International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# A Comparative Study on Instrument Assisted Soft Tissue Mobilization Versus Autogenic Inhibition Technique on Pain Intensity and Function In Subjects with Mechanical Neck Pain

**Devarapalli Dileep[1], Kavalakuntla Priyanka[2], Patchava Apparao[3], Rayudu Geetha Mounika[4]**

[1]Post Graduate Student MPT (Orthopaedics), Department of Physiotherapy, Swatantra Institute of Physiotherapy and Rehabilitation, Rajamahendravaram, Andhra Pradesh, India.
[2] Assistant Professor, Department of Physiotherapy, GSL college of physiotherapy, Rajamahendravaram, Andhra Pradesh, India
[3]Principal, Swatantra Institute of Physiotherapy and Rehabilitation, Rajamahendravaram, Andhra Pradesh, India.
[4]Professor, Department of Physiotherapy, GSL college of physiotherapy, Rajamahendravaram, Andhra Pradesh, India

**ABSTRACT:**

**Background:** Mechanical neck pain is a common musculoskeletal condition. This study aims to compare the effectiveness of two manual therapy approaches Instrument Assisted Soft Tissue Mobilization (IASTM) and Autogenic Inhibition Technique (AIT) in reducing pain intensity and improving functional ability in individuals with Mechanical Neck Pain.

**Methods**: Quasi experimental study design was used, 80 subjects with age between 18 to 70 years having a clinical diagnosis of Mechanical Neck Pain were randomly allocated in to two groups. In Group A (n=40) subjects were treated with Instrument Assisted Soft Tissue Mobilization whereas in Group B (n=40) subjects received with Autogenic Inhibition Technique. Participants were given intervention thrice a week for 4 weeks. The outcome measures of this intervention were measured in terms of Visual Analogue Scale for Pain, Universal Goniometer for Cervical Range of Motion and Neck Disability Index for Function.

**Results:** Independent 't' test was used to compare the mean significance difference between continuous variables. Paired 't' test was used to assess the Statistical significance difference between Pre and Post test score. Statistical analysis of the data revealed that within the group comparison, both groups showed significant improvement in all parameters. Whereas, in between the group comparison, Instrument Assisted Soft Tissue Mobilization showed better improvement compared to Autogenic Inhibition Technique.

**Conclusion**: After 4 weeks of intervention both Instrument Assisted Soft Tissue Mobilization and Autogenic Inhibition Techniques showed significant improvement on reducing Pain, improving Cervical Range of Motion and Function. However, Instrument Assisted Soft Tissue Mobilization group were found to be more effective when compared to Autogenic Inhibition Technique. From the findings of the current

study, Instrument Assisted Soft Tissue Mobilization can be opted as a treatment of choice for the management of subjects with Mechanical Neck Pain.

**Keywords:** Mechanical Neck Pain, Visual Analogue Scale, Cervical Range of Motion, Function, Instrument Assisted Soft Tissue Mobilization and Autogenic Inhibition Technique.

## INTRODUCTION

Neck pain is a prevalent condition that places a significant burden on society.[1] Majority of neck pain cases are mechanical in nature, and Mechanical Neck Pain (MNP) is characterised as pain that is localized in the cervical spine or cervicothoracic junction and increases with cervical movement, standing, or cervical region muscle palpation. Nowadays, Mechanical Neck Pain is a common problem that makes it difficult for people to go about their daily lives.[2]

Several epidemiological and statistical studies have shown very common Mechanical Neck Pain is, with 50% of people reporting some degree of neck pain at some point in their lives, women are more likely than men to experience it in middle age. The prevalence of neck pain varies widely across studies, with a mean lifetime prevalence of 48.5% (range 12.2-71.0%) and a mean point prevalence of 7.6% (range 5.9-38.7%).[3] One of the most common health issues treated by Physiotherapy units in primary care is Mechanical Neck Pain, with an estimated yearly incidence of 12 episodes per 1000 participants with a primary care visit.[4]

The primary etiology of neck pain is not fully understood. Often prolonged work stations use and biomechanical causes such as position and endurance of neck motion can be cause of cervical pain.[5]Disorders of the neural tissue, discs, bones, periosteum, muscles, ligaments, uncovertebral or intervertebral joints, and discs can all cause Mechanical Neck Pain. The abnormal physical load on different tissues makes people more vulnerable to musculoskeletal injuries.[6] Numerous factors, including social, psychological, and environmental components, influence the incidence of neck pain.[7]

The neck pain task force group should focus on grading or classifying patients into four general categories instead of determining a precise anatomical diagnosis. Research and treatment for neck pain vary depending on its grade.

Grade I: Neck pain that doesn't impede too much with day-to-day activities and doesn't show any indications of a serious illness.

Grade II: Neck pain that interferes with everyday activities but does not show any indications of a significant pathology.

Grade III: Neurologic evidence of nerve compression accompanied by neck pain.

Grade IV: Signs of significant structural pathology together with neck pain.[8]

Most of the studies have revealed that individuals experiencing persistent neck discomfort exhibit modified cross-sectional regions within the deep cervical extensor musculature, particularly in the semispinalis cervicis and cervical multifidus muscles.[9] Reduced mobility in the upper cervical spine can result in increased movement in the lower cervical spine, increase fatigue in the sternocleidomastoid, anterior scalene, and upper trapezius, alter breathing patterns and postures, and reduce range of motion.[10] Inadequate activation of the deep cervical muscles in the cervical spine can result in joint instability, recurrent microtrauma, and finally discomfort.[11] On physical examination, guarding may cause a limited range of motion and palpably painful neck muscles. Research has indicated that people experiencing neck pain exhibit elevated myoelectric activity, regardless of the underlying cause.[12]

There are number of risk factors that might lead to neck pain, such as psychopathology, heredity, poor sleep, smoking, obesity, sedentary lifestyle, trauma, prior neck pain, back pain, and overall poor health. Athletes, wrestlers, and ice hockey players had the highest rates of neck pain among sports and occupational accidents.[13] Especially work-related characteristics associated with neck discomfort are seen in manual labourers, healthcare workers, office and computer workers, and occupational drivers are more likely than others to experience neck and shoulder pain.[14]

Mechanical Neck Pain is treated with a combination of medications, muscle relaxants, anti-inflammatory drugs, injections of botulinum toxin, anticonvulsants, muscle relaxation training, Physical therapy management includes Manipulation techniques, Dry needling, Laser therapy, intermittent mechanical or manual traction, Muscle Energy Techniques, Stretching, Strengthening, Endurance exercises, Aerobic training, muscle building exercises, and posture correction.[15,16,17]

Recent research indicates that a highly skilled myofascial approach called Instrument Assisted Soft Tissue Mobilization has been popular in recent decades for the treatment of soft-tissue conditions.[18] It is based on the theory put forth by James Cyriax, however instead of applying cross friction massage with fingers, specifically made steel implements are used to induce controlled micro damage in the soft tissue and activate fibroblasts to aid in the healing process.[19]

By applying deep pressure to a larger area, this technique not only reduces pain but also helps achieve a greater effect.[20] Additionally, after acute and chronic soft tissue injuries, Instrument Assisted Soft Tissue Mobilization may enhance patients function and lessen their short-term suffering. Because it affects range of motion and flexibility, it can also be utilised to treat non-pathological conditions such as muscle tightness and delayed onset of muscle soreness. Sports recovery and athletic training may benefit from these advantages.[21]

Advanced soft tissue active stretching techniques known as Muscle Energy Techniques (MET) are a part of manual therapy for Mechanical Neck Pain. It entails stretching the muscles that restore range of motion and gently contracting the muscles that aid in relaxing. By stretching short muscles and fascia, strengthening weak muscles, mobilising joints, and enhancing muscle tone and circulation, these techniques help to relieve pain.[22]

Autogenic Inhibition refers to the reduction in excitability that happens in a contracted or stretched muscle as a result of inhibitory signals coming from the same muscle's Golgi tendon organ. The Golgi tendon organs Ib afferent fibers become activated as a result of this strain. Afferent fibers transmit signals to the spinal cord, where the stimuli trigger the activity of inhibitory interneurons in the spinal cord.[23]

By providing an inhibitory stimulation to the alpha motor neuron, these interneurons reduce the excitability of the nerves and the efferent motor drive of the muscles. According to theory, this response happens when the body tries to distribute the strain equally among the muscle's motor units, supporting the body's asynchronous recruitment in preventing the fatigue of particular motor units.[24]

Due to the growing evidence based treatment for Mechanical Neck Pain, S.Sbardella et al, concluded in a systematic review there is still limited available evidence regarding Muscle Energy Technique in Mechanical Neck Pain.[25] Matthew Lambert et,al in a systematic review concluded Instrument Assisted Soft Tissue Mobilization is effective treatment intervention in reducing pain and improving function in musculoskeletal impairments further research is required to strengthen available evidence to examine the effects of Instrument Assisted Soft Tissue Mobilisation in relation to other manual therapy techniques.[26]

This study is beneficial for therapists in providing evidence-based treatment and which technique to add to their regular practices for managing Mechanical Neck Pain. Furthermore, this study adds new advances

in treatment techniques available for managing Mechanical Neck Pain in long term.

## NEED OF THE STUDY

Mechanical neck pain is considered as one of the most widely recognized musculoskeletal condition. It commonly arises insidiously and is generally multifactorial in origin. Nearly 50% of the population suffers from neck pain at least once in their life time, due to stress, sedentary lifestyle and poor posture. Moreover, continuous load on the cervical spine alters the spinal curve, resulting in joint degeneration, a straight cervical spine and forward head posture. Increased myoelectric activity in patients with neck pain, muscle spasms will occur in neck muscles. Due to neck muscles tightness and cervical spine stiffness the cervical range of motion decreases and it affects the activities of daily living. There are numerous Physiotherapeutic interventions are available for Mechanical Neck Pain. Recent studies suggests that Instrument Assisted Soft Tissue Mobilization and Autogenic Inhibition Technique have been found to be effective in reducing pain, improving function and cervical range of motion, but there are limited studies found on their comparison. So the need of the study arises.

