

The Effects of Cervical Spine Self Mobilisation versus Conventional Exercises on Pain, Range of Motion and Functional Disability in Patients with Chronic Non-Specific Neck Pain

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Publication Date: 2026/10/21

Abstract:

➤ Background:

Chronic nonspecific neck pain (CNSNP) is associated with pain, restricted cervical movement, and functional disability. Physiotherapy commonly includes therapeutic exercises and cervical mobilisation. However, limited evidence compares self-mobilisation with conventional exercises. Therefore, this study compared their effects on cervical range of motion and functional disability in patients with CNSNP.

➤ Methodology:

A comparative study was conducted on 40 participants with CNSNP. Group A (n=20) received cervical self-mobilisation, while Group B (n=20) received conventional exercises. Pre- and post-intervention assessments included cervical ROM and Neck Disability Index (NDI). Data were analysed using appropriate statistical tests with significance set at $p < 0.05$.

➤ Results:

Both groups showed significant improvements in pain, cervical ROM, and functional disability ($p < 0.001$). Group A showed greater improvement than Group B in VAS (-2.55 vs -0.90), cervical ROM, and NDI (-20.65% vs -7.05%). Between-group differences were statistically significant for all outcomes ($p \leq 0.002$).

➤ Conclusion:

Both interventions improved pain, cervical ROM, and functional disability in patients with chronic nonspecific neck pain. However, cervical spine self-mobilisation produced significantly greater improvements than conventional exercises in this study.

Keywords: Blinding, Chronic Nonspecific Neck Pain, Chit Method, Randomised Control Trial, Self-Mobilisation.

How to Cite: Dr. Bhagyashree Rathi; Dr. Tejal Sonawane; Dr. Manoj Suryawanshi (2026) The Effects of Cervical Spine Self Mobilisation versus Conventional Exercises on Pain, Range of Motion and Functional Disability in Patients with Chronic Non-Specific Neck Pain. *International Journal of Innovative Science and Research Technology*, 11(10), 1093-1105. <https://doi.org/10.38124/ijisrt/26oct423>

I. INTRODUCTION

Neck pain is one of the most common musculoskeletal conditions worldwide and is an important cause of pain, disability and activity limitation. A systematic review by Fejer et al. reported a one-year prevalence of neck pain ranging from 16.7% to 75.1% in adults, demonstrating its considerable burden in the general population. [1] An Indian

community-based study reported a point prevalence of 21% for nonspecific neck pain among adults, highlighting its considerable burden in the population. [2]

Chronic nonspecific neck pain (CNSNP) refers to neck pain persisting for more than 12 weeks without an identifiable specific pathology such as fracture, infection, malignancy or serious neurological disorder. [3,4] The development and

persistence of CNSNP are multifactorial and may be associated with prolonged or awkward postures, occupational demands, repetitive activities, reduced physical activity and psychosocial factors. [3,4] A systematic review and meta-analysis reported that patients with chronic nonspecific neck pain demonstrated reduced size of the longus colli and semispinalis capitis muscles compared with healthy individuals, suggesting the involvement of cervical muscle alterations in CNSNP. [5]

Clinically, patients with CNSNP commonly experience neck pain, stiffness and restricted cervical range of motion, which may be accompanied by impaired cervical muscle performance and functional limitations. [3,4] These impairments can interfere with occupational activities and activities of daily living, thereby contributing to disability and reduced quality of life. Therefore, management of CNSNP should aim not only to reduce pain but also to improve cervical mobility and functional ability. [3,4]

Physiotherapy is an important component of conservative management of nonspecific neck pain. Therapeutic exercise, strengthening exercises, motor-control training, stretching, postural exercises and manual therapy are commonly used interventions. [3,4] Evidence from a systematic review and meta-analysis of 68 trials indicates that resistance, motor-control and mindfulness-based exercises can improve pain and disability in patients with chronic nonspecific neck pain. [6] However, different exercise approaches may produce different effects, indicating the need to investigate effective active treatment strategies for improving cervical function. [6]

Conventional neck exercise programmes commonly include cervical range-of-motion exercises, stretching, deep cervical flexor exercises such as chin-tucks, cervical strengthening through isometric exercises and scapular stabilization exercises. These exercises are directed towards improving cervical muscle strength and endurance, postural control and functional cervical movement. [7,8] A randomized controlled study reported that craniocervical flexion and isometric neck exercises can improve cervical muscle performance and clinical outcomes in patients with chronic neck pain. [7] Scapular stabilization and deep cervical flexor exercises have also been used as components of conventional exercise programmes for patients with chronic nonspecific neck pain. [8]

Cervical spine self-mobilisation is an active approach in which patients perform controlled cervical movements, sometimes with the assistance of a towel, strap or mobilisation belt. It promotes active patient participation and repeated cervical movement and may help improve cervical mobility and reduce functional limitations. Recent evidence by Sun et al. (2024) showed that exercise combined with cervical or cervicothoracic self-mobilisation improved selected cervical range-of-motion outcomes and quality of life compared with exercise alone. [9] However, self-mobilisation in this study was used in addition to exercise, rather than being compared independently with a conventional exercise programme. [9]

➤ *Need of the Study*

Chronic nonspecific neck pain (CNSNP) is a common musculoskeletal condition associated with pain, restricted cervical range of motion and functional disability, affecting daily and work-related activities. Therefore, physiotherapy aims to reduce pain and improve cervical mobility and functional ability.

Cervical spine self-mobilisation is an active approach that involves controlled cervical movements and may promote active participation, movement practice and self-management, thereby improving cervical mobility and function. Although recent studies have reported benefits when self-mobilisation is added to exercise, the available literature has predominantly investigated it as a combined or adjunct intervention rather than as a standalone intervention. Therefore, its specific effect cannot be clearly established. Moreover, limited direct evidence exists comparing standalone cervical spine self-mobilisation with conventional exercise in patients with CNSNP. Thus, it remains unclear whether self-mobilisation alone can provide comparable or greater improvements in cervical range of motion and functional disability.

In clinical practice, maintaining participation over a prolonged treatment period may be challenging because of time constraints, work or academic responsibilities, travel, and other daily commitments, which may influence treatment adherence and completion. Therefore, Evaluating a shorter treatment duration may provide clinically useful information regarding the early response to treatment while reducing the overall time commitment for patients. Hence, the present study is conducted to assess the short-term effects of adding cervical self-mobilisation to conventional exercises over 4 weeks, compared with conventional exercises alone, on pain, cervical range of motion, and functional disability in individuals with chronic non-specific neck pain.

II. MATERIALS AND METHODS

A comparative study was conducted on 40 participants with chronic nonspecific neck pain. Participants were divided into two groups, with Group A receiving cervical spine self-mobilisation and Group B receiving conventional exercises. Pain, cervical range of motion, and functional disability were assessed before and after the intervention using VAS, cervical ROM measurement, and Neck Disability Index (NDI), respectively. Data were analysed using appropriate statistical tests, with the level of significance set at $p < 0.05$.

➤ *Selection Criteria*

• *Inclusion Criteria*

- ✓ A history of chronic neck pain lasting at least 3 months localized to the back of the head and neck
- ✓ AGE – 18 -35
- ✓ NPRS pain score ≥ 3
- ✓ No treatment received within the past month
- ✓ Willingness to sign an informed consent form.

- **Exclusion Criteria**

- ✓ A history of trauma or surgery to the head, neck, or other spinal segments
- ✓ Severe cervical spondylotic radiculopathy, cervical spondylosis affecting the spinal cord, or cervical spondylosis affecting the vertebral artery.

- ✓ Presence of conditions such as osteoporosis, cervical tuberculosis, or tumors.
- ✓ Cardiovascular or thoracic lung disease that could affect pulmonary ventilation and air exchange.

