Galore International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Vol. 10; Issue: 3; July-Sept. 2025
Website: www.gijhsr.com
P-ISSN: 2456-9321
Original Research Article

Effectiveness of Manual Mobilization in the Management of Patients with Chronic Neck Pain

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DOI: https://doi.org/10.52403/gijhsr.20250307

ABSTRACT

Background and Objectives: Neck pain is prevalent across all age groups and it is the main reason for discomfort and disability in the neck. It is usually categorized into two categories: severe and persistent neck pain. Treatment options for pain over the neck include conservative management and manual mobilization techniques. Conventional physiotherapy interventions encompass a variety of exercises such as range of motion exercises (including passive, active-assisted, active, and isometric neck exercises), stretching exercises, hot packs, and ultrasound therapy. Conservative treatment often involves physical therapy interventions like electrotherapy, manual therapy, mobilization, and rehabilitation.

Despite the widespread use of manual mobilization techniques, there has been relatively little research conducted over time on their effectiveness for neck pain conditions. Among the various approaches to manual therapy, one of the most common and straightforward methods employed by physiotherapists is mobilization based on the Maitland concept. This study intends to assess how well manual mobilization works while treating chronic neck pain with a focus on maximizing range of motion, lowering disability, and enhancingpainallevation.

Need of study: The reason behind this research is to ascertain whether manual mobilization in conjunction with traditional physiotherapy yields greater results for patients with persistent neck discomfort than does traditional physiotherapy alone. Arthrokinematic oscillations or back- and-forth movements are applied to the afflicted areas during manual therapy, also known as hands-on mobilization, with the aim of improving range of motion, lowering stiffness, and easing discomfort. But because there are several schools of thinking in practice, there is a dearth of evidence.

Methods: Thirty individuals were selected at random and assigned to two groups: Fifteen individuals in the study where part of the conventional group was given standard physiotherapy, while the other fifteen in the experimental group received manual mobilization in addition to the standard physiotherapy. The Numerical Pain Rating Scale, Neck Disability Index, and Range of Motion were the outcome tools used for assessments both before and after treatment.

Results: Significant improvements were observed in both the experimental and conventional groups in all measured variables. However, while there were no notable differences within each group, a marked difference was observed when comparing the posttest results between the experimental and conventional groups.

Conclusion: For people with chronic neck discomfort, the manual mobilization approach is a useful therapeutic strategy for lowering pain, increasing range of movement, and easing neck impairment.

Keywords: manual mobilization, chronic neck pain, pain alleviation, range of motion, neck impairment.

INTRODUCTION

Musculoskeletal conditions rank as the second primary cause of years lived with disability worldwide. Among these, cervical pain is particularly prevalent, with an age-standardized lifetime prevalence of 66.7% and 12- month prevalence rates ranging from 20% to 40%. Individuals suffering from neck pain often exhibit impaired physical function, including neck muscle weakness. [1]

Patients with neck pain often struggle with daily activities due to neck muscle weakness, which significantly contributes to the development of forward head posture, associated deformities, and coordination impairments. [2] Chronic and mechanical neck discomfort are two different categories. Pain that has lasted more than three months is referred to as persistent neck pain, while mechanical neck pain is caused by damage to the cervical spinal neurons, joints, or muscles. [3]

The medical management of cervical pain usually includes the use of pain relievers such as NSAIDs or muscle relaxants, while surgical intervention is rarely required and is usually reserved for cases involving nerve root or spinal cord compression. Physical therapy techniques like application of electrical modalities, hands-on-technique, and therapeutic exercise are frequently administered as conservative treatment methods. [4] For short-term relief of severe neck discomfort, manual therapy - encompassing manipulation, mobilization, and rehabilitation is often recommended. However, research on the long-term effectiveness of this is limited; manual mobilization methods for treating neck pain. Among the various approaches to manual therapy, mobilizations based on the Maitland concept are arguably the most widely used and straight forward method employed by physiotherapists. [5]

The concept of Maitland mobilization was introduced by Geoffrey Douglas Maitland, the founder of Maitland Mobilization Techniques, in the 1960s. Maitland acknowledged that "pain is influenced by a variety of factors and manifests in many different ways." From a physiotherapy perspective, manual therapy is a crucial tool and a widely used treatment method for managing tissue, joint, and movement dysfunction.