## AIM OF THE STUDY

The aim of the study is to compare the Instrument Assisted Soft Tissue Mobilization versus Autogenic Inhibition Technique on pain intensity and function in subjects with Mechanical Neck Pain.

## OBJECTIVES OF THE STUDY

1. To determine the effect of Instrument Assisted Soft Tissue Mobilization on pain intensity and function in subjects with Mechanical Neck Pain.
2. To determine the effect of Autogenic Inhibition Technique on pain intensity and function in subjects with Mechanical Neck Pain.
3. To compare the Instrument Assisted Soft Tissue Mobilization versus Autogenic Inhibition Technique on pain intensity and function in subjects with Mechanical Neck Pain.

## MATERIALS AND METHODOLOGY

**STUDY DESIGN:** Quasi experimental study design

**ETHICAL CLEARANCE AND INFORMED CONSENT:** The study protocol was approved by the Ethical Committee of GSL Medical College & General hospital (Annexure-I), the investigator explained the purpose of the study and given the patient information sheet. The participants were requested to provide their consent to participate in the study (Annexure-II). All the participants signed the informed consent and the rights of the included participants have been secured.

**STUDY POPULATION:** Subjects with Mechanical Neck Pain

**STUDY SETTING:** The study was conducted at Department of Physiotherapy OPD, Tertiary care Teaching Hospital, Rajamahendravaram

**STUDY DURATION:** Study was conducted during period between 1st August 2023 to 31st July 2024

**INTERVENTION DURATION:** 12 sessions,3 days a week for 4 weeks

**SAMPLING METHOD:** Systematic Random Sampling

**SAMPLE SIZE:** 80 subjects for prevalence of 7.6%[27] Mechanical Neck Pain by formula Z2PQ/L2 (HereZ=1.96, prevalence(p)=7.6%, Q=100%-P=92.4%, Absolute error(L)=6)

A total of 85 subjects were screened in that 80 subjects, both male and female with Mechanical Neck Pain

who are willing to participate in the study were included in the study, all the recruited participants were explained about the study. After obtaining informed consent form and meeting the criteria, total 80 subjects were allocated into two groups equally by convenience sampling method.

**GROUP A:** Instrument Assisted Soft Tissue Mobilization along with Conventional Physiotherapy (40 subjects)
**GROUP B:** Autogenic Inhibition Technique along with Conventional Physiotherapy (40 subjects)

| GROUP | NO. OF SUBJECTS | TREATMENT |
|---|---|---|
| GROUP-A | 40 | INSTRUMENT ASSISTED SOFT TISSUE MOBILIZATION |
| GROUP-B | 40 | AUTOGENIC INHIBITION TECHNIQUE |

**Materials used:**

1. M2T blade
2. Transcutaneous electrical nerve stimulation (TENS)
3. Lubricant
4. Straps
5. Electrodes
6. Ice packs
7. Hot moist packs
8. Towel
9. Chair
10. Bed.

**CRITERIA FOR SAMPLE COLLECTION**

**INCLUSION CRITERIA:**

- Age group 18-70 years
- Both males and females
- Subjects with Mechanical Neck Pain are referred by Orthopaedic surgeon
- Mechanical neck pain for more than 4 weeks with limited neck range of motions
- Visual analogue scale score equal and more than 3 cm
- Individuals having localized pain or stiffness in spine or both combined between C3 and C7 without upper-limb radiculopathy

**EXCLUSION CRITERIA:**

- History of neck or upper back surgery
- Trauma or fracture of cervical spine
- History of a whiplash injury
- Cervical radiculopathy
- Tuberculosis, carcinoma, heart diseases, and osteoporosis
- Ongoing radiotherapy, chemotherapy, steroid therapy, or anticoagulants
- Psychiatric diseases such as phobia / obsession and depression

**OUTCOME MEASURES**

Visual Analogue Scale (VAS):[28] It was used to measure the severity of pain. It is a 10 cm line is shown to the subjects where one end is marked 0 and the other end is marked 10. It was explained to subjects that 0 represents no pain and 10 represents the maximum pain. The subjects were marked the scale based on the severity.

Universal Goniometer:[29] It was used to measure the range of motion. Movements of cervical spine such as flexion, extension, lateral flexion, rotation, was measured before and after the treatment.

Neck Disability Index scale:[30] It consists of 10 multiple choice questions for neck pain, 7 related to activities of daily living (ADL), 2 related to pain, and 1 related to concentration, each item was scored from 0 to 5, and the total score was expressed as a percentage, with higher score corresponding to greater disability

**INTERVENTION**

**GROUP A:**

The subjects in the Group A received Instrument Assisted Soft Tissue Mobilization[31] along with Conventional Physiotherapy, the position of the patient is sitting on a chair in a comfortable position, apply IASTM followed by the application of lubricant material on the treating area.

The Ergon IASTM technique involves applying circular or semicircular specialised IASTM strokes to targeted myofascial constriction sites. Furthermore, particular strokes are used in this approach to separate myofascial components. The surgical grade stainless steel M2T- blades that were used were constructed of one piece. One-way (from inferior to superior) strokes for five minutes at the start of the treatment session and five more minutes thirty minutes later, at a rate of eighty strokes per minute. A force of about 500–750 grams was administered for 90 seconds at the conclusion of each session and for three minutes at the start of the therapy. Each side hyperaemia was occurred following the application of instrument-assisted soft tissue mobilisation; to lessen this hyperaemia, administered cold packs for ten minutes.

Treatment duration: Each session was last for 45 minutes, 3 times a week for 4 weeks.

**Fig. no: 1 Application of Ergon IASTM technique**

**GROUP B:**

The subjects in the Group B received Autogenic Inhibition Technique[32] along with Conventional Physiotherapy.

Autogenic Inhibition includes stretching of the affected muscle and performing isometric contraction with 50% of the total patient's effort in the same muscle that was being stretched and position hold for 10 seconds, with 5 seconds of rest after every repetition. This procedure was repeated for 5 times.
We execute the isometric contraction of the relevant muscle during autogenic inhibition.
In order to target the upper trapezius muscle, the patient should lie supine with their neck fully bent and slightly rotated in the opposite direction of the side being treated. During the Autogenic Inhibition Technique, the therapist was instructed to move the ear towards the shoulder of the affected side and maintain against the resistance of the therapist's hand.

**Fig no :2 Performing AI Technique for upper trapezius muscle**

The patient was positioned supine with the neck in flexion, rotation, and lateral flexion to target the levator scapulae muscle. In order to perform the Autogenic Inhibition Technique, the therapist was requested to return the head to a neutral posture towards the affected side while maintaining resistance from their hand.

**Fig no: 3 Performing AI Technique for levator scapulae muscle**

With a folded towel beneath the upper back and neck in a modest extension and contralateral rotation, the patient was lying supine for the Scalene muscle. Using three different positions with differing degrees of rotation, this approach was work for the anterior, middle, and posterior fibres of the scalene muscle. The overall procedure was the same: the necks of the posterior, middle, and anterior fibres were held in full contralateral rotation and slight extension, 45 degrees of contralateral rotation and slight extension, and less than 45 degrees of rotation and slight extension. Against the resistance of the patient, the therapist was required to rotate the head towards the affected side. For the Autogenic Inhibition Technique, the therapist was instructed to turn the head to the affected side and hold it there against the therapist's hand's resistance.

**Fig no: 4 Performing AI Technique for posterior and middle fibers of scalene muscle**

**Fig no: 5 Performing AI Technique for anterior fibers of scalene muscle**

In order to target the Sternocleidomastoid muscle, the patient was lying supine with their head rotated away from the afflicted side and their shoulders supported by a folded towel. For the Autogenic Inhibition Technique, the therapist was instructed to raise the spinning head slightly towards the ceiling and hold it there against the therapist's hand resistance.

Treatment duration: Each session was last for 45 minutes, 3 times a week for 4 weeks.

**Fig no: 6 Performing AI Technique for sternocleidomastoid muscle**

**CONVENTIONAL PHYSIOTHERAPY:** Both groups was received Conventional Physiotherapy.

Conventional Physiotherapy includes:

- Transcutaneous electrical nerve stimulation in combination with superficial heat for 10 minutes.[33]
- Cryotherapy for 10 minutes.[34]
- Isometric neck strengthening exercises in sitting position and each exercise with 10 repetitions with 5 seconds.[35]