- **Concert Chart**

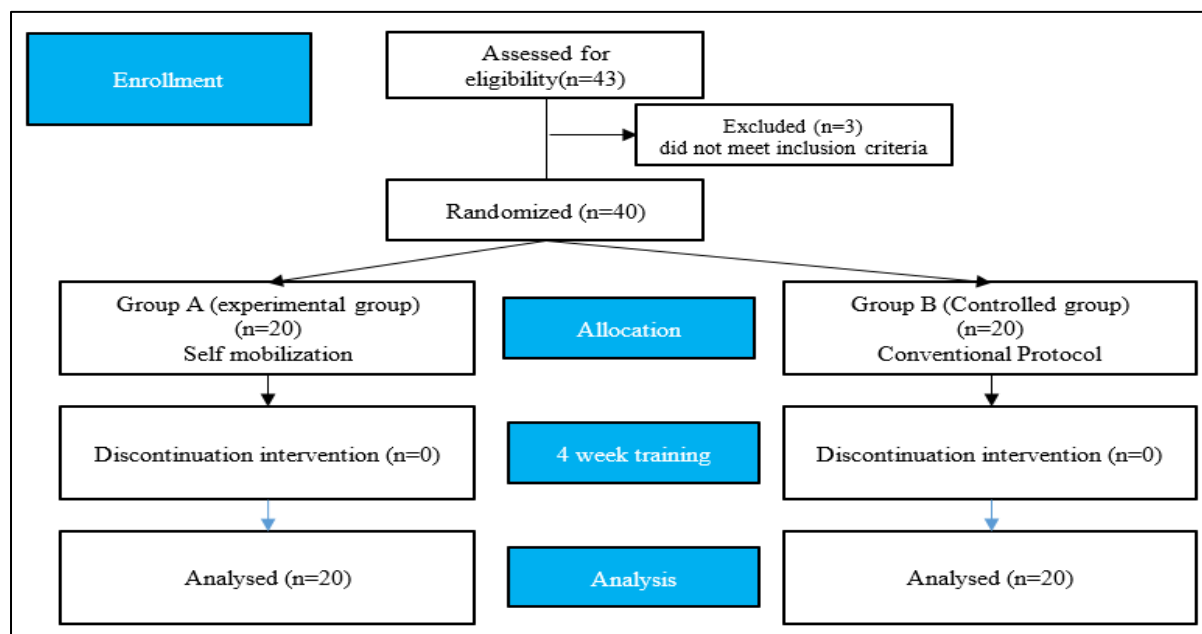


Fig 1 Concert Chart

➤ **Outcome Measures**

Each of the 2 groups was evaluated by the same evaluator. Pain, six-way cervical ROM, cervical dysfunction, were assessed before and after the 4-week intervention.

- **NPRS:**

Pain reported by the participants on the day of the measurement was recorded using NPRS. The participants were instructed to select a number between 0 (no pain) and 10 (unbearable pain) that corresponds to the level of pain. The test-retest reliability and validity of NPRS were ICC=0.61-0.77 and ICC=0.85, respectively. ^[10]

- **Cervical ROM:**

By universal goniometer-^[11] The participant is seated comfortably in an upright position with the back supported and feet flat on the floor. The head and trunk are aligned in a neutral position. A universal goniometer is used for the measurement.

- ✓ **Cervical Flexion:**

Sitting with trunk well supported, neck in anatomical position, hand placed on lap, shoulder relaxed. Axis of goniometer placed over external auditory meatus, stationary arm is aligned perpendicular to the floor, moving arm is aligned with the base of the nares. The participant is then instructed to bend the head forward, bringing the chin toward the chest.

- ✓ **Cervical Extension:**

Sitting with trunk well supported, neck in anatomical position, hand placed on lap, shoulder relaxed. Axis of goniometer placed over external auditory meatus, stationary arm is aligned perpendicular to the floor, moving arm is aligned with the base of the nares. The participant is then instructed to tilt the head backward.

- ✓ **Cervical Lateral Flexion:**

Sitting with trunk well supported, neck in anatomical position, hand placed on lap, shoulder relaxed. Axis of goniometer placed over C7 spinous process. Stationary arm is aligned perpendicular to the floor, moving arm is aligned over external occipital protuberance of the occipital bone. The participant is instructed to tilt the head toward the shoulder without rotating the head or elevating the shoulder.

- ✓ **Cervical Rotation:**

Sitting with trunk well supported, neck in anatomical position, hand placed on lap, shoulder relaxed. Axis of goniometer placed over the centre of the cranial aspect of the head. Stationary arm placed in line with acromion process of the side measured. Moving arm is aligned with tip of the nose. The participant is instructed to rotate the head to the right and left as far as possible without trunk movement. ⁽²⁵⁾

- **NDI:**

The NDI measures disability in the neck. The NDI is a

self-report instrument for assessing disability in subjects with neck pain (cervical spine dysfunction index = total score of each item/number of items completed by the subject $\times 5 \times 100\%$)25. The intraclass correlation coefficient ($r = 0.92$) and the evaluation method of criterion reliability by internal consistency and Cronbach's alpha coefficient ($\alpha = 0.96$) demonstrated a high degree of reliability.^[13]

Participants will be explained about the NDI questionnaire and instructed to select one statement per section that best describes their condition. Each item is scored from 0 to 5, and the total score is expressed as a percentage (total possible score, 100%), with higher scores corresponding to greater disability.⁽¹²⁾

✓ Interpretation of NDI:

- 4 points (0-8%) no disability
- 5-14points (10 – 28%) mild disability
- 15-24points (30-48%) moderate disability
- 25-34points (50- 64%) severe disability
- Above 34 points (70- 100%) complete disability

➤ Procedure

➤ Self-Mobilisation Exercises

• Self-Mobilisation Exercises (Group -A)

In this group, self-mobilization training for the cervical spine was given as follows: ⁽¹⁴⁾

✓ Cervical Spine Rotation:

Taking right rotation as an example, participants used a cervical self-mobilization band(Towel) positioned over the spinous processes of the affected cervical vertebrae. Both hands held the ends of the band (Towel), with the left elbow supported against the back of a chair to limit upper back movement. As the neck rotated to the right, the right hand pulled the band in alignment with the facet joint plane of the cervical spine. At the end of the motion, gentle pressure will applied to the facet joint surface without inducing pain.

✓ Cervical Extension:

A folded band (Towel) will placed over the spinous process of the affected cervical segment. Participants then pulled both ends of the band upward, guiding it along the treatment plane of posterior cervical extension. This facilitated vertebral gliding and promoted increased joint mobility.

