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Effectiveness of neural mobilisation along with McKenzie approach (directional preference) for cervical derangement syndrome

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Abstract
Purpose: The study was conducted to identify and investigate the therapeutic effectiveness of the neural mobilization technique, given along with the McKenzie Approach (Directional Preference) for the treatment of Cervical Derangement Syndrome. This study has made the comparison, in order to discover the most effective treatment protocol to alleviate the symptoms of the condition.
Objectives: To assess the effect on pain after introducing Neural Mobilization for Cervical Derangement Syndrome, to measure the severity of pain by using Numeric Pain Rating Scale (NPRS), to identify the distribution of pain, to measure the functional disability by using Neck Disability Index (NDI), to explore the socio-demography of the participants, to investigate the effect on reducing discomfort and functional disability after introducing Neural Mobilization.
Methodology: The study was an experimental design and conducted by using Randomized Control Trial (RCT).
Results: The study has used statistical analysis by unrelated *t* test to compare the Experimental and Control Group and analysed by interpreting the probability level of significance of *t*-value. The results were found to be significant for *t*-value at probability level 0.05**.**
Conclusion: The study concludes that the combination technique is significantly capable of producing beneficial effects on pain reduction, minimization of functional disability and cervical spinal mobility in patients with Cervical Derangement Syndrome.

Keywords: neural mobilization, neurodynamic, mckenzie approach, directional preference, cervical derangement syndrome

1. Introduction

Cervical spine disorders are very common and often result in a disabling condition [14]. Patients who are suffering from the symptoms of this condition frequently attend for physiotherapy [2]. According to Schenk, 25% are referred for treatment for cervical pain of the total patients seen in outpatient physical therapy [20].

Among people, Neck pain and disability are major problems and the prevalence of neck pain in general population in one year ranging from 4.8% to 79.5%, On the other hand, Neck pain that restricts daily functional activities is not also rare (17% to 70%) [23].

Cervical radiculopathy has a reported annual incidence of 83.2 per 100000 and an increased prevalence in the fifth decade of life among the general population [18]. Among them the prevalence rate of Cervical Derangement Syndrome varies quite widely across different surveys, and McKenzie [13] states that "most patients develop pain and seek assistance as the result of derangement". The pain caused by Cervical Derangement Syndrome occurs as a result of anatomical disruption and the flow or displacement within the intervertebral disc.

Cervical Derangement is a disorder which commonly manifests clinical features of pain radiating from the neck into the distribution of the affected nerve root. Patients usually complain of pain, numbness, tingling sensation, and weakness in the upper extremity, which often results in significant functional limitations and disability [9].

The symptoms of cervical derangement syndrome may be felt locally or centrally to the Spinal column, and may radiate and be referred distally in the form of pain, paraesthesia or numbness [13].

Depending on the affected nerve root level, the site and pattern of symptoms may vary and can include alteration of sensory and/or motor functions if the dorsal and/or ventral nerve root is involved [19].

Disc derangement in the cervical spine may be diagnosed by utilizing the McKenzie protocols of end range loading, looking for a pattern of peripheralization and centralization of pain [6].

The McKenzie mobilization technique works on the principle of centralization in subjects with cervical syndromes. Centralization refers to the phenomenon by which distal limb pain and symptoms' originating from the spine is abolished in response to the slow, careful and measured application of loading strategies. This phenomenon is characteristic of derangement syndrome [9].

McKenzie & May [11] defined directional preference as repeated movements in the direction that decreases, centralizes or abolishes symptoms, and/or produces a positive mechanical response. On the other hand, Neural mobilization of the nervous system, described by Maitland in 1985, Elvey in 1986 and refined by Butler in 1991, is an addition to the assessment and treatment of neural pain syndromes, including cervical spinal syndromes [3].

Neural mobilization is a gentle movement technique used by

the physiotherapists to move the nerves. It contributes to restoring the stretching and tensile ability of neural tissue and stimulates the restoration of normal physiological function of nerve cells [17].

It should be mentioned that, Cervical Derangement Syndrome causes peripheral neuropathic pain (PNP) that arises as a result of a lesion or disease affecting the somato-sensory component of the peripheral nervous system [24].

Nee & Butler proposed that neurodynamic mobilization techniques can be effective in addressing peripheral neuropathic pain where nerve roots may have been injured [17].

A derangement of the intervertebral disc may lead to cervical radiculopathy and the neural mobilization is reported to be an effective intervention for cervical radiating pain due to derangement [15].

Considering the facts of cervical syndrome it is evident that the treatment methods should target the reduction of pain which is due to neural compression.

Cervical spine mobilization according to the McKenzie approach, and neural mobilization, plays important roles in decreasing pain and improving the range of motion of the cervical spine in patients with derangement syndrome [15].

Cervical mobilization permits early treatment by gentle oscillatory movements, which have the effects of decreasing muscle spasm and pain and thus gradually improving mobility [16].

Neural tests are mechanically used to stimulate and move neural tissues, in order to gain insight into their mobility and sensitivity to movement. In the presence of an abnormality, skilled manual therapy treatment using these tests is designed to improve the mobility of the neural structures and consequently to reduce sensitivity to movement and tension. Examples of these include Straight Leg Raising (SLR), Passive neck flexion (PNF), Slump test and Upper limb tension test (ULTT) [21].

As very few studies have been done to compare the efficacy for patients, of cervical spine mobilization according to the McKenzie approach on one hand, and patients receiving both the McKenzie approach, together with neural mobilization for cervical derangement syndrome. The design of this study will make the comparison, in order to discover which treatment is the most effective to alleviate the symptoms of the condition.

2. Materials and Method

This study was an experimental design to evaluate the effectiveness of physiotherapy techniques combining Neural Mobilization along with the McKenzie Approach (Directional Preference) and also to compare their effectiveness with the McKenzie Approach (Directional Preference) alone for the management of pain and improvement of different functional activities of the patients with Cervical Derangement Syndrome. To identify the effectiveness of this treatment regime, Numeric Pain Rating Scale (NPRS) and Neck Disability Index (NDI) were used as measurement tools for measuring the pain intensity and to assess how the pain affect different functional abilities to manage in everyday life.

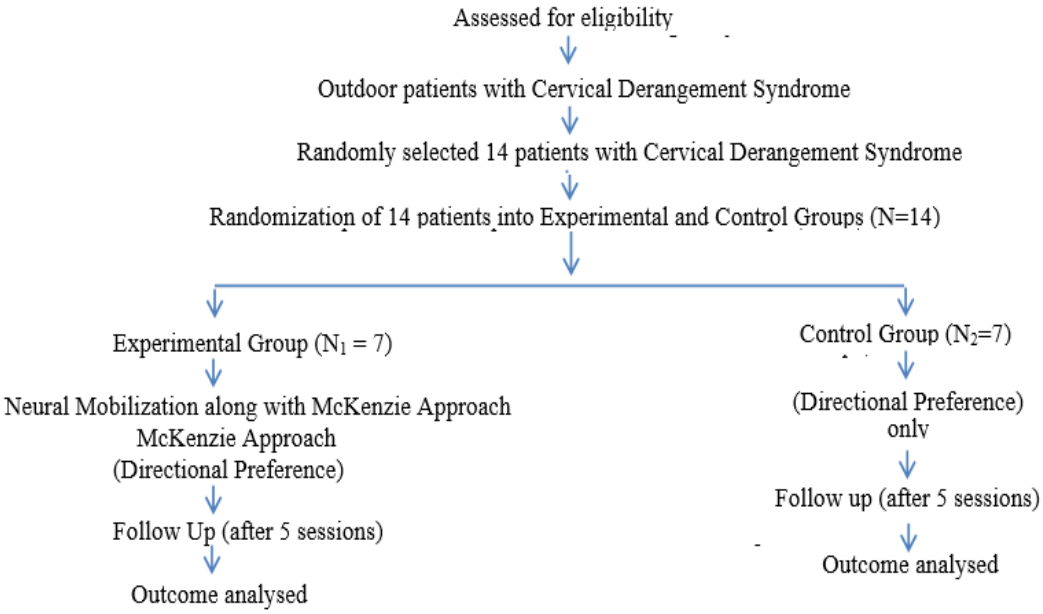
2.1 Study Design

The study was designed using an experimental design quantitative research. According to DePoy & Gitlin the design could be shown by:

Experimental Group	:	R	O_1	X	O_2
Control Group	:	R	O_1		O_2

The study is an experimental between two subject designs. Neural Mobilization and McKenzie Approach has applied to the experimental group and only McKenzie Approach applied to the control group.

A pre-test (before intervention) and post-test (after intervention) has administered with each subject of both groups to compare the pain effects before and after the treatment.



Flow chart 1: Flow Chart of the phases of Randomized Controlled Trial

2.2 Treatment Regimen

2.2.1 Control Group

Control Group was given McKenzie Approach (Directional Preference) Only according to patient's response to treatment.

2.2.2 McKenzie Approach (Directional Preference)

Before starting McKenzie Approach all the patients were assessed properly by McKenzie test movements for cervical spine in the study clinical settings. From test movements a particular posture and direction was selected. The directional preference was carefully chosen from the responses of the test movements.

- Retraction (With overpressure, sitting or lying)
- Retraction and extension (With overpressure, sitting or lying)
- Maintenance of retracted head posture, Extension (In sitting or lying prone)
- Extension with traction and rotation in lying
- Extension in lying prone
- Extension mobilization
- Lateral flexion (with overpressure in sitting)
- Lateral flexion mobilization in sitting or lying
- Rotation (with overpressure in sitting)
- Rotation mobilization in sitting or lying
- Flexion in sitting followed by extension in sitting or lying
- Flexion mobilization (if necessary) (McKenzie, 1990).

2.2.3 Experimental Group

Experimental Group was given both McKenzie Approach (Directional Preference) and Neural Mobilization. McKenzie Approach (Directional Preference) was common treatment regimen for both groups. But Neural Mobilization was given along with McKenzie Approach (Directional Preference) given by single qualified physiotherapist who is expertise in neural mobilization technique.

2.2.4 Neural Mobilization

Table 1: Neural Mobilization Protocol

	ULTT2a	ULTT2b	ULTT3
Nerve Bias	Median nerve	Radial nerve	Ulnar nerve (C8, T1)
Shoulder	Depression and abduction -10 degrees	Depression and abduction -10 degrees	Depression and abduction (10-90 degrees hand to ear)
Elbow	Extension	Extension	Flexion
Forearm	Supination	Pronation	Supination
Wrist	Extension	Flexion and Ulnar deviation	Extension and Radial deviation
Fingers and thumb	Extension	Flexion	Extension
Shoulder joint	Lateral rotation	Medial rotation	Lateral rotation
Cervical spine	Contralateral side flexion	Contralateral side flexion	Contralateral side flexion

2.2.5 Procedure

The subjects were treated with neural mobilization for cervical derangement syndrome for 5 days. For this, participants were given a comfortable supine lying position. ULTT method was implemented to the ipsilateral upper limb given in the table.

Experimental group was treated with neural mobilization of 20 seconds oscillations of three sets during each session.

In this technique gentle and firm movements, through and end range was applied.

Active or passive mobilizations were applied according to the patient's symptoms.

Grades 1 to grade 4 oscillations were applied from the distal component.

Duration of oscillation was 60 seconds, which was divided in to three, equal burst.

After mobilization, patients were advised for self-mobilization techniques.

2.3 Study Area

Musculo-skeletal Unit of Physiotherapy Department at Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka.

2.4 Study Population

The study population was the patients diagnosed as Cervical Derangement Syndrome attended in the Musculo-skeletal Unit of Physiotherapy Department at CRP, Savar, Dhaka.

2.5 Sample Size

Sample size was 14 participants. 7 participants were in experimental group and 7 participants in control group.

2.6 Sampling Technique

Simple Random sampling technique was used in this study. Subjects, who met the inclusion criteria, were taken as sample in this study. 14 patients with Cervical Derangement Syndrome were selected from outdoor musculoskeletal unit of physiotherapy department of CRP, Savar and then 7 patients were randomly assigned to Experimental group comprising of treatment approaches of Neural Mobilization along with the McKenzie Approach (Directional Preference) and 7 patients to the only the McKenzie Approach (Directional Preference) for this study. The study was a single blinded technique. When the samples were collected, the researcher randomly assigned the participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc. for the control group and E1, E2, E3 etc. for experimental group. Total 14 samples were included in this study, among them 7 patients were selected for the experimental group [received Neural Mobilization along with the McKenzie Approach (Directional Preference)] and rest 7 patients were selected for control group (receive only the McKenzie Approach (Directional Preference)]

2.7 Inclusion criteria

- Mechanical cause of cervical pain and its radiation to the arm, forearm, and hand.
- Age group: 18-60 year. McKenzie stated this age group for describing Cervical Derangement Syndrome. Even he also stated that, Cervical Syndrome may occur because of different causes even from age of 12 years [13].
- Both sex
- Patients who experiences recurrent episodes of pain at neck or reference to upper or mid scapula or limb proximally or intermittent symptoms. McKenzie included the symptom for describing cervical syndrome or neck pain [13].
- Not any history of previous physiotherapy

2.8 Exclusion Criteria

- Patients with clinical disorder where Neural Mobilization is contraindicated
- Diagnosis of secondary complications such as tumour, TB spine, fracture, dislocation and severe osteoporosis, Paget's disease
- All sorts of infection, Rheumatoid Arthritis, Ankylosing Spondylitis
- Cauda-equina lesions, Cord signs & Syndrome, Transverse myelitis
- Surgery to the neck spine
- Vertibro-basillary artery insufficiency, Vascular abnormality.

2.9 Data Collection Tools

- Record or Data collection form
- Consent Form
- Structured questionnaire. (Both open ended and close ended questionnaire)
- Numeric Pain Rating Scale – for measuring pain.
- Neck Disability Index (NDI)
- Pen, Papers

2.10 Measurement Tools

2.10.1 Numeric Pain Rating Scale (NPRS): McCaffery used a numeric scale to rate the pain status experienced by patients. It is known as Numeric Pain Rating Scale. The scale is a 10cm long scale ranging from 0-10. Here a zero (0) means no pain, 1-3 indicates mild pain, 3-5 indicates that pain is in moderate state and 6-10 is worst possible pain feeling experienced by patients [10]. Cleland examined the test-retest reliability of the NPRS for a subgroup of patients with mechanical neck pain. The results of this study suggest that the NPRS exhibited moderate test-retest reliability, which is similar to the test-retest reliability identified in a patient population with cervical radiculopathy or mechanical causes of neck pain [4]. Most recently the results of the study exhibited fair test-retest reliability in patients with Cervical Radiculopathy [26].

2.10.2 Neck Disability Index (NDI): This is a set of questionnaire that has been designed to provide information regarding how the patient's neck pain affects his/her ability to manage in everyday life. Neck Disability Index (NDI) is developed by [25]. NDI contains 10 different sections of questions, each of which has 6 grades of defined statements. For each section the total possible score is 5: if the first statement is marked the section score = 0, if the last statement is marked the section score = 5. Cleland *et al*. (2008) examined the test-retest reliability of the NDI for a subgroup of patients with mechanical neck pain. The results of this study suggest that the NDI exhibits only fair test-retest reliability. Similarly the results of the study by Young *et al*. (2010) suggest that the NDI exhibits only fair test-retest reliability, which is lower than the values reported by Cleland in patients with mechanical neck pain or cervical radiculopathy [4].

2.11 Data Collection Procedure

The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at department, the patients were assessed by a graduate qualified physiotherapist. 5 sessions of treatment was provided for every subject. 14 subjects were chosen for data collection according to the inclusion criteria. All participants were divided into two groups and coded C1, C2, C3, C4, C5, C6, C7 for control group and E1, E2, E3, E4, E5, E6, E7 for experimental group.

Data was gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form. Pre-test was performed before beginning the treatment and the intensity of pain was noted with NPRS score and NDI questionnaire form. The same procedure was performed to take post-test at the end of 5 sessions of treatment. The assessment form was provided to each subject before starting treatment and after 5 sessions of treatment patient was instructed to put mark on the line of NPRS according to their intensity of pain. The data were collected from both in experimental and control group in front of a graduate qualified physiotherapist and verified by a witness selected by the Head of clinical setting in order to reduce the biasness. At the end of the study, for statistical analysis different tests were carried out to perform statistical analysis.

2.12 Data Analysis

Statistical analysis was performed by using Microsoft Excel 2013 and Scientific Calculator.

2.13 Statistical Test

The data was analysed by unrelated *t* test as the study was a before-and-after observations on the same subjects and there was a comparison of two different methods of measurement or two different treatments where the measurements/treatments are applied to the same subjects.

According to Hicks, experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is interval or ratio should be analysed with unrelated *t* test [7]. This test is used when' the experimental design compares two separate or different unmatched groups of subjects participating in different conditions. When calculating the unrelated *t* test, you find the value called '*t*' which you then look up in the probability tables associated with the *t* test to find out whether the *t* value represents a significant difference between the results from your two groups.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{(\sum X_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad (1)$$

Where,

$\bar{x}_1$ = Mean of scores from control group.

$\bar{x}_2$ = Mean of scores from experimental group.

$\sum X_1$ = The total of the individual score from control group.

$\sum X_2$ = The total of the individual score from experimental group.

$\sum X_1^2$ = The summation of square of the each individual score from control group.

$\sum X_2^2$ = The summation of square of the each individual score from experimental group.

n_1 = Number of subjects in control group.

n_2 = Number of subjects in experimental group.

2.14 Level of Significance

In order to find out the significance of the study, the "p" value was calculated. The p values refer to the probability of the results for experimental study. The word probability refers to the accuracy of the findings. A p value is called level of significance for an experiment and a p value of <0.05 was accepted as significant result for health service research. If the p value is equal or smaller than the significant level, the results are said to be significant.

2.15 Ethical Issues

The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guidelines and World Health Organization (WHO) Research guidelines. The proposal of the dissertation including methodology was approved by Institutional Review Board and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). Again before the beginning of the data collection, the researcher obtained the permission ensuring the safety of the participants from the concerned authorities of the clinical setting and was allotted with a witness from the authority for the verification of the collected data. The researcher strictly maintained the confidentiality regarding participant's condition and treatments.

2.16 Informed Consent

The researcher obtained informed consent to participate from every subject. A signed informed consent form was received from each participant. The participants were informed that they have the right to meet with outdoor doctor if they think that the treatment is not enough to control the condition or if the condition become worsen. The participants were also informed that they are completely free to decline answering any question during the study and are free to withdraw their consent and terminate participation at any time. Withdrawal of participation from the study should not affect their treatment in the physiotherapy department and they should still get the same facilities. Every subject had the opportunity to discuss their problem with the senior authority or administration of CRP and have any questioned answer to their satisfaction.

3. Results

3.1 Mean Age of the Participants

Table 2: Mean Age of the Participants

Experimental Group		Control Group	
Subjects	**Age (Years)**	**Subjects**	**Age (Years)**
E1	50	C1	35
E2	26	C2	60
E3	34	C3	44
E4	32	C4	30
E5	34	C5	60
E6	50	C6	22
E7	50	C7	49
Mean Age	39 years	Mean Age	42 years

3.2 Age Range

The majority of the participants 36% (n=5) were in "41-50" years of age followed by 29% (n=4) were in "31-40" years, 21% (n=3) were in "21-30"years and 14% (n=2) were in "51-60" years of age range group.

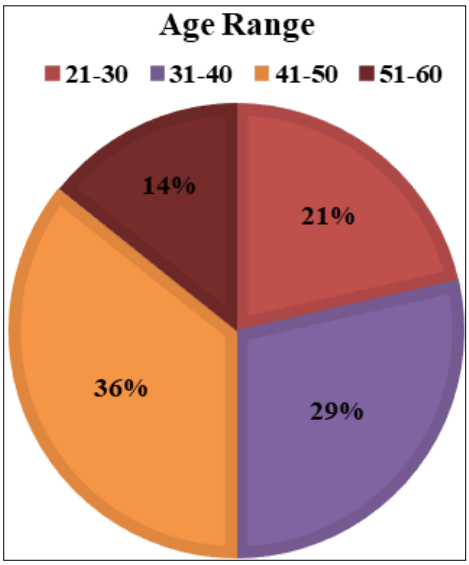


Fig 1: Age Range of the Participants with percentage

3.3 Sex of the Participants

14 Patients with Cervical Derangement Syndrome were included as sample of the study, among them 50% (n=7) were Male and 50% (n=7) were Female. On the other hand, In Experimental Group 29% (n=4) were Male and 21% (n=3) were Female and in Control Group 21% (n=3) were Male and 29% (n=4) were Female.

Table 3: Gender Distribution with percentage

Sex of the Participants	Experimental Group	Control Group
Male	29% (n=4)	21% (n=3)
Female	21% (n=3)	29% (n=4)

3.4 Types and Distribution of Pain

All the 14 patients of this study were suffering from neck pain and 50% (n=7) were of chronic neck pain, 7% (n=1) were of acute neck pain and 43% (n=6) were of sub-acute low back pain.

Among them 13 patients had radiating pain up to arm and 36% (n=5) of them had chronic arm pain, 14% (n=2) had acute arm pain, 43% (n=6) had sub-acute arm pain and 1

patient had no arm pain e.g. 7%.
Among them 7 patients had radiating pain up to forearm and 22% (n=3) of them had chronic forearm pain, 14% (n=2) had sub-acute forearm pain, 14% (n=2) had acute forearm pain and 7 patients had no forearm pain e.g. 50%.

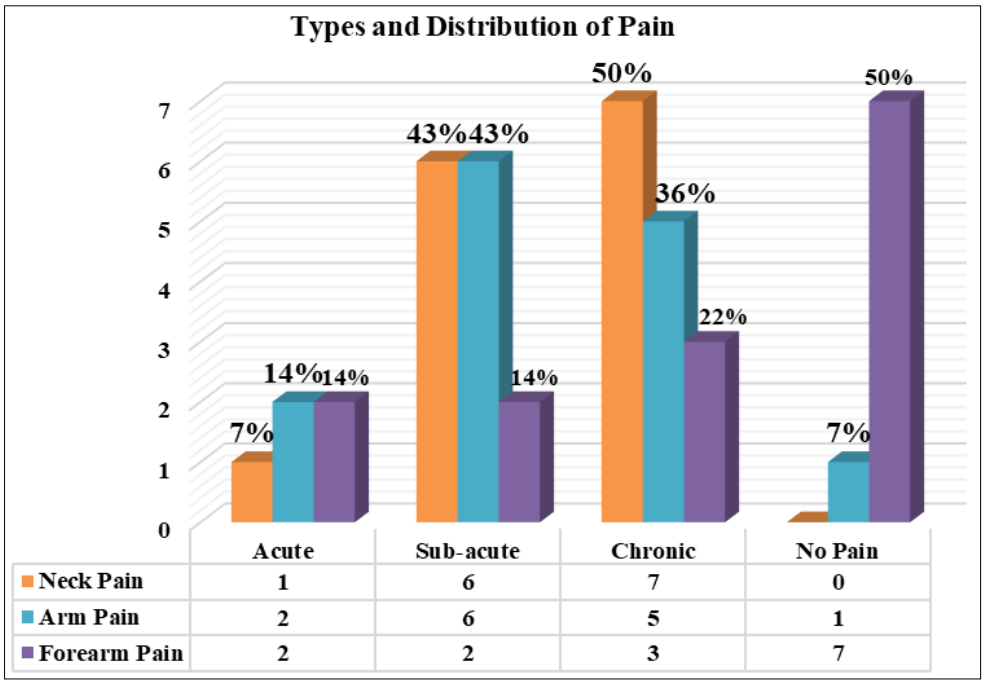


Fig 2: Types and Distribution of Pain

3.5 Reported Weakness in the Upper Limb

The pie chart shows that among the participants it was found that, half of them that is 50% (n=7) reported of getting less strength in upper limb on the other hand, 50% (n=7) were reported not in Cervical Derangement Syndrome.

Table 4: Reported Weakness in the Upper Limb

Weakness in the Upper limb	Present	Absent
	50% (n=7)	50% (n=7)

3.6 Reported Paraesthesia or Numbness in Upper Limb

The pie chart shows that among the participants it was found that 29% (n=4) were reported no paraesthesia or numbness meanwhile 71% (n=10) were reported of feeling paraesthesia or numbness in the upper limb in Cervical Derangement Syndrome.

Table 5: Reported Paraesthesia and Numbness in the Upper Limb

Paraesthesia or Numbness in the Upper limb	Present	Absent
	29% (n=4)	71% (n=10)

3.7 Causes of Pain

According to the patients opinion, half of the patients that is 50% (n=7) were suffering from neck pain due to bad posture, 7% (n=1) were due to lifting heavy weight, 43% (n=6) were due to others or unknown causes of neck pain. No one was reported suffering due to trauma or injury to neck pain in the study.

Table 6: Causes of Neck Pain as reported by the patients.

Causes of Neck Pain	Number (n)	Percentage (%)
Bad Posture	7	50%
Heavy Weight Lifting	1	7%
Others	6	43%

3.8 Frequency of taking treatment previously

Among 14 participants, 12 patients (about 60%) took Medicine (pain killer) for their neck pain. 5 patients (about 25%) used Cervical Collar, 2 patients (about 10%) took Rest and 1 patient (about 5%) took massage therapy for their neck pain and disability. None of them had any injection therapy, operation or any other methods of treatments previously.

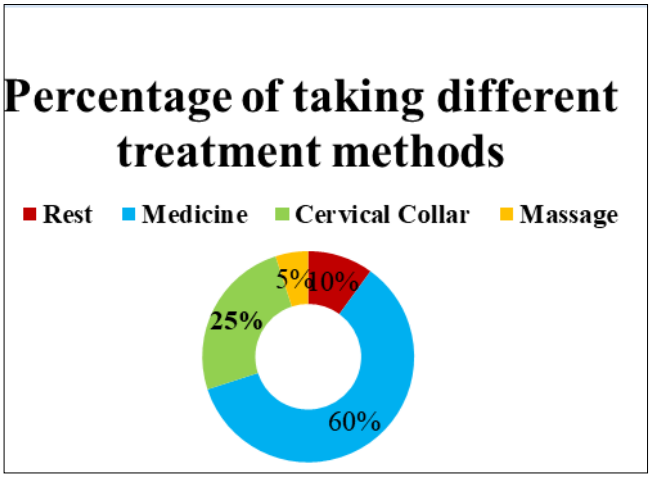


Fig 3: Frequency of taking treatment previously.

3.9 Pain progression

After taking previous treatment only 14% (n=2) patients complained that their pain was not changing and 79% (n=11) patients complained that their pain was worsening. Only 7% (n=1) patients told that their pain was improving.

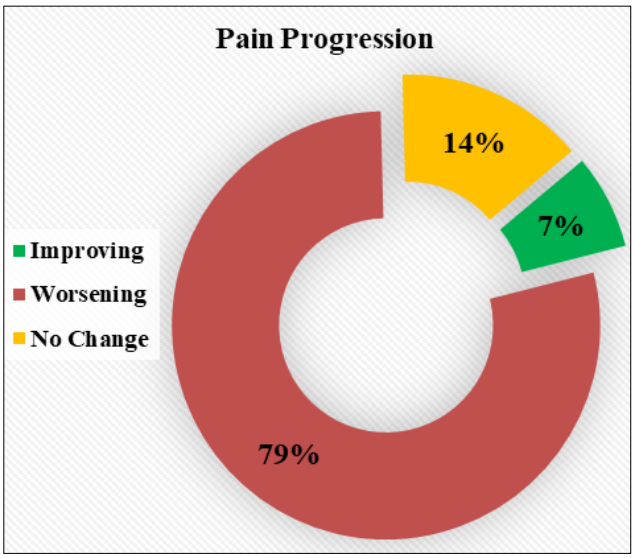


Fig 4: Pain progression

3.10 Mean Difference of Pain Reduction in Control Group

Table 7: Mean Difference of Pain Reduction in Control Group

Control Group	Neck Pain		Arm Pain		Forearm Pain	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Mean	6.4	3.1	6.7	3.4	7	3
Mean Difference	3.3		3.3		4	

3.11 Mean Difference of Pain Reduction in Experimental Group

Table 8: Mean Difference of Pain Reduction in Experimental Group

Experimental Group	Neck Pain		Arm Pain		Forearm	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Mean	7.1	1.8	5.8	1.3	6.3	1.3
Mean	5.3		4.5		5	

The column chart is showing the mean difference of pain reduction rate for neck, arm and forearm pain in both experimental and control group.

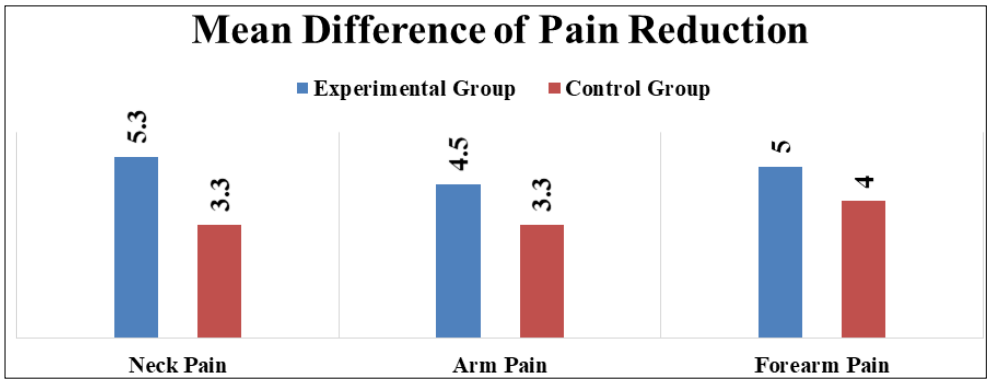


Fig 5: Mean Difference of Pain Reduction

The data was analysed statistically by unrelated *t* test in order to find out the statistical significance of the study. The results were found to be significant for *t*-value at probability level 0.05. The interpretation is given below in the table -

Interpreting the Results of *t* test

Table 9: Interpretation of *t* test Results

	df	Level of Significance for one-tailed test at probability of 0.05		*t*-value	Probability Level	Comments
Neck Pain	12	1.782	2.179	1.89	$p < 0.05$	significant
Arm Pain	11	1.796	2.201	1.812	$p< 0.05$	significant
Forearm Pain	4	2.132	2.776	2.503	$p < 0.05$	significant

3.13 Mean Difference in Neck Disability Index of Control Group

Table 10: Mean Difference in NDI of Control Group

Control Group	Neck Disability Score	
	Pre-test	Post-test
Mean	57.3	10.2
Mean Difference	47.1	

3.14 Mean Difference in Neck Disability Index of Experimental Group

Table 11: Mean Difference in NDI of Experimental Group

Experimental Group	Neck Disability Score	
	Pre-test	Post-test
Mean	7.1	1.8
Mean Difference	5.3	

The column chart is showing the mean difference of neck disability reduction rate for both experimental and control group.