Patients with varying limitations can benefit from mobilization grading by having their range of motion improved and pain alleviated. Clinical trials frequently employ this technique on spinal and vertebral joints, as it involves applying oscillations or to-and-fro motions to the targeted areas to reduce stiffness and enhance range of motion. Numerous researchers have also demonstrated that these techniques alleviate pain. Small-amplitude movements with little resistance are employed in Grade I mobilization to treat a variety of clinical disorders. Grade II mobilization is used to treat various disorders and entails motions with a larger amplitude while remaining pain-free. When resistance is perceived before the pain threshold is reached, grades I & II are utilized. In grades III & IV, oscillatory motions are used to reduce stiffness, relax contractures, and improve movement efficiency; Grade IV moves more quickly than Grades II and III. In Grade V, a thrust at a high speed is employed for manipulation. In addition to its other uses, the Maitland mobilization treatment technique is a stretching therapy that helps to avoid muscle spasms. [7] [8]

Upon reaching more than 60% of the optimal range of motion while still in pain, methods were commonly applied to improve movement range and pain reduction in the afflicted muscles as well as joints. In contrast to physiological movements, Maitland contends that pain reactions are "virtually always associated with non-physiological movements."[9]

The review of literature shows that numerous studies have examined the effectiveness of manual mobilization techniques in reducing discomfort and enhancing mobility (ROM).

Some research only examined Maitland Grades I and II, but other investigations centered on Grades III and IV.[10] However, detailed findings from these studies are limited, leaving some uncertainty about the application of these techniques. Therefore, the rationale for this study is to assess whether incorporating manual mobilization can enhance the effectiveness of conventional rehabilitation in managing persistent cervical pain. In this study, the effects of manual mobilization—more especially, the Maitland mobilization approach—on pain, disability, & range of motion are investigated among individuals who suffer from persistent cervical pain.

AIM OF THE STUDY

The study aims to evaluate the effectiveness of incorporating manual mobilization into the management of chronic neck pain, specifically to improve pain, disability, and range of motion.

OBJECTIVES

1) To determine whether manual mobilization is a useful tool for treating chronic cervical discomfort in terms of pain management.
2) To evaluate the impact of including manual mobilization in managing persistent cervical pain on reducing neck disability.
3) To determine if manual mobilization can be effective in improving range of motion in treatment of persistent neck pain.

MATERIALS & METHODS

MATERIALS USED:

*Documentation formats such as assessment chart, evaluation form, and consent letter.
*Couch for manual therapy.
*360-degree goniometer.

STUDY DESIGN:

Experimental study design with pre- and post-test analysis of outcome measures.

STUDY SETTING:

Study was conducted at: -
*Sree Narayana Medical Mission Hospital [X-ray], Cherthala.
*Indo-American Hospital, Chemmanakary & Vaikom.

STUDY DURATION:

One Year; [data collection was done from 03/10/2023 to 03/01/2024].

SAMPLE SIZE:

30 individuals who have had ongoing neck pain for three months or longer.

SAMPLING METHOD:

Convenience sampling method.

VARIABLES:

INDEPENDENT VARIABLE

*Manual mobilization

DEPENDENT VARIABLE

*Pain
*Neck disability
*Range of motion

INCLUSION CRITERIA:

*Age varying from 25 to 45.
*Men and women alike.
*Prolonged neck pain that lasts for at least three months.
*According to the Numerical Pain Rating Scale, the range of pain intensity is 2 to 7.

EXCLUSION CRITERIA:

Recognized Past of:
*Prior neck surgery.
*Fracture of the cervical spine
*Psychiatric problems.
*Malignant neoplasm.
*Osteoporosis.
*Arthritis.

*Signs of instability at cervical spine.

OUTCOME MEASURES:

***Numeric Pain Rating Scale [NPRS]**

The Numeric Pain Rating Scale (NPRS) is a one-dimensional tool used to measure pain intensity in patients, including those with chronic pain. It employs an 11-point scale, where '0' indicates no pain and '10' represents the worst pain imaginable.

***Neck Disability Index [NDI]**

A popular method for assessing self-reported disability brought on by neck pain is the Neck Disability Index (NDI). There is a maximum potential score of 50 and it comprises of 10 elements, each with a score between 0 and 5. To get the score as a percentage, just multiply the sum by two.

***ROM using Goniometer**

A goniometer is a tool used to measure the angle of a joint and is commonly used to assess range of motion (ROM). Degree readings from 0 to 360 are provided by goniometers. The forward, lateral, and rotational movements of the neck as well as variations in neck flexion will be measured with a 360-degree goniometer.

TREATMENT PROCEDURE

On basis of predetermined inclusion and exclusion criteria, thirty patients with neck pain that persisted for three months above were chosen for the study. Participants were either self- reported neck pain sufferers or hospital referrals from physicians; they were informed in great detail about the procedure and gave their consent on a consent form; finally, they were split into two groups at random using a lottery system.

Socioeconomic data were recorded prior to the study. Outcome measures, including NPRS, NDI, and ROM, were assessed on the first day. Pretest and posttest assessments were conducted before and after the treatment. The results were analyzed statistically and will be published.