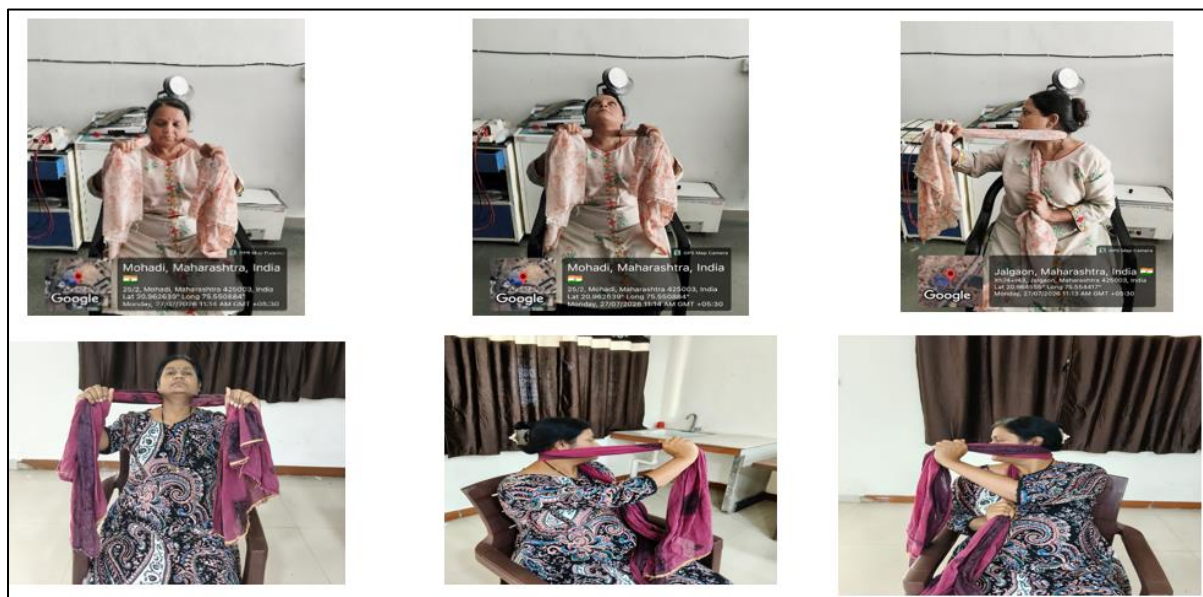


Fig 2 Self-Mobilisation Exercises
6-10 Reps (3 sets)

➤ Conventional Exercises (Group B)

Before starting the specific treatment, participants in both groups underwent a conventional PT intervention using a hydrocollator hot pack applied to the posterior neck area while lying in a supine position.

• Chin Tuck Exercise ^[15]

✓ Procedure:

- Sit/stand straight.

- Gently pull chin backward to make a “double chin.”
- Keep head level—move straight back, not up/down.
- Breathe normally.

✓ Hold Time: Hold 5–10 seconds.

✓ Relaxation: Slowly release to neutral position and relax for 3–5 seconds.

✓ Repetitions: 10 reps $\times$ 2–3 sets daily.



Fig 3 Chin Tuck Exercise

➤ *Isometric Exercises:*

Cervical flexion: Lean the neck slightly forward, place palm of both hands on forehead and push the head towards

the hands while resisting the movement with hands.

Cervical extension: Keep the neck straight, put palm of both hands behind the head, push the head backwards the hands while resisting the movement with hands.

Right Lateral Flexion: Keep the neck straight, put palm of right hand on right side of the head, push the head towards the hand to bring head down to the right shoulder while pushing the hand vice versa.

Left Lateral Flexion: Keep the neck straight, put palm of left hand on left side of the head, push the head towards the hand to bring head down to the left shoulder while pushing the hand vice versa.

Right Rotation: Put palm of right hand on right side of face, rotate the head slightly to the right while resisting the movement with hand. Left Rotation: Put palm of left hand on left side of face, rotate the head slightly to the left while resisting the movement with hand. ^[16]

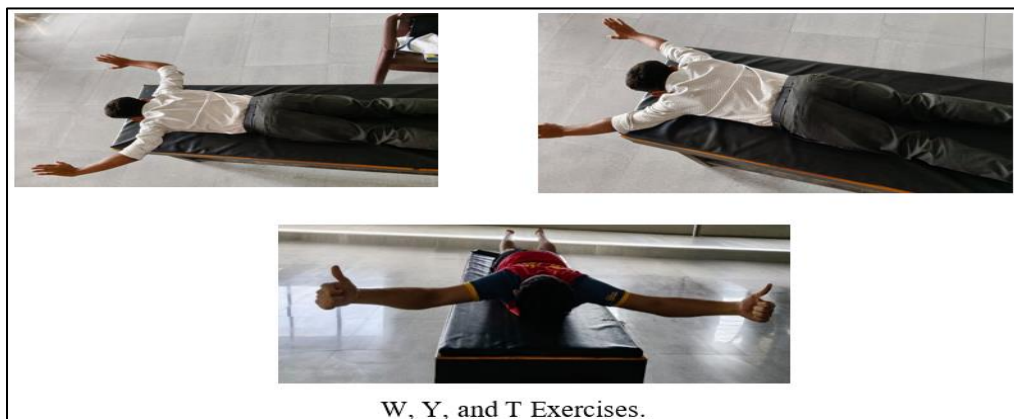


Fig 4 Isometric Exercises

Each contraction was held progressively for 3, 5, 7, and 10s, with each duration repeated 10 times per session. A 30-s gap was provided between consecutive contractions. The exercises were performed once daily, 3 days a week, for a total of 4week.

The scapular stability exercise program will conducted as follows : participants lay in a prone position with their head positioned beyond the edge of the bed and arms extended to create W, Y, and T shapes. ^[17]

- W movement: The shoulders will abducted to 90°, elbows flexed to 90°, and the arms will raised and lowildd slowly.
- Y movement: The shoulders will elevated to approximately 130°, elbows kept straight, and the arms will swung in a controlled motion.
- T movement: The shoulders will abducted to 90°, elbows straightened, and the arms will lifted and lowildd slowly.



W, Y, and T Exercises.

Fig 5 W, Y, and T Exercises.

During the first three weeks, each exercise will be performed in two sets of 15 repetitions, three times per week. In the subsequent three weeks, the exercises will progress to 30 repetitions per set.

➤ *Statistical Method Used:*

The entire data of the study was entered and organized in Microsoft Excel before being statistically analysed.

- All the results were presented in tabular as well as graphical formats to clearly visualize the differences between and within the study groups.
- The quantitative data were presented as Mean $\pm$ Standard Deviation (SD) wherever applicable.
- The Shapiro-Wilk test was used to assess the normality of the data.
- For within-group pre-test and post-test comparison, the Paired t-test was used for normally distributed data, while the Wilcoxon signed-rank test was used for non-normally distributed data.
- For between-group comparison of Group A (Self-Mobilization) and Group B (Conventional Protocol), the

Independent/Unpaired t-test was used for normally distributed data, while the Mann-Whitney U test was used for non-normally distributed data.

- The level of statistical significance was set at $\alpha = 0.05$, with a two-tailed test.
- The data were statistically analysed using Python software with SciPy, NumPy and pandas libraries.

III. RESULTS

Both groups were comparable at baseline in terms of age (Group A: 26.2 ± 4.8 years; Group B: 26.7 ± 5.3 years; $p = 0.828$), gender distribution (Group A: 9M/11F; Group B: 8M/12F), and all primary outcome measures ($p > 0.05$ for 7 of 8 variables). The minor statistical difference noted in cervical extension ROM at baseline is clinically negligible and, if anything, slightly favoured Group B at the outset. Any post-intervention differences observed between groups therefore reflect genuine treatment effects rather than pre-existing group differences.

Table 1 Age Distribution

Characteristic	Group A (Self-Mobilization)	Group B (Conventional)	p-value
n	20	20	—
Age (years), Mean $\pm$ SD	26.2 ± 4.8	26.7 ± 5.3	0.828
Age range	19–35 years	18–35 years	—
Gender (Male / Female)	9 / 11	8 / 12	—

