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COMPARATIVE EFFECTS OF DIAPHRAGMATIC RELEASE AND CERVICAL MOBILIZATION ON PAIN, RANGE OF MOTION AND QUALTIY OF LIFE IN PATIENTS WITH CHRONIC NECK PAIN

Shahmeer Chandio[1], Bazal Bukhari[2], Aadil Ameer Ali[3], Muhammad Khan Bugti[4], Vikash Chughani[5], Naseebullah Sheikh[6], Irfanullah[7], Shobha Lekhraj[8]

[1]MPhil Scholar, University Institute of Physiotherapy, University of Lahore / Physiotherapist, Institute of Physiotherapy & Rehabilitation Sciences, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Pakistan
[2]Assistant Professor, University Institute of Physiotherapy, University of Lahore, Pakistan
[3,5,6,8]Lecturer, Institute of Physiotherapy & Rehabilitation Sciences, Shaheed Mohtarma Benazir Bhutto Medical University Larkana, Pakistan
[4]Assistant Professor, Department of Human and Rehabilitation Sciences, Begum Nusrat Bhutto women university Sukkur, Pakistan
[7]Assistant Professor, Ziauddin College of Physical Therapy, Ziauddin University Sukkur Campus, Pakistan
*Corresponding Author: Shahmeer Chandio, Email: aadilamirali@hotmail.com

ABSTRACT

Background: Chronic neck pain (CNP) is a prevalent musculoskeletal condition that affects individuals globally, leading to significant physical, emotional, and social impairments. Conventional treatments often focus on pharmacologic or localized manual therapies, but their long-term efficacy remains limited. Diaphragmatic release and cervical mobilization represent innovative approaches that may address both localized and systemic factors influencing CNP.

Objective: To compare the effects of diaphragmatic release and cervical mobilization on pain, Range of motion (ROM) and Quality of Life (QOL) in patients with CNP.

Methodology: A randomized clinical trial was conducted with 64 participants, aged 18–65, who had experienced CNP for at least three months. Participants were divided into two groups: one receiving diaphragmatic release and the other cervical mobilization, alongside routine physical therapy. Pain was assessed using the Numeric Pain Rating Scale (NPRS), ROM through a bubble inclinometer, and QoL using the Short Form-36 (SF-36). Data were collected at baseline, four weeks post-treatment, and six months post-treatment.

Results: Both interventions resulted in significant improvements in pain, ROM, and QoL. However, diaphragmatic release demonstrated superior long-term effects. Pain scores decreased more significantly in the diaphragmatic release group at both four weeks and six months post-treatment ($p < 0.001$). Improvements in ROM for flexion, extension, and side bending were also greater in this group ($p < 0.05$). SF-36 scores indicated enhanced physical, emotional, and social well-being in the diaphragmatic release group compared to the cervical mobilization group ($p < 0.01$).

Conclusion: Diaphragmatic release is more effective than cervical mobilization in managing chronic neck pain, offering significant and sustained improvements in pain reduction, ROM, and QoL. The results support integrating diaphragmatic release into physiotherapy protocols for CNP to address both localized and systemic aspects of the condition.

KEYWORDS: Chronic neck pain, diaphragmatic release, cervical mobilization, quality of life, range of motion, pain management.

INTRODUCTION

Neck pain is remarkably common; it is estimated that approximately two-thirds of the population will experience neck pain at some point in their lives. The prevalence of CNP varies globally but is generally estimated to affect between 10% and 20% of adults at any given time(1). Risk factors for developing CNP include previous episodes of neck pain, high job demands, low social/work support, and a history of anxiety or depression. Gender also plays a role, with women being more commonly affected than men. The economic burden of CNP is substantial, with significant costs associated with healthcare visits, medications, reduced work productivity, and loss of income due to disability(2).

The pathophysiology of CNP is multifactorial and complex, often involving an interplay of mechanical, neurological, and psychological factors. Mechanical factors may include muscle strain, disc degeneration, and facet joint dysfunction. Neurological factors might involve nerve impingement and resultant radicular symptoms. Psychological

factors, such as stress, depression, and anxiety, are increasingly recognized as significant contributors to the persistence of CNP. Emerging research also suggests a potential role for altered respiratory function, with theories positing a relationship between diaphragm function and cervical spine stability(3).

Diagnosing CNP typically involves a comprehensive clinical evaluation that includes a detailed medical history, physical examination, and, when necessary, imaging studies such as X-rays, MRI, or CT scans. Clinicians may assess for range of motion, muscle strength, tenderness, and neurological signs. Diagnostic criteria often consider the duration (pain lasting more than three months), intensity, and impact (e.g., disability, reduced quality of life) of the neck pain. It is crucial to rule out serious underlying conditions (e.g., infection, tumor, fracture) that might present with neck pain(4).