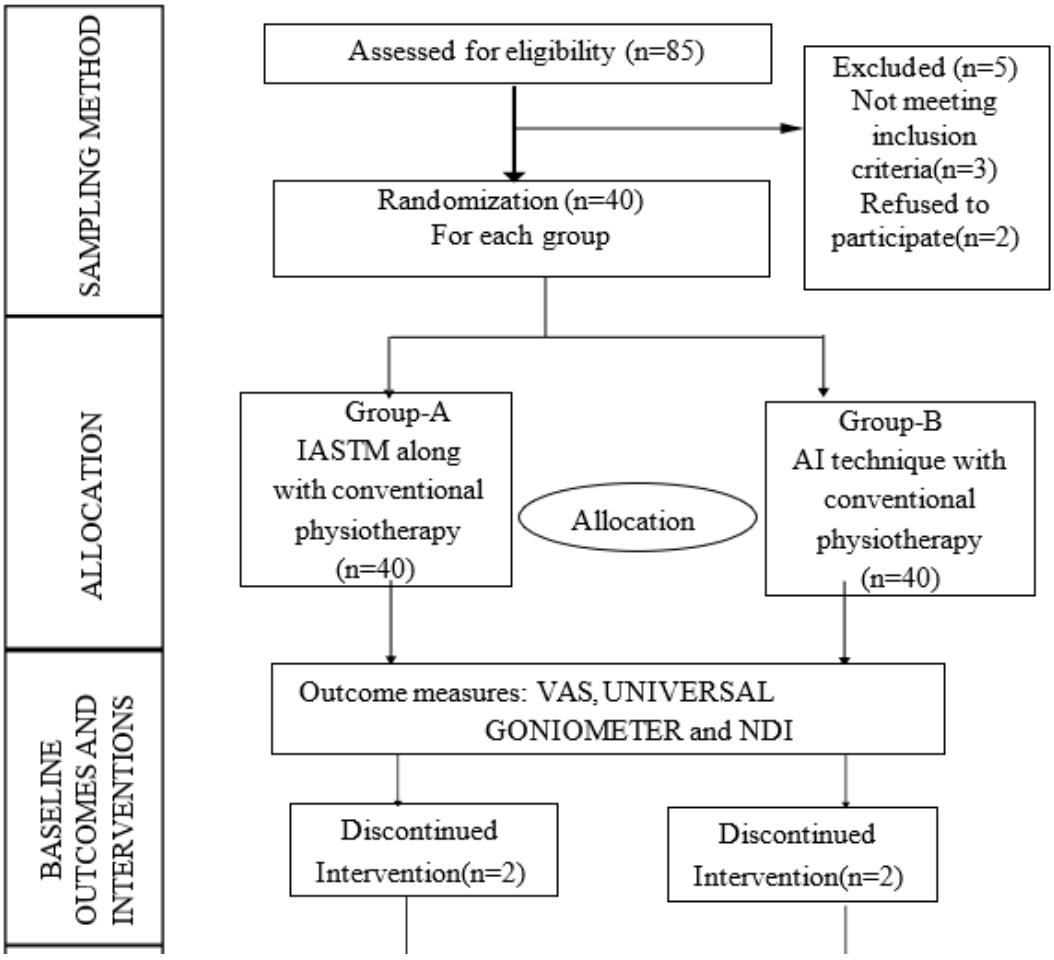
**Fig no: 7 Application of TENS**

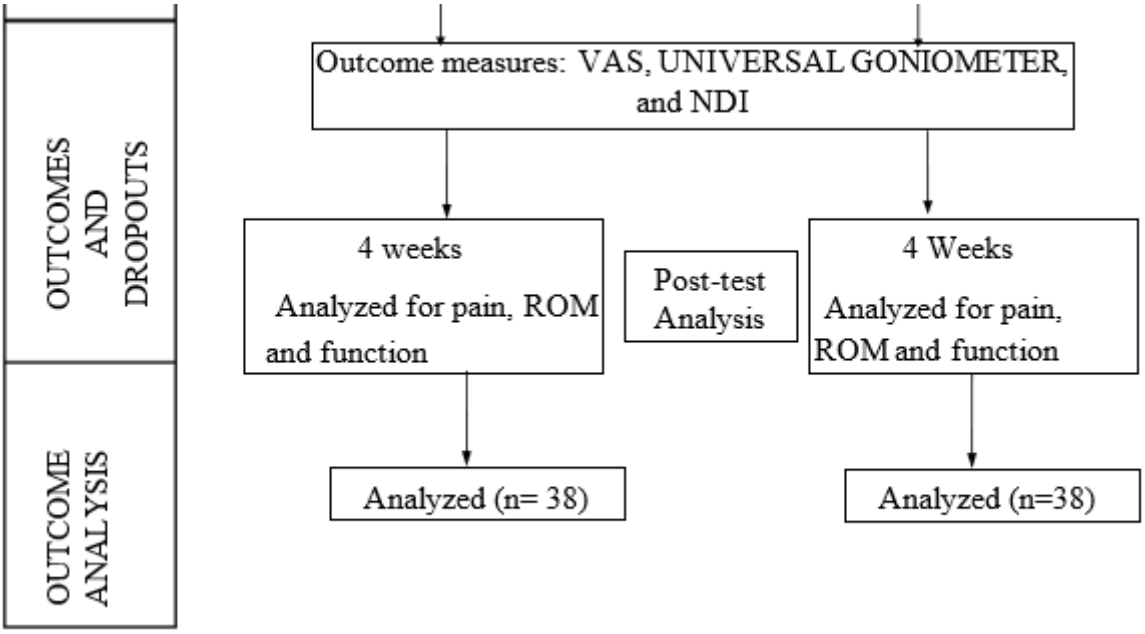
**Fig no: 8 Application of superficial heat**

**Fig no: 9 Application of cryotherapy**

**Fig no: 10 Performing Neck isometric exercises**

**Flow Chart**






**STATISTICAL ANALYSIS**

All statistical analysis was done by using SPSS software version 20.0 and MS excel –2010.

All descriptive statistical data was presented as mean ± standard deviation and main differences was calculated and presented.

Within the groups: Paired student t-test was performed to assess the statistical difference within the groups for Mechanical Neck Pain, pain intensity, function, cervical range of motion from pre-test and post-test values.

Between the groups: Independent student t-test was performed to assess the statistically significant difference in mean value between the groups, Visual Analogue Scale for pain, Universal Goniometer for cervical range of motion and Neck disability Index for function.

Data also tabulated and graphically represented. For all statistical analysis, $P<0.05$ was considered as statistically significant.

**RESULTS**

The results of this study were analysed in terms of reduction of pain on VAS, reduced neck disability on NDI, improved neck range of motion i.e., flexion, extension, right lateral flexion, left lateral flexion, right rotation, left rotation on universal Goniometer. The consort flow chart of the study showed the study organization in terms of subjects screening, random allocation and analysis following the intervention.

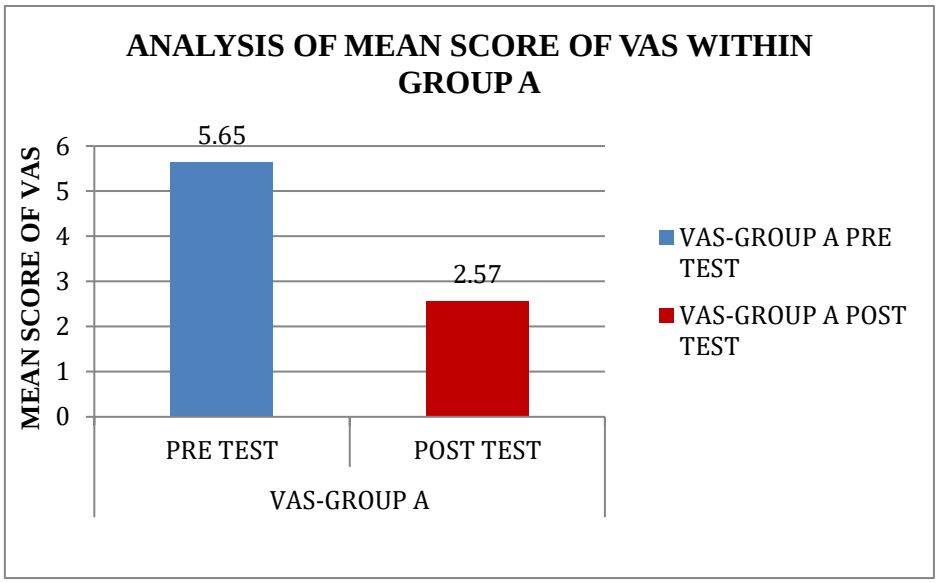
A total of 85 subjects with Mechanical Neck Pain were screened for eligibility, amongst 80 subjects were included in the study trail. All the 80 subjects who met the inclusion criteria had undergone baseline assessment and included subjects were randomized into two equal groups consisting of 40 participants in group A and 40 participants in group B.

In this study 38 participants completed training in group A and 38 participants completed training in Group B with dropouts of 2 in each group, results showed that there is a statistical difference in two groups.

**ANALYSIS OF MEAN SCORE OF VAS WITHIN GROUP A**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| VAS | PRE TEST | 5.81 | 1.27 | 0.001 | Highly Significant |
| | POST TEST | 3.52 | 1.10 | | |

**TABLE -1**

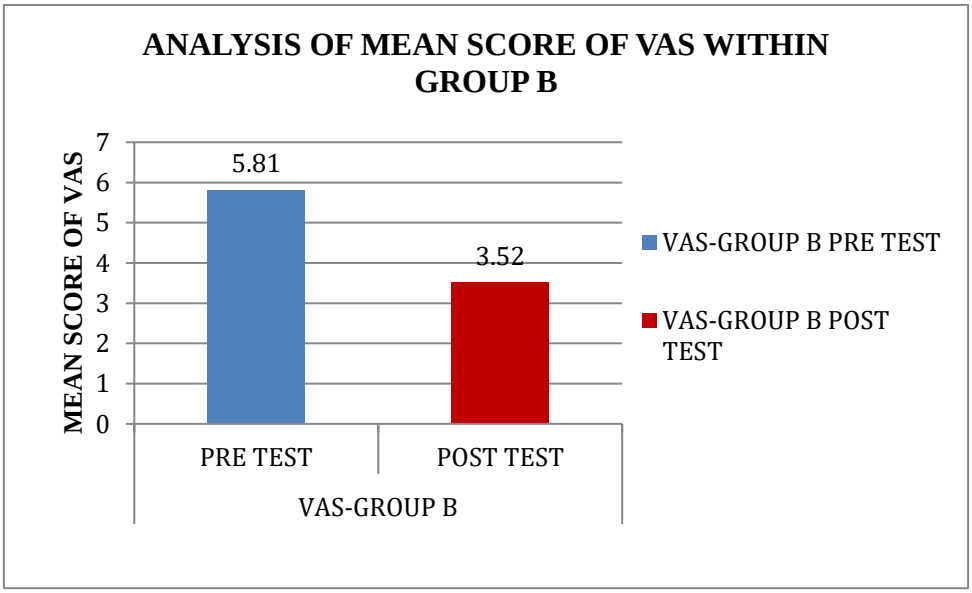



**GRAPH-1**

**RESULTS:** The above table and graph shows that the mean score of VAS changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF VAS WITHIN GROUP B**