➤ *Age Distribution*

- GROUP A: Age distribution 19-35 yrs
- GROUP B: Age distribution 18-35 yrs

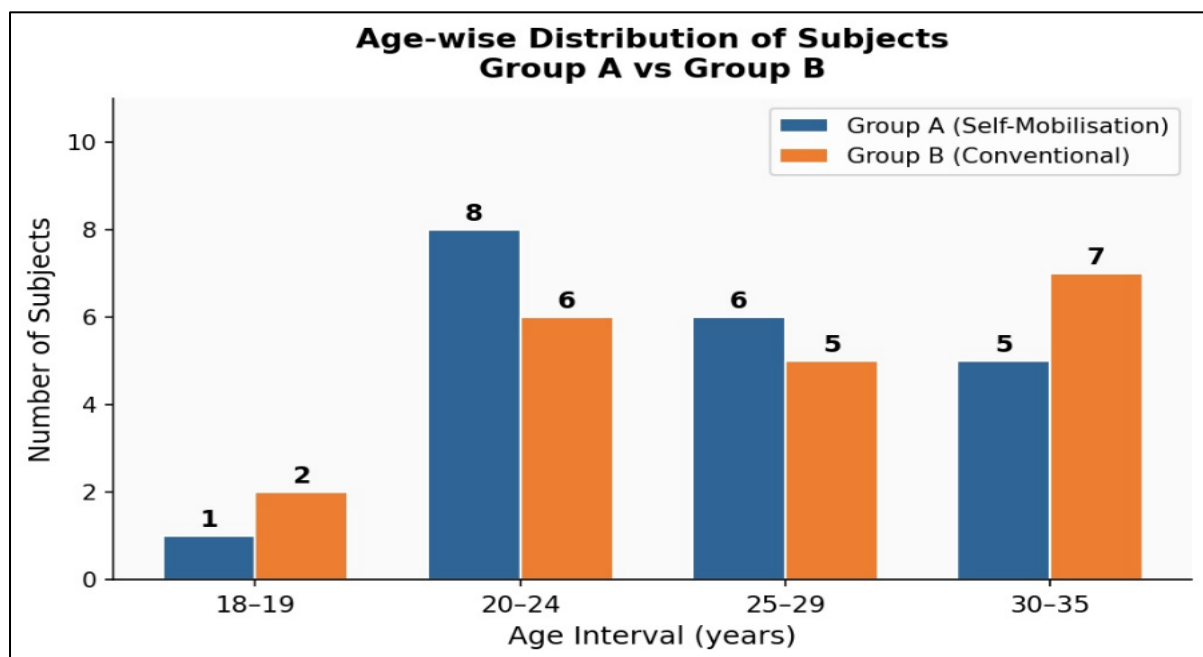


Fig 6 Age Wise Distribution of Subjects

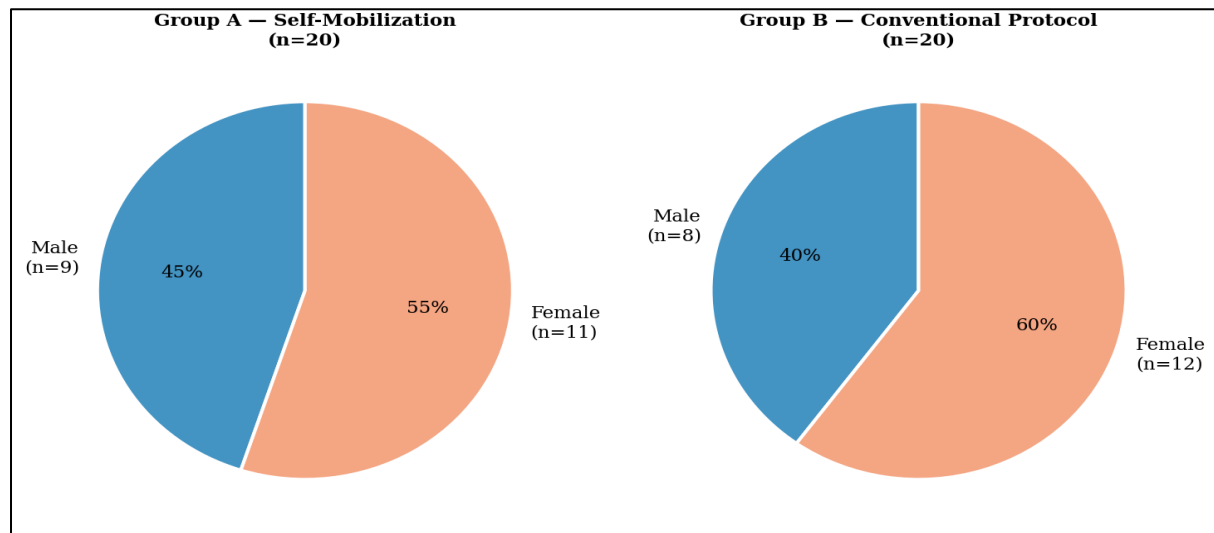


Fig 7 Gender Distribution by Group

Group A: 9 males (45%) / 11 females (55%). Group B: 8 males (40%) / 12 females (60%).

➤ Normality Testing (Shapiro-Wilk)

All normality decisions were based on the difference scores (Post – Pre), which is the appropriate distribution to test for paired comparisons. A Shapiro-Wilk test p-value ≥ 0.05 was taken as evidence of normality.

Table 2 Shapiro-Wilk Normality Test Results (Change Scores)

Variable	Group A W	Group A p	Normal?	Group B W	Group B p	Normal?
NPRS	0.855	0.006	No	0.728	<0.001	No
Cervical Flexion ROM	0.928	0.142	Yes	0.866	0.010	No
Cervical Extension ROM	0.930	0.152	Yes	0.627	<0.001	No
Left Lateral Flexion ROM	0.931	0.162	Yes	0.803	0.001	No
Right Lateral Flexion ROM	0.907	0.056	Yes	0.902	0.044	No
Left Rotation ROM	0.961	0.572	Yes	0.869	0.011	No
Right Rotation ROM	0.949	0.347	Yes	0.873	0.013	No
NDI (%)	0.815	0.001	No	0.926	0.132	Yes

Where change scores deviated from normality ($p < 0.05$), non-parametric Wilcoxon signed-rank tests were applied. Paired t-tests were used only where change scores satisfied normality.

Shapiro-Wilk tests applied to the difference scores (Post – Pre) revealed that NPRS and NDI change scores in Group A were non-normally distributed ($p < 0.05$), as were all ROM change scores and NPRS in Group B. Consequently, a mixed analytical strategy was employed: paired t-tests for within-group comparisons where change scores were normally

distributed, and Wilcoxon signed-rank tests otherwise. All between-group comparisons used the Mann-Whitney U test, as parametric assumptions could not be uniformly satisfied across both groups simultaneously for any variable.

➤ Group A — Within-Group Analysis (Self-Mobilization)

Group A comprised 20 participants who received a cervical spine self-mobilization (SNAG) protocol. Pre- and post-intervention measurements were compared for all eight outcome variables using the appropriate statistical test as determined by the Shapiro-Wilk normality assessment.

Table 3 Group A Descriptive Statistics

Variable	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	Mean Change $\pm$ SD
NPRS (0–10)	6.50 $\pm$ 1.40	3.95 $\pm$ 1.10	–2.55 $\pm$ 0.76
Cervical Flexion ROM (°)	36.45 $\pm$ 3.46	42.20 $\pm$ 2.26	+5.75 $\pm$ 2.47
Cervical Extension ROM (°)	34.65 $\pm$ 2.98	41.90 $\pm$ 2.22	+7.25 $\pm$ 2.10
Left Lateral Flexion ROM (°)	36.70 $\pm$ 3.67	42.55 $\pm$ 2.06	+5.85 $\pm$ 2.06
Right Lateral Flexion ROM (°)	36.55 $\pm$ 2.80	42.55 $\pm$ 2.06	+6.00 $\pm$ 2.05
Left Rotation ROM (°)	65.95 $\pm$ 5.59	77.20 $\pm$ 2.75	+11.25 $\pm$ 4.09
Right Rotation ROM (°)	65.90 $\pm$ 3.48	77.10 $\pm$ 2.15	+11.20 $\pm$ 2.97
NDI (%)	48.30 $\pm$ 5.93	27.65 $\pm$ 2.11	–20.65 $\pm$ 5.82