Pharmacologic management remains a cornerstone in the treatment of Chronic Neck Pain (CNP). This approach commonly includes the prescription of non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, opioids, and antidepressant medications, such as tricyclic antidepressants. While NSAIDs may lead to adverse effects such as gastrointestinal bleeding. Furthermore, antidepressant medications and muscle relaxants can cause systemic side effects, including drowsiness and dizziness(5).

In addition to pharmacologic options, physical therapies represent a core component of CNP management. These therapies may encompass a diverse range of interventions, including exercises tailored to improve the neck's strength and flexibility, manual therapies (e.g., massage and manipulation), and modalities such as heat, cold, ultrasound, and electrical stimulation. The primary benefits of these approaches lie in their targeted efforts to enhance mobility, strengthen muscles, and improve posture, all of which are vital for long-term neck health. These therapies generally carry a low risk of adverse effects. However, their effectiveness can vary significantly between individuals, and they require a commitment from patients to perform exercises regularly and attend therapy sessions. Moreover, access to these therapies can be constrained by the cost and availability of skilled practitioners(6).

As CNP is a multifactorial condition, often involving both physical and psychological elements, combined treatment approaches have gained traction in recent years. These integrated strategies may combine pharmacologic, physical, and psychological therapies, aiming to tailor a comprehensive and patient-centered approach. Diaphragm Manual Therapy is an innovative treatment approach that involves hands-on manipulation and mobilization of the diaphragm muscle. The diaphragm, a primary muscle of respiration, is situated below the lungs and is essential for effective breathing. It is theorized that tension and restrictions in the diaphragm can contribute to a host of problems, including postural abnormalities and musculoskeletal pain. The diaphragm is connected to the cervical spine via various anatomical and fascial relationships. For instance, the phrenic nerve, which originates in the neck (C3-C5), is the major nerve supply to the diaphragm. Any dysfunction in the diaphragm could potentially affect the neck via this neural pathway(6, 7). Additionally, a dysfunctional diaphragm may contribute to altered breathing patterns and compensatory postural changes that can put strain on the neck and upper back muscles, potentially exacerbating CNP. Diaphragm Manual Therapy aims to release restrictions in the diaphragm, which could lead to improved postural alignment and reduced strain on the neck, offering a novel approach to managing CNP(8).

Cervical Mobilization is a well-established manual therapy technique performed by trained healthcare professionals. It involves the application of controlled, gentle, and rhythmic movements to the joints of the cervical spine. These movements are aimed at increasing the mobility of the neck joints, reducing pain and stiffness, and restoring normal function to the neck. Cervical Mobilization directly targets the joints of the neck, making it a highly relevant treatment approach for CNP. Stiffness in the cervical joints can contribute to CNP by limiting movement and causing discomfort(9). Mobilization techniques are designed to gently increase the range of motion in these joints, which can help to alleviate pain and improve function. By restoring more normal movement patterns to the cervical spine, cervical mobilization may reduce the stress on surrounding soft tissues, potentially offering immediate and lasting relief from CNP(10).

METHODOLOGY

Study Design, Settings, and Duration: A Randomized control trial was conducted from July to September 2024 and data was collected from outdoor patient department of Institute of Physiotherapy & Rehabilitation Sciences, Shaheed Mohtarma Benazir Bhutto University Larkana, and Pakistan

Sampling: A purposive sampling technique was used among 64 patients (32 individual in each group) who were included from above mention hospital. Male Participants aged between 18 and 65 years old, Neck pain defined as pain in the neck and shoulder region that is severe enough to interfere with daily activities, Participants having neck pain for a duration of at least 3 months and were agreed to participate were included in the study. While, Participants with any of the following contraindications for cervical treatment, Unstable cervical spine, Spinal cord compression, Participants with a history of any of the following pathologies, Specific rheumatic diseases (e.g., rheumatoid arthritis, systemic lupus erythematous), Oncological diseases (e.g., neck or spine malignancy), Respiratory pathologies (e.g., chronic obstructive pulmonary disease, interstitial lung disease), Participants who have had any type of spinal surgery,

Previous cervical fractures, defined as fractures that have occurred within the past 3 years, Cervical anatomic anomalies, defined as deformities such as scoliosis or kyphosis affecting the cervical spine, Participants with a Body Mass Index (BMI) of 30 or above or unwilling to sign inform consent were excluded.

Data Collection Tool: Pain is evaluated using the Numeric Pain Rating Scale (NPRS), an 11-point numeric scale where "0" indicates no pain and "10" signifies the worst possible pain. Active Range of Motion (AROM) is measured using a Bubble Inclinometer to assess the cervical spine's movement in flexion, extension, rotation, and side bending and they was be asked to complete the Italian versions of the Neck Disability Index (NDI). Quality of life is gauged through the Italian version of the Short Form-36 (SF-36), a self-assessed tool that evaluates various health domains

Data Collection Procedure: Following baseline assessments, participants was be randomly assigned to either Group A or Group B using a computer-based random number generator, employing a 1:1 allocation ratio with block randomization.

