

Original Article

Immediate Effectiveness of Soft Tissue Mobilization versus Scapular Mobilization on Mechanical Neck Pain

Mustabshera Murtaza,¹ Azanish Butt,² Irfan Haider,³ Hifza Aslam,⁴ Eman Hidayat,⁵ Abdul Haseeb⁶

Abstract

Objective: The objective of the study was to determine the immediate effectiveness of soft tissue mobilization versus scapular mobilization on mechanical neck pain.

Study Design: It was Randomized controlled trial.

Place and duration of study: This study was conducted at Al Khidmat Razi hospital and CASHT clinic, over a period of six-months from March 2025 to August 2025.

Material and Methods: A total of 52 patients of both genders, aged 18–60 years, with diagnosed mechanical neck pain were randomly allocated to two groups using the coin-toss method. Patients with cervical radiculopathy, scapular winging, severe cognitive impairment, cervical spine infection or abscess, soft tissue or joint malignancy, a recent related fracture, or recent surgery were excluded. Group 1 received soft tissue mobilization and Group 2 received scapular mobilization; pain was measured using the Numeric Pain Rating Scale (NPRS) before and immediately after treatment. Data were analysed using SPSS version 27.

Results: The mean NPRS score in Group 1 improved from 7.38 ± 1.203 to 2.15 ± 1.156 ($p < 0.05$), and in Group 2 from 7.27 ± 1.218 to 3.88 ± 1.558 ($p < 0.05$); between-group comparison also showed a significant difference ($p < 0.05$). When both groups were compared, p value < 0.05 indicated that there is significant difference between both techniques with soft tissue mobilization being more effective than scapular mobilization.

Conclusion: Soft tissue mobilization was more effective than scapular mobilization in providing immediate pain reduction in patients with mechanical neck pain.

Keywords: Mechanical neck pain, soft tissue mobilization, scapular mobilization, manual therapy, physiotherapy.

1. Introduction

Neck pain remains one of the most burdensome musculoskeletal conditions worldwide. Neck pain affected an estimated 203 million people globally in 2020—a prevalence of about 2,450 per 100,000 that is higher among women—with rates projected to climb as the population ages.⁽¹⁾ Neck pain prevalence and associated disability continue to climb globally, driven substantially by occupational and postural risk factors⁽²⁾. Mechanical neck pain (MNP), a subtype provoked by sustained posture, movement, or palpation rather than by neurological or systemic pathology is particularly common among office workers and students who spend long hours in static, forward-

flexed postures. Prolonged computer and screen use is a well-recognized occupational risk factor, since sustained postural loading of the cervical spine promotes muscular fatigue and imbalance^(3,4).

The cervical spine does not function in isolation; it shares a close biomechanical relationship with the scapulothoracic complex, where disruption in one region frequently transmits strain to the other. The scapula acts as a critical stabilizing link between the cervical spine and shoulder girdle during head and upper-limb movement, and scapular dyskinesia is a frequently under-recognized contributor to shoulder and neck dysfunction⁽⁵⁾.

DPT, Center of Advanced Studies in Health and Technology, Rawalpindi,¹ Physiotherapist, Shifa Tameer-e-Milat University, Islamabad,² DPT, Center of Advanced Studies in Health and Technology, Rawalpindi,^{3,4} House Officer, POF Hospital, Wah Cantt, Government College University, Faisalabad (GCUF),⁵ Lecturer (Universal College of Pharmacy, Gujarkhan), Government College University, Faisalabad (GCUF),⁶

Correspondence: Center of Advanced Studies in Health and Technology, Rawalpindi

Email: mustabsheramurtaza@gmail.com

When scapular positioning or motion becomes abnormal, the resulting muscular imbalance alters cervical loading patterns and aggravates neck symptoms. Conversely, chronic neck dysfunction can disturb scapular kinematics, a bidirectional relationship reflected across various clinical presentations: structured rehabilitation approaches address scapular dyskinesis across populations ranging from office workers to elite athletes ⁽⁶⁾, deep cervical flexors exhibit reduced electromyographic activity in individuals experiencing neck pain ⁽⁷⁾, and abnormal neck and shoulder-girdle muscle activation patterns occur alongside altered cervical curvature ⁽⁸⁾.