Table 4 Group A Statistical Test Results

Variable	GROUP A (Self Mobilization)			
	Test	Statistic	p-value	Significance
NPRS	Wilcoxon	0	<0.001	***
Cervical Flexion ROM	Paired t-test	-10.4184	<0.001	***
Cervical Extension ROM	Paired t-test	-15.4432	<0.001	***
Left Lateral Flexion ROM	Paired t-test	-12.7062	<0.001	***
Right Lateral Flexion ROM	Paired t-test	-13.0767	<0.001	***
Left Rotation ROM	Paired t-test	-12.3027	<0.001	***
Right Rotation ROM	Paired t-test	-16.8846	<0.001	***
NDI (%)	Wilcoxon	0	<0.001	***

➤ *Interpretation — Group A*

All eight outcome variables demonstrated statistically highly significant improvements following the self-mobilization intervention (all $p < 0.001$). Effect sizes were uniformly large (Cohen's d ranging from 2.330 to 3.776; $r = 0.877$ for non-parametric outcomes), confirming that the treatment effects were clinically important. The mean NPRS reduction of 2.55 points exceeded the MCID of 2.0, indicating clinically relevant pain relief. Cervical ROM improved across all six planes, with the greatest absolute gains in rotation (left: $+11.25^\circ$; right: $+11.20^\circ$). NDI declined by 20.65 percentage points, shifting the group mean from the

moderate disability category (40–54%) to the mild disability category (10–28%), representing a substantial functional improvement.

➤ *Group B — Within-Group Analysis (Conventional Protocol)*

Group B comprised 20 participants who received a conventional physiotherapy protocol. The same analysis procedure was applied, with test selection guided by the Shapiro-Wilk normality results for Group B difference scores.

Table 5 Group B Descriptive Statistics

Variable	Pre Mean $\pm$ SD	Post Mean $\pm$ SD	Mean Change $\pm$ SD
NPRS (0–10)	6.65 $\pm$ 1.23	5.75 $\pm$ 1.21	-0.90 $\pm$ 0.55
Cervical Flexion ROM ($^\circ$)	35.50 $\pm$ 3.22	38.80 $\pm$ 2.40	+3.30 $\pm$ 2.54
Cervical Extension ROM ($^\circ$)	36.55 $\pm$ 2.80	38.80 $\pm$ 3.25	+2.25 $\pm$ 2.57
Left Lateral Flexion ROM ($^\circ$)	34.65 $\pm$ 2.98	36.55 $\pm$ 2.84	+1.90 $\pm$ 1.29
Right Lateral Flexion ROM ($^\circ$)	36.20 $\pm$ 3.37	37.60 $\pm$ 2.72	+1.40 $\pm$ 1.14
Left Rotation ROM ($^\circ$)	67.00 $\pm$ 3.83	68.60 $\pm$ 4.11	+1.60 $\pm$ 1.05
Right Rotation ROM ($^\circ$)	67.85 $\pm$ 4.51	69.05 $\pm$ 4.65	+1.20 $\pm$ 0.83
NDI (%)	49.25 $\pm$ 3.42	42.20 $\pm$ 4.09	-7.05 $\pm$ 3.10

Table 6 Group B Statistical Test Results

Variable	GROUP B (Conventional Protocol)			
	Test	Statistic	p-value	Significance
NPRS	Wilcoxon	0	<0.001	***
Cervical Flexion ROM	Wilcoxon	0	<0.001	***
Cervical Extension ROM	Wilcoxon	0	<0.001	***
Left Lateral Flexion ROM	Wilcoxon	10.5	<0.001	***
Right Lateral Flexion ROM	Wilcoxon	0	<0.001	***
Left Rotation ROM	Wilcoxon	0	<0.001	***
Right Rotation ROM	Wilcoxon	0	<0.001	***
NDI (%)	Paired t-test	10.1605	<0.001	***

➤ *Interpretation — Group B*

All eight outcome variables demonstrated statistically significant improvements following the conventional physiotherapy protocol (all $p < 0.001$), with large effect sizes throughout, confirming that conventional physiotherapy is effective for chronic nonspecific neck pain. However, the absolute magnitude of improvement was substantially smaller than Group A across all variables. The NPRS reduction of 0.90 points did not reach the MCID threshold of 2.0, suggesting the change may not represent a perceptible clinical benefit. ROM gains were modest (1.20° to 3.30°).

NDI declined by 7.05 percentage points; however, participants remained in the moderate disability category post-intervention (mean NDI 42.20%), indicating incomplete functional recovery.

➤ *Between-Group Comparison (Change Scores)*

To determine whether self-mobilization produced superior outcomes compared to conventional physiotherapy, the change scores (Post – Pre) of both groups were compared using the Mann-Whitney U test for all eight outcome variables. This non-parametric test was selected because

normality could not be uniformly satisfied in both groups' change score distributions for any single variable.

Baseline comparability note: Baseline values were comparable between groups on seven of eight variables ($p > 0.05$). A minor statistically significant difference was noted

in cervical extension ROM at baseline (Group A: 34.65° ; Group B: 36.55° ; $p = 0.033$); however, this 1.9° difference is clinically negligible and Group B actually began with a slightly higher extension ROM, meaning any post-intervention advantages observed for Group A cannot be attributed to a lower starting value.

Table 7 Between-Group Comparison of Change Scores (Mann-Whitney U)

Variable	Group A Mean Change	Group B Mean Change	U Statistic	p-value	Significance
NPRS	-2.55 ± 0.76	-0.90 ± 0.55	18.00	<0.001	***
Cervical Flexion ROM ($^\circ$)	$+5.75 \pm 2.47$	$+3.30 \pm 2.54$	312.00	0.002	**
Cervical Extension ROM ($^\circ$)	$+7.25 \pm 2.10$	$+2.25 \pm 2.57$	378.00	<0.001	***
Left Lat. Flexion ROM ($^\circ$)	$+5.85 \pm 2.06$	$+1.90 \pm 1.29$	382.50	<0.001	***
Right Lat. Flexion ROM ($^\circ$)	$+6.00 \pm 2.05$	$+1.40 \pm 1.14$	387.00	<0.001	***
Left Rotation ROM ($^\circ$)	$+11.25 \pm 4.09$	$+1.60 \pm 1.05$	398.00	<0.001	***
Right Rotation ROM ($^\circ$)	$+11.20 \pm 2.97$	$+1.20 \pm 0.83$	400.00	<0.001	***
NDI (%)	-20.65 ± 5.82	-7.05 ± 3.10	20.00	<0.001	***

*** $p < 0.001$; ** $p < 0.01$. Significance threshold: $\alpha = 0.05$ (two-tailed).

All eight between-group comparisons were statistically significant ($p \leq 0.002$), with Group A demonstrating significantly greater improvements than Group B on every outcome variable. Effect sizes were large for seven of eight variables ($r = 0.761$ to 0.855), and moderate-to-large for cervical flexion ROM ($r = 0.479$). The greatest between-group differences were observed in cervical rotation ROM, where Group A produced approximately 7.0 times greater

improvement in left rotation and 9.3 times greater improvement in right rotation.

• Pain (NPRS):

Group A reduced pain by 2.55 ± 0.76 points versus 0.90 ± 0.55 points in Group B ($U = 18.00$, $p < 0.001$, $r = 0.778$). Self-mobilization provided approximately 2.8 times greater pain relief. Group A's reduction exceeded the MCID of 2.0 points; Group B's did not.