EXPERIMENTAL GROUP

Manual mobilization technique [Maitland] along with conventional physiotherapy is administered to this group.

1. **Maitland Mobilization Technique.**

Maitland mobilization grades 3 and 4 for the cervical and upper spine significantly decrease Neck Disability Index (NDI) scores and pain levels, while improving the range of motion.

Principles of Maitland Mobilization Technique: -

- The force producing
- Type of glide
- The speed

Supine Lying Position

Patients were asked to lie supine position on a treatment couch without pillow. A towel was rolled and placed over the nape of neck region for stabilization and support. Patient were asked to breathe in and out while performing mobilization. Therapist applies to and fro oscillatory movement over C7 vertebrae. After mobilization, patient was asked to perform neck exercise.

Prone Lying Position

Patients were asked to lie prone position on a treatment couch without pillow. Towel was rolled and placed over the face region for support. Patients were asked to take breathe in and out while performing mobilization. Therapist applies to and fro oscillatory movement over C7 vertebrae with both thumbs. After mobilization, patient was asked to perform neck exercise.

*Set-1 set of mobilization per exercise.
*Duration- 30 seconds up to 1 minute.
*Frequency-2 Hz (120 movements per minute).
*Rhythm-oscillatory rhythm.
*Rest Interval-60 seconds.
*Progression up to 10% per week.
Total treatment duration for mobilization group was given for 6 weeks.

CONVENTIONAL GROUP
Conventional physiotherapy of the North American Spine Society Protocol was given to this group.
Conventional physiotherapy includes active neck exercises within the pain-free range which includes stretching exercises isometric neck exercises, range of motion, hot packs, and ultrasound therapy.

Active Neck Exercises:
Stretching exercises:
Upper Back Stretch:
The patient should reach toward the floor, look down at their hands, interlace their fingers in front of them, and sit or stand until a little upper back stretch is felt. After 30 seconds, hold this posture, then take a step back to start. Make sure to perform three repetitions of this stretch every day.
Ear to Shoulder Stretch:
The patient needs to be able to stand or sit. To feel a slight stretch, turn the ear gently in the direction of the shoulder. Return to the beginning position after maintaining this posture for 30 seconds. Every day, perform this stretch three times in total.
Pectoral Stretch:
Position yourself in a doorway with your hands placed on each side of the frame. For each of the three positions, take a small step forward into the doorway until you experience a mild stretch in the front of your shoulder. Repeat this stretch in each of the three positions: -
- Hands at hip level.
- Hands at shoulder level.
- Hands above shoulder level.

Hold it for 30 seconds. Perform this daily with a total of 3 repetitions.
Isometric neck exercises were performed for the flexors, extensors, rotators, and lateral flexors of the neck. The patient was instructed to contract the working muscle isometrically for 10 seconds against their hand, which was positioned in alignment with the working muscles. This process was repeated for a total of 10 repetitions.
Cervical Flexion:
Put your hand on your forehead and gently tilt your neck forward. Using your hand as resistance, try bending your head even further forward. For ten seconds, maintain this posture. Work out like this twice a day for ten reps in total.
Cervical Extension:
Place both hands on the back of head and maintain a straight neck. With your hands resisting, try to force your head backward. For ten seconds, maintain this posture. Work out twice a day for a total of ten repetitions of this activity.
Cervical Side Bending:
Maintain a straight head. Place right hand on right side of your head. With right hand resisting, try to lower head towards right shoulder. With left hand, perform the motion to the left side. Take ten seconds to hold each posture. Work out twice a day for ten reps on each side of the activity.
Cervical Rotation:
Tilt head slightly to right side, and place left hand at chin height. Place right hand on right side of face and, using your right hand as resistance, turn head to the right. Place left hand on your left side of your face and tilt your head to the left to repeat the

exercise on the left side. Perform this exercise twice a day, holding each posture for ten seconds, and doing ten reps on each side.

Range of motion exercises:

Cervical Extension:

Sit up straight, drawing your shoulder blades together and tucking your chin in slightly. While maintaining this chin tuck, look up towards the ceiling, stretching your head backward. Move as far as is comfortable, then return to the starting position. Perform this exercise twice daily, completing a total of 10 repetitions.

Cervical Flexion:

Pulling your shoulder blades together and tucking your chin in slightly will help you sit upright. Keep your chin tucked in and steadily tilt your head forward until your neck starts to lengthen. Proceed as far as feels comfortable, then take a step back to the beginning. Work out like this twice a day for ten reps in total.