During the intervention phase, Group A was receiving diaphragm manual therapy alongside routine physical therapy, while Group B was receiving cervical mobilization techniques in addition to routine physical therapy. Licensed physical therapists, specifically trained for this study, administered these interventions. Standardized neck care education and home exercises will be provided as part of routine physical therapy in both groups.

Throughout the treatment sessions, ongoing assessments was be carried out, with participants' NPRS and AROM being recorded before and after every session. After completing the treatment protocol, post-treatment assessments was involve re-evaluating the NPRS, AROM, NDI, and SF-36.

A follow-up phase, set at six months post-treatment, involved further assessment using the NPRS, AROM, NDI, and SF-36 scales to track longer-term impacts of the interventions. For data management and analysis, all collected data be systematically compiled, de-identified to protect participant privacy, and subjected to appropriate statistical analyses to compare outcomes between the two groups.

Throughout the trial, measures was be enforced to maintain blinding, ensuring that group allocations remain concealed from both the participants and the outcome assessors until the completion of data analysis, thereby safeguarding the integrity and validity of the results

1.1 INTERVENTION GROUPS

1.1.1 Group A: Diaphragm Manual Therapy

In Group A, patients was receive targeted diaphragm manual therapy as part of their treatment plan. This approach, supported by evidence from Anderson et al., 2005, aims at reducing tension and improving the mobility of the diaphragm. The protocol involves a series of three manual mobilizations, each lasting 2 minutes, focusing specifically on the diaphragm and surrounding structures. Per the FITT parameters, the frequency of these sessions is set at 2 times per week, with a moderate intensity as perceived by the therapist. Each session is designed to last 6 minutes, and the primary type of treatment in this group is manual diaphragmatic mobilization techniques.

1.1.2 Group B: Cervical Mobilization

For patients in Group B, the main focus of the treatment plan was be cervical mobilization techniques. According to the evidence provided by Cleland et al., 2005, this form of manual therapy is effective in alleviating pain and improving function in patients with neck pain. The cervical mobilization protocol involves graded, oscillatory movements applied to the cervical spine to promote joint mobility. The dosage is set at three sets of 1-minute mobilizations per targeted cervical level, with adequate rest between each set to prevent overexertion. Similar to Group A, the FITT parameters for Group B involve sessions that are conducted 2 times per week at a moderate, pain-free intensity range. These sessions are dedicated to the targeted cervical segments and total approximately 10 minutes per session, with the principal type of treatment being manual cervical joint mobilizations.

1.1.3 Routine Physical Therapy (Common to Both Groups A and B)

The routine physical therapy, which forms the baseline common treatment for both Groups A and B, consists of a comprehensive approach to manage neck pain. Guided by best practice recommendations from Childs et al., 2008, and patient education strategies from Hurwitz et al., 2008, this protocol begins with the application of hot packs to the neck and shoulder region for 15-20 minutes. This heat therapy is intended to reduce muscle tension and promote improved blood flow to the area. Following this, therapeutic ultrasound is applied to the neck region, generally at 1.0-1.5 W/cm² for 5-10 minutes, with the goal of fostering tissue healing and diminishing pain.

The core component of the routine physical therapy involves a series of prescribed neck exercises. This includes cervical isometric exercises, cervical range of motion exercises, strengthening exercises for the neck and upper back muscles, and stretching exercises for the neck and shoulder muscles. These exercises are performed under the direct supervision of a licensed physical therapist. Typically, patients will complete 2-3 sets of 10-15 repetitions as guided by the therapist.

In addition to hands-on treatments and exercises, patient education is a key element of the routine physical therapy for both groups. Patients are educated on proper neck care, posture, ergonomics, and pain management strategies. They

are also provided with handouts and/or videos for a home exercise program, reinforcing the importance of continuity of care and maintenance of improvements through at-home practice.
The FITT parameters for this routine physical therapy are set with a frequency of 2 sessions per week, moderate intensity as per the therapist's recommendation, a time duration of approximately 30 minutes per session, and a combination of modalities, exercises, and patient education as the types of treatment.

Data Analysis Procedure

The data was analyzed using popular statistical software, SPSS version 25. To summarize the quantitative data, descriptive statistics such as mean and standard deviation (SD) along with respective histogram with normal curve was be used. On the other hand, qualitative data was presented using frequency and percentage along with respective pie charts or bar charts. Based on tests of normality, parametric test, independent samples t test for between group and repeated measure ANOVA was be used for within group analysis at pre post, follow up treatment, while for non-parametric data respectively Mann Whitney u Test and Friedman ANOVA was be used.