Furthermore, scapular dysfunction remains a central clinical consideration in neck pain management ⁽⁹⁾. While chronic structural changes such as cervical spondylosis represent a separate, degenerative contributor to neck pain more broadly ⁽¹⁰⁾, mechanical neck pain is specifically defined by the absence of such underlying pathology—making it a distinct, modifiable target for manual therapy.

Among the manual therapy approaches, soft tissue mobilization (STM) and scapular mobilization (SM) are two of the most widely applied. STM acts directly on the muscular and fascial layers, using sustained pressure and cross-friction strokes to break down adhesions, deactivate myofascial trigger points, and restore normal viscoelastic properties of connective tissue ^(11,12). SM, in contrast, addresses the joint and periarticular structures, applying graded manual glides to the scapula through its principal planes of movement to correct dyskinesis and reduce compensatory strain on the cervical spine; SM directed at the scapulothoracic region has separately shown benefit for related shoulder and chronic neck conditions involving scapular dyskinesis ^(13,14).

Although soft tissue mobilization and scapular mobilization are commonly used in the management of mechanical neck pain, limited evidence is available regarding their immediate comparative effects on pain intensity. Most previous studies have evaluated these interventions

either independently or over multiple treatment sessions rather than through a direct comparison of their immediate effects. Therefore, the present study aimed to compare the immediate effectiveness of soft tissue mobilization and scapular mobilization in reducing pain among patients with mechanical neck pain. It was hypothesized that soft tissue mobilization would produce greater immediate pain reduction than scapular mobilization.

2. Materials & Methods

This study was conducted as a randomized controlled trial in accordance with the CONSORT 2010 guidelines and received ethical approval from the Ethical Review Committee of the Center of Advanced Studies in Health and Technology (CASHT), Pakistan (Ref. CASHT/IRB/2024/40). The sample size was calculated using the OpenEpi sample size calculator based on data reported by Özdemir et al. An assumed mean difference of 1.3, with a pooled standard deviation of approximately 1.65, corresponding to a standardized effect size (Cohen's *d*) of approximately 0.79, was used for the calculation. Using a two-sided significance level of 0.05, 80% statistical power, and equal allocation between the two groups, the calculated sample size was 52 participants, with 26 participants allocated to each group ⁽¹⁴⁾. The study was conducted over six months, from March 2025 to August 2025, at Al Khidmat Razi Hospital and CASHT Clinic.

The inclusion criteria were patients aged 18–60 years, diagnosed with mechanical neck pain, of either gender, and able to provide informed consent. The exclusion criteria included malignancy involving soft tissues or joints, infection or abscess of the cervical spine, cervical radiculopathy, recent fracture or surgery, severe cognitive impairment, or scapular winging.

Eligible participants were recruited using a non-probability purposive sampling technique. After enrollment, participants were randomly allocated to two intervention groups using a coin-toss method. Recruitment, allocation, intervention delivery, and outcome assessment were performed as separate roles to reduce the risk of selection and assessment bias. Group 1 received soft tissue mobilization, whereas Group 2 received scapular mobilization. Thus, Group 2 served as an active comparator rather than an untreated or no-intervention control group. No third control group was included because the study aimed to directly compare the immediate effects of two clinically used manual therapy techniques. Data collection was performed after obtaining informed consent from all participants.

For soft tissue mobilization in Group 1, gentle to sustained pressure was applied using the fingertips or thumb pads along the trapezius muscle with moderate to firm intensity, aiming to produce a sensation of release. Each participant received three sets of 10 repetitions on each side. For scapular mobilization in Group 2, slow and controlled movements focused on the gliding motion of the scapula over the rib cage in all directions, with three sets of 10 circular movements performed on each side.