**TABLE – 2**



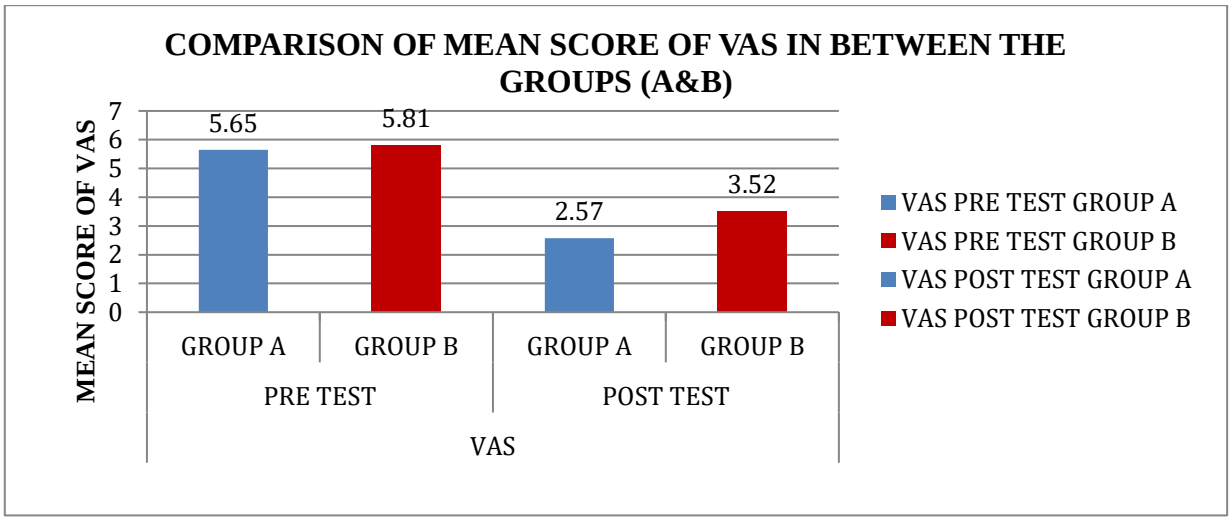
**GRAPH - 2**

**RESULTS:** The above table and graph shows that the mean score of VAS changes from pre - test to post - test values with in group B were found to be statistically highly significant ( p<0.005).

**COMPARISON OF MEAN SCORE OF VAS IN BETWEEN THE GROUPS (A&B)**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| VAS PRE TEST | A | 5.65 | 1.34 | 0.5998 | In Significant |
| | B | 5.81 | 0.85 | | |
| VAS POST TEST | A | 2.57 | 1.27 | 0.0001 | Highly Significant |
| | B | 3.52 | 1.10 | | |

**TABLE – 3**




**GRAPH - 3**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of VAS in between the groups were found statistically highly significant.

**ANALYSIS OF MEAN SCORE OF NDI WITHIN GROUP A**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| NDI | PRE TEST | 21.81 | 4.39 | 0.001 | Highly Significant |
| | POST TEST | 8.6 | 2.48 | | |

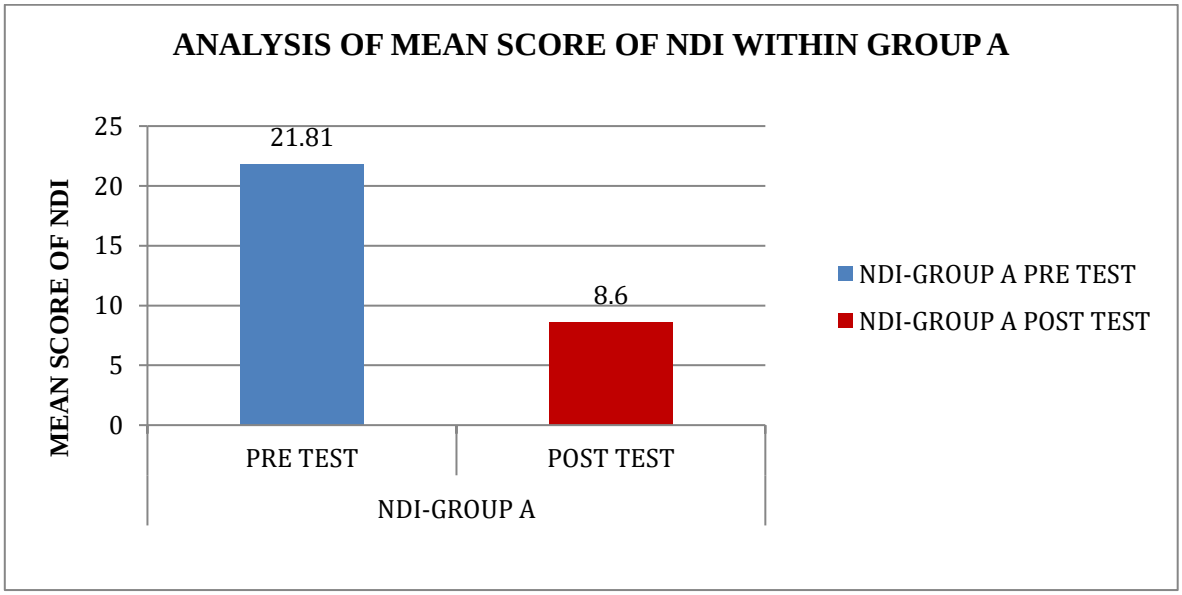


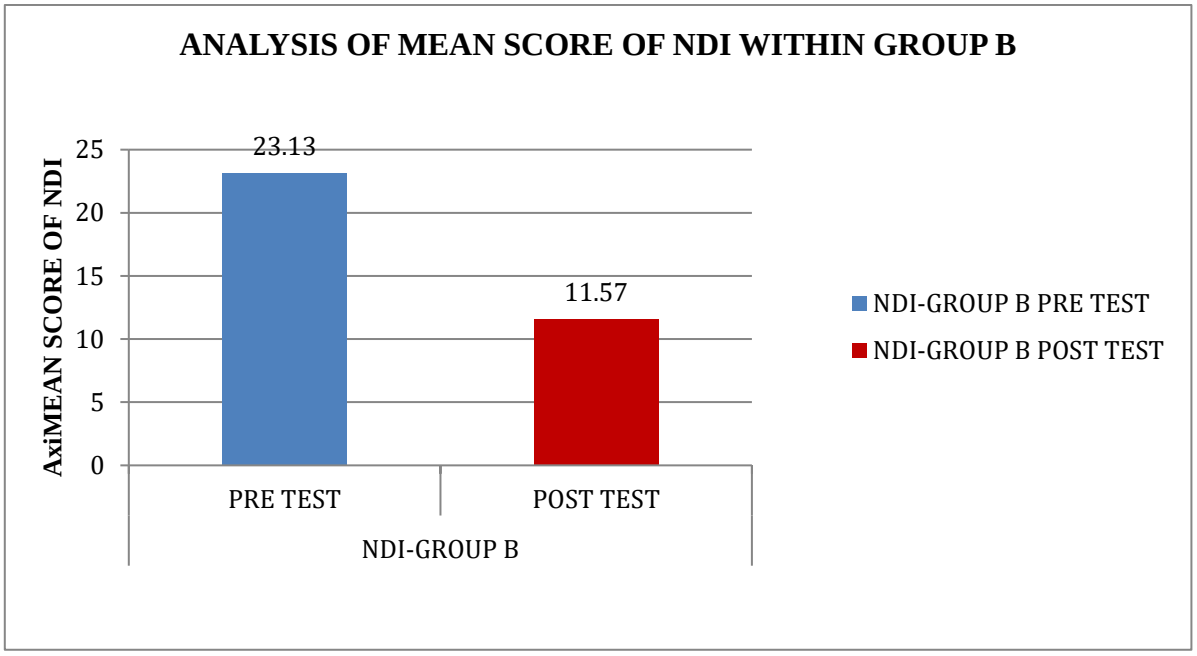

**TABLE -4**
**GRAPH - 4**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| NDI | PRE TEST | 23.13 | 4.04 | 0.001 | Highly Significant |
| | POST TEST | 11.57 | 2.77 | | |

**RESULTS:** The above table and graph shows that the mean score of NDI changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF NDI WITHIN GROUP B**

**TABLE -5**



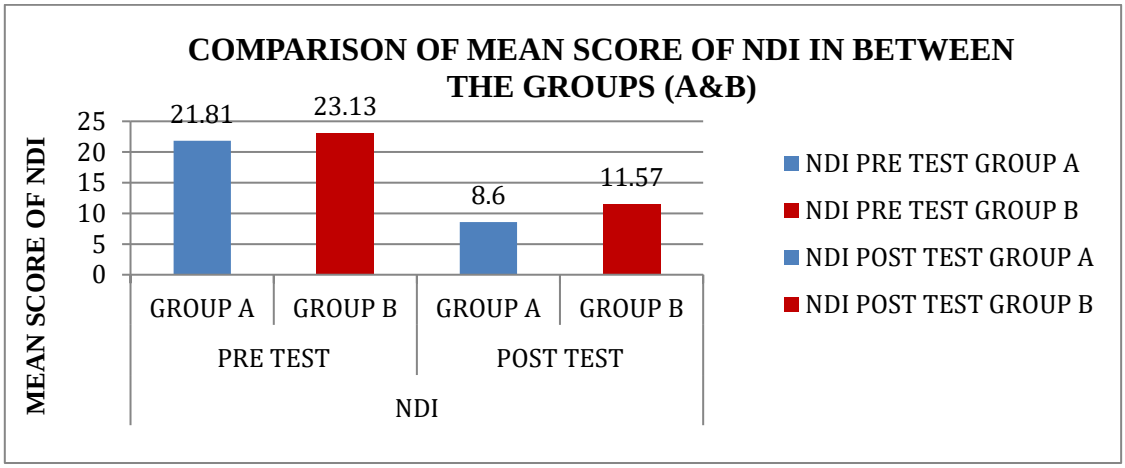

**GRAPH - 5**

**RESULTS:** The above table and graph shows that the mean score of NDI changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF NDI IN BETWEEN THE GROUPS (A&B)**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| NDI PRE TEST | A | 21.81 | 4.39 | 0.1783 | In Significant |
| | B | 23.13 | 4.04 | | |
| NDI POST TEST | A | 8.60 | 2.48 | 0.0001 | Highly Significant |
| | B | 11.57 | 2.77 | | |

