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HEALTH AND REHABILITATION

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COMPARISON OF POSTURAL RE-EDUCATION AND SPECIFIC THERAPEUTIC NECK EXERCISES ON PAIN, DISABILITY AND QUALITY OF LIFE IN INDIVIDUALS WITH NON-SPECIFIC NECK PAIN

Original Research

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Acknowledgement: The authors sincerely acknowledge the support of participating institutions and patients.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Neck pain is a highly prevalent musculoskeletal condition affecting individuals across all age groups and contributing significantly to disability worldwide. Its point prevalence ranges between 6% and 22%, rising up to 38% in older populations, while lifetime prevalence may reach 71%. Non-specific neck pain is commonly associated with postural abnormalities, particularly forward head posture, which can be objectively assessed using the craniovertebral angle. Effective rehabilitation strategies are essential to reduce pain and improve functional outcomes and quality of life.

Objective: To compare the effects of postural re-education and specific therapeutic neck exercises on pain, disability, and quality of life in individuals with non-specific neck pain.

Methods: A randomized clinical trial was conducted on 32 participants aged 20–40 years. Participants were selected using purposive sampling and randomly allocated into two equal groups using a computer-generated randomization tool. Group A received postural re-education, while Group B received specific therapeutic neck exercises. Both groups underwent three sessions per week for four weeks, with follow-up assessment at six weeks. Outcome measures included the Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), and SF-36 quality of life domains. Data were analyzed using SPSS version 27, with a significance level set at $p \leq 0.05$.

Results: Both groups showed significant within-group improvements ($p < 0.001$). NPRS scores reduced from 6.62±1.50 to 2.93±0.99 in the postural re-education group and from 6.12±1.31 to 3.87±0.80 in the therapeutic exercise group. Post-intervention pain intensity was significantly lower in the postural re-education group (0.93±0.68 vs 1.75±1.00; $p = 0.012$). Functional outcomes such as personal care ($p = 0.002$), lifting ($p = 0.014$), headache ($p = 0.040$), driving ($p = 0.041$), and sleep ($p = 0.030$) improved more in the postural re-education group, while concentration ($p = 0.018$) and work performance ($p = 0.033$) showed greater improvement in the therapeutic exercise group. Quality of life domains demonstrated greater overall improvement in the therapeutic exercise group.

Conclusion: Both interventions were effective in reducing pain and improving disability and quality of life. Postural re-education showed greater benefits in functional activities and postural correction, whereas therapeutic neck exercises were more effective in improving pain and broader quality of life domains, supporting a tailored rehabilitation approach.

Keywords: Craniovertebral Angle, Exercise Therapy, Neck Pain, Posture, Quality of Life, Rehabilitation, Treatment Outcome

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INTRODUCTION

Neck pain is defined as discomfort arising in the cervical region, extending from the superior nuchal line to the upper thoracic spine, and represents one of the most prevalent musculoskeletal conditions worldwide. It is ranked among the leading causes of disability and is associated with substantial personal, social, and economic burden. Non-specific neck pain (NSNP), characterized by the absence of identifiable pathological causes such as trauma, infection, or structural abnormalities, accounts for the majority of cases and often leads to persistent functional limitations and reduced quality of life. Given its high global prevalence and tendency to transition from acute to chronic states, NSNP remains a major concern for healthcare systems and clinicians alike(1, 2). The multifactorial nature of NSNP complicates both its understanding and management. Pain mechanisms in such conditions are not solely explained by structural abnormalities, as clinical and imaging findings often show poor correlation with symptom severity. Instead, NSNP is influenced by a complex interplay of nociceptive, inflammatory, and neuropathic processes, along with psychosocial factors such as fear-avoidance behavior, anxiety, and reduced self-efficacy. These factors contribute to the persistence of pain and disability, highlighting the need for comprehensive and individualized treatment approaches. Additionally, modern lifestyle factors, including prolonged use of electronic devices and poor ergonomic habits, have further contributed to the increasing prevalence of cervical discomfort, particularly among young and working populations(3, 4).