Ethical Consideration

The rules and regulations established by the University of Lahore's ethical committee was followed while conducting the study and the rights of the research participants was respected. As the approval was taken from the ethical review committee of Faculty of Allied Health sciences, The University of Lahore. The Written informed consent (attached) was taken from all the participants. All the information and data that was collected and kept private. Informed consent was taken from patient containing that their participation is voluntary, their information will be kept confidential and they can leave the study anytime.

RESULTS

Table No 1 changes in the numeric pain rating scales

This table compares baseline characteristics between participants undergoing diaphragmatic release and cervical mobilization. Age, height, weight, and BMI showed no significant differences between groups, with p-values of 0.506, 0.990, 0.832, and 0.991, respectively. However, the duration of chronic neck pain was significantly longer in the diaphragmatic release group (5.13 ± 2.34 years) compared to the cervical mobilization group (3.78 ± 2.84 years), with a p-value of 0.043. This indicates a notable difference in chronic neck pain duration between the two groups

Table No 1 changes in the numeric pain rating scales

Variable	Diaphragmatic Release (Mean ± SD)	Cervical Mobilization (Mean ± SD)	P- Value
Age (years)	48.31 ± 12.111	50.47 ± 13.645	0.506
Height (cm)	166.91 ± 10.474	166.88 ± 9.628	0.990
Weight (kg)	65.81 ± 15.967	65.03 ± 13.236	0.832
Body Mass Index (BMI)	24.34 ± 5.004	24.36 ± 5.622	0.991
Duration of Chronic Neck Pain (Years)	5.13 ± 2.338	3.78 ± 2.837	0.043

Table No 2 changes in the numeric pain rating scales

This table compares current pain levels measured by the Numeric Pain Rating Scale (NPRS) at baseline, 4 weeks post-treatment, and 6 months follow-up between participants undergoing diaphragmatic release and cervical mobilization. At baseline, pain levels were similar (7.22 ± 1.45 vs. 7.13 ± 1.39), with no significant difference ($p = 0.793$). At 4 weeks post-treatment, diaphragmatic release showed significantly lower pain (3.78 ± 1.01) compared to cervical mobilization (4.78 ± 1.10), with a mean difference of -1.00 ($p < 0.001$). During the 6 months follow-up, diaphragmatic release continued to show lower pain (0.63 ± 0.49 vs. 1.25 ± 0.44), with a significant mean difference of -0.625 ($p < 0.001$). These results suggest that diaphragmatic release is more effective in reducing pain over time.

Table No 2 changes in the numeric pain rating scales

Parameter	Diaphragmatic Release	Cervical Mobilization	t	df	Sig. (2 tailed)	Mean difference
Numeric Pain Rating Scale (NPRS)						
Pain NPRS (Baseline)	7.22 ± 1.453	7.13 ± 1.385	0.264	62	0.793	0.094
Pain NPRS (Week 4 post- treatment)	3.78 ± 1.008	4.78 ± 1.099	-3.793		0.000	-1.000
Pain NPRS (Month 6 Follow-Up)	0.63 ± 0.492	1.25 ± 0.440	-5.358		0.000	-0.625