**TABLE - 6**



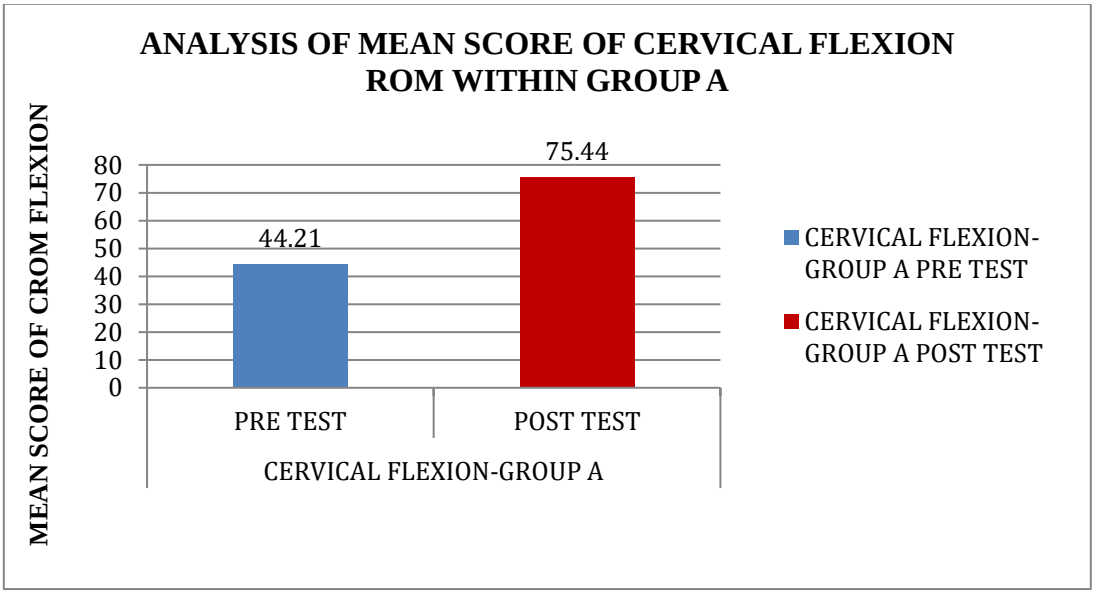
**GRAPH -6**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of NDI in between the groups were found statistically highly significant.

**ANALYSIS OF MEAN SCORE OF CERVICAL FLEXION ROM WITHIN GROUP A**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL FLEXION | PRE TEST | 44.21 | 6.42 | 0.001 | Highly Significant |
| | POST TEST | 75.44 | 3.88 | | |

**TABLE - 7**



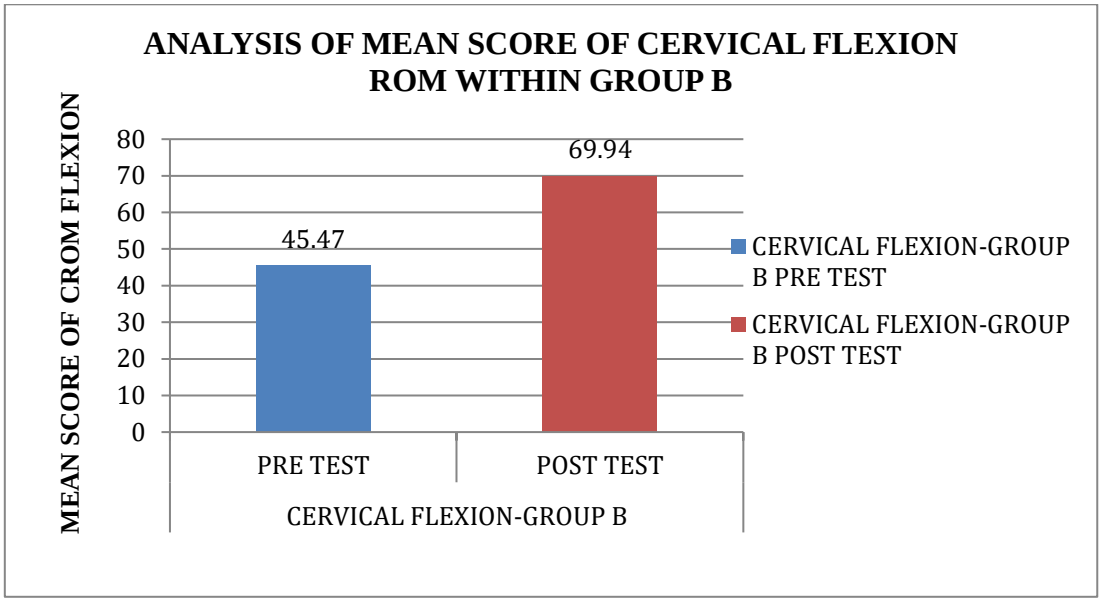

**GRAPH - 7**

**RESULTS:** The above table and graph shows that the mean score of cervical flexion ROM changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF CERVICAL FLEXION ROM WITHIN GROUP B**

**TABLE - 8**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL FLEXION | PRE TEST | 45.47 | 6.10 | 0.001 | Highly Significant |
| | POST TEST | 69.94 | 4.36 | | |



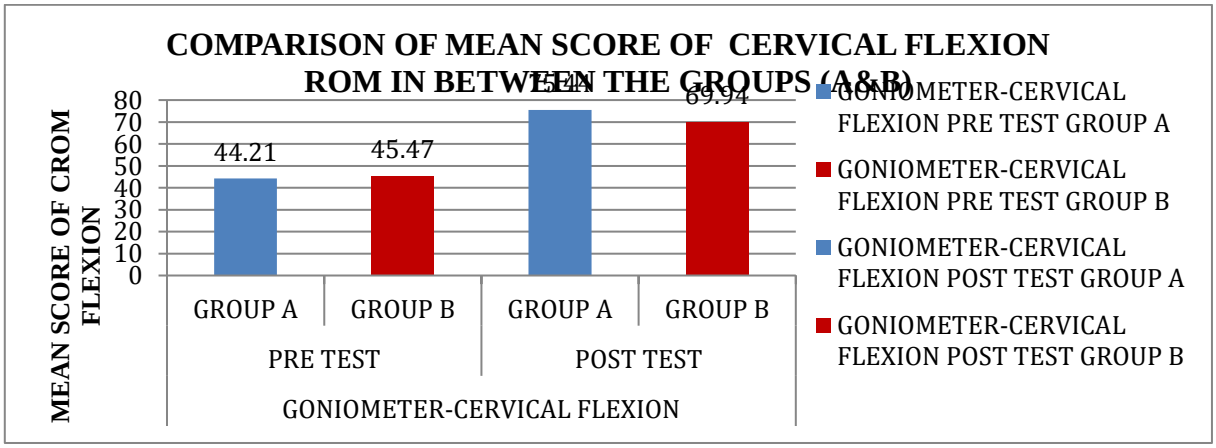

**GRAPH - 8**

**RESULTS:** The above table and graph shows that the mean score of cervical flexion ROM changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF CERVICAL FLEXION ROM IN BETWEEN THE GROUPS (A&B)**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL FLEXION PRE TEST | A | 44.21 | 6.42 | 0.3824 | In Significant |
| | B | 45.47 | 6.10 | | |
| GONIOMETER CERVICAL FLEXION POST TEST | A | 75.44 | 3.88 | 0.0001 | Highly Significant |
| | B | 69.94 | 4.36 | | |

**TABLE – 9**



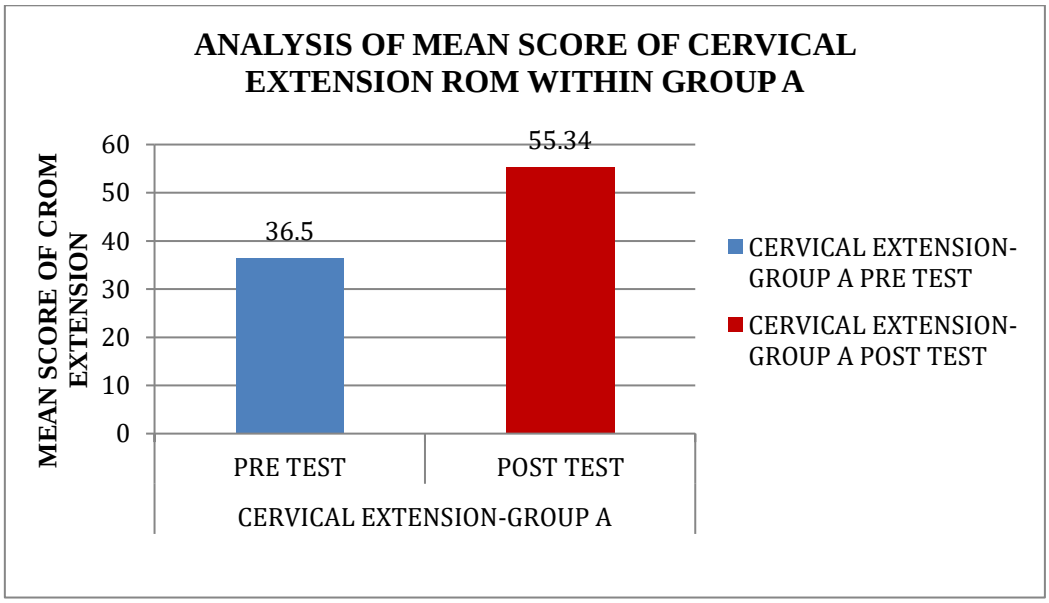
**GRAPH - 9**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of cervical flexion ROM in between the groups were found statistically highly significant.

