Group A		
Pre-treatment extension ROM	37.61±1.19	0.000
Post-treatment extension ROM	52.61±1.19	
Group B		
Pre-treatment extension ROM	37.07±1.25	0.000
Post-treatment extension ROM	39.30±1.75	

NPRS: Numeric pain rating scale, NDI: Neck disability index, ROM: Range of motion, SD: Standard deviation

The experimental group showed more improvement than the control group in gaining cervical flexion and extension ROM.

Table 3 illustrates the between-group comparisons of NPRS, NDI, and neck flexion and extension in both groups. Group A pre-treatment mean difference for NPRS was 6.38 ± 1.04, and for Group B, it was 6.46 ± 1.12 with ($P = 0.858$). The post-treatment mean difference for Group A was 2.92 ± 0.75, and for Group B, it was 5.53 ± 1.05 with ($P < 0.05$). Pre-treatment in Group A showed a mean difference NDI of 19.46 ± 2.78 whereas Group B showed 19.07 ± 2.59 with ($P = 0.719$). The post-treatment mean difference for Group A was 10.23 ±1.64 and for Group B, it was 15.38 ± 2.02 with ($P < 0.05$). The pre-treatment flexion ROM mean difference

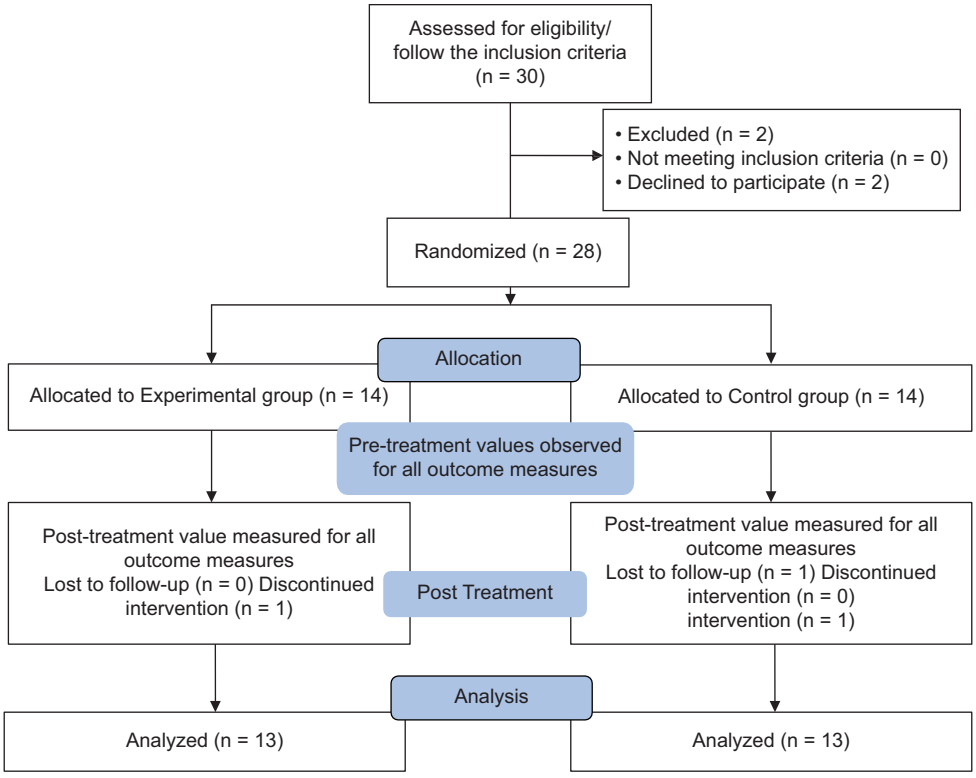

Figure 1: Consort flow chart.

Table 3: Between-group comparison (independent sample *t*-test).

Study groups		Mean±SD	*P*-value
Group A	Pre-treatment	6.38±1.04	0.858
Group B	NPRS	6.46±1.12	
Group A	Post-treatment	2.92±0.75	0.000
Group B	NPRS	5.53±1.05	
Group A	Pre-treatment	19.46±2.78	0.719
Group B	NDI	19.07±2.59	
Group A	Post-treatment	10.23±1.64	0.000
Group B	NDI	15.38±2.02	
Group A	Pre-treatment	51.69±5.02	0.035
Group B	Flexion ROM	47.00±5.67	
Group A	Post-treatment	56.76±5.08	0.004
Group B	Flexion ROM	50.00±5.67	
Group A	Pre-treatment	37.61±1.19	0.273
Group B	Extension ROM	37.07±1.25	
Group A	Post-treatment	52.61±1.19	0.000
Group B	Extension ROM	39.30±1.75	