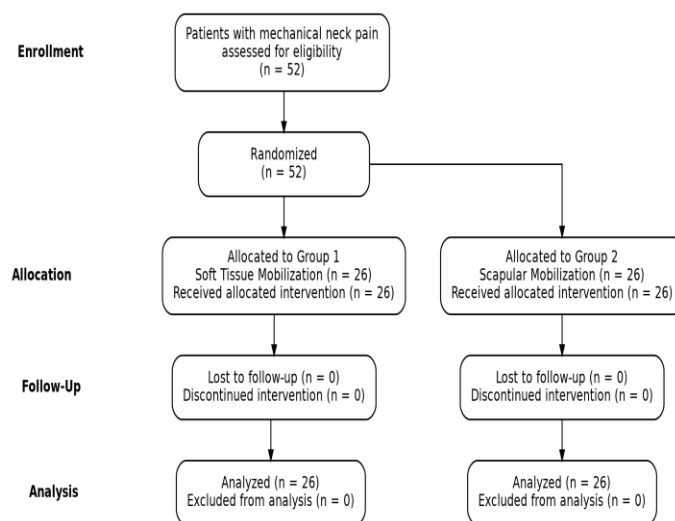
Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), a validated and reliable instrument 18. This was a single-blinded, two-arm randomized controlled trial in which the outcome assessor was blinded to the participants' group allocation during outcome assessment. The NPRS was completed by the participants immediately before and after the assigned intervention.

Statistical analysis was conducted using SPSS version 27. The Shapiro–Wilk test was used to

assess the normality of continuous variables. As the data were normally distributed, continuous variables were presented as mean $\pm$ standard deviation, and parametric tests were applied. Within-group changes in NPRS scores from pre- to post-intervention were analyzed using paired-samples t-tests, while between-group differences in NPRS scores were analyzed using independent-samples t-tests. A p-value of <0.05 was considered statistically significant.

Ethical standards were maintained throughout the study. Informed consent and voluntary participation were ensured, participant confidentiality was protected, and efforts were made to minimize discomfort or harm during the interventions. The study was conducted in accordance with applicable ethical principles, regulations, and guidelines for research involving human participants.

Figure 1. CONSORT flow diagram



3. Results

A total of 52 participants were included in the study, comprising 26 males (50%) and 26 females (50%). The mean age of the participants was 30 years in Group 1 and 31 years in Group 2. Participants were equally allocated between the two groups, with 26 participants in Group 1 and 26 participants in Group 2.

Within-group analysis using paired-samples t-tests demonstrated a statistically significant reduction in NPRS scores from pre- to post-intervention in both groups ($p < 0.001$). In Group 1, the mean NPRS score decreased from 7.38 ± 1.203 before the intervention to 2.15 ± 1.156 after the intervention. Similarly, in Group 2, the mean NPRS score decreased from 7.27 ± 1.218 to 3.88 ± 1.558 after the intervention.

Table 1

Paired t-test comparison of mean scores of NPRS pre and post intervention in Group 1 and Group 2

Variable	Group	Pre-intervention (Mean± SD)	Post-intervention (Mean± SD)	P value
NPRS Score	Group 1	7.38±1.203	2.15±1.156	<0.001
	Group 2	7.27±1.218	3.88±1.558	<0.001

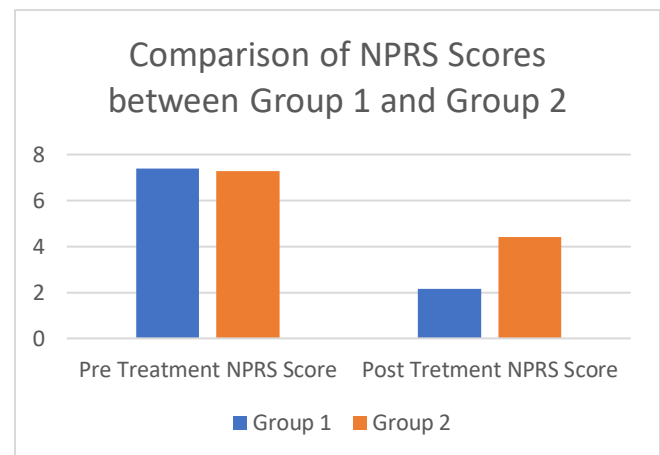
Independent-samples t-test showed no statistically significant difference in baseline NPRS scores between Group 1 and Group 2 (7.38 ± 1.203 vs. 7.27 ± 1.218 , $p = 0.0745$). However, after the intervention, a statistically significant difference was observed between the two groups, with Group 1 demonstrating a lower mean NPRS score than Group 2 (2.15 ± 1.156 vs. 3.88 ± 1.558 , $p < 0.001$).