Cervical Lateral Flexion:

Stretch your shoulders downward by keeping your head down and tilting head to the side so that left ear is moving towards left shoulder. Go as far as is comfortable, then come back to the starting position. Repeat this exercise twice a day for a total of ten repetitions. Sit up straight, squeeze your shoulder blades together, and tuck your chin in gently.

Cervical Rotation:

Sit up straight, with your shoulder blades pulled together and your chin gently tucked in. Grip the chair with both hands to keep your shoulders relaxed. Turn your head to look over your right shoulder, moving as far as comfortable. Then, return to the starting position. Perform this exercise twice daily, completing a total of 10 repetitions.

Hot packs were applied to the upper trapezius and neck muscles for 5 minutes after the treatment for pain relief.

Ultrasound therapy was applied to the neck area where tenderness and spasms were present, using a continuous mode to produce thermal effects. The treatment was administered at an intensity of 1.5W/cm^2 to 2 W/cm^2 for 7 minutes

*Duration: - 6 weeks

*Frequency: - 10 repetitions

*Treatment plan: - First 3 weeks the exercise was performed as department programme. Out of these 2 weeks programme was given on regular basis and the remaining 1-week programme were given on alternate basis. The next 2 weeks treatment was given as home programme and updates were taken through phone calls. The last 1week, the patient arrives at department for post assessment.

RESULT

This study aimed to assess the effectiveness of manual mobilization in alleviating pain, reducing neck disability, and enhancing the range of motion in patients with chronic neck pain.

STATISTICAL ANALYSIS

SPSS software (version 20) was used for statistical analysis. Descriptive statistics were employed to analyse demographic data. Paired t-tests were used for within-group comparisons, while unpaired t-tests were used for between-group comparisons. A p-value of less than 0.05 was considered significant for each outcome.

According to age distribution, patients aged between 30-35 years were more in experimental group (33.33%) when compared with other age groups between 25-40 years. In conventional group, patient aged between 40-45 years were more (33.33%).

In terms of gender distribution, the experimental group had a higher proportion of males compared to females (53.30%). Conversely, the conventional group had a higher proportion of females compared to males (60%).

According to occupational distribution, patients who were undergoing moderate working condition were more in experimental group (46.70%). Patients who were undergoing mild working condition were more in conventional group (60%).

Statistical analysis of pain (VAS) using t-test

The mean column displays the average pretest and posttest pain scores for individuals in the Experimental Group. SD denotes the standard deviations of these pain scores for the pre-test and post- test, respectively. The mean change of 3.13 reflects the difference between the pretest (6.4) and posttest (3.27) scores. With a p-value less than 0.001, there is a statistically significant reduction in pain from pretest to the posttest among individuals in the Experimental Group. This indicates a notable decrease in pain following the intervention, demonstrating the effectiveness of manual mobilization in reducing pain.

The mean column shows the average pre-test and post-test pain scores for individuals in the Conventional Group. SD indicates the standard deviations of these pain scores for the pre-test and post-test, respectively. The mean change of 2.47 reflects the difference between the pretest (6.8) and posttest (4.33) scores. With a p-value of less than 0.001, there is a statistically significant reduction in pain from pretest to posttest among individuals in the Conventional Group. This indicates a significant decrease in pain following the intervention, demonstrating the effectiveness of conventional exercises in reducing pain.

The Mean column in the t-test table displays the average pre-test pain scores for both the Experimental and Conventional Groups. The Standard Deviation column indicates the variability of scores within each group. The difference of 0.4 reflects the gap between the mean scores of the two groups (6.4 and 6.8). Since the p-value is greater than 0.05, there is no significant difference in pre- test pain scores between the Conventional and Experimental Groups, suggesting that the groups are homogeneous at baseline.

Mean, standard deviation, and t-value for comparing posttest pain (VAS) scores between the Experimental Group and Conventional Group using t test

Group	Posttest mean	S.D.	Difference in mean	n	t	*df*	*p-value*
Experimental	3.27	1.03	1.06	30	2.91	28	<0.01
Conventional	4.33	0.98					

Table 1: - A table comparing the posttest VAS scores between the experimental and conventional groups

The Mean column in the t-test table shows the average post-test pain scores for both the Experimental and Conventional Groups. The standard deviation column indicates the variability of the scores within each group. The difference of 1.06 represents the gap between the mean scores of the two groups (3.27 in the Experimental Group and 4.33 in the Conventional Group). With a p-value less than 0.01, there is a significant difference in post-test pain scores between the two groups, with the Experimental Group experiencing significantly lower pain levels. This suggests that incorporating manual mobilization is more effective in reducing pain.