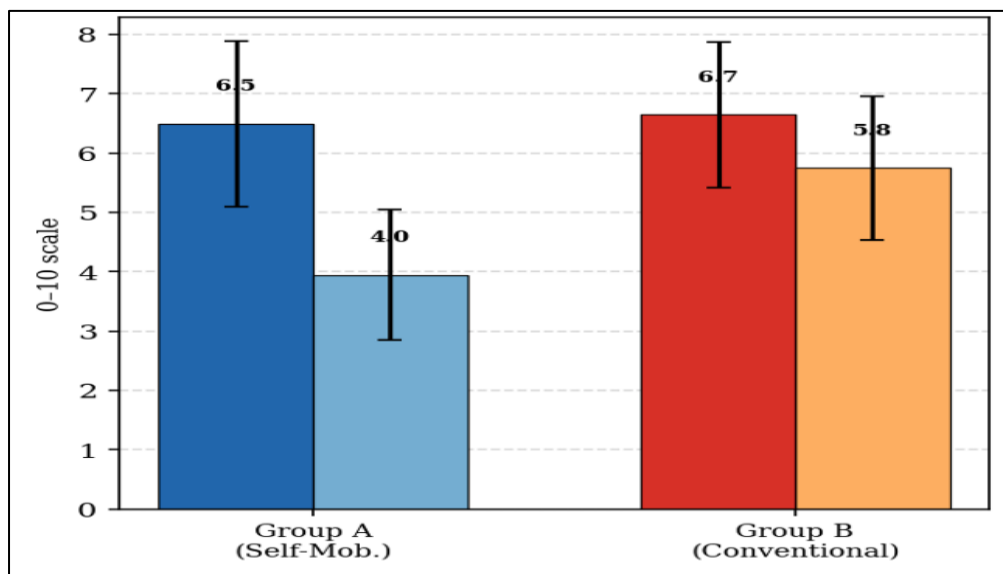


Fig 8 Pain (NPRS)

➤ ROM:

- Cervical Flexion: Group A improved by $5.75 \pm 2.47^\circ$, compared with $3.30 \pm 2.54^\circ$ in Group B. The difference was statistically significant ($p = 0.002$), with a moderate effect size.
- Cervical Extension: Group A improved by $7.25 \pm 2.10^\circ$, while Group B improved by $2.25 \pm 2.57^\circ$. Group A showed significantly greater improvement ($p < 0.001$).

- Left Lateral Flexion: Group A improved by 5.85° , compared with 1.90° in Group B ($p < 0.001$).
- Right Lateral Flexion: Group A improved by 6.00° , compared with 1.40° in Group B ($p < 0.001$).
- Left Rotation: Group A improved by 11.25° , compared with 1.60° in Group B ($p < 0.001$).
- Right Rotation: Group A improved by 11.20° , compared with 1.20° in Group B ($p < 0.001$), showing the greatest difference between groups.

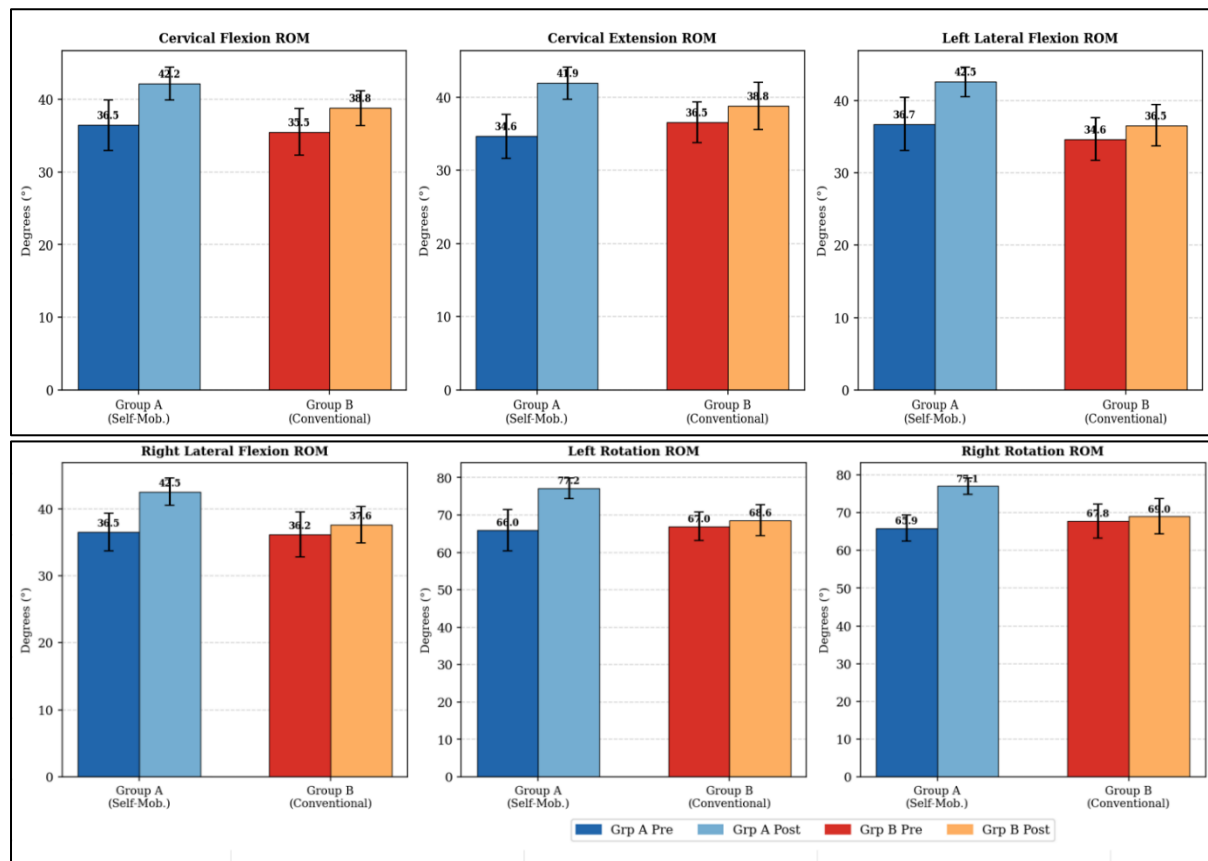


Fig 9 Range of Motion (ROM)

✓ Neck Disability Index:

Group A reduced NDI by $20.65 \pm 5.82\%$ versus $7.05 \pm 3.10\%$ in Group B ($U = 20.00$, $p < 0.001$, $r = 0.770$). Group A transitioned from moderate to mild disability; Group B remained in the moderate disability range post-intervention (42.20%).

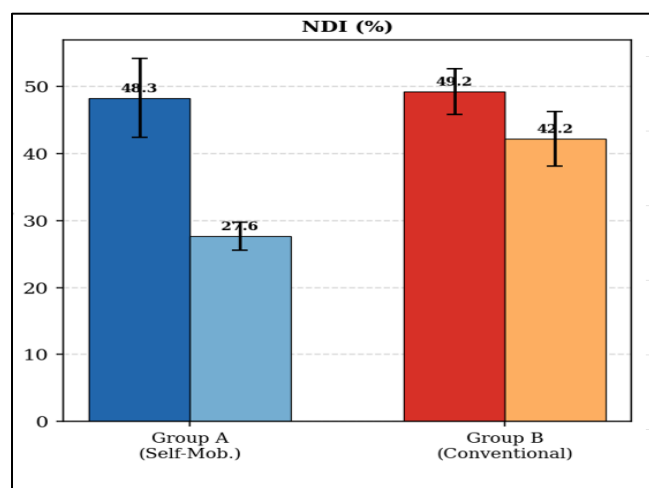


Fig 10 Neck Disability Index

IV. DISCUSSIONS

The present study demonstrated that both self-mobilization and conventional exercise interventions were effective in reducing pain, improving cervical range of motion and reducing neck disability in patients with chronic

nonspecific neck pain; however, the self-mobilization group demonstrated consistently greater improvement across all outcome measures. This finding is in agreement with Sun et al. (2024), who reported that adding cervical or cervicothoracic self-mobilization to exercise produced greater improvements in cervical extension, lateral flexion and rotation, while cervicothoracic self-mobilization also produced greater pain reduction than exercise alone. Their findings support the present observation that incorporating self-mobilization provides an additional therapeutic benefit beyond exercise alone.