Table 2

Independent sample t-test for between-group analysis

Variable	At Baseline			After Intervention		
	Group 1 Mean±SD	Group 2 Mean±SD	P value	Group 1 Mean±SD	Group 2 Mean±SD	P value
NPRS Score	7.38±1.203	7.27±1.218	.0745	2.15±1.156	3.88±1.558	<0.001

Figure 2: Comparison of means between the Groups, pre-intervention and post intervention.



4. Discussion

This study comprehensively evaluated the relative effectiveness of soft tissue mobilization versus scapular mobilization for mechanical neck pain. Our rigorous findings demonstrated a statistically significant difference in their immediate therapeutic effects. Moreover, these results align with prior research that consistently underscores the clinical significance of both interventions in managing mechanical neck pain. Comparable evidence for the analgesic potency of soft-tissue techniques was reported earlier by Costello et al., whose randomized clinical trial found that soft tissue mobilization produced immediate improvements in pain and neural mechanosensitivity relative to therapeutic

ultrasound in patients with neck and arm pain; although their sample presented with neurogenic involvement rather than the purely mechanical neck pain assessed here, the shared randomized, single-session design supports the internal validity of the rapid within-session effect observed in the present trial⁽¹⁵⁾. Kompal et al., studying a similarly balanced sample of patients with mechanical neck pain, likewise confirmed the substantial role of soft tissue techniques in delivering rapid pain modulation, although their trial evaluated the additive value of stretching exercises rather than a direct comparison with another manual technique⁽¹⁶⁾. More recently, Makin et al., in a systematic review and meta-analysis comparing manual therapy with oral pain medication⁽¹⁹⁾, and Benetton et al., in a systematic review with meta-analysis and meta-regression of randomized controlled trials, both confirmed that manual and joint mobilization techniques reliably reduce pain and disability in neck pain populations, reinforcing the broader efficacy of manual therapy demonstrated in the present cohort⁽²⁰⁾. However, neither of these recent reviews isolated the immediate, single-session, head-to-head comparison between two specific manual techniques that the present trial provides; by directly comparing STM against SM within the same session, this study extends both the earlier and the more recent literature by identifying soft tissue mobilization specifically as the faster-acting of the two techniques.

The comparatively smaller improvement observed with scapular mobilization is also consistent with, and partly explained by, recent studies of scapular-directed interventions. Macias et al., in a randomized controlled trial of patients with mechanical cervicalgia, demonstrated that scapular mobilization favorably influences neural mechanosensitivity of the upper limb, but their outcome was restricted to neurodynamic tension

rather than the broader pain intensity captured by the NPRS in the present trial⁽¹⁷⁾. Gutiérrez-Espinoza et al., similarly reported measurable gains in pain and function following scapular mobilization, but in patients with subacromial impingement syndrome, a shoulder pathology mechanically distinct from the cervically driven mechanical neck pain in the current sample, which may partly explain why the effect of SM was smaller here than in their cohort⁽¹³⁾. Özdemir et al., whose outcome data also informed the sample-size calculation for the present trial, found that a structured, multi-session programme of scapular stabilization exercises benefited patients with chronic neck pain and scapular dyskinesis, but only after repeated sessions rather than a single mobilization bout⁽¹⁴⁾. Taken together, this recent evidence suggests that scapular-directed interventions act primarily on joint play and the biomechanical alignment of the scapulothoracic interface, and that such functional adaptations typically require cumulative treatment sessions to fully manifest, which is consistent with the comparatively slower immediate response to scapular mobilization observed in the present cohort. Mylonas et al. additionally showed that instrument-assisted soft tissue mobilization combined with neuromuscular exercise improved forward head posture and functional outcomes⁽²¹⁾, results that align with, and help explain, the pain reduction achieved through STM alone in the present trial, while suggesting that these immediate gains could be further consolidated when paired with active exercise in subsequent treatment sessions.