Statistical Analysis of Neck Disability Using t-Test

The Mean column displays the average pretest and posttest neck disability scores for individuals in the Experimental Group. SD represents the standard deviations of these scores for both the pretest and posttest. The mean change of 9.53 reflects the difference between the pretest score of 25.6 and the posttest score of 16.07. With a p-value less than 0.001, there is a significant difference between the pretest and posttest neck disability scores in the Experimental Group. This significant decrease in neck disability following the intervention demonstrates the effectiveness of manual mobilization.

The Mean column displays the average pretest and posttest neck disability scores for individuals in the Conventional Group. SD indicates the standard deviations of these scores for both the pretest and posttest. The mean change of 6.67 represents the difference between the pretest score of 25.07 and the posttest score of 18.4. With a p-value less than 0.001, there is a significant difference between the pretest and posttest neck disability scores in the Conventional Group. This substantial decrease in neck disability following the intervention demonstrates the effectiveness of conventional exercises.

We have noted a significant reduction in neck disability for individuals in both the Experimental and Conventional Groups. Next, we will assess whether there was homogeneity in pretest neck disability scores between the Conventional and Experimental Groups and evaluate if manual mobilization is more effective by comparing the post-test neck disability scores between the two groups.

The mean column in the t-test table shows the average pretest neck disability scores for both the Experimental and Conventional Groups. The standard deviation column indicates the variability of these scores within each group. The difference of 0.53 represents the gap between the mean scores of the two groups (25.6 and 25.07). With a p-value greater than 0.05, there is no significant difference in pretest neck disability scores between the Experimental and Conventional Groups, indicating that the groups are homogeneous at baseline.

Mean, standard deviation, and t-value for comparing posttest neck disability scores between the Experimental and Conventional Groups using a t-test

Group	Post-test Mean	S.D.	Difference in mean	*N*	*t*	*df*	*p-value*
Experimental	16.07	2.58					
Conventional	18.4	2.82	2.33	30	2.36	28	*< 0.05*

Table 2: - Table comparing the posttest NDI scores between the Experimental and Conventional Groups

The Mean column in the t-test table displays the average post-test neck disability scores for both the Experimental and Conventional Groups. The standard deviation column reflects the variability of these scores within each group. The difference of 2.33 represents the gap between the mean scores of the two groups (16.07 for the Experimental Group and 18.4 for the Conventional Group). With a p-value less than 0.05, there is a significant difference in post-test neck disability scores between the two groups, with the Experimental Group showing notably lower levels of neck disability. This suggests that manual mobilization is more effective in reducing neck disability.

Statistical Analysis of Lateral Flexion Using a t-Test

The Mean column shows the average pretest and posttest lateral flexion scores for individuals in the Experimental Group. SD indicates the standard deviations of these scores for both the pre-test and post-test. The mean change of 8.8 represents the difference between the pretest score of 24.47 and the posttest score of 33.27. With a p-value less than 0.001, there is a significant difference between the pretest and posttest lateral flexion scores in the Experimental Group. The substantial increase in lateral flexion observed in the post-test demonstrates the effectiveness of manual mobilization.

The Mean column shows the average pretest and posttest lateral flexion scores for individuals in the Conventional Group. SD represents the standard deviations of these scores for both the pretest and posttest. The mean change of 5.86 reflects the difference between the pre-test (25.47) and post-test (31.33) scores. With a p-value less than 0.001, there is a significant difference in lateral flexion scores from pretest to post-test in the Conventional Group. This indicates a substantial increase in lateral flexion, demonstrating the effectiveness of conventional exercises.

We have observed a significant increase in lateral flexion in both the Experimental and Conventional Groups. Next, let's determine whether there was homogeneity in pretest lateral flexion scores between the Conventional and Experimental Groups. We will also assess whether manual mobilization is more effective by comparing post-test lateral flexion scores between the two groups.
The Mean column in the t-test table shows the average pretest lateral flexion scores for the Experimental and Conventional Groups. The standard deviation column provides the standard deviations of these scores for each group. The difference of 1.0 reflects the gap between the mean scores of the two groups (24.47 for the Experimental Group and 25.47 for the Conventional Group). With a p-value greater than 0.05, there is no significant difference in pretest lateral flexion scores between the two groups. Therefore, the groups can be considered homogenous at the baseline level.

Mean, standard deviation, and t-value for comparing posttest lateral flexion scores between the Experimental and Conventional Groups using a t-test

Group	Posttest Mean	S.D.	Difference in mean	*n*	*t*	*df*	*p-value*
Experimental	33.27	2.46	1.94	30	2.17	28	*< 0.05*
Conventional	31.33	2.41					

Table 3: - Table showing the comparison of post-test lateral flexion scores between the Experimental and Conventional Groups

The Mean column in the t-test table presents the average posttest lateral flexion scores for the Experimental and Conventional Groups. The standard deviation column indicates the variability of these scores within each group. The difference of 1.94 reflects the gap between the mean scores of the two groups (33.27 for the Experimental Group and 31.33 for the Conventional Group). With a p-value less than 0.05, there is a significant difference in posttest lateral flexion scores between the two groups, with
the Experimental Group showing significantly higher lateral flexion. This suggests that manual mobilization is more effective in improving lateral flexion.