NPRS: Numeric pain rating scale, NDI: Neck disability Index, ROM: Range of motion, SD: Standard deviation

for Group A was 51.69 ± 5.02; for Group B, it was 47.00 ± 5.67 (P = 0.035). The post-treatment flexion ROM mean difference for Group A was 56.76 ± 5.08; for Group B, it was 50.00 ± 5.67 with P < 0.004. The pre-treatment extension ROM mean difference for Group A was 37.61 ± 1.19; for Group B, it was 37.07 ± 1.25 with P = 0.275. The post-treatment extension ROM mean difference for Group A was 52.61 ± 1.19; for Group B, it was 39.30 ± 1.75 with P < 0.000.

DISCUSSION

In the present study, scapular stabilization exercises combined with relaxation techniques resulted in considerable improvements in people with persistent neck pain. The technique reduced neck pain, increased cervical ROM, and reduced neck impairment. Significant improvements in flexion and extension ROM were noted. The findings support the practical application of these interventions within the context of the research population.

In the present study, significant differences (P < 0.05) were observed in all study outcomes including reductions in neck pain and disability and improvements in cervical ROM between the experimental and control groups. In line with these findings, a study by Rupesh *et al.,* in 2017, checked the efficacy of neck stabilization in 19 subjects with chronic non-specific neck pain (CNNP) and FHP. Results revealed that stabilization exhibited positive results.[11]

In the recent study, an independent *t*-test for between-group analysis illustrated post-treatment NDI (P = 0.000), which showed that the group that received SSP exercises

and the relaxation exercises on the cervicoscapular region had shown more improvement in neck disability. A previous study supported these findings, which showed that NDI was significantly improved in the stabilization group from 14.4 ± 8 to 7.9 ± 3.1 with $P = 0.000$.[12] Another study in 2021 by Özdemir *et al.* concluded that individuals with chronic neck pain and scapular dyskinesis improved in terms of pain and function status when scapular stabilization exercises were included in the regular therapy protocol.[13]

Results of the present study revealed that in the experimental group, pre-treatment flexion ROM showed a mean difference of 51.69 ± 5.02 and post-treatment mean difference as 56.76 ± 5.08 with $P < 0.000$, and pre-treatment extension ROM showed a mean difference of 37.61 ± 1.19 and post-treatment mean difference as 52.61 ± 1.19 with $P < 0.001$. In support of these findings, Abbas *et al.* found a significant improvement in that group, which received stabilization exercises of the scapula along with conventional physiotherapy. Significant improvements were seen in all outcomes of the study.[14]

The limitations of this study are the inclusion of only individuals with chronic NNP, and the assessment was short-term. The long-term effects of SSP were not evaluated in patients with chronic NNP. Moreover, the study was conducted at a single medical center in Lahore, which may limit the generalizability of the findings to broader populations or different geographic regions.

CONCLUSION

Both groups showed improved outcomes including pain, cervical disability, and cervical ROM, but a significant difference was found in the control and experiment groups. Participants of experiment groups had shown more improvement in all outcome measures as compared to the control group. The trial concluded that in treating NNP, the SSP exhibits effective results in reducing pain and improving disability and neck mobility.

Recommendations

A longitudinal study with multiple assessments on intervals with long follow-ups is recommended. Furthermore, further studies should be conducted recruiting patients with other cervical problems including cervical radiculopathy, spondylosis, etc., to see the efficacy of scapular stabilization exercises on other diseases.

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CLINICAL TRIAL REGISTRY

It was registered in the NIH Clinical Trial Library U.S. and has reference no. # NCT05392023.

AUTHORS' CONTRIBUTIONS

MAK was involved in research conception and design, ZAS and HZ collected and assembled the data, SS analyzed and interpreted the data, SUR drafted the article and RN critically revised the article. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

ETHICAL APPROVAL

All ethical concerns were taken into account. The study received ethical approval from the Institutional Review Board of "Riphah International University, Islamabad" on March 04, 2022, Ref No: REC/RCR and AHS/22/0143.

DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate participants consent forms for this study. In the form, the participants have given their consent for their images and other clinical information to be reported in the journal. The participants understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY FOR MANUSCRIPT PREPARATION

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

CONFLICTS OF INTEREST

There are no conflicting relationships or activities.

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