Similar findings have been reported by Abbas et al. (2024), who compared cervicothoracic junction mobilization, muscle-energy techniques and conventional treatment in patients with chronic mechanical neck pain. Their study demonstrated improvements in pain, disability, cervical ROM and proprioception following interventions involving the cervicothoracic region, supporting the importance of addressing cervical and cervicothoracic joint mobility rather than relying exclusively on conventional exercise.

The greater improvement observed in the present self-mobilization group can be explained by several physiological and biomechanical mechanisms. Self-mobilization produces controlled accessory gliding of the cervical facet joints during active movement, which may improve arthrokinematic movement and reduce mechanical restriction. The technique also provides repeated sensory input from joint and surrounding soft-tissue mechanoreceptors, which may improve proprioceptive feedback and neuromuscular

coordination. The Sun et al. (2024) similarly proposed that localized joint gliding and appropriate pressure through the mobilization technique can reduce joint stiffness and improve coordination of the cervical musculature. Recent experimental evidence also supports this mechanism; Akbaba et al. (2025) found that mobilization-with-movement produced beneficial changes in pain, cervical ROM and cervical muscle stiffness in individuals with mechanical neck pain, suggesting that mobilization can influence both joint movement and surrounding muscular properties.

➤ *Effect on Pain*

The present study demonstrated a greater reduction in neck pain following self-mobilization compared with conventional exercise. This finding is supported by Sun et al. (2024), who reported that cervicothoracic self-mobilization combined with exercise produced superior pain improvement compared with exercise alone. Similarly, Akbaba et al. (2025) demonstrated that mobilization with movement produced beneficial effects on pain and cervical muscle stiffness compared with sham treatment, supporting the analgesic effect of cervical mobilization.

The reduction in pain may occur through both mechanical and neurophysiological mechanisms. Mobilization provides afferent stimulation to mechanoreceptors within the cervical joints and surrounding tissues, which may modulate nociceptive processing and increase the tolerance to movement. At the same time, restoration of normal joint movement may reduce abnormal mechanical loading of cervical structures. Reduced muscle stiffness and protective muscle activity may further decrease nociceptive input. The Sun et al. (2024) also proposed that mobilization may increase pain threshold and influence endogenous pain-inhibitory mechanisms. Thus, the greater pain reduction in the present self-mobilization group may reflect the combined effect of mechanical correction, sensory stimulation, reduction in muscular tension and improved movement confidence.

➤ *Cervical Range of Motion*

The present study showed greater improvement in all six directions of cervical ROM in the self-mobilization group, with particularly evident improvements in cervical rotation and lateral flexion. Rather than considering each direction separately, the overall improvement may be explained by restoration of cervical segmental mobility and reduction of muscular and joint stiffness. This finding is consistent with Sun et al. (2024), who found that the addition of self-mobilization to exercise produced greater improvement in extension, lateral flexion and rotation ROM than exercise alone. Their study further suggested that self-mobilization improves cervical mobility by promoting joint movement, reducing surrounding muscle stiffness and improving cervical–thoracic movement coordination.

The findings are also supported by Abbas et al. (2024), whose randomized controlled trial reported improvements in cervical ROM following cervicothoracic junction mobilization combined with conventional treatment. In addition, Seo et al. (2022) found that interventions directed

toward thoracic mobility, when combined with cervical mobilization and deep cervical flexor exercises, significantly improved cervical ROM in individuals with chronic nonspecific neck pain. These findings suggest that cervical movement is influenced not only by local cervical joint mobility but also by the mobility and mechanical interaction of the cervicothoracic region.

Physiologically, repeated self-mobilization may decrease abnormal mechanical stiffness and improve accessory joint movement, allowing greater physiological movement during active cervical motion. Reduction of excessive muscle guarding may further permit the cervical segments to move through a greater available range. In chronic neck pain, persistent pain and protective muscle activity can restrict normal movement; therefore, the combination of active movement with controlled mobilization may help break this cycle of pain, stiffness and restricted movement. The marked improvement in cervical ROM observed in the present self-mobilization group is therefore consistent with the proposed biomechanical and neuromuscular effects of mobilization.

➤ *Effect on Neck Disability*

The present study showed a greater improvement in Neck Disability Index in the self-mobilization group compared with the conventional group. This finding is consistent with the evidence reported by Wilhelm et al. (2023), whose systematic review and meta-analysis found that manual therapy combined with exercise was more effective than exercise alone for reducing disability in individuals with nonspecific neck pain. Likewise, Abbas et al. (2024) reported improvement in neck disability following cervicothoracic mobilization-based intervention, further supporting the role of mobilization in improving functional outcomes.

Improvement in disability is likely to be a consequence of the combined reduction in pain and restoration of cervical movement. As pain decreases, patients may experience less fear or avoidance of cervical movement and become more capable of performing activities involving sustained or repeated neck movements. Improved cervical ROM also allows daily activities such as looking up, turning the head, working and maintaining functional postures to be performed with less restriction. In addition, improved cervical neuromuscular coordination following repeated active mobilization may contribute to more efficient movement. Therefore, the greater reduction in disability in the self-mobilization group may represent a functional consequence of simultaneous improvements in pain, mobility and movement control.

➤ *Effect of Conventional Exercise Group*

The conventional exercise group also demonstrated significant improvement in pain, cervical ROM and neck disability. This indicates that conventional physiotherapy remains an effective intervention for chronic nonspecific neck pain and should not be considered ineffective simply because the self-mobilization group demonstrated greater improvement. Sun et al. (2024) reported that exercise

involving deep cervical flexor training and scapular stabilization significantly improved pain, cervical ROM, neck function and deep cervical flexor performance even without the addition of self-mobilization. Similarly, Wilhelm et al. (2023) concluded from their systematic review that exercise itself is beneficial, although the addition of manual therapy provides an additional advantage for pain and disability compared with exercise alone.

The improvement following conventional exercise can be physiologically explained by enhancement of deep cervical flexor function, improved cervical motor control and better stabilization of the cervical spine. Exercise may reduce excessive recruitment of superficial muscles and improve the coordination between the cervical and scapular musculature. The Sun et al. (2024) similarly reported that deep cervical flexor and scapular stabilization exercises can improve muscle strength and endurance and contribute to better cervical movement and function. Therefore, the significant improvement observed in the conventional group in the present study is physiologically plausible and supported by recent evidence.

However, the comparatively smaller improvement in the conventional group may be explained by the fact that exercise primarily targets muscle performance, endurance and motor control, whereas self-mobilization additionally provides a direct mechanical and sensory stimulus to the cervical joints. Thus, when both interventions are compared, self-mobilization may address both muscular and joint-related contributors to chronic nonspecific neck pain, which may explain its greater effect on pain, ROM and disability in the present study. This interpretation is also consistent with the systematic review by Wilhelm et al. (2023), which found that adding manual therapy to exercise generally produced greater improvements in pain and disability than exercise alone.

➤ Overall Interpretation

Overall, the findings of the present study suggest that both interventions are useful for chronic nonspecific neck pain, but self-mobilization provides an additional therapeutic advantage when incorporated into treatment. The improvement is likely not attributable to a single mechanism; rather, it may result from the interaction of improved cervical joint mobility, reduced muscle stiffness, enhanced sensory input, improved neuromuscular coordination, reduced pain sensitivity and better functional movement. The close agreement between the present findings and recent studies by Sun et al. (2024), Abbas et al. (2024), Akbaba et al. (2025), and Wilhelm et al. (2023) strengthens the interpretation that self-mobilization can be a clinically useful component of physiotherapy management for chronic nonspecific neck pain.

V. CONCLUSION

Cervical spine self-mobilization produced statistically significant and clinically superior improvements in pain intensity, cervical range of motion (all planes), and functional disability compared to conventional exercises in patients with

chronic nonspecific neck pain. These findings suggest that self-mobilization should be considered as a primary or adjunct intervention strategy in clinical practice for this patient population.