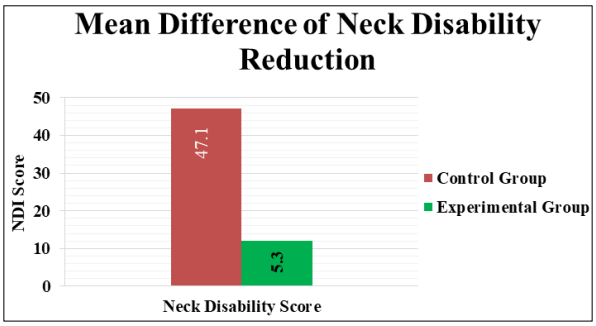


Fig 6: Mean Difference of Neck Disability Reduction

4. Discussion

The result of this study reported that the combination of Neural Mobilization and McKenzie Approach (Directional Preference) is capable of producing beneficial effect for patients with Cervical Derangement Syndrome. The combination technique used in experimental group may be beneficial for reducing pain, functional disability in the subjects with cervical derangement syndrome.

The experimental design employed in this study is mainly suitable for a comprehensive investigation of the management of participating subjects [20]. There were 14 participants in this study. They were distributed randomly in two groups of Experimental Group and Control Group. Experimental group received both Neural Mobilization technique and McKenzie Approach (Directional Preference) as a combination treatment technique and the Control group received only McKenzie Approach (Directional Preference) for treatment of Cervical Derangement Syndrome.

As the study was done based on McKenzie Approach and techniques of neural mobilization, and as the clinical settings of this study uses McKenzie Cervical Spine Assessment Form for provisionally classify the syndromes of neck pain complains, the age range was taken based on the theoretical basis of McKenzie Approach and its inclusion criteria. McKenzie stated age range from 12 – 60 found having frequency of cervical syndrome, where this study age range was 18 – 60 which includes within that range. He also stated the incidence of neck pain found highest at the age of 45 to 50. In this study, the mean age of the participants was 39 in Experimental group and 42 in Control group [13]. On the other hand, According to Kramer, Intervertebral disc syndromes occurs commonly in middle age, the maximum of which is between fourties and fifties of age and 68% is aged between 30 to 60 years. So it supports the samples of this study [8].

According to Kramer, cervical syndromes affect equally in male and female. This also supports the male and female samples of this study. Because there was 50% male and 50% female participated in both control and experimental group in the study [8].

The subjects participated in this study fulfilled the symptomatic criteria for Cervical Derangement Syndrome and was found to meet the inclusion criteria and excluding the contraindications to the applied therapies [12].

The causes of pain due to Cervical Derangement Syndrome, its symptoms and signs was suggested to be neurogenic because of the types and distribution of the pain [12, 5].

The mean difference of pain reduction from both experimental and control group shows that the study was effective in reducing pain intensity and proves clinically significant. On the other hand, the mean difference of neck disability reduction from both groups also shows that the study was beneficial in terms of reducing disability and proves clinically significant.

The analysis of significance was carried out by using unrelated *t* test to compare the effectiveness of Neural Mobilization technique along with McKenzie Approach (Directional Preference) as a combination therapy for management of pain and minimize disability of the patients with Cervical Derangement Syndrome as compared to McKenzie Approach (Directional Preference) alone.

By using an unrelated *t* test on the data the results were found to be significant ($p < 0.05$ for a one-tailed hypothesis). The null hypothesis can therefore be rejected. This means that Neural Mobilization along with McKenzie Approach (Directional Preference) is more effective than McKenzie Approach (Directional Preference) only for reducing pain and disability in patients with Cervical Derangement Syndrome.

Kumar (2010) found in his study, statistically significant in McKenzie Approach group and Neural Mobilization group separately. The Mean percentage of improvement in arm for McKenzie group was 73 % on 5th day and 96 % in 10th day with t-value 3.467 and p-value less than 0.02.

In this study, Researcher found reduction of pain in both control group and experimental group. But the comparisons of both groups show that, Neural Mobilization along with McKenzie Approach (Directional Preference) is effective in reducing neck pain and disability.

5. Conclusion

The study was an experimental design to examine the effectiveness of Neural Mobilization along with McKenzie Approach (Directional Preference) for Cervical Derangement Syndrome, where the results of the study have demonstrated that the combination technique is significantly capable of producing beneficial effects on pain reduction, functional disability minimization and cervical spinal mobility in patients with Cervical Derangement Syndrome.

Reduction of pain and associated symptoms were maximum in the patients treated with combination of Neural Mobilization technique along with McKenzie Approach (Directional Preference), Range of Motion recovery as well as Reduction of Functional Disability was also found clinically significant.

The result also indicate that the significant changes in both groups are due to the selection of a well- defined population of mechanical neck pain patients using specific inclusion and exclusion criteria. It may be helpful for patient with mechanical neck pain to increase functional abilities for mechanical neck pain.

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