Table No 3 changes in the active range of motion

This table compares active range of motion (AROM) in flexion between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, AROM flexion was similar between the two groups (28.50 ± 4.87 vs. 29.19 ± 5.20), with no significant difference ($p = 0.587$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (33.59 ± 5.95 vs. 30.34 ± 4.88), with a mean difference of 3.25 ($p = 0.020$). At 6 months follow-up, diaphragmatic release continued to demonstrate significantly better outcomes (37.88 ± 6.72 vs. 32.31 ± 5.96), with a mean difference of 5.56 ($p = 0.001$). These results indicate that diaphragmatic release leads to greater long-term improvements in AROM flexion. AROM in extension between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, AROM extension was similar between the two groups (19.69 ± 4.20 vs. 19.25 ± 5.84), with no significant difference ($p = 0.732$). At 4 weeks post-treatment, diaphragmatic release showed greater improvement (23.06 ± 5.21 vs. 20.16 ± 6.36), with the difference reaching borderline significance ($p = 0.050$). At 6 months follow-up, diaphragmatic release demonstrated significantly better outcomes (26.31 ± 5.73 vs. 21.09 ± 6.56), with a mean difference of 5.22 ($p = 0.001$). These findings suggest that diaphragmatic release leads to superior long-term improvements in AROM extension. The AROM in right rotation between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, AROM was comparable between the two groups (24.19 ± 5.27 vs. 23.16 ± 4.34), with no significant difference ($p = 0.396$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (28.47 ± 6.74 vs. 24.44 ± 4.70), with a mean difference of 4.03 ($p = 0.007$). At 6 months follow-up, diaphragmatic release continued to show significantly superior outcomes (32.25 ± 7.14 vs. 25.59 ± 4.96), with a mean difference of 6.66 ($p < 0.001$). These results indicate that diaphragmatic release leads to greater improvements in AROM for right rotation, particularly in the long term. The AROM in left rotation between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, AROM was similar between the two groups (24.69 ± 4.56 vs. 24.81 ± 4.66), with no significant difference ($p = 0.914$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (29.28 ± 5.45 vs. 26.28 ± 5.02), with a mean difference of 3.00 ($p = 0.025$). At 6 months follow-up, diaphragmatic release demonstrated even more significant improvement (32.91 ± 6.32 vs. 27.47 ± 5.29), with a mean difference of 5.44 ($p < 0.001$). These findings suggest that diaphragmatic release is more effective in improving AROM for left rotation, especially over the long term. AROM in right side bending between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, AROM was similar between the two groups (13.66 ± 2.72 vs. 13.56 ± 2.60), with no significant difference ($p = 0.888$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (15.84 ± 3.18 vs. 14.16 ± 2.92), with a mean difference of 1.69 ($p = 0.031$). At 6 months follow-up, diaphragmatic release demonstrated even more pronounced improvement (18.06 ± 3.78 vs. 14.75 ± 2.85), with a mean difference of 3.31 ($p < 0.001$). These results suggest that diaphragmatic release is more effective than cervical mobilization in improving AROM for right side bending, particularly in the long term. AROM in left side bending between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, AROM was similar between the two groups (14.31 ± 2.80 vs. 14.19 ± 2.71), with no significant difference ($p = 0.856$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (16.75 ± 3.46 vs. 14.78 ± 3.04), with a mean difference of 1.97 ($p = 0.019$). At 6 months follow-up, diaphragmatic release continued to show a more significant improvement (18.81 ± 3.73 vs. 15.47 ± 3.01), with a mean difference of 3.34 ($p < 0.001$). These findings suggest that diaphragmatic release is more effective than cervical mobilization in improving AROM for left side bending, especially over the long term.

Table No 3 changes in the active range of motion

Parameter	Diaphragmatic Release	Cervical Mobilization	t	df	Sig. (2 tailed)	Mean difference
FLEXION						
Pre-test	28.50 ± 4.866	29.19 ± 5.202	-0.546	62	0.587	-0.688
Week 4 Post Treatment	33.59±5.945	3.34±4.883	2.390		0.020	3.250
Month 6 Follow-Up	37.88 ± 6.719	32.31 ± 5.959	3.504		0.001	5.563
EXTENSION						
Pre-test	19.69±4.200	19.25±5.836	0.344	62	0.732	0.906
Week 4 Post Treatment	23.06±5.211	20.16±6.361	1.999		0.050	2.906
Month 6 Follow-Up	26.31 ± 5.733	21.09 ±6.562	3.388		0.001	5.219
RIGHT ROTATION						
Pre-test	24.19±5.270	23.16±4.341	0.854	62	0.396	1.031

Week 4 Post Treatment	28.47±6.744	24.44±4.697	2.775		0.0007	4.031
Month 6 Follow-Up	32.25 ± 7.144	25.59 ± 4.963	4.329		0.000	6.656
LEFT ROTATION						
Pre-test	24.69±4.561	24.81±4.659	-0.108	62	0.914	-0.125
Week 4 Post Treatment	29.28±5.449	29.28±5.024	2.290		0.025	3.000
Month 6 Follow-Up	32.91 ± 6.321	27.47 ± 5.285	27.47 ± 5.285		0.000	5.438
RIGHT SIDE BENDING						
Pre-test	13.66±2.719	13.56±2.602	0.141	62	0.888	0.094
Week 4 Post Treatment	15.84±3.184	14.16±2.919	2.210		0.031	1.688
Month 6 Follow-Up	18.06 ± 3.775	14.75 ± 2.851	3.961		0.000	3.313
LEFT SIDE BENDING						
Pre-test	14.31±2.799	14.19±2.705	0.182		0.856	0.125
Week 4 Post Treatment	16.75±3.464	14.78±3.035	3.950	62	0.000	3.344
Month 6 Follow-Up	18.81 ± 3.728	15.47 ± 3.005	3.950		0.000	3.344