A key strength of this study is its rigorous randomized controlled design, which minimized selection bias, alongside a balanced demographic sample of male and female participants. The use of the validated NPRS further ensured accurate

quantification of acute pain changes (18). Manual techniques such as STM and SM are also generally regarded as low-risk; nonetheless, Minnucci et al.'s systematic review of the benefits and harms of spinal manipulative therapy for neck pain underscores the importance of ongoing safety monitoring even with lower-force manual interventions (22).

Certain limitations should also be acknowledged. This trial evaluated only the immediate, single-session response to each technique, and the short observation window precludes any conclusion about the durability of pain relief or the persistence of the between-group difference over time; longitudinal follow-up is needed to establish longer-term efficacy. The use of a non-probability purposive sampling technique, combined with patient recruitment from a limited number of hospitals in Rawalpindi, may restrict the generalizability of these findings to broader, more diverse populations with mechanical neck pain.

Conclusion

Soft tissue mobilization produced greater immediate pain reduction than scapular mobilization in patients with mechanical neck pain. These findings suggest that soft tissue mobilization may be considered as an effective option for immediate symptomatic pain management in this population. However, further studies with longer follow-up periods are required to determine the sustained effects of both interventions.

References:

1. GBD 2021 Neck Pain Collaborators. Global, regional, and national burden of neck pain, 1990-2020, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021. *Lancet Rheumatol.* 2024;6(3):e142-e155. doi: 10.1016/S2665-9913(23)00321-1.
2. Kazeminasab S, Nejadghaderi SA, Amiri P, Pourfathi H, Araj-Khodaei M, Sullman MJ, et al. Neck pain: global epidemiology, trends and risk factors. *BMC Musculoskelet Disord.* 2022;23:26. doi: 10.1186/s12891-021-04957-4.
3. Shamsi S, Khan S, Al Muhanna NA, Hussein ASB, Al Ghamdi AHA, Hasan Z, et al. Prevalence of neck pain among computer users: a systematic review. *Int J Rec Innov Med Clin Res.* 2022;4(3):99-105.
4. Khanum F, Khan AR, Khan A, Aafreen A, Khan AA, Ahmad A, et al. Predicting mechanical neck pain intensity in computer professionals using machine learning: identification and correlation of key features. *Front Public Health.* 2024;12:1307592. doi: 10.3389/fpubh.2024.1307592.
5. Panagiotopoulos AC, Crowther IM. Scapular dyskinesia, the forgotten culprit of shoulder pain and how to rehabilitate. *SICOT-J.* 2019;5:29. doi: 10.1051/sicotj/2019029.
6. Cools AMJ, Struyf F, De Mey K, Maenhout A, Castelein B, Cagnie B. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. *Br J Sports Med.* 2014;48(8):692-697. doi: 10.1136/bjsports-2013-092148.
7. Falla DL, Jull GA, Hodges PW. Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. *Spine (Phila Pa 1976).* 2004;29(19):2108-14. doi: 10.1097/01.brs.0000141170.89317.0e.