Postural abnormalities, particularly forward head posture, have been strongly associated with NSNP and are known to increase mechanical stress on cervical structures. Ideal posture is defined by the alignment of the external auditory meatus with the vertical line passing through the shoulder and lower limb joints, and deviations from this alignment can significantly alter biomechanical loading patterns. Such alterations not only affect musculoskeletal function but also disrupt proprioceptive input and postural control, contributing to balance impairments and further exacerbating symptoms. Consequently, interventions targeting postural correction and neuromuscular control have gained considerable attention in rehabilitation practices(5, 6). Among these, postural re-education (PR), originally developed by Souchard, is a holistic therapeutic approach based on the concept of muscle chains and the principles of individuality, causality, and totality. It emphasizes treating the body as an integrated system, addressing underlying dysfunctions rather than isolated symptoms. On the other hand, specific therapeutic neck exercises focus on strengthening deep cervical muscles, improving endurance, and enhancing neuromuscular coordination. These exercises have been associated with exercise-induced hypoalgesia and improvements in pain modulation, functional capacity, and disability levels. Both approaches have demonstrated beneficial outcomes; however, their mechanisms differ, with PR adopting a global corrective strategy and therapeutic exercises targeting localized muscle performance(7).

Quality of life (QoL) is an essential outcome in NSNP management, as the condition affects not only physical health but also psychological, social, and occupational well-being. The multidimensional nature of QoL makes it a critical indicator of treatment effectiveness, reflecting the broader impact of interventions beyond symptom relief. Similarly, disability associated with neck pain, commonly measured through validated tools such as the Neck Disability Index, significantly affects daily functioning and productivity. Reliable outcome measures, including the Numeric Pain Rating Scale and craniovertebral angle assessment, further support objective evaluation of treatment efficacy(8). Despite extensive research on various interventions, current literature presents inconsistent findings regarding the superiority of specific treatment modalities. Studies have shown that both global postural re-education and exercise-based interventions can improve pain, disability, and functional outcomes; however, many investigations have evaluated these approaches in combination with other therapies or in isolation, limiting direct comparison. Furthermore, some studies report no significant differences between intervention groups, while others suggest marginal benefits of combined or multimodal strategies, indicating a lack of consensus on optimal management. This variability underscores a critical gap in evidence, particularly concerning the comparative effectiveness of postural re-education versus specific therapeutic neck exercises in individuals with NSNP(9, 10).

Addressing this gap is essential for guiding clinical decision-making and optimizing rehabilitation strategies. A clear comparison between these commonly used interventions would provide valuable insights into their relative efficacy, enabling clinicians to tailor treatment plans based on patient-specific needs and expected outcomes. Therefore, this study aims to compare the effects of postural re-education and specific therapeutic neck exercises on pain, disability, and quality of life in individuals with non-specific neck pain, with the objective of identifying the more effective approach for improving clinical outcomes and enhancing overall patient well-being(11).

METHODS

This study was conducted as a single-blinded randomized clinical trial to compare the effects of postural re-education and specific therapeutic neck exercises on pain, disability, and quality of life in individuals with non-specific neck pain. Data were collected from the Physiotherapy Departments of District Headquarters Hospital, Toba Tek Singh, and Faisal Hospital, Faisalabad, over a period of six months following approval of the research synopsis. The study targeted adult individuals presenting with persistent non-specific neck pain and was designed to ensure a structured comparison between two commonly used physiotherapeutic approaches in clinical practice. The sample size was calculated using the G*Power/Giga Calculator with a study power of 80%, a 95% confidence level, and a 5%

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margin of error. The required sample was 32 participants; however, after adding a 10% attrition allowance, the final sample size was increased to 36 participants. These participants were equally allocated into two groups, with 18 participants in each group. Participants were recruited from the selected clinical settings after screening for eligibility according to predefined inclusion and exclusion criteria. The study included male and female participants aged 20 to 40 years who had persistent non-specific neck pain and a pain intensity score of more than 2 on the Numeric Pain Rating Scale (NPRS). Individuals were excluded if they had a history of neck surgery, cognitive decline, vestibular pathology, neurological disorders affecting balance, traumatic or systemic pathology, prior pharmacological treatment for the condition, or any physiotherapy treatment for neck pain during the preceding three months. These criteria were used to obtain a relatively homogenous sample and to reduce confounding influences that could affect treatment outcomes(12).