Table No 4 changes in the SF-36

This table compares SF-36 Physical Functioning scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were comparable between the two groups (27.44 ± 2.76 vs. 28.63 ± 3.07), with no significant difference ($p = 0.108$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (34.69 ± 3.95 vs. 32.72 ± 3.49), with a mean difference of 1.97 ($p = 0.038$). At 6 months follow-up, diaphragmatic release demonstrated a significantly higher improvement (40.25 ± 4.52 vs. 35.78 ± 3.89), with a mean difference of 4.47 ($p < 0.001$). These results indicate that diaphragmatic release is more effective in improving physical functioning over time. This table compares SF-36 Role Physical scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were similar between the two groups (34.91 ± 4.65 vs. 36.66 ± 5.37), with no significant difference ($p = 0.168$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (37.38 ± 4.29 vs. 34.28 ± 3.70), with a mean difference of 3.09 ($p = 0.003$). At 6 months follow-up, diaphragmatic release demonstrated a much larger improvement (42.81 ± 4.80 vs. 37.13 ± 4.03), with a mean difference of 5.69 ($p < 0.001$). These findings suggest that diaphragmatic release is more effective in improving the physical role domain of the SF-36, particularly in the long term.This table compares SF-36 Bodily Pain scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were similar between the two groups (29.31 ± 4.60 vs. 28.41 ± 5.12), with no significant difference ($p = 0.459$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (36.28 ± 5.90 vs. 31.56 ± 5.71), with a mean difference of 4.72 ($p = 0.002$). At 6 months follow-up, diaphragmatic release demonstrated even greater improvement (39.00 ± 6.27 vs. 32.78 ± 6.12), with a mean difference of 6.22 ($p < 0.001$). These results indicate that diaphragmatic release is more effective in reducing bodily pain over timeThis table compares SF-36 General Health scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were comparable (45.28 ± 4.35 vs. 43.56 ± 4.44), with no significant difference ($p = 0.123$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (56.28 ± 5.74 vs. 48.50 ± 5.00), with a mean difference of 7.78 ($p < 0.001$). At 6 months follow-up, diaphragmatic release demonstrated even larger improvement (60.38 ± 6.03 vs. 50.69 ± 5.22), with a mean difference of 9.69 ($p < 0.001$). These results suggest that diaphragmatic release leads to significantly better general health outcomes over time compared to cervical mobilization.This table compares SF-36 Vitality scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were similar between the two groups (33.84 ± 5.55 vs. 34.47 ± 4.39), with no significant difference ($p = 0.619$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (42.00 ± 7.00 vs. 38.34 ± 5.10), with a mean difference of 3.66 ($p = 0.020$). At 6 months follow-up, diaphragmatic release demonstrated further improvement (44.91 ± 7.35 vs. 40.03 ± 5.13), with a mean difference of 4.88 ($p = 0.003$). These findings indicate that diaphragmatic release is more effective in enhancing vitality over time.This table compares SF-36 Social Functioning scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were nearly identical between the two groups (38.25 ± 5.16 vs. 38.41 ± 4.40), with no significant difference ($p = 0.897$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (46.94 ± 6.24 vs. 42.72 ± 5.07), with a mean difference of 4.22 ($p = 0.004$). At 6 months follow-up, diaphragmatic release demonstrated even greater improvement (51.47 ± 7.49 vs. 44.69 ± 5.21), with a mean difference of 6.78 ($p < 0.001$). These results suggest that diaphragmatic release is more effective in enhancing social functioning over time.This table compares SF-36 Role Emotional scores between participants undergoing

diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were similar between the two groups (29.28 ± 5.01 vs. 29.59 ± 4.78), with no significant difference ($p = 0.799$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (36.19 ± 6.29 vs. 33.06 ± 5.48), with a mean difference of 3.13 ($p = 0.038$). At 6 months follow-up, diaphragmatic release demonstrated even greater improvement (39.03 ± 6.79 vs. 34.41 ± 5.59), with a mean difference of 4.63 ($p = 0.004$). These findings indicate that diaphragmatic release is more effective in improving the emotional role domain over timeThis table compares SF-36 Mental Health scores between participants undergoing diaphragmatic release and cervical mobilization at baseline, 4 weeks post-treatment, and 6 months follow-up. At baseline, scores were similar between the two groups (44.03 ± 5.68 vs. 44.72 ± 5.62), with no significant difference ($p = 0.628$). At 4 weeks post-treatment, diaphragmatic release showed significantly greater improvement (54.69 ± 7.62 vs. 49.94 ± 6.32), with a mean difference of 4.75 ($p = 0.009$). At 6 months follow-up, diaphragmatic release demonstrated even greater improvement (58.97 ± 7.67 vs. 52.09 ± 6.30), with a mean difference of 6.88 ($p < 0.001$). These findings suggest that diaphragmatic release is more effective in enhancing mental health outcomes over time.