Statistical Analysis of Flexion Using a t-Test

The Mean column shows the average pretest and posttest flexion scores for individuals in the Experimental Group. SD indicates the standard deviations of these scores for both pretest and posttest. The mean change of 5.2 reflects the difference between the pretest (81.93) and posttest (87.13) scores. With a p-value less than 0.001, there is a significant difference in flexion scores from pretest to posttest in the Experimental Group. This significant increase in flexion demonstrates the effectiveness of manual mobilization.
The Mean column displays the average pretest and posttest flexion scores for individuals in the Conventional Group. SD represents the standard deviations of these scores for both pretest and posttest. The mean change of 3.0 reflects the difference between the pretest (82.93) and posttest (85.93) scores. With a p-value less than 0.001, there is a significant difference between pretest and posttest flexion scores in the Conventional Group, indicating a notable increase in flexion. This demonstrates the effectiveness of conventional exercises on flexion.
We have observed a significant increase in flexion among individuals in both the Experimental and Conventional Groups. Next, we will determine whether there was homogeneity in pretest flexion scores between the Conventional and Experimental Groups and evaluate whether manual mobilization is more effective by comparing the posttest flexion scores between the two groups.
The Mean column in the t-test table presents the average pretest flexion scores for the Experimental and Conventional Groups.

The standard deviation column indicates the variability of these scores within each group. The difference of 1.0 represents the gap between the mean scores of the two groups (81.93 for the Experimental Group and 82.93 for the Conventional Group). With a p-value greater than 0.05, there is no significant difference in pretest flexion scores between the two groups. Therefore, the groups can be considered homogenous at the baseline level.

Mean, standard deviation, and t-value for comparing posttest flexion scores between the Experimental and Conventional Groups using a t-test.

Group	Posttest Mean	S.D.	Difference in mean	*n*	*t*	*Df*	*p-value*
Experimental	87.13	1.6	1.2	30	2.16	28	*< 0.05*
Conventional	85.93	1.44					

Table 4: - A table showing the change in posttest flexion scores between the Experimental and Conventional Groups

The Mean column in the t-test table shows the average posttest flexion scores for the Experimental and Conventional Groups. The standard deviation column indicates the variability of these scores within each group. The difference of 1.2 represents the gap between the mean scores of the two groups (87.13 for the Experimental Group and 85.93 for the Conventional Group). With a p- value less than 0.05, there is a significant difference in posttest flexion scores between the two groups, with the Experimental Group demonstrating significantly higher flexion. This suggests that manual mobilization is more effective in improving flexion.

Statistical Analysis of Extension Using a t-Test

The Mean column shows the average pretest and posttest extension scores for individuals in the Experimental Group. SD indicates the standard deviations of these scores for both pretest and posttest. The mean change of 6.47 reflects the difference between the pretest (59.93) and posttest (66.4) scores. With a p-value less than 0.001, there is a significant difference in extension scores from pretest to posttest in the Experimental Group, indicating a notable increase in extension. This demonstrates the effectiveness of manual mobilization in improving extension.

The Mean column shows the average pretest and posttest extension scores for individuals in the Conventional Group. SD indicates the standard deviations of these scores for both pretest and posttest. The mean change of 3.4 reflects the difference between pretest (59.87) and posttest (63.27) scores. With a p-value less than 0.001, there is a significant difference in extension scores from pretest to posttest in the Conventional Group, demonstrating a notable increase in extension. This highlights the effectiveness of conventional exercises in improving extension.

We have observed a significant increase in extension scores in both the Experimental and Conventional Groups. Next, we will assess whether there was homogeneity in pretest extension scores between the Conventional and Experimental Groups and evaluate the effectiveness of manual mobilization by comparing posttest extension scores between the two groups.

The Mean column in the t-test table shows the average pretest extension scores for the Experimental and Conventional Groups. The standard deviation column indicates the variability of these scores within each group. The difference of 0.06 represents the gap between the mean scores of the two groups (59.93 for the Experimental Group and 59.87 for the Conventional Group). With a p-value greater than 0.05, there is no significant difference in pre-test extension scores between the two groups, indicating that the groups are homogenous at the baseline level.

Mean, standard deviation, and t-value for comparing posttest extension scores between the Experimental and Conventional Groups using a t-test.