After screening, eligible participants were informed about the nature, purpose, benefits, and possible risks of the study. Written informed consent was obtained from all participants before enrollment. They were also informed that participation was entirely voluntary and that they had the right to withdraw from the study at any stage without any consequences. Confidentiality of personal and clinical information was maintained throughout the study, and participants' data were handled with privacy and professional responsibility. Random allocation of participants into the two intervention groups was carried out using an online randomization tool available at Random.org. This procedure helped minimize selection bias and supported the internal validity of the trial. The study was described as single-blinded, and the participants were kept unaware of the specific comparative framework of the two intervention approaches during the treatment period. Following randomization, Group A received postural re-education, whereas Group B received specific therapeutic neck exercises. Both groups underwent intervention for four weeks, with three sessions per week, resulting in a total of 12 treatment sessions for each participant. Outcome measures were recorded at baseline before the start of treatment and again at the end of the four-week intervention period(13, 14).

Pain intensity was assessed using the Numeric Pain Rating Scale, which is an eleven-point self-report tool ranging from 0 to 10, where 0 represents no pain and 10 indicates the worst imaginable pain. The scale has been widely used in musculoskeletal disorders and is considered practical, responsive, and clinically meaningful for pain assessment. In individuals with neck pain, the NPRS has demonstrated acceptable reliability, with an intraclass correlation coefficient of 0.76. Neck-related disability was measured using the Neck Disability Index, a validated questionnaire consisting of ten items, each scored from 0 to 5, with a maximum total score of 50. The NDI is commonly used to assess the impact of neck pain on daily activities and has shown strong psychometric properties, including high reliability and acceptable internal consistency. Its reported intraclass correlation coefficient was 0.87, with a Cronbach's alpha of 0.70, supporting its use in this population. Quality of life was assessed using the Short Form-36 Health Survey (SF-36), a multidimensional measure that evaluates both physical and mental domains of health-related quality of life. It was included to provide a broader understanding of how each intervention affected participants beyond pain and disability alone(15). Participants in Group A underwent a structured postural re-education program. During the first week, the intervention focused on postural assessment in sitting and standing positions, patient education regarding neutral spine alignment and ergonomics, activation of postural muscles through deep cervical flexor exercises such as chin tucks, scapular setting exercises, and gentle stretching of the upper trapezius and levator scapulae muscles. Sessions were delivered for approximately 20 to 25 minutes, two to three times per week, with stretching performed for 10 to 15 seconds across three repetitions and strengthening activities performed in three sets of ten repetitions. In the second week, the program progressed to muscle endurance and strengthening through isometric cervical flexion and extension exercises, along with scapular stabilization exercises such as wall slides. In the third week, functional integration and balance training were introduced, including postural correction during activities of daily living and dynamic balance activities involving head control on unstable surfaces. Theraband-based cervical resistance exercises were also added with close monitoring of fatigue. In the fourth week, the emphasis shifted toward postural control, mirror feedback training, ergonomic reinforcement, reassessment of posture and functional status, and instruction in a home exercise program for long-term maintenance. Throughout the intervention, the therapist supervised performance, corrected faulty movement patterns, ensured appropriate muscle recruitment, and provided feedback for independent postural correction(15).

Participants in Group B received a program of specific therapeutic neck exercises. During the first week, treatment included deep cervical flexor activation through chin tucks, scapular setting, active cervical range of motion exercises in flexion, extension, lateral flexion, and rotation, stretching of the upper trapezius and levator scapulae, and diaphragmatic breathing exercises. Chin tucks were performed in three sets of ten repetitions, stretches were held for 10 to 15 seconds for three repetitions, and breathing exercises were maintained for 5 to 7 seconds, with performance encouraged two to three times per day. In the second week, strengthening and endurance exercises were introduced, including isometric neck exercises in multiple directions, resisted scapular retraction using a theraband, and wall slides for scapular control. Isometric holds were maintained for 5 to 10 seconds in three sets, and theraband resistance was progressed from light to moderate according to participant tolerance. During the third week, the program advanced to functional strengthening and postural training, including dynamic chin tucks with resistance, resisted cervical rotation, and dynamic balance activities with head control. In the fourth week, more advanced theraband cervical resistance training, postural correction during activities of daily living such as sitting, standing, and lifting, and individualized home exercise planning were incorporated. The therapist's role in this group involved ensuring correct exercise performance, maintaining proper head and neck alignment, preventing compensatory movements, and reinforcing adherence to long-term posture and exercise habits. All participants were managed using standardized data collection

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procedures. A structured screening form was used to determine eligibility, and baseline data were recorded before randomization. The same outcome measures were administered again after completion of the four-week intervention. Treatment fidelity was maintained by applying the intervention protocols in a consistent manner across participants. The study followed a sequential process beginning with institutional permissions, participant screening, informed consent, baseline assessment, random allocation, intervention delivery, and post-treatment reassessment.