8. Lim J, Lee D, Kim S, Lee S, Ryu JS. Analysis of abnormal muscle activities in patients with loss of cervical lordosis: a cross-sectional study. *BMC Musculoskelet Disord.* 2023;24(1):666. doi: 10.1186/s12891-023-06782-3.
9. Cagnie B. The relevance of scapular dysfunction in neck pain: a brief commentary. *J Orthop Sports Phys Ther.* 2014;44(6):435-9. doi: 10.2519/jospt.2014.5038.
10. Jull G, Thomas L, Liang Z, Treleaven J. Current and future advances in practice: cervical spondylosis and mechanical neck pain. *Rheumatol Adv Pract.* 2025;9(4):rkaf127. doi: 10.1093/rap/rkaf127.
11. Cheatham SW, Lee M, Cain M, Baker R. The efficacy of instrument assisted soft tissue mobilization: a systematic review. *J Can Chiropr Assoc.* 2016;60(3):200-211.
12. Hunter G. Specific soft tissue mobilization in the management of soft tissue dysfunction. *Man Ther.* 1998;3(1):2-11. doi: 10.1054/MATH.1998.0310.
13. Gutiérrez-Espinoza H, Pinto-Concha S, Sepúlveda-Osses O, Araya-Quintanilla F. Effectiveness of scapular mobilization in people with subacromial impingement syndrome: a randomized controlled trial. *Ann Phys Rehabil Med.* 2023;66(5):101744. doi: 10.1016/j.rehab.2023.101744.
14. Özdemir F, Toy Ş, Kızılay F, Avcı ZT, Altay Z, Çolak C. Effects of scapular stabilization exercises in patients of chronic neck pain with scapular dyskinesis: a quasi-experimental study. *Turk J Phys Med Rehabil.* 2021;67(1):77-83. doi: 10.5606/tftrd.2021.6775.
15. Costello M, Puentedura EL, Cleland J, Ciccone CD. The immediate effects of soft tissue mobilization versus therapeutic ultrasound for patients with neck and arm pain with evidence of neural mechanosensitivity: a randomized clinical trial. *J Man Manip Ther.* 2016;24(3):128-40. doi: 10.1179/2042618614Y.0000000083.
16. Kompal R, Jabeen Z, Kashif M. Comparison between immediate effects of soft tissue mobilization along with stretching exercises and without stretching exercises in patients with mechanical neck pain. *Isra Med J.* 2019;11(2):96-100.
17. Macias CH, Ortega JR, Serrano-Sánchez FJ, Díaz-Mancha JA, Seguíñ LF, Cabañes-García J. Effectiveness of the scapula mobilization technique on the neural mechanosensitivity of the upper limb neural test 1 in individuals with mechanical cervicgia: a randomized controlled trial. *J Bodyw Mov Ther.* 2024;40:1926-31. doi: 10.1016/j.jbmt.2024.10.006.
18. Young IA, Dunning J, Butts R, Mourad F, Cleland JA. Reliability, construct validity, and responsiveness of the neck disability index and numeric pain rating scale in patients with mechanical neck pain without upper extremity symptoms. *Physiother Theory Pract.* 2019;35(12):1328-35. doi: 10.1080/09593985.2018.1471763.
19. Makin J, Watson L, Pouliopoulou DV, Laframboise T, Gangloff B, Sidhu R, et al. Effectiveness and safety of manual therapy when compared with oral pain medications in patients with neck pain: a systematic review and meta-analysis. *BMC Sports Sci Med Rehabil.* 2024;16(1):86. doi: 10.1186/s13102-024-00874-w.
20. Benetton A, Battista S, Berton G, Rossetini G, Falsiroli Maistrello L. Effectiveness of manual joint mobilization techniques in the treatment of nonspecific neck pain: systematic review with meta-analysis and meta-regression of randomized controlled trials. *J Orthop Sports Phys Ther.* 2025;55(3):173-192. doi: 10.2519/jospt.2025.12836.

21. Mylonas K, Angelopoulos P, Billis E, Tsepis E, Fousekis K. Combining targeted instrument-assisted soft tissue mobilization applications and neuromuscular exercises can correct forward head posture and improve the functionality of patients with mechanical neck pain: a randomized control study. *BMC Musculoskelet Disord.* 2021;22(1):212. doi: 10.1186/s12891-021-04080-4.
22. Minnucci S, Innocenti T, Salvioli S, et al. Benefits and harms of spinal manipulative therapy for treating recent and persistent nonspecific neck pain: a systematic review with meta-analysis. *J Orthop Sports Phys Ther.* 2023;53(8):510-528.