Group	Posttest Mean	S.D.	Difference in mean	*n*	*t*	*df*	*p-value*
Experimental	66.4	3.85	3.13	30	2.18	28	*< 0.05*
Conventional	63.27	4.03					

Table 5: -A table illustrating the change in posttest extension scores between the Experimental and Conventional Groups

The Mean column in the t-test table shows the average posttest extension scores for the Experimental and Conventional Groups. The standard deviation column indicates the variability of these scores within each group. The difference of 3.13 reflects the gap between the mean scores of the two groups (66.4 for the Experimental Group and 63.27 for the Conventional Group). With a p-value less than 0.05, there is a significant difference in post-test extension scores between the two groups, with the Experimental Group demonstrating significantly higher extension. This suggests that manual mobilization is more effective in improving extension.

Statistical Analysis of Rotation Using a t-Test

The Mean column shows the average pretest and posttest rotation scores for individuals in the Experimental Group. SD indicates the standard deviations of these scores for pretest and posttest. The mean change of 6.47 represents the difference between the pretest score (80.53) and the posttest score (87). With a p-value less than 0.001, there is a significant difference between pretest and posttest rotation scores in the Experimental Group, demonstrating a substantial increase in rotation. This indicates that manual mobilization effectively improves rotation.

The Mean column shows the average pretest and posttest rotation scores for individuals in the Conventional Group. SD represents the standard deviations of these scores for both pretest and posttest. The mean change of 3.34 reflects the difference between the pretest score (81.53) and the posttest score (84.87). With a p-value less than 0.001, there is a significant difference between pretest and posttest rotation scores in the Conventional Group, indicating a substantial increase in rotation. This demonstrates the effectiveness of conventional exercise in improving rotation.

We have observed significant increases in rotation scores in both the Experimental and Conventional Groups. Next, we will assess whether the pretest rotation scores were homogeneous between the Conventional and Experimental Groups and evaluate the effectiveness of manual mobilization by comparing posttest rotation scores between the two groups.

The Mean column in the t-test table shows the average pre-test rotation scores for both the Experimental and Conventional Groups. The standard deviation column indicates the variability of these scores within each group. The difference of 1.0 reflects the gap between the mean scores of the two groups (80.53 for the Experimental Group and 81.53 for the Conventional Group). With a p-value greater than 0.05, there is no significant difference in pre-test rotation scores between the two groups, suggesting that the groups are homogenous at the baseline level.

Mean, standard deviation, and t-value for comparing posttest rotation scores between the Experimental Group and the Conventional Group using a t-test

Group	Posttest Mean	S.D.	Difference in mean	*n*	*T*	*df*	*p-value*
Experimental	87.0	2.48					
Conventional	84.87	2.85	2.13	30	2.19	28	*< 0.05*

Table 6: -Table showing the difference in posttest rotation scores between the Experimental Group and the Conventional Group

The Mean column in the t-test table presents the average posttest rotation scores for the Experimental Group and the Conventional Group. The standard deviation column indicates the variability of these scores within each group. The difference of 2.13 represents the gap between the mean scores of the two groups (87 for the Experimental Group and 84.87 for the Conventional Group). With a p-value less than 0.05, there is a significant difference in posttest rotation scores between the Experimental and Conventional Groups, with the Experimental Group showing notably higher rotation. This suggests that manual mobilization is more effective in enhancing rotation.

DISCUSSION

This study is one of the few experimental investigations into the effectiveness of manual mobilization for managing chronic neck pain. It evaluates pain reduction using the VAS score, neck disability with the NDI score, and range of motion improvements using a goniometer for both experimental and conventional groups.

Manual mobilization is a therapeutic technique that alleviates pain, reduces joint stiffness, and significantly improves the range of motion. In the stream of physiotherapy, manual technique is a vital tool and a frequently employed method for treating tissue, joint, and movement dysfunctions.

In Grade I mobilization, small-amplitude movements with minimal resistance are employed, which helps address pathological conditions. Grade II mobilization involves movements with a larger amplitude but remains within the pain-free range, making it suitable for various pathologies. When resistance is felt prior to crossing the pain threshold, grades I and II are used. Oscillatory motions are utilized in Grades III and IV to improve movement efficiency by easing stiffness and contractures. The velocities in Grade IV are higher than in Grade III. High-speed thrusts utilized for manipulation are part of Grade V. In order to treat patients with persistent neck discomfort, this research use Maitland mobilization techniques on the cervical spine, namely Grades III and IV.