**ANALYSIS OF MEAN SCORE OF CERVICAL EXTENSION ROM WITHIN GROUP A**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL EXTENSION | PRE TEST | 36.5 | 6.17 | 0.0001 | Highly Significant |
| | POST TEST | 55.34 | 2.87 | | |

**TABLE - 10**



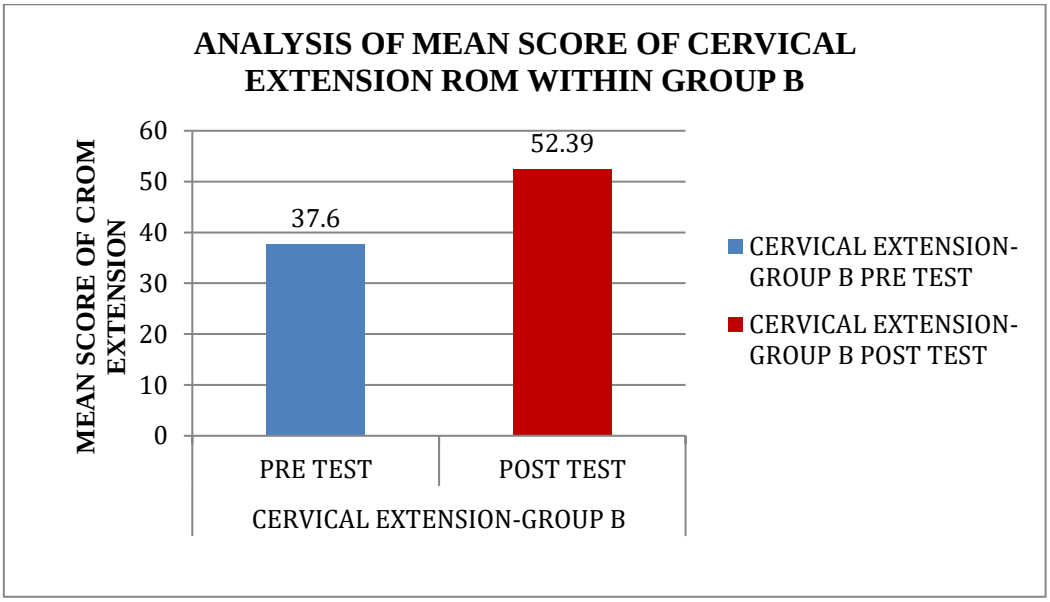

**GRAPH - 10**

**RESULTS:** The above table and graph shows that the mean score of cervical extension ROM changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF CERVICAL EXTENSION ROM WITHIN GROUP B**

**TABLE - 11**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL EXTENSION | PRE TEST | 37.6 | 7.48 | 0.0001 | Highly Significant |
| | POST TEST | 52.39 | 3.38 | | |



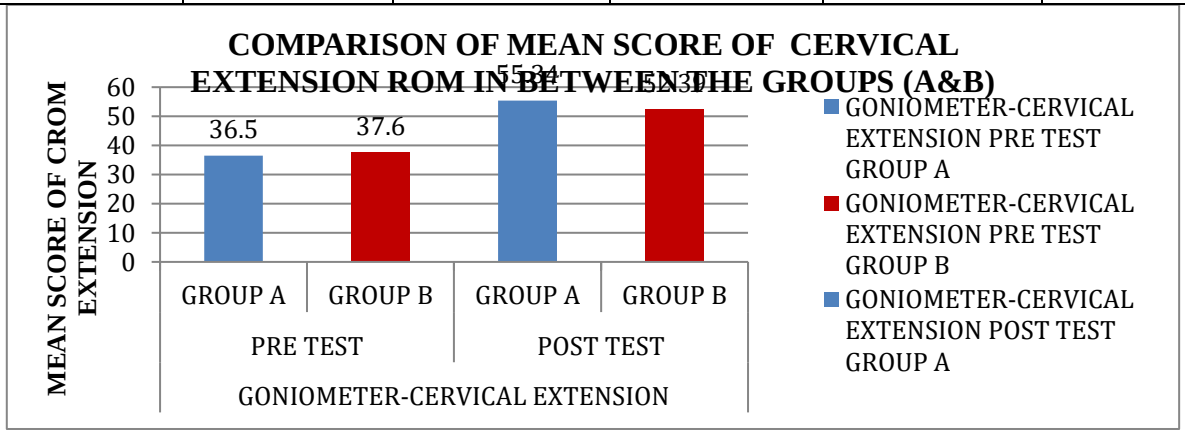

**GRAPH - 11**

**RESULTS:** The above table and graph shows that the mean score of cervical extension ROM changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF CERVICAL EXTENSION ROM IN BETWEEN THE GROUPS (A&B)**

**TABLE - 12**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL EXTENSION PRE TEST | A | 36.5 | 6.17 | 0.4848 | In Significant |
| | B | 37.60 | 7.48 | | |
| GONIOMETER CERVICAL EXTENSION POST TEST | A | 55.34 | 2.87 | 0.0001 | Highly Significant |
| | B | 52.39 | 3.38 | | |



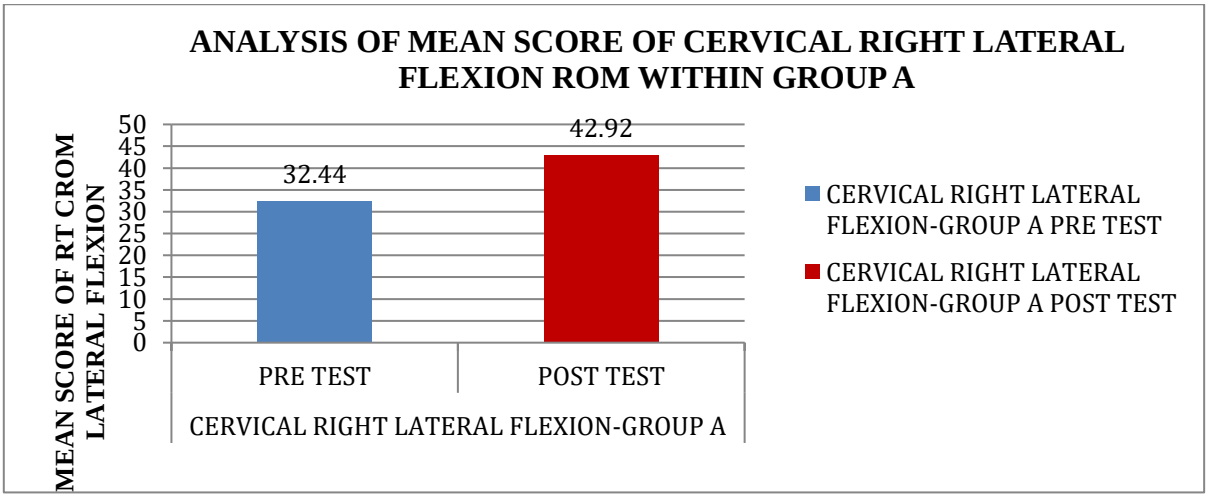

**GRAPH - 12**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of cervical extension ROM in between the groups were found statistically highly significant.

**ANALYSIS OF MEAN SCORE OF CERVICAL RIGHT LATERAL FLEXION ROM WITHIN GROUP A**

**TABLE - 13**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL RIGHT LATERAL FLEXION | PRE TEST | 32.44 | 4.16 | 0.0001 | Highly Significant |
| | POST TEST | 42.92 | 2.45 | | |



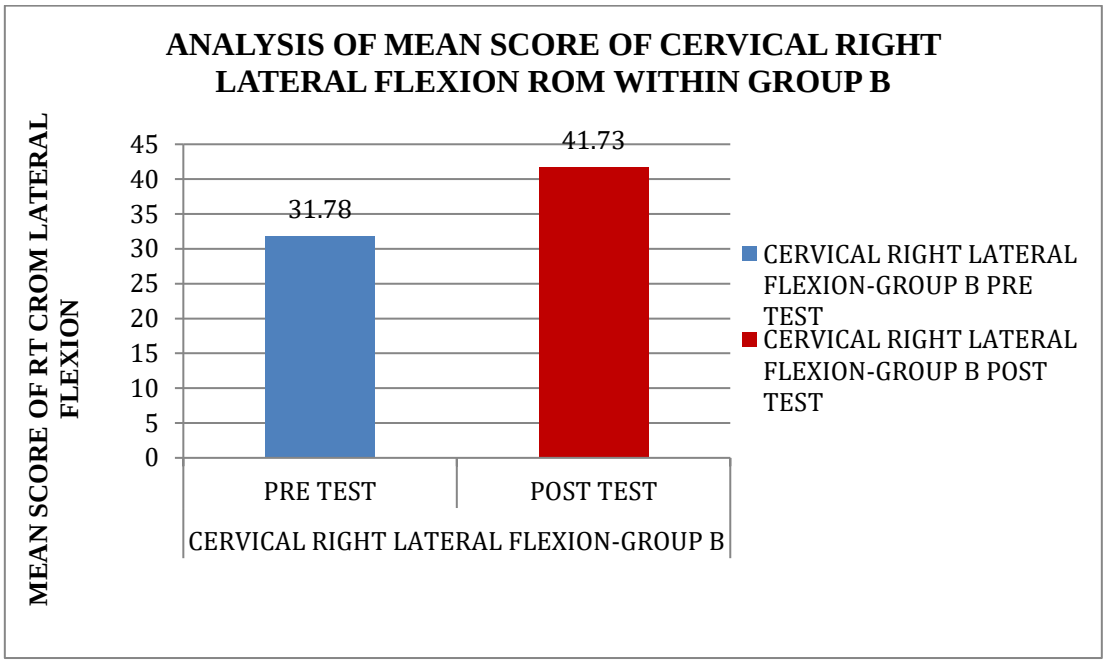

**GRAPH - 13**

**RESULTS:** The above table and graph shows that the mean score of cervical right lateral flexion ROM changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF CERVICAL RIGHT LATERAL FLEXION ROM WITHIN GROUP B**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL RIGHT LATERAL FLEXION | PRE TEST | 31.78 | 5.34 | 0.0001 | Highly Significant |
| | POST TEST | 41.73 | 2.70 | | |