➤ Clinical Implications

The results support the clinical superiority of cervical spine self-mobilization over conventional exercises for improving ROM and reducing pain and disability in chronic nonspecific neck pain.

➤ Limitation

- The study had a small sample size of 40 participants.
- Long-term effects were not explored in this study, however chronic non-specific neck pain is chronic and prone to recurrence.

➤ Future Scope

- Future studies can include a larger number of participants.
- The effects of self-mobilisation can be studied for a longer period.

➤ Financial Support and Sponsorship

Nil.

➤ Conflicts of Interest

There are no conflicts of interest.

REFERENCES

- [1.] Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: a systematic critical review of the literature. *European spine journal*. 2006 Jun;15(6):834-48.
- [2.] Bhojraj SY, Bang AA, Deshmukh M, Kalkotwar S, Joshi VR, Yarmal T, Varma R, Kalkonde YV, Bang AT. Clinical patterns and their prevalence among adult population with back pain: A community-based cross-sectional study in rural Gadchiroli, India. *Journal of Global Health*. 2021 Nov 27;11:12004.
- [3.] Blanpied PR, Gross AR, Elliott JM, Devaney LL, Clewley D, Walton DM, Sparks C, Robertson EK, Altman RD, Beattie P, Boeglin E. Neck pain: revision 2017: clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy*. 2017 Jul;47(7):A1-83.
- [4.] Cohen SP. Epidemiology, diagnosis, and treatment of neck pain. In *Mayo Clinic Proceedings* 2015 Feb 1 (Vol. 90, No. 2, pp. 284-299). Elsevier.
- [5.] 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*. 2004 Oct 1;29(19):2108-14.
- [6.] Mueller J, Weinig J, Niederer D, Tenberg S, Mueller S. Resistance, motor control, and mindfulness-based

- exercises are effective for treating chronic nonspecific neck pain: a systematic review with meta-analysis and dose-response meta-regression. *Journal of orthopaedic & sports physical therapy*. 2023 Aug;53(8):420-59.
- [7.] Falla D, Jull G, Hodges PW. Training the cervical muscles with prescribed motor control exercises improves muscle performance and clinical outcomes in patients with chronic neck pain. *J Appl Physiol*. 2006;101(5):1426-1431.
- [8.] Aydoğmuş H, Şenocak Ö, Döner SM, Keskinoglu P. Investigation of the effectiveness of neck stabilization exercises in patients with chronic neck pain: A randomized, single-blind clinical, controlled study. *Turk J Phys Med Rehabil*. 2022 Aug 25;68(3):364-371. doi: 10.5606/tftrd.2022.8481. PMID: 36475101; PMCID: PMC9706793.
- [9.] Sun X, Chai L, Huang Q, Zhou H, Liu H. Effects of exercise combined with cervicothoracic spine self-mobilization on chronic non-specific neck pain. *Scientific reports*. 2024 Mar 4;14(1):5298.
- [10.] Kim WD, Shin D. Comparison of outcomes of physical therapy exercises combined with either a video-based smartphone application system or a written exercise program handout in 34 patients with non-specific neck pain. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*. 2024 Aug 31;30:e945349-1.
- [11.] Bharti N, Ahmed H, Hasan S, Iqbal A, Uddin S, Ahamed WM, Ahmad F, Mujtaba MA, Alghadir AH. Efficacy of scapular functional and cervical isometric exercises in the management of chronic mechanical neck pain: a randomized comparative trial. *Pain Research and Management*. 2024;2024(1):5873384.
- [12.] Zhang Y, Lin W, Yi M, Song J, Ding L. Effect of long-term cervical extensor exercise program on functional disability, pain intensity, range of motion, cervical muscle mass, and cervical curvature in young adult population with chronic non-specific neck pain: a randomized controlled trial. *Journal of Orthopaedic Surgery and Research*. 2024 Jan 3;19(1):9.
- [13.] Ceylan İ, Canlı M, Kuzu Ş, Ayhan DT, Gürses ÖA, Oyman BE, Alkan H, Doğan E. The effectiveness of two different treatment approaches in individuals with chronic non-specific neck pain: a randomized control trial. *Turk J Health S*. 2023 Aug;4(2):56-62.
- [14.] Kim Y, Beak HJ, Cho YH, Park W. Effects of Cervical Mobilization and Stabilization Exercises on the Cervical ROM, Muscle Function, and Neck Pain in Adults with Chronic Neck Pain. *Journal of The Korean Society of Living Environmental System*. 2025 Jun 30;32(3):295-304.
- [15.] Chiarotto A, Maxwell LJ, Ostelo RW, Boers M, Tugwell P, Terwee CB. Measurement properties of visual analogue scale, numeric rating scale, and pain severity subscale of the brief pain inventory in patients with low back pain: a systematic review. *The journal of pain*. 2019 Mar 1;20(3):245-63.
- [16.] Farooq MN, Bandpei MA, Ali M, Khan GA. Reliability of the universal goniometer for assessing active cervical range of motion in asymptomatic healthy persons. *Pakistan journal of medical sciences*. 2016 Mar;32(2):457.
- [17.] Vernon H. The Neck Disability Index: state-of-the-art, 1991-2008. *Journal of manipulative and physiological therapeutics*. 2008 Sep 1;31(7):491-502.
- [18.] Shin EJ, Lee BH. The effect of sustained natural apophyseal glides on headache, duration and cervical function in women with cervicogenic headache. *Journal of exercise rehabilitation*. 2014 Apr 30;10(2):131.
- [19.] Paquin JP, Tousignant-Laflamme Y, Dumas JP. Effects of SNAG mobilization combined with a self-SNAG home-exercise for the treatment of cervicogenic headache: a pilot study. *Journal of Manual & Manipulative Therapy*. 2021 Jul 4;29(4):244-54.
- [20.] Sadeghi A, Rostami M, Ameri S, Karimi Moghaddam A, Karimi Moghaddam Z, Zeraatchi A. Effectiveness of isometric exercises on disability and pain of cervical spondylosis: a randomized controlled trial. *BMC Sports Science, Medicine and Rehabilitation*. 2022 Jun 16;14(1):108.
- [21.] Blomgren J, Strandell E, Jull G, Vikman I, Røijezon U. Effects of deep cervical flexor training on impaired physiological functions associated with chronic neck pain: a systematic review. *BMC musculoskeletal disorders*. 2018 Nov 28;19(1):415.
- [22.] Wilhelm M, Cleland J, Carroll A, Marinch M, Imhoff M, Severini N, Donaldson M. The combined effects of manual therapy and exercise on pain and related disability for individuals with nonspecific neck pain: A systematic review with meta-analysis. *Journal of Manual & Manipulative Therapy*. 2023 Nov 2;31(6):393-407.
- [23.] Abbas HI, Kamel RM, Shafei AE, Mahmoud MA, Lasheen YR. Cervicothoracic junction mobilization versus autogenic muscle energy technique for chronic mechanical neck pain: A randomized controlled trial. *Journal of Manual & Manipulative Therapy*. 2025 Jan 2;33(1):36-46.
- [24.] Analay Akbaba Y, Özdemir AE, Bali K, Yalçın E. Immediate effects of mobilization with movement technique on cervical muscle stiffness, pain, and range of motion in individuals with mechanical neck pain: a double-blind randomized controlled trial. *Physiotherapy theory and practice*. 2025 Sep 2;41(9):1783-94.
- [25.] Seo J, Song C, Shin D. A single-center study comparing the effects of thoracic spine manipulation vs mobility exercises in 26 office workers with chronic neck pain: a randomized controlled clinical study. *Medical science monitor: international medical journal of experimental and clinical research*. 2022 Jul 8;28:e937316-1.