Thirty participants were chosen on basis of specific inclusion & exclusion criteria at Sree Narayana Medical Mission Hospital, Cherthala. They were randomly allocated to one of the experimental or conventional group through lottery method. The experimental group received Maitland mobilization techniques along with the conventional physiotherapy treatment, while the conventional group received physiotherapy measures following the North American Spine Society Protocol. Outcome measures, such as VAS, NDI, and ROM, were evaluated before and after the intervention. A descriptive analysis was carried out for demographic data, while statistical analysis included paired t-tests were used to compare results within each group whereas unpaired t-tests to compare results between groups. A significance threshold of 5% ($p < 0.05$) were applied.

A statistical examination of the VAS values for the manual mobilization group found significant difference between pretest & posttest scores, with t-value of 16.33 and $p < 0.001$. The pretest and posttest scores of the conventional group also shows significant difference, with t-value of 9.01 and $p < 0.001$.

Manual mobilization reduces pain more effectively than traditional methods, according to an unpaired t-test (t-value = 2.91, $p < 0.01$) comparing the experimental and conventional groups. This indicates that when combined with traditional physiotherapy, manual mobilization considerably enhances pain relief as compared to traditional physiotherapy alone. This result aligns with Zaidi Syeda et al.'s study, which similarly emphasizes cervical manual mobilization's efficacy in treating neck pain.

The manual mobilization group found high significant difference (t-value of 11.37 and $p < 0.001$) between pretest and posttest ratings for neck impairment. A p-value <

0.05 was found in unpaired t-test comparing the experimental and conventional groups, suggesting that manual mobilization is superior to conventional physiotherapy alone in reducing neck impairment.

A t-value of 15.42 with $p < 0.001$ for lateral flexion indicates that the experimental group significantly improved from the pretest to the posttest. The conventional group also found notable improvement, with t-value of 10.18 & $p < 0.001$. It was evident from the unpaired t-test comparing the experimental and conventional groups that experimental group had improved more than conventional group, with t-value of 2.17 and $p < 0.05$.

As flexion increased from the pretest to the posttest, the manual mobilization group found a significant increase (t-value = 29.79, $p < 0.001$). At t-value of 13.75 and $p < 0.001$, the traditional group likewise found a substantial improvement. When the experimental and conventional groups were compared using unpaired t-test, manual mobilization group was found to have significant advantage with t-value of 2.16 & $p < 0.05$.

In terms of extension, the manual mobilization group found significant improvement, with t-value of 20.1 & p-value less than 0.001. The result for the traditional group were also impressive, with t-value of 11.13 and p-value less than 0.001. With t-value of 2.18 and $p < 0.05$, the study's findings showed that manual mobilization had a higher effect than conventional exercise.

The t-value of 16.14 and p-value of less than 0.001 for the experimental group indicate that there was significant difference between pre-test & post-test scores for rotation. The traditional group's results were also impressive, with t-value of 10.46 & $p < 0.001$. When the two groups were compared, t-value of 2.19 & $p < 0.05$ indicated that manual mobilization was significantly more beneficial than traditional exercise.

STRENGTHS OF THE STUDY

- **Cost-Effective:** The study utilized cost-effective methods.
- **Generalizability:** The findings are applicable to a broader population.
- **Sample Size Equality:** The study maintained an equal number of samples in both groups.

LIMITATIONS OF THE STUDY

Evaluation in the Short Term: The study just evaluated the impacts of manual mobilization in the short term.

RECOMMENDATIONS FOR FUTURE RESEARCH

Exploration of Other Techniques: While this study focused on Maitland mobilization for chronic neck pain, future research could investigate the effectiveness of other manual mobilization techniques, such as Mulligan, in managing neck disorders.

Long-term follow-up: The study evaluates only short term follow up, it is better to prove the effect on long term.

CONCLUSION

The study found that manual mobilization is effective in managing chronic neck pain, significantly improving pain levels, reducing disability, and enhancing range of motion. This hands-on technique, administered by a skilled practitioner, found notable differences both within the experimental group and between the experimental and conventional groups.

Manual mobilization was found to be significantly more effective than conventional treatments in reducing neck impairment, enhancing movement range, and relieving pain among individuals with persistent cervical discomfort, according to statistical analysis.

Based on its strong benefits on pain relief, disability enhancement, and improved range of motion, the research concluded that manual mobilization is a useful method for managing chronic neck pain.

For people with chronic neck discomfort, the manual mobilization approach is a useful therapeutic strategy for lowering pain, increasing range of movement, and easing neck impairment.

Declaration by Authors

Ethical Approval: Approved
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Aritha R, K.S. Sharad, Rejeesh Kumar R. Effectiveness of manual mobilization in the management of patients with chronic neck pain. *Gal Int J Health Sci Res*. 2025; 10(3): 62-76. *DOI: https://doi.org/10.52403/gijhsr.20250307*

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