**TABLE - 14**



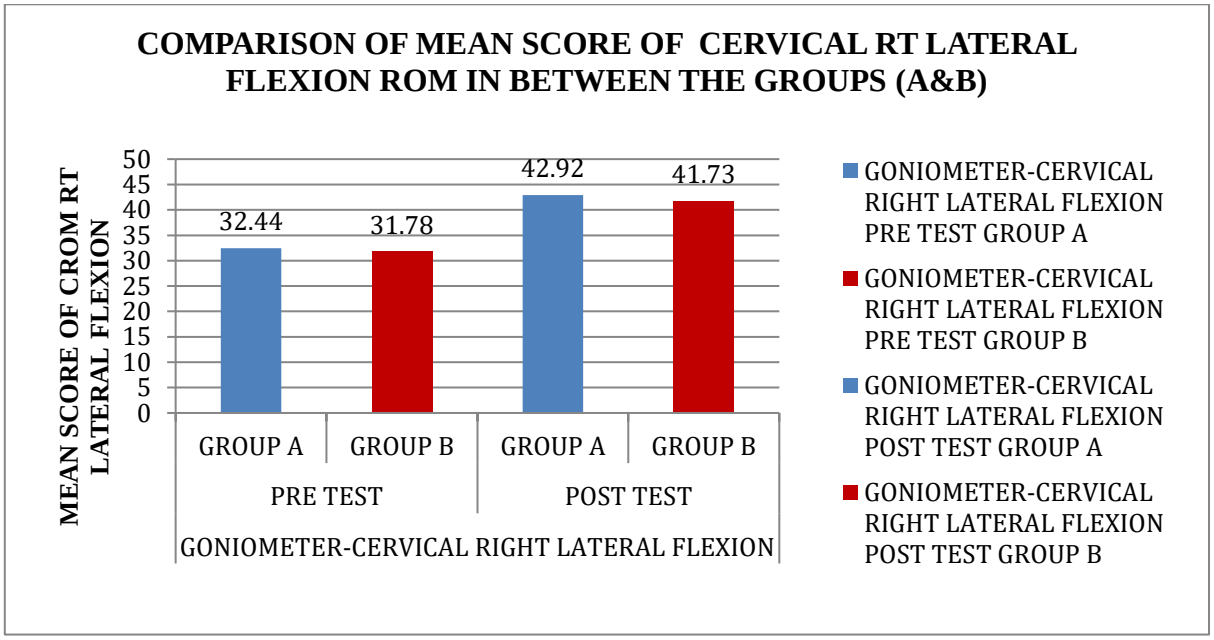

**GRAPH - 14**

**RESULTS:** The above table and graph shows that the mean score of cervical right lateral flexion ROM changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF CERVICAL RIGHT LATERAL FLEXION ROM IN BETWEEN THE GROUPS (A&B)**

**TABLE - 15**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL RIGHT LATERAL FLEXION PRE TEST | A | 32.44 | 4.16 | 0.5512 | In Significant |
| | B | 31.78 | 5.34 | | |
| GONIOMETER CERVICAL RIGHT LATERAL FLEXION POST TEST | A | 42.92 | 2.45 | 0.0494 | Highly Significant |
| | B | 41.73 | 2.70 | | |



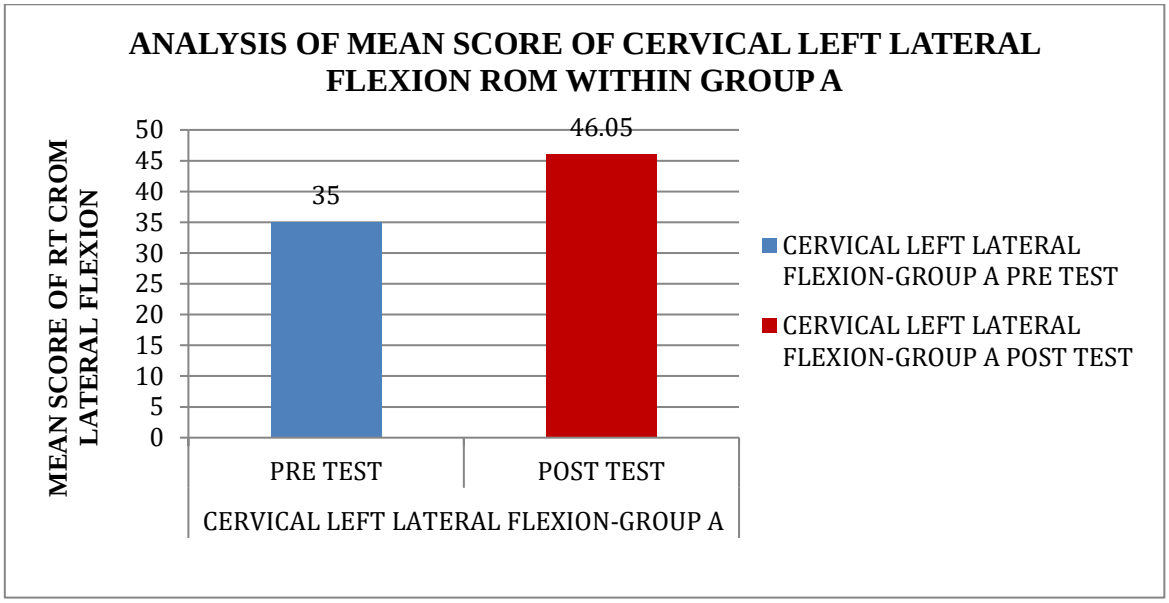

**GRAPH – 15**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of cervical right lateral flexion ROM in between the groups were found statistically highly significant.

**ANALYSIS OF MEAN SCORE OF CERVICAL LEFT LATERAL FLEXION ROM WITHIN GROUP A**

**TABLE - 16**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL LEFT LATERAL FLEXION | PRE TEST | 35 | 4.18 | 0.0001 | Highly Significant |
| | POST TEST | 46.05 | 3.19 | | |



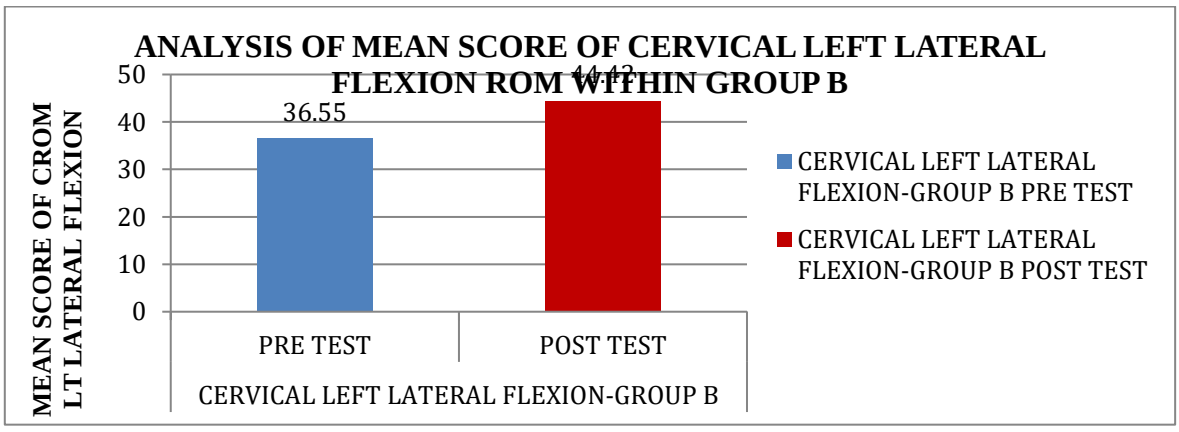

**GRAPH - 16**

**RESULTS:** The above table and graph shows that the mean score of cervical left lateral flexion ROM changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF CERVICAL LEFT LATERAL FLEXION ROM WITHIN GROUP B**

**TABLE - 17**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL LEFT LATERAL FLEXION | PRE TEST | 36.55 | 3.78 | 0.0001 | Highly Significant |
| | POST TEST | 44.42 | 3.10 | | |



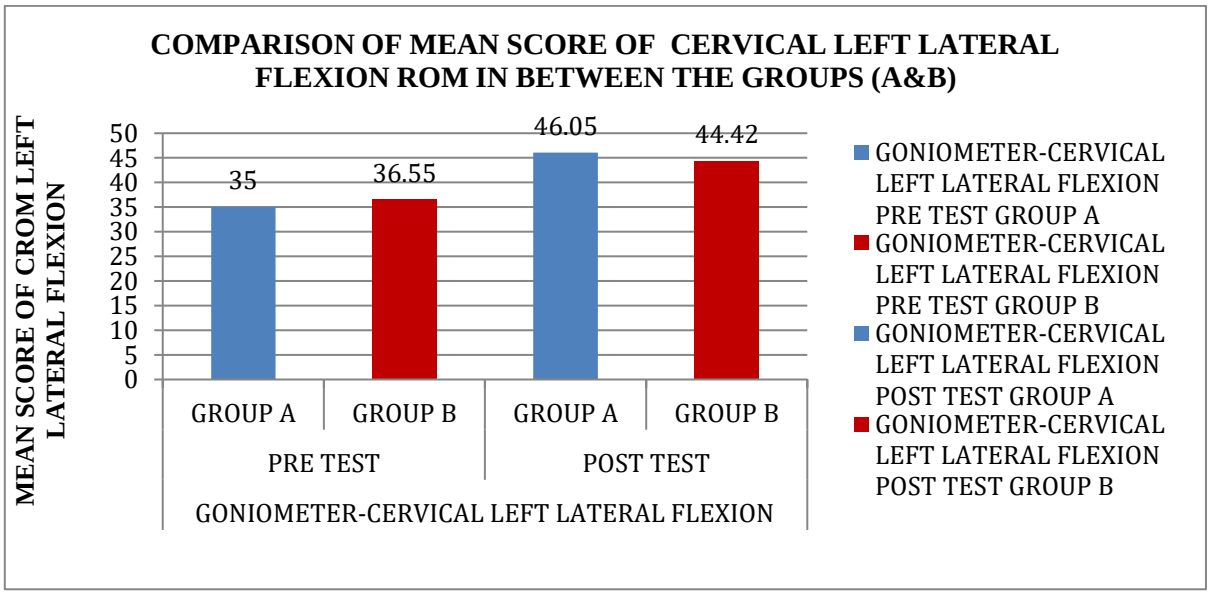

**GRAPH - 17**

**RESULTS:** The above table and graph shows that the mean score of cervical left lateral flexion ROM changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF CERVICAL LEFT LATERAL FLEXION ROM IN BETWEEN THE GROUPS (A&B)**