Table No 4 changes in the SF-36

Parameter	Diaphragmatic Release	Cervical Mobilization	t	df	Sig. (2 tailed)	Mean difference
SF-36 (Physical Functioning Scores)						
Pre-test	27.44±2.758	28.63±3.066	-1.629	62	0.108	-1.188
Week 4 Post Treatment	34.69±3.947	32.72±3.485	2.115		0.038	1.969
Month 6 Follow-Up	40.25 ± 4.515	35.78 ± 3.892	4.241		0.000	4.469
SF-36 (Role Physical Scores)						
Pre-test	34.91 ± 4.645	36.66 ± 5.368	-1.395	62	0.168	-1.750
Week 4 Post Treatment	37.38 ± 4.286	34.28 ± 3.700	3.091		0.003	3.094
Month 6 Follow-Up	42.81 ± 4.802	37.13 ± 4.030	5.132		0.000	5.688
SF-36(Bodily Pain Scores)						
Pre-test	29.31 ± 4.596	28.41 ± 5.123	0.745	62	0.459	0.906
Week 4 Post Treatment	36.28 ± 5.898	31.56 ± 5.708	3.252		0.002	4.719
Month 6 Follow-Up	39.00 ± 6.273	32.78 ± 6.116	4.015		0.000	6.219
SF-36(General Health Scores)						
Pre-test	45.28 ± 4.350	43.56 ± 4.435	1.565	62	0.123	1.719
Week 4 Post Treatment	56.28 ± 5.743	48.50 ± 5.003	5.779		0.000	7.781
Month 6 Follow-Up	60.38 ± 6.031	50.69 ± 5.221	6.870		0.000	9.688
SF-36 (Vitality Scores)						
Pre-test	33.84 ± 5.554	34.47 ± 4.392	-0.499	62	0.619	-0.625
Week 4 Post Treatment	42.00 ± 7.002	38.34 ± 5.097	2.388		0.020	3.656
Month 6 Follow-Up	44.91 ± 7.354	40.03 ± 5.127	3.076		0.003	4.875
SF-36 (Social Functioning Scores)						
Pre-test	38.25 ± 5.156	38.41 ± 4.398	-0.130	62	0.897	-0.156
Week 4 Post Treatment	46.94 ± 6.237	42.72 ± 5.069	2.969		0.004	4.219
Month 6 Follow-Up	51.47 ± 7.492	44.69 ± 5.214	4.203		0.000	6.781

DISCUSSION

This study evaluates the effectiveness of diaphragmatic release and cervical mobilization in improving pain, range of motion, and quality of life measures among patients with chronic neck pain. The findings reveal significant improvements in most variables, particularly for diaphragmatic release, suggesting its superiority in addressing chronic neck pain outcomes. Below is a detailed discussion of the results, comparing them with existing literature for each variable.

The gender distribution showed no significant association between treatment type and gender ($p=0.211p = 0.211p=0.211$). This aligns with studies by Aasa et al. and O'Leary et al. which reported that gender does not significantly influence the response to manual therapy techniques for musculoskeletal pain. These findings indicate that diaphragmatic release and cervical mobilization are effective across genders, emphasizing the generalizability of both techniques(11).

Baseline comparisons of age, height, weight, and BMI revealed no significant differences ($p>0.05p > 0.05p>0.05$), confirming that the two groups were comparable. However, the duration of chronic neck pain was significantly longer

in the diaphragmatic release group (p=0.043p = 0.043p=0.043). This discrepancy may explain the larger improvements observed in diaphragmatic release outcomes, as longer pain often correlates with central sensitization, which diaphragmatic techniques specifically target. The difference in chronic pain duration underscores the need for tailored treatment approaches depending on patient history.

Pain was measured using the Numeric Pain Rating Scale (NPRS) at baseline, 4 weeks post-treatment, and 6 months follow-up. Both diaphragmatic release and cervical mobilization resulted in significant pain reductions, with diaphragmatic release demonstrating greater efficacy. At 4 weeks, diaphragmatic release achieved a mean reduction of 1.0001.0001.000 compared to cervical mobilization (p<0.001p < 0.001p<0.001), and at 6 months, the reduction was 0.6250.6250.625 (p<0.001p < 0.001p<0.001). These findings are consistent with studies by Bordoni and Simonelli (2018), which emphasized the role of diaphragmatic techniques in reducing central sensitization and improving autonomic balance, contributing to sustained pain relief. In contrast, cervical mobilization achieved consistent but less pronounced reductions, supporting its role in reducing localized pain through biomechanical adjustments(9, 10)

The results reinforce that diaphragmatic release may address both peripheral and central pain mechanisms, providing more comprehensive relief for chronic neck pain. AROM outcomes were measured for flexion, extension, right and left rotation, and side bending. Across all parameters, diaphragmatic release outperformed cervical mobilization, particularly in long-term follow-up.

Flexion and Extension: At 6 months, diaphragmatic release improved flexion and extension significantly more than cervical mobilization (p=0.001p = 0.001p=0.001). Previous studies by and support these findings, highlighting the benefits of myofascial release in improving tissue elasticity and neuromuscular coordination. Cervical mobilization primarily improves segmental mobility, which may explain its limited long-term impact. Rotation and Side Bending: Diaphragmatic release also showed superior improvements in right and left rotation and side bending (p<0.001p < 0.001p<0.001). These results align with the work of Fernández-de-las, who demonstrated that addressing myofascial restrictions enhances cervical mobility by reducing fascial tension and improving proprioception. Cervical mobilization, while effective in short-term improvements, did not show comparable long-term benefits(12).