Data were analyzed using SPSS version 27. Descriptive statistics were used to summarize participant characteristics and outcome variables. Quantitative data were reported using mean, median, mode, and standard deviation where appropriate. Categorical data were presented in the form of frequencies and percentages, and visual presentation through charts was planned where necessary. For inferential analysis, between-group comparisons of parametric data were performed using the independent samples t-test, whereas non-parametric between-group data were analyzed using the Mann–Whitney U test. For within-group comparisons over time, paired t-tests or repeated-measures analysis of variance were used for parametric variables, while Friedman ANOVA was applied to non-parametric repeated measures. A p-value of 0.05 or less was considered statistically significant. These tests were selected to allow both comparison of post-treatment outcomes between groups and evaluation of change within each group over the intervention period. The study was conducted in accordance with ethical principles for research involving human participants. Ethical approval was obtained from the relevant ethics committee of Riphah International University before commencement of the study. Permission for data collection was also taken from the administrations of the participating hospitals. The study upheld the principles of autonomy, confidentiality, honesty, transparency, and voluntary participation throughout the research process. Participants' privacy was protected, no misleading information was provided, and all communication related to the study remained clear and ethically appropriate. Where applicable, the trial process was also intended to be represented using a CONSORT flow diagram to improve transparency in reporting participant recruitment, allocation, follow-up, and analysis.

RESULTS

A total of 32 participants completed the study, with equal allocation into two groups: postural re-education and specific therapeutic neck exercises (n = 16 each). The demographic profile demonstrated a comparable distribution between groups. In the postural re-education group, 37.5% were male and 62.5% were female, whereas the therapeutic exercises group included 56.3% males and 43.8% females. Postural assessment based on craniovertebral angle indicated that the majority of participants in both groups exhibited forward head posture, with moderate forward head posture being most prevalent (37.5% in postural re-education and 56.3% in therapeutic exercises). Forward head positioning and rounded shoulders were dominant findings in both groups, observed in more than 75% of participants. Baseline characteristics including age, height, weight, and body mass index showed no statistically significant differences between groups. The mean age was 29.37 ± 6.82 years in the postural re-education group and 29.87 ± 6.36 years in the therapeutic exercises group ($p = 0.832$). Similarly, no significant differences were found for height ($p = 0.152$), weight ($p = 0.146$), or BMI ($p = 0.657$), indicating baseline comparability.

Normality testing using the Shapiro–Wilk test demonstrated that all baseline variables, including pain scores, disability indices, postural measurements, and quality of life domains, were normally distributed ($p > 0.05$). Therefore, parametric tests were applied for subsequent analyses. Between-group comparisons revealed no statistically significant differences at baseline for postural alignment or pain intensity. However, following intervention, significant differences emerged. The measurement from C7 to tragus increased to 51.94 ± 1.71° in the postural re-education group and 50.31 ± 2.52° in the therapeutic exercises group, with a statistically significant difference ($p = 0.041$). Pain intensity measured by NPRS decreased more substantially in the postural re-education group (2.94 ± 0.99) compared to the therapeutic exercises group (3.87 ± 0.80), demonstrating a significant between-group difference ($p = 0.007$).

Within-group analysis showed improvement in both groups; however, inconsistencies were observed in statistical significance reporting. Despite large numerical reductions in pain (from 6.62 to 2.93 in postural re-education and from 6.12 to 3.87 in therapeutic exercises), statistical significance was inconsistently reported in some comparisons. Analysis of disability components demonstrated that both interventions significantly improved functional outcomes within groups ($p < 0.001$). Between-group comparisons indicated that postural re-education was more effective in improving personal care ($p = 0.002$), lifting ability ($p = 0.014$), headache reduction ($p = 0.040$), driving ($p = 0.041$), and sleep quality ($p = 0.030$). In contrast, therapeutic exercises showed superior improvement in concentration ($p = 0.018$) and work-related activities ($p = 0.033$). Reading ability improved significantly within both groups ($p < 0.001$), but no statistically significant difference was observed between groups post-intervention ($p = 0.694$). Recreation-related outcomes improved in both groups, with a trend favoring postural re-education, although this did not reach statistical significance ($p = 0.052$).