**TABLE – 18**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL LEFT LATERAL FLEXION PRE TEST | A | 35 | 4.18 | 0.0940 | In Significant |
| | B | 36.55 | 3.78 | | |
| GONIOMETER CERVICAL LEFT LATERAL FLEXION POSTTEST | A | 46.05 | 3.19 | 0.0270 | Highly Significant |
| | B | 44.42 | 3.10 | | |



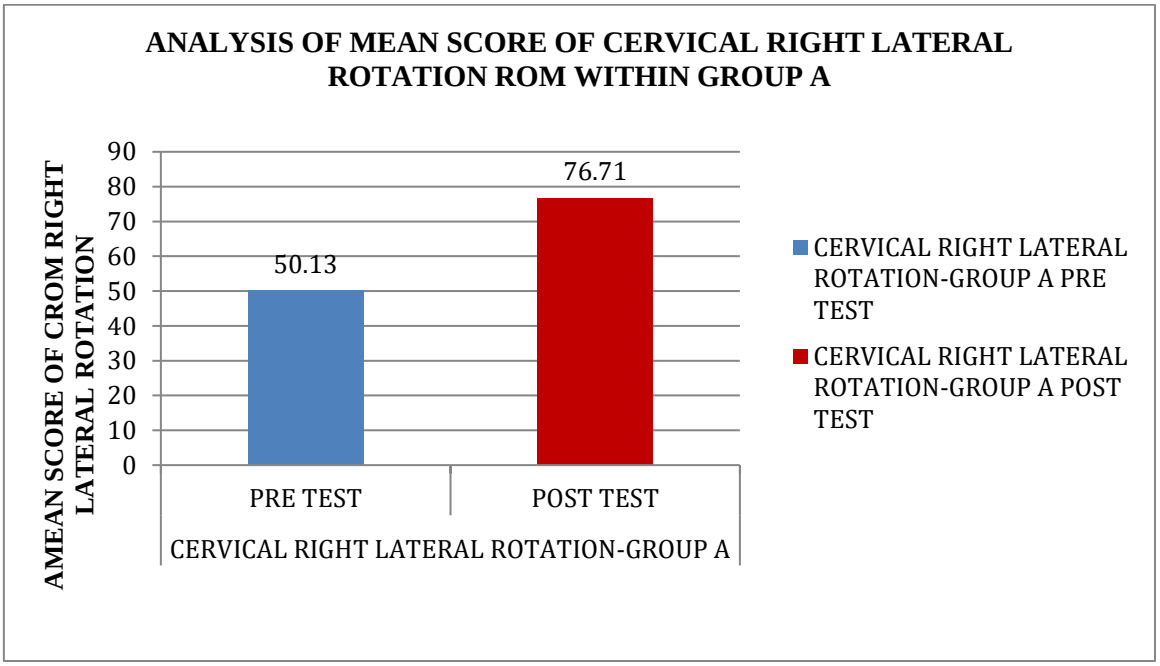

**GRAPH – 18**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of cervical right lateral flexion ROM in between the groups were found statistically highly significant.

**ANALYSIS OF MEAN SCORE OF CERVICAL RIGHT LATERAL ROTATION ROM WITHIN GROUP A**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL RIGHT LATERAL ROTATION | PRE TEST | 50.13 | 8.81 | 0.0001 | Highly Significant |
| | POST TEST | 76.71 | 3.86 | | |

**TABLE – 19**



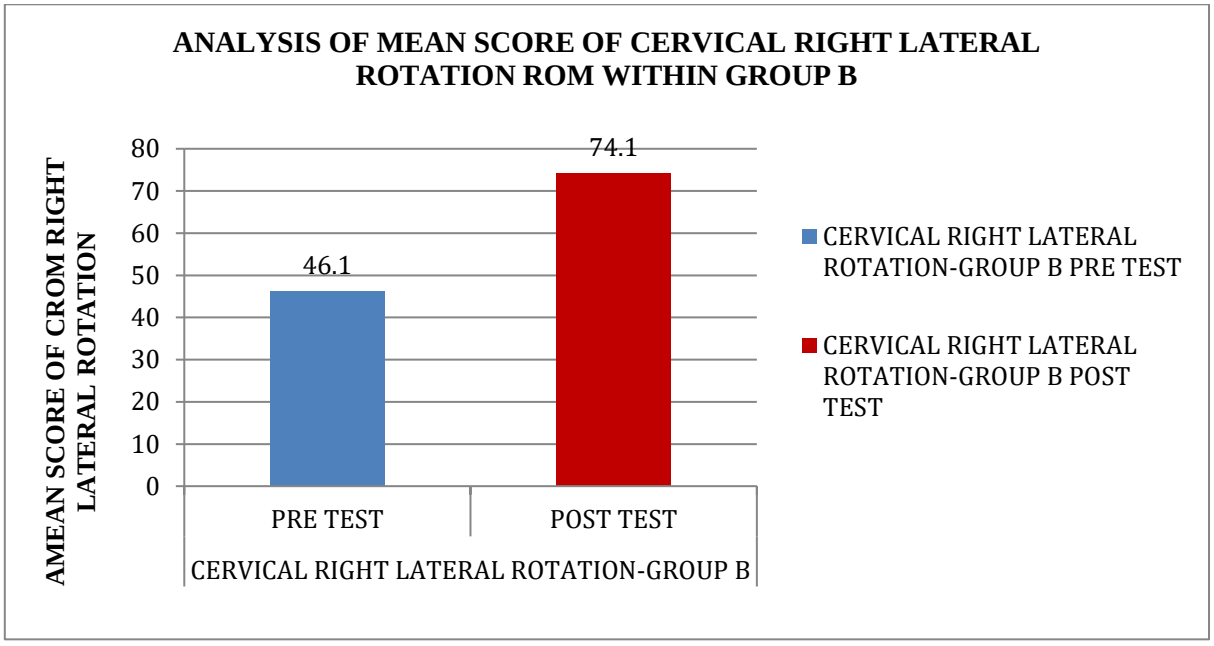

**GRAPH - 19**

**RESULTS:** The above table and graph shows that the mean score of cervical right lateral rotation ROM changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF CERVICAL RIGHT LATERAL ROTATION ROM WITHIN GROUP B**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL RIGHT LATERAL ROTATION | PRE TEST | 46.1 | 8.93 | 0.0001 | Highly Significant |
| | POST TEST | 74.1 | 4.67 | | |

**TABLE - 20**



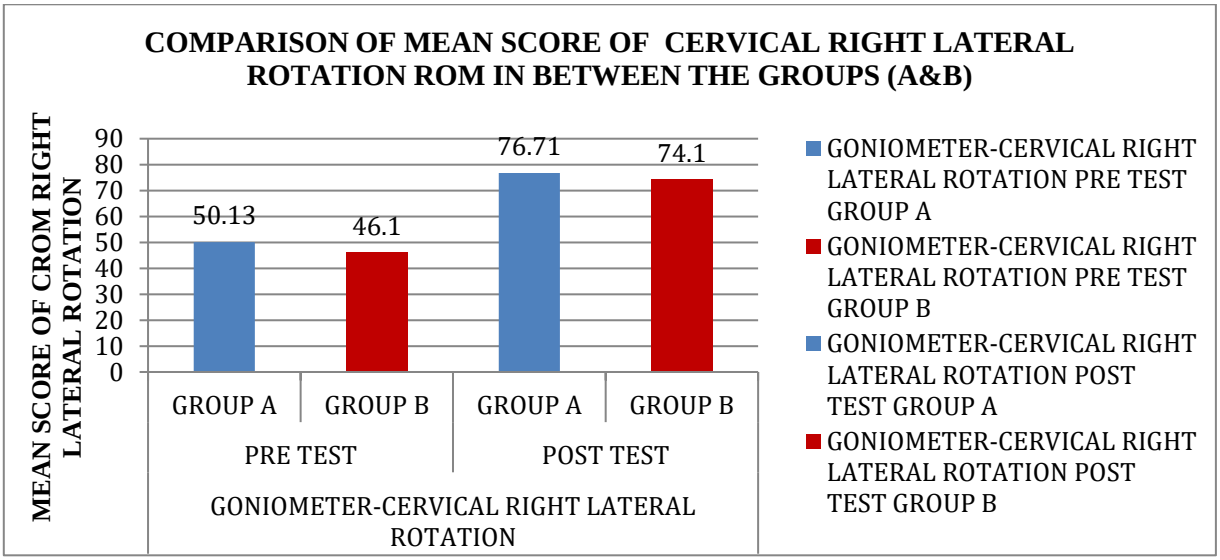

**GRAPH - 20**

**RESULTS:** The above table and graph shows that the mean score of cervical right lateral rotation ROM changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF CERVICAL RIGHT LATERAL ROTATION ROM IN BETWEEN THE GROUPS (A&B)**

**TABLE – 21**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL