COMPARING THE EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION VERSUS NERVE GLIDING TECHNIQUE ON PAIN AND FUNCTIONAL DISABILITY IN PATIENTS WITH CERVICAL RADICULOPATHY

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ABSTRACT:

Cervical radiculopathy is a condition which is clinically referred as pain in one or both upper limbs starting from the cervical region. This occurs because of disc herniation in the intervertebral discs of cervical region or arthritic degeneration or osteophyte processes which involves the nerve root, leading to symptoms produced into the neck and arm of the affected region. This comparative study includes 30 individuals who were recruited with age group between 18 to 50 years including both male and females from shri isari velan mission hospital. They were divided into two groups and were given proprioceptive neuromuscular facilitation (PNF) and nerve gliding techniques. Results showed a highly significant improvement VAS and NDI scores. Based on the statistical analysis, This study concludes that both proprioceptive neuromuscular facilitation (PNF) and nerve gliding showed considerable effects in improving pain and functional disability. However proprioceptive neuromuscular facilitation (PNF) demonstrated greater improvement than compared with nerve gliding technique.

KEYWORDS:

Proprioceptive neuromuscular facilitation, cervical radiculopathy, nerve gliding, visual analog scale, radial nerve

INTRODUCTION

Cervical radiculopathy (CR), commonly referred to as a “pinched nerve,” occurs when a nerve root in the cervical spine becomes compressed or irritated at the point where it exits the spinal cord. It is a disorder affecting the spinal nerve roots and is most caused by space-occupying lesions such as intervertebral disc herniation, compression, and bony spurs, particularly osteophytes in the cervical spine. The condition is characterized by nerve root compression resulting from herniated disc material or degenerative arthritic changes of the vertebrae [(1)]. These pathological changes may stimulate pain receptors in the surrounding soft tissues, producing pain that originates in the neck and radiates into one or both upper limbs. Such lesions can lead to nerve root inflammation, impingement, or a combination of both [(2)]. The primary causes of cervical radiculopathy include mechanical compression and chemical irritation of the cervical nerve roots. In addition to neck pain and stiffness, patients often experience discomfort in the shoulders, upper back, and chest region. It is also commonly associated with sensory disturbances such as tingling or numbness in the upper extremities and may sometimes lead to headaches [(3,4)]. The natural course of cervical radiculopathy

is generally favourable, as approximately 83% of individuals recover within 24 to 36 months, with significant improvement typically occurring within 4 to 6 months after the onset of symptoms. The incidence of cervical radiculopathy is estimated to be around 83 cases per 100,000 individuals, with a prevalence of approximately 3.5 cases per 1,000 persons. This condition can have a considerable social and occupational impact, as persistent symptoms may interfere with daily activities and reduce overall quality of life [(5)].The reasons include degenerative disc diseases, osteophyte formation or foraminal narrowing, while trauma and infections can also be added as other causes. Symptoms appear with burning pain which radiates into the upper limbs along with sensory loss, motor weakness or reflex changes. Symptoms of cervical radiculopathy also include neck and upper limb pain along with neurological signs such as muscle weakness, disturbed sensation, and decreased reflex. Patients with cervical radiculopathy showed sensory alterations including reduced sensation (mechanical, thermal, and vibratory) along with increased sensitivity to cold and pressure pain in the most painful region and the affected dermatome. These sensory changes were assessed using quantitative sensory testing (QST), including measures such as pressure pain threshold (PPT), cold pain threshold (CPT), and heat and cold detection thresholds (HDT/CDT). Even though the direct costs for conservative care are very less for this population in contrast with non-specific neck pain, this group (i.e. cervical radiculopathy) might have more indirect costs due to a longer time of diminished efficiency [(6)]. Proprioceptive neuromuscular facilitation (PNF) is a technique which is widely used as a rehabilitation approach in physiotherapy field. It emphasizes a positive approach, a functional approach and the use of motor learning principles. PNF exercises are a pattern of movements which help in rectification and facilitation of sensory and motor function. This concept uses movement patterns to restore lost function. The procedures of PNF combine with manual therapies that makes the muscles stronger, flexible and capable of movement. These techniques are applied across numerous patient populations, which includes neurological, musculoskeletal, and for conditions affecting the old age people .

The PNF contain stretching and control activities which involves the neuromuscular system. The techniques of PNF are Hold-relax, contract-relax and hold-relax-contract. The techniques and principles of PNF may include multiple stimuli, traction techniques and resistance for muscle enhancement and motor learning. PNF stretching which is composed of hold-relax technique includes an isometric contraction and allows a longer duration for the muscle to relax before the stretch is applied. The contract-relax technique which will be carried out with forceful contractions of the muscle and its release. The hold-relax-contract technique combines both hold-relax and contract-relax. The uses of PNF comprise of specific patterns of resisted muscle contraction and stretching for improving the neuromuscular coordination and mobilization of joints [(7)]. Neurodynamic mobilization techniques, also called Nerve gliding exercises which involves a series of upper or lower limb movements incorporated for gentle stretching and mobilization of nerves. These exercises are given to decrease the symptoms which are in relation with neural mechanosensitivity in facilitation of peripheral nerve excursion related to other nearby tissues. This will potentially lower intraneural oedema, improves the neural mobility, and decreases pain-related protective responses [(8)]. These exercises are commonly incorporated in treating various musculoskeletal conditions, where specific limb positions help in improving nerve flexibility and function as part of therapy [(9)]. Nerve gliding (or) flossing includes passive movement techniques in which the nervous and anatomical structures which surrounds the affected nerve tissue will be gently mobilized along with controlled movements and it is believed to improve the nerve health by increasing axonal flow, facilitating intraneural circulation, controlling fluid accumulation, and restoring the mobility of the nerve by modulating the mechanical pressure and connective tissue function [(10)]. So here, our present study was conducted to evaluate the effectiveness of proprioceptive neuromuscular facilitation and nerve gliding in treating cervical radiculopathy.

AIM OF THE STUDY:

The aim of the study is to compare the effects of proprioceptive neuromuscular facilitation versus nerve gliding technique on pain and functional disability in patients with cervical radiculopathy.

OBJECTIVE OF THE STUDY:

To evaluate the effectiveness of proprioceptive neuromuscular facilitation exercises on treating pain and improving functional disability in cervical radiculopathy patients.

To evaluate the effectiveness of nerve gliding techniques on treating pain and improving functional disability in cervical radiculopathy patients

BACKGROUND OF THE STUDY:

Cervical radiculopathy (CR), commonly referred to as a "pinched nerve," occurs when a nerve root in the cervical spine becomes compressed or irritated at the point where it exits the spinal cord. It is a disorder affecting the spinal nerve roots and is most caused by space-occupying lesions such as intervertebral disc herniation, compression, and bony spurs, particularly osteophytes in the cervical spine. The condition is characterized by nerve root compression resulting from herniated disc material or degenerative arthritic changes of the vertebrae (1). These pathological changes may stimulate pain receptors in the surrounding soft tissues, producing pain that originates in the neck and radiates into one or both upper limbs. Such lesions can lead to nerve root inflammation, impingement, or a combination of both (2). The primary causes of cervical radiculopathy include mechanical compression and chemical irritation of the cervical nerve roots. In addition to neck pain and stiffness, patients often experience discomfort in the shoulders, upper back, and chest region. It is also commonly associated with sensory disturbances such as tingling or numbness in the upper extremities and may sometimes lead to headaches.

NEED OF THE STUDY:

- The need of the study is to reduce pain and improving functional disability in patients with cervical radiculopathy.
- Cervical radiculopathy occurs when a nerve root in the cervical spine becomes irritated at the point where it exits the spinal cord. This occurs because of disc herniation in the intervertebral discs or arthritic degeneration of cervical region.
- Proprioceptive neuromuscular facilitation exercises are a pattern of movements which help in rectification and facilitation of sensory and motor function and uses movement patterns to restore lost function.
- Nerve gliding exercises involve a series of upper or lower limb movements given to decrease the symptoms with neural mechano sensitivity and pain related protective responses.

NULL HYPOTHESIS:

There is no significant difference between proprioceptive neuromuscular facilitation and nerve gliding techniques in reducing pain and improving functional disability in cervical radiculopathy patients.

ALTERNATE HYPOTHESIS:

There is a significant difference between proprioceptive neuromuscular facilitation and nerve gliding in reducing pain and improving functional disability in cervical radiculopathy patients.

REVIEW OF LITERATURE

1. **Umaima Naeem et al (2025)**: In this study "proprioceptive neuromuscular facilitation and passive vertebral mobilization for neck disability in patients with mechanical neck pain", they have concluded that proprioceptive neuromuscular facilitation has better short-term pain-relieving effects.
2. **Ali Husnain et al (2025)**: In this study, "comparative effectiveness of PNF technique and mulligan concept of mobilization on pain, range of motion and functional mobility in text neck syndrome", they have concluded that PNF has significantly improved pain, range of motion and functional mobility in patients.
3. **Osain bin Khalid et al (2025)**: In this study, "effectiveness of nerve glides among housewives with radiating neck pain to improve functional outcomes", they have concluded that nerve gliding exercises have significantly improved pain and functional outcomes in housewives with radiating neck pain.
4. **Faruk Danisman et al (2025):** In this study, **"**mulligan and proprioceptive neuromuscular facilitation techniques in the treatment of neck pain", they have concluded that proprioceptive neuromuscular facilitation stands out as proven effective method in treating neck pain.
5. **Ammar A. Rizk et al (2025):** In this study, **"**adverse neural tension versus neural gliding on pain and hand grip in patients with cervical radiculopathy" they have concluded that neural gliding is helpful in the decline of pain, functional abnormality and improving the physiological functioning of the nerve root and increasing the hand grip strength.
6. **Kaiqi fan et al (2025):** In this study, **"**efficacy of tuina versus proprioceptive neuromuscular facilitation (PNF) technique in patients with nonspecific chronic neck pain" they have concluded that proprioceptive neuromuscular facilitation may offer short term pain relief compared to monotherapies for nonspecific chronic neck pain.
7. **Surbhi Kaura et al (2025):** In this study **"**impact of PNF stretching and mobilisation on pain and quality of life in cervical radiculopathy" they have concluded that PNF stretching and mobilisation are beneficial for pain, hand grip strength and improving the quality of life.
8. **Datri Bhattacharya et al (2025):** In this study "efficacy of proprioceptive neuromuscular facilitation technique in patients with cervical originated arm pain on pain and functional disability" they have concluded that use of proprioceptive neuromuscular facilitation in treating cervical originated arm pain is more effective.

METHODOLOGY:

STUDY DESIGN: Experimental study design.
STUDY TYPE: Comparative study pre and post type.
STUDY DURATION:four weeks.
STUDY SAMPLING METHOD: Simple random sampling was taken. **STUDY SETTING:** Shri Isari Velan Mission Hospital, Thazhambur
SAMPLE SIZE: 30 subjects
SAMPLE SELECTION:

INCLUSION CRITERIA:

- Age group between 18-50 years.
- Patient who are involved to participate in this study (both males and females).
- NDI scoring of less than 5% and VAS scoring of more than 4 out of 10.
- History of neck pain in past 3 months.
- Reduced cervical range of motion.
- Positive Spurling and compression test.
- Subacute pain lasting for 2 months.

EXCLUSION CRITERIA:

- Patients with Upper limb problems.
- Patient who are not involved to participate in this study (both males and females).
- Patients with Head injuries and cervical spine injuries.
- Patients with Birth or acquired defects.
- Resting blood pressure more than 149/90 mmHg.
- Patients with Psychiatric disorders.
- Uncontrolled dizziness (or) vertigo.

OUTCOME MEASURES:

- Neck Disability Index (NDI).
- Visual Analog Scale (VAS).

PROCEDURE:

Total of 30 subjects who had fulfilled the inclusion and exclusion criteria were selected for the study. They were divided into two groups, Group A and Group B. Each group consists of 15 subjects. Group A was given with PNF techniques and Group B was given with nerve gliding techniques. The study was conducted within a duration of four weeks. After the procedures, both groups were assessed by neck disability index, visual analog scale. The treatment protocol was explained to the subjects in advance.

GROUP A received proprioceptive neuromuscular facilitation techniques.

PROGRESSION- Done three times in a week for four weeks. Each pattern is performed 10 times with 3 repetitions. Each session consists of 20 to 30 minutes.

TECHNIQUE: The Proprioceptive neuromuscular facilitation technique involves various superimposed techniques and methods at muscle contraction, relaxation and in strengthening.

Proprioceptive neuromuscular facilitation techniques include

a) Hold-relax technique.
b) Contract-relax technique.
c) Hold-contract-relax technique.

PROCEDURE:

- Patient is placed in sitting position
- Therapist stands slightly to right of the patient behind them aligning their body posture diagonally towards the direction of the neck's intended movement.
- Then, the therapist performs the following movements

1. Cranio-cervical extension with left rotation.
2. Cranio-cervical extension with right rotation.
3. Cranio-cervical flexion with left rotation.
4. Cranio-cervical flexion with right rotation.

- Therapist may apply therapeutic grips i.e. hold relax for neck and contract relax for shoulder girdle.
- These techniques are applied in a combination of rhythmic initiation, a blend of isotonic, dynamic reversals and contract-relax method.

GROUP B received nerve gliding techniques.

PROGRESSION- Done three times in a week for four weeks. 12 sessions will be performed in total. Each session will be performed within a duration of 20 to 30 minutes. Gliding was done in four sets of 10 repetitions.

TECHNIQUE: Nerve gliding techniques includes the following

a) Median nerve gliding.
b) Radial nerve gliding.
c) Ulnar nerve gliding.

PROCEDURE:

a) MEDIAN NERVE GLIDING:

- Patient is placed in supine lying on the bed. Therapist should position themselves on the affected side adjacent to the patient.
- Therapist performs shoulder depression, elbow 90^0 flexion, forearm supination, wrists and fingers extension then Passively takes the arm to 90-100^0 of abduction.
- Gliding was done in a series of four sets of 10 repetitions was altered between extension of elbow and flexion of wrist and flexion of elbow and flexion of wrist.
- Slow oscillations were done for 10 seconds at each rep with 30 seconds between each set.

b) RADIAL NERVE GLIDING:

- Patient is placed in supine lying in bed and therapist sitting adjacent to the patient.
- Patient's Shoulder is abducted with shoulder girdle depression, elbow extension, shoulder internal rotation, forearm pronation, flexion of wrist, thumb and all fingers and ulnar deviation.

c) ULNAR NERVE GLIDING:

- Patient is placed in supine lying and therapist sitting adjacent to the patient.
- Therapist then performs the following movements: shoulder depression, 90^0abduction, elbow in full flexion, forearm in full pronation, head face opposite side, the patient's wrist brought to radial deviation in full extension.

DATA ANALYSIS

The collected data are tabulated using Microsoft excel. An unpaired t test was used to assess the outcome measures of PNF and nerve gliding between the groups. Paired t test was used to assess the outcome of PNF and nerve gliding within the groups using VAS and NDI. A p value of less than 0.05 were considered statistically significant. Results were presented in the form of tables and graphs.

TABLE 1
COMPARISON OF VAS SCORES BETWEEN GROUP A AND GROUP B USING UNPAIRED T-TEST

TEST	GROUP A MEAN	GROUP A SD	GROUP B MEAN	GROUP B SD	T VALUE	SIGNIFICANCE
PRE	6.6	0.99	6.53	0.92	0.1919	0.8492
POST	3.2	0.68	4.2	0.68	4.0505	0.0004

($p < 0.05$) ($p<0.001$)
The above table reveals the mean, standard deviation (S.D), statistical significance two tailed p value of the pre and post-test values of VAS between group A and group B.
This table shows that there is a significant difference in post-test values of VAS between group A and group B in post-test weeks.

GRAPH-1
COMPARISON OF PRE AND POST VALUES OF VAS BETWEEN GROUPS

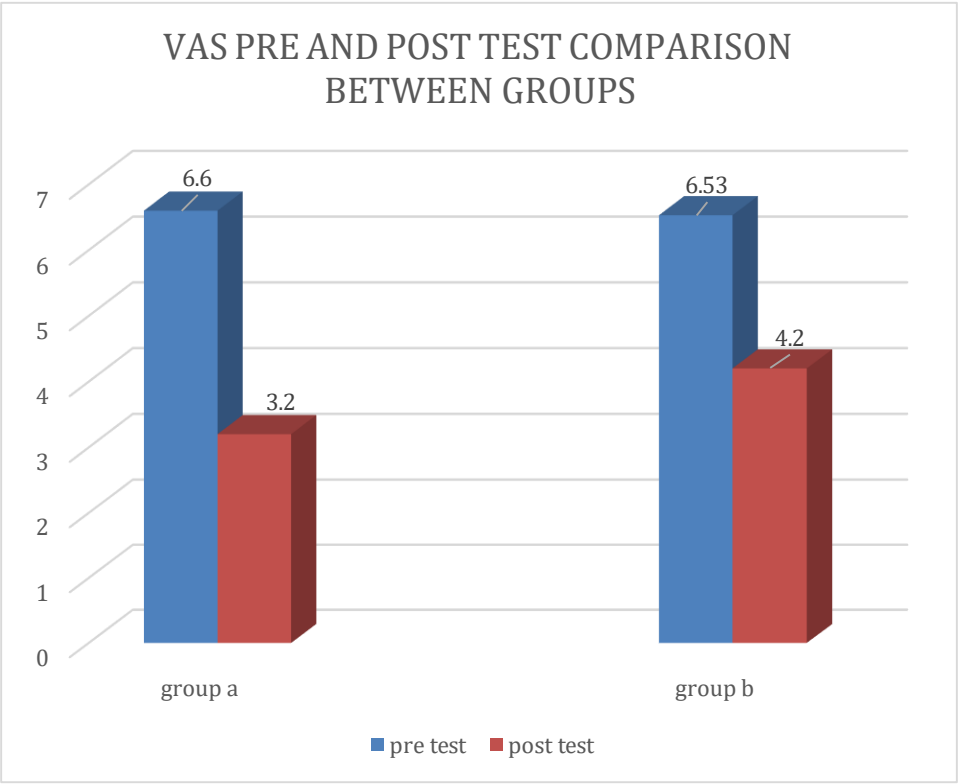


TABLE 2

COMPARISON OF NDI SCORES BETWEEN GROUP A AND GROUP B USING UNPAIRED T-TEST

TEST	GROUP A MEAN	GROUP A SD	GROUP B MEAN	GROUP B SD	T VALUE	SIGNIFICANCE
PRE	31.67	3.09	30.6	2.38	1.0593	0.2985
POST	15.13	1.73	22.13	2	10.2749	0.0001

($p<0.05$) ($p<0.001$)

The above table reveals the mean, standard deviation (S.D), statistical significance two tailed p value of the pre and post-test values of NDI between group A and group B.

This table shows that there is a significant difference in post-test values of NDI between group A and group B in post-test weeks.

GRAPH-2

COMPARISON OF PRE AND POST VALUES OF NDI BETWEEN GROUPS

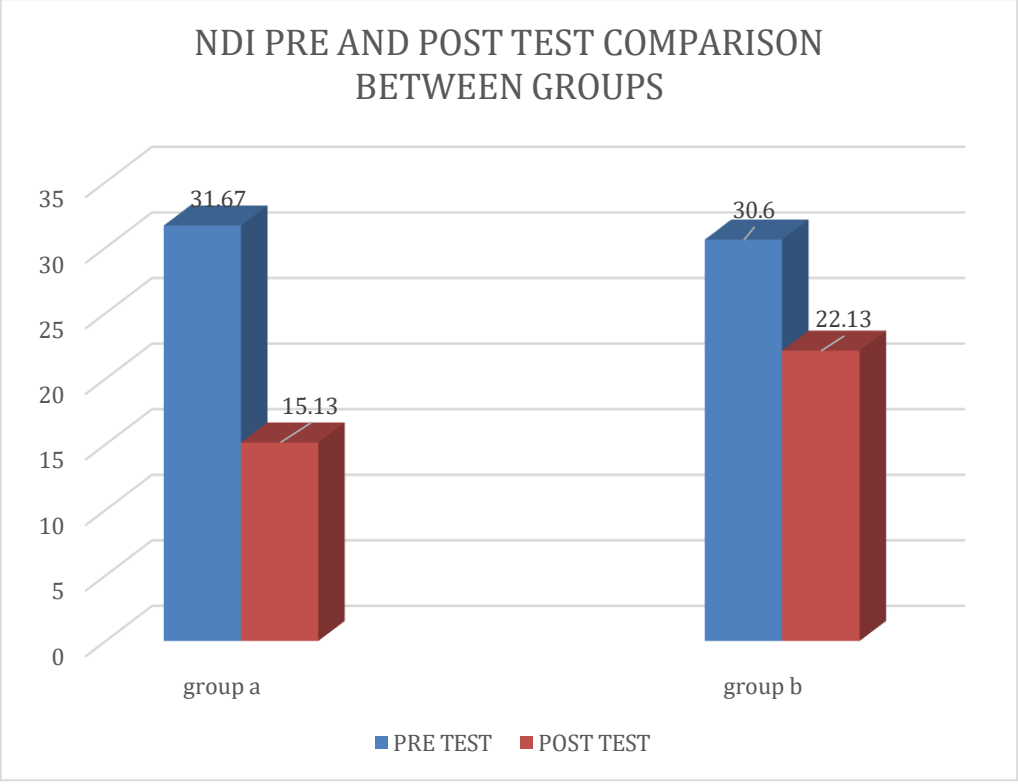


TABLE 3

PRE-TEST AND POST-TEST COMPARISON OF VAS AND NDI SCORES USING PAIRED T-TEST WITHIN GROUP A

TEST	PRE TEST		POST TEST		T VALUE	SIGNIFICANCE
	MEAN	S. D	MEAN	S. D		
VAS	6.60	0.99	3.20	0.68	15.9020	0.001
NDI	30.67	2.97	15.13	1.73	14.80	0.001

$p < 0.05$

The above table reveals the mean, standard deviation (S.D), statistical significance two tailed p value of the pre and post-test values of VAS and NDI within group A.

This table shows that there is a significant difference in post-test values of VAS and NDI within group A in post-test weeks.

GRAPH-3

COMPARISON OF VAS AND NDI SCORES (PRE AND POST) WITHIN GROUP A

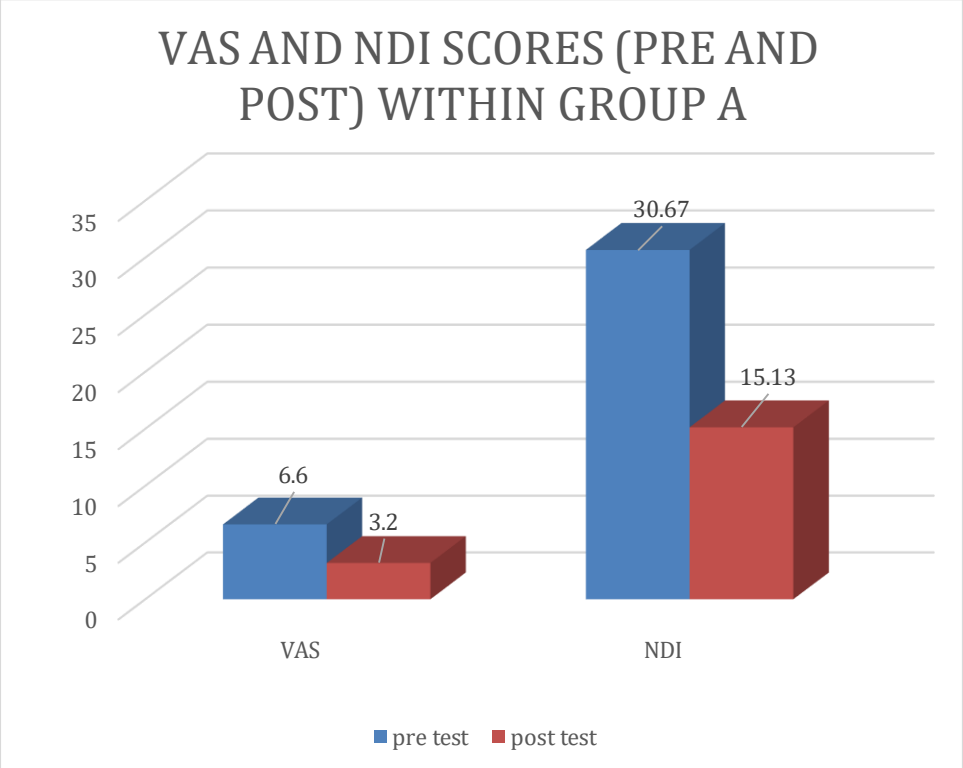


TABLE 4

PRE TEST AND POST TEST COMPARISON OF VAS AND NDI USING PAIRED T TEST WITHIN GROUP B

TEST	PRE TEST		POST TEST		T VALUE	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
VAS	6.53	0.92	4.20	0.68	14.6416	0.0001
NDI	30.60	2.38	22.13	2.00	13.20	0.0001