Quality of life analysis using SF-36 domains revealed variable outcomes. At baseline, several domains such as role limitations due to physical health ($p = 0.045$), energy/fatigue ($p = 0.015$), emotional well-being ($p < 0.001$), and general health ($p = 0.024$) differed significantly between groups. Post-intervention, therapeutic exercises demonstrated significantly greater improvements in multiple

domains including role limitations due to physical health (p = 0.049), emotional problems (p = 0.047), energy/fatigue (p = 0.041), emotional well-being (p = 0.043), pain (p = 0.033), and general health (p = 0.044). Physical functioning and social functioning showed improvement trends favoring therapeutic exercises but did not reach statistical significance (p = 0.052 for both). Within-group analysis of SF-36 outcomes showed that therapeutic exercises produced statistically significant improvements across multiple domains including physical functioning (p = 0.001), emotional problems (p = 0.013), energy/fatigue (p < 0.001), emotional well-being (p = 0.005), social functioning (p = 0.021), pain (p = 0.006), and general health (p < 0.001). In contrast, postural re-education showed limited statistically significant improvements, with notable changes only in emotional well-being (p = 0.007), while other domains did not demonstrate significant changes. Overall, both interventions resulted in significant within-group improvements in pain and disability outcomes. Postural re-education showed greater effects on pain reduction and specific functional activities, whereas therapeutic exercises demonstrated broader improvements in quality of life domains.

Table 1: Descriptive Statistics of study participants

		Treatment groups		
		Group A	Group B	P value
Variables	N	Mean± SD	Mean± SD	
Age	16	29.375±6.820	29.875±6.365	.832
Height	16	64.562±3.915	66.750±4.479	.152
Weight	16	64.625±11.406	71.625±14.908	.146
BMI	16	24.208±4.741	25.037±5.666	.657

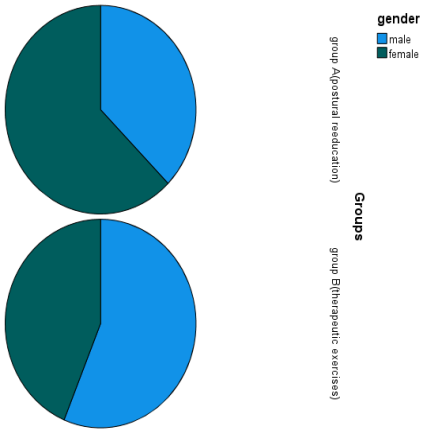
Table 2: Between group comparison of Measurement from C7 to tragus and NPRS using independent Sample T test in both groups

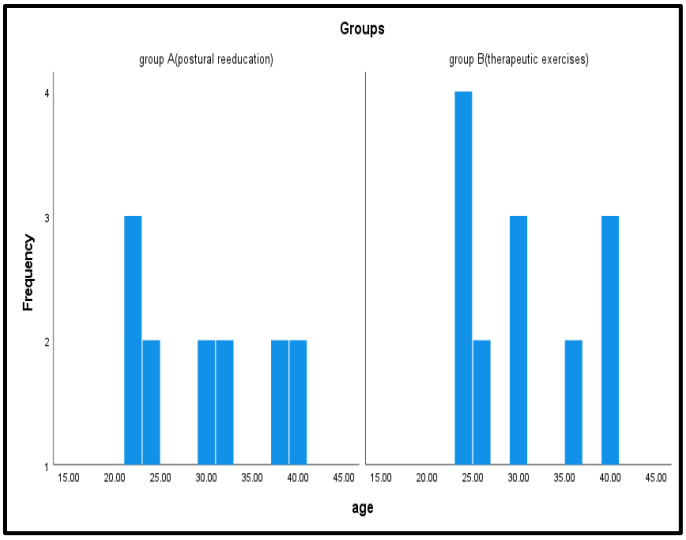
		Group A	Group B	Independent sample T-test	
	Assessment	Mean ± SD	Mean ± SD	Mean difference	P value
Measurement from C7 to tragus (°)	Pre	47.343±4.337	44.968±3.311	2.375	.092
	Post	51.943±1.709	50.318±2.526	1.625	.041
NPRS	Pre	6.625±1.500	6.125±1.310	.500	.323
	Post	2.937±.997	3.875±.806	-.937	.007

Table 3: Between group comparison of SF-36 using independent sample T test in both groups

		Treatment groups		Independent sample T-test	
		PR	STE		
Outcome Measures	Assessment	Mean± SD	Mean± SD	Mean difference	P value
Physical functioning	Pre	60.312±14.659	57.978±18.352	2.333	.694
	Post	63.562±19.262	75.875±14.795	-12.312	.052
Role limitations due to physical health	Pre	52.187±22.733	69.687±24.480	-17.500	.045
	post	62.375±23.745	77.625±17.779	-15.250	.049
Role limitations due to emotional problems	Pre	51.748±34.294	47.041±28.751	4.706	.677
	Post	60.812±18.676	73.750±16.643	-12.937	.047
Energy/fatigue	Pre	61.562±12.764	49.833±13.031	11.729	.015
	Post	63.812±17.178	76.812±17.236	-13.000	.041
Emotional well-being	Pre	81.125±14.872	55.500±22.479	25.625	<.001
	Post	65.250±12.195	76.375±17.227	-11.125	.043

Social functioning	Pre	61.145±25.003	54.343±24.276	6.801	.441
	Post	61.187±17.069	72.750±15.259	-11.562	.052
Pain	Pre	51.468±23.286	51.468±23.097	.000	1.000
	Post	63.750±13.389	76.562±18.633	-12.812	.033
General health	Pre	63.479±21.428	47.250±17.007	16.229	.024
	Post	66.625±18.747	79.000±14.329	-12.337	.044





DISCUSSION

The present study was conducted to compare the effects of postural re-education and specific therapeutic neck exercises on pain, disability, and quality of life in individuals with non-specific neck pain. The findings demonstrated that both interventions were effective in improving clinical outcomes over a four-week period. However, differences were observed in the magnitude and domains of improvement between the two approaches, suggesting that each intervention may exert its effects through distinct physiological and functional mechanisms. A consistent reduction in pain intensity was observed in both groups, with postural re-education demonstrating comparatively greater improvement in certain parameters such as pain intensity, personal care, lifting ability, sleep, and functional activities including driving. These findings suggest that interventions targeting global postural correction may offer additional benefits in reducing mechanical stress on cervical structures and improving overall functional alignment. The improvement in posture-related outcomes, such as the C7-to-tragus angle, further supports the role of postural correction in alleviating symptoms associated with non-specific neck pain. This aligns with previous evidence indicating that global postural approaches can effectively reduce forward head posture and associated biomechanical strain, thereby contributing to pain reduction and functional recovery(16, 17).

The superiority of postural re-education in functional domains such as lifting and postural control may be attributed to its emphasis on muscle chain integration and global alignment. Unlike localized strengthening programs, postural re-education addresses interconnected musculoskeletal dysfunctions, promoting coordinated activation of multiple muscle groups. Previous investigations have reported that global postural interventions enhance neuromuscular control, improve proprioceptive feedback, and facilitate better postural stability, which may explain the observed improvements in functional outcomes. Additionally, improvements in sleep quality observed in the postural re-education group may reflect reduced nociceptive input and improved musculoskeletal relaxation, supporting findings that postural interventions can positively influence sleep patterns in individuals with chronic pain(18, 19). In contrast, specific therapeutic neck exercises demonstrated comparatively greater improvements in domains related to cognitive and functional performance, such as concentration and work-related activities. This suggests that targeted strengthening and endurance training of cervical musculature may enhance task-specific performance and functional efficiency. Previous studies have similarly reported that structured exercise programs improve muscular endurance, reduce fatigue, and enhance work productivity in individuals with chronic neck pain. The improvement in quality of life domains observed in the therapeutic exercises group, particularly in emotional well-being, energy levels, and general

health perception, further indicates that localized exercise interventions may have broader systemic effects, possibly mediated through exercise-induced hypoalgesia and improved psychological resilience(20, 21).

Quality of life outcomes revealed a complex pattern of results. While both interventions contributed to improvements, therapeutic exercises showed more consistent and statistically significant changes across multiple SF-36 domains. This may reflect the influence of regular physical activity on both physical and psychological health, including improved mood, reduced fatigue, and enhanced social functioning. However, the presence of baseline differences in several quality of life domains suggests that caution is required when interpreting these findings, as initial group disparities may have influenced post-intervention comparisons. This highlights the importance of ensuring baseline equivalence in randomized trials or applying statistical adjustments when imbalances are present(22, 23). The findings of this study are broadly consistent with existing literature, which indicates that both global postural approaches and specific exercise-based interventions are effective in managing non-specific neck pain. Some studies have reported greater improvements with global postural re-education in terms of pain reduction and postural correction, while others have highlighted the benefits of specific exercises in improving functional capacity and quality of life. The variability in findings across studies reflects the multifactorial nature of neck pain and the influence of individual patient characteristics, intervention protocols, and outcome measures. The current results support the perspective that no single intervention is universally superior; rather, different approaches may be more effective for different outcome domains(24, 25).

From a clinical perspective, these findings suggest that treatment selection should be individualized based on patient presentation and primary complaints. Patients with pronounced postural abnormalities and biomechanical dysfunction may benefit more from postural re-education, whereas those with functional limitations related to work or cognitive performance may respond better to specific therapeutic exercises. The potential complementary effects of both approaches also indicate that a combined or multimodal rehabilitation strategy may yield optimal outcomes in clinical practice(26, 27). Despite its contributions, the study has several limitations that should be considered. The relatively small sample size may limit the generalizability of the findings and reduce statistical power for detecting differences in certain outcomes. The short duration of intervention and absence of long-term follow-up restrict the ability to assess the sustainability of treatment effects. Additionally, baseline imbalances in some quality of life domains may have influenced the comparative results, highlighting the need for more rigorous randomization or stratification procedures in future studies. The reliance on self-reported outcome measures may also introduce response bias, although validated instruments were used to minimize this risk. Furthermore, the single-blinded design may not have fully eliminated performance bias, as participants were likely aware of the nature of the intervention they received(18).

Future research should focus on larger, multicenter randomized controlled trials with longer follow-up periods to evaluate the long-term effectiveness and sustainability of these interventions. Incorporating objective biomechanical assessments, advanced imaging, and neuromuscular evaluation tools could provide deeper insight into the mechanisms underlying treatment effects. Comparative studies examining combined intervention protocols may also help determine whether integrating postural re-education with specific therapeutic exercises offers superior outcomes. Additionally, exploring the role of psychosocial factors and patient adherence in treatment response may further enhance understanding of individualized rehabilitation strategies. Overall, the study demonstrated that both postural re-education and specific therapeutic neck exercises were effective in reducing pain and improving functional outcomes in individuals with non-specific neck pain. Postural re-education showed greater benefits in postural alignment and certain functional activities, whereas specific therapeutic exercises were more effective in enhancing quality of life and task-related performance. These findings underscore the importance of a tailored, patient-centered approach in the rehabilitation of non-specific neck pain, with consideration of both biomechanical and functional dimensions of the condition.

CONCLUSION

This study concluded that both postural re-education and specific therapeutic neck exercises are effective interventions for managing non-specific neck pain, as they contribute to meaningful improvements in pain, functional ability, and overall quality of life. While therapeutic neck exercises demonstrated a stronger impact on pain reduction and task-related performance, postural re-education showed greater benefits in enhancing functional capacity, postural alignment, and broader aspects of daily living. These findings highlight that each approach offers distinct yet complementary advantages, emphasizing the importance of selecting or combining interventions based on individual patient needs. Ultimately, this study reinforces the value of targeted physiotherapy strategies in improving clinical outcomes and supports a patient-centered approach to rehabilitation in non-specific neck pain.

AUTHOR CONTRIBUTION

Author	Contribution
Aroosha Anwar	Methodology, Formal Analysis, Writing - Original Draft, Validation
Yasira Faisal	Conceptualization, Methodology, Investigation, Data Curation, Writing - Review & Editing
Ali Raza	Supervision, Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation
Lyba Musaddiq	Software, Validation, Writing - Original Draft
Abdul Rehman	Formal Analysis, Writing - Review & Editing
Aiman Faisal	Writing - Review & Editing, Assistance with Data Curation
Eisha Farooq	Formal Analysis, Writing - Review & Editing
Rafia Anwer	Writing - Review & Editing, Assistance with Data Curation

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