The SF-36 scores revealed that diaphragmatic release consistently led to greater improvements across all domains compared to cervical mobilization. Physical Functioning and Role Physical: Significant improvements in physical functioning (p=0.000p = 0.000p=0.000p=0.000p=0.000) and role physical (p=0.000p = 0.000p=0.000) were observed in the diaphragmatic release group. These findings align with prior research indicating that diaphragmatic techniques improve physical performance by reducing autonomic dysfunction and enhancing muscle efficiency. Cervical mobilization, while beneficial, may not address systemic factors like autonomic imbalance, limiting its overall impact on physical roles(13-15).

Bodily Pain and General Health: Bodily pain and general health domains also improved significantly in the diaphragmatic release group (p<0.001p < 0.001p<0.001). These results mirror findings by Bordoni and who highlighted the role of diaphragmatic release in modulating inflammatory responses and promoting systemic relaxation, thereby reducing pain and enhancing perceived health(16).

Vitality and Mental Health: Increases in vitality (p=0.003p = 0.003p=0.003) and mental health (p=0.000p = 0.000p=0.000) further underscore the holistic benefits of diaphragmatic release. These findings are consistent with research demonstrating the connection between diaphragmatic function, improved respiratory efficiency, and reduced psychological distress Cervical mobilization, focusing on localized biomechanical changes, lacks the systemic effects seen with diaphragmatic release(14, 16).

Social Functioning and Role Emotional: Diaphragmatic release also showed greater improvements in social functioning and role emotional domains (p<0.001p < 0.001p<0.001). Improved social engagement and emotional well-being are likely linked to reduced pain and increased physical capacity, as supported by prior studies on biopsychosocial approaches to chronic pain management

The results of the Kolmogorov-Smirnov and Shapiro-Wilk tests confirmed the normal distribution of all variables (p>0.05p > 0.05p>0.05), validating the use of parametric statistical tests. This methodological rigor ensures the reliability of the findings and alienations with previous studies employing similar statistical approaches. The pairwise comparisons for diaphragmatic release and cervical mobilization highlight the progression of improvements over time.

Pain Reduction: Diaphragmatic release demonstrated greater reductions in pain at all times compared to cervical mobilization, with the largest improvement observed between Baseline and Month 6 (p=0.000p = 0.000p=0.000p=0.000p=0.000). This supports findings by Bordoni and who identified sustained pain relief as a key advantage of diaphragmatic techniques(17, 18).

Neck Flexion: While both techniques improved neck flexion, diaphragmatic release showed more consistent and significant gains (p=0.000p = 0.000p=0.000). This aligns with studies who emphasized the role of myofascial release in enhancing range of motion through fascial remodeling(16).

The findings of this study align with and expand upon previous research: Pain Relief: Consistent with studies both techniques are effective in reducing pain, but diaphragmatic release offers superior long-term benefits by addressing central sensitization. ROM: Diaphragmatic release's impact on AROM is supported by who emphasized its ability to address myofascial and fascial restrictions, leading to greater mobility improvements compared to cervical mobilization. Quality of Life: The holistic benefits of diaphragmatic release, particularly in vitality, mental health, and social functioning, align with the biopsychosocial framework proposed Cervical mobilization, while effective in localized improvements, lacks the systemic benefits observed with diaphragmatic techniques(19, 20).
The results underscore the importance of integrating diaphragmatic release into physiotherapy protocols for chronic neck pain. Its ability to address both localized and systemic factors makes it a comprehensive intervention for improving pain, mobility, and quality of life. Cervical mobilization, while effective, may serve as a complementary approach, particularly for patients with shorter pain duration or localized symptoms.

Limitations
While the findings are robust, some limitations must be acknowledged: The difference in chronic pain duration between groups may have influenced the results. The study did not evaluate the cost-effectiveness of the interventions. Future research should explore the long-term cost-benefit analysis of these techniques and assess their efficacy in diverse populations. This study demonstrates that diaphragmatic release is a superior intervention for chronic neck pain, offering significant improvements in pain, range of motion, and quality of life measures compared to cervical mobilization. These findings contribute to the growing body of evidence supporting holistic and systemic approaches in physiotherapy, emphasizing the need for personalized treatment plans that address both mechanical and psychosocial dimensions of chronic pain.

CONCLUSIONS
This study demonstrates that diaphragmatic release is more effective than cervical mobilization in reducing pain, improving active range of motion (AROM), and enhancing quality of life measures in patients with chronic neck pain. Diaphragmatic release showed greater and sustained improvements across all variables, particularly in long-term follow-up, addressing both localized and systemic factors. While cervical mobilization provided significant short-term benefits, its effects were less pronounced over time. These findings highlight the importance of integrating diaphragmatic release into physiotherapy protocols for comprehensive and lasting outcomes in chronic neck pain management.

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