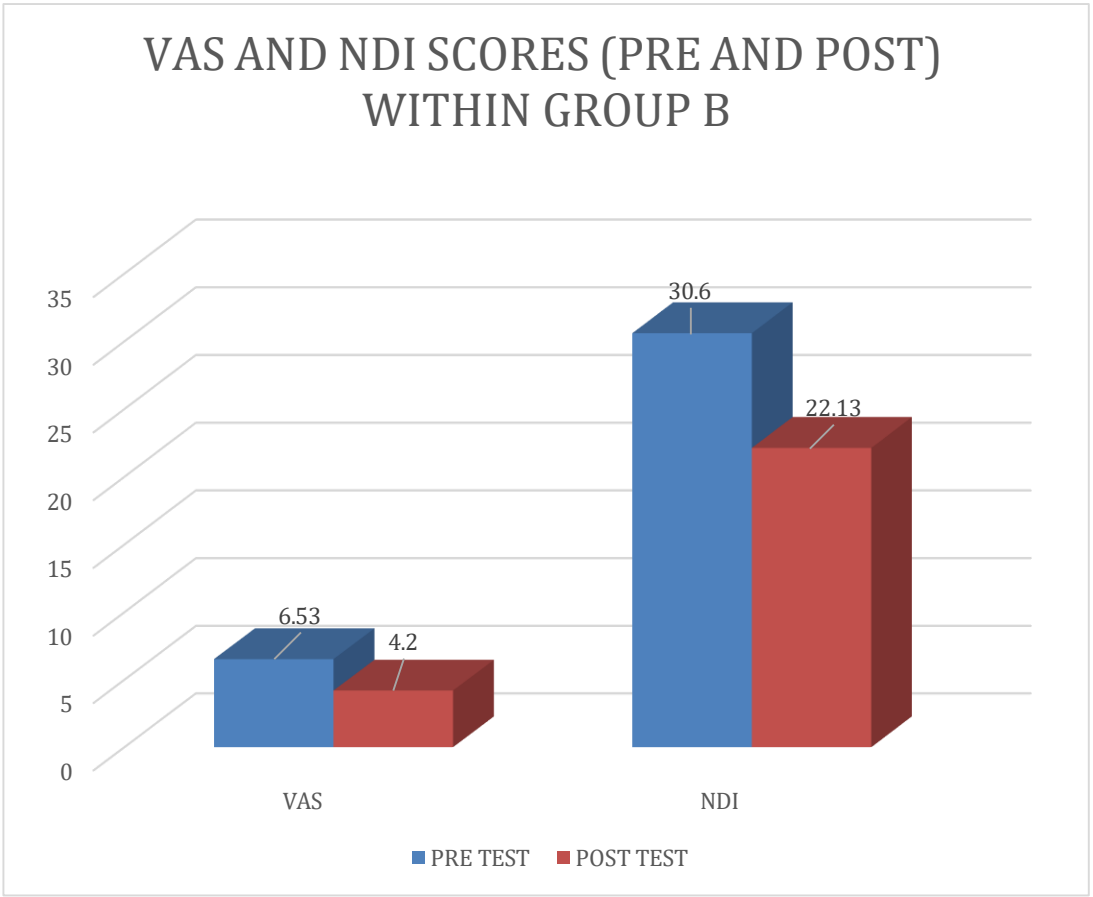
$p < 0.05$

The above table reveals the mean, standard deviation (S.D), statistical significance two tailed p value of the pre and post-test values of VAS and NDI within group B.

This table shows that there is a significant difference in post-test values of VAS and NDI within group B in post-test weeks.

GRAPH-4

COMPARISON OF VAS AND NDI SCORES (PRE AND POST) WITHIN GROUP B



RESULT:

On comparing the mean values of both group A and group B obtained from VAS and NDI using unpaired t test (between groups), they showed significant difference in posttest mean values, with group A showing lower mean values than group B. Therefore, null hypothesis is rejected.

On comparing the mean values of both group A and group B obtained from VAS and NDI using paired t test (within groups), both groups showed significant improvement between pre- test and post-test values. Therefore, null hypothesis is rejected.

Hence group A is more effective than group B in reducing pain and disability.

DISCUSSION:

Cervical radiculopathy is a condition that affects the spinal nerve roots and is most caused by space-occupying lesions such as intervertebral disc herniation compression and bony spurs and characterized by nerve root compression resulting from herniated disc material or degenerative arthritic changes of the vertebrae. The incidence of cervical radiculopathy is estimated to be around 83 cases per 100,000 individuals, with a prevalence of approximately 3.5 cases per 1,000 persons. This condition can have a considerable social and occupational impact, as persistent symptoms may interfere with daily activities and reduce overall quality of life. The aim of the study is to compare the effects of proprioceptive neuromuscular facilitation versus nerve gliding technique in patients with cervical radiculopathy. In this study, proprioceptive neuromuscular facilitation was found to be more effective and patients who received nerve gliding also showed significant improvement in which was not better than the patients who had received proprioceptive neuromuscular facilitation technique. Outcome measures were taken using visual analog scale and neck disability index.

The present study was to compare the effects of proprioceptive neuromuscular facilitation technique versus nerve gliding technique in patients who are suffering from cervical radiculopathy. The purpose of this study was to evaluate the range of motion, decrease in pain and help in improving the quality of life in cervical radiculopathy patients.

Proprioceptive neuromuscular facilitation is a technique which is a widely used rehabilitation approach in physiotherapy field. These techniques are applied across numerous patient populations including neurological, musculoskeletal and for conditions affecting the old age populations. These exercises involve hold-relax, contract-relax and hold-contract-relax techniques which helps in neuromuscular coordination and mobilization of joints. Hold-Relax and Contract-Relax are stretching techniques in the PNF concept used for muscle elasticity improvement, and they have a positive influence on passive and active ROM.

CONCLUSION:

Based on the statistical analysis this study concludes that both proprioceptive neuromuscular facilitation (PNF) and nerve gliding showed considerable effects in improving pain and functional disability. However proprioceptive neuromuscular facilitation (PNF) demonstrated greater improvement than compared with nerve gliding technique.

LIMITATIONS OF THE STUDY:

- Small sample size.
- The duration of the study is short.
- Long term follow up of the patients was not possible.
- Study was done between 18-50 years of age.

RECOMMENDATIONS OF THE STUDY:

- Large sample size can be used.
- Different age group can be analyzed.
- Long duration studies are recommended with a regular and a long term follow up.
- Studies can be performed either in male or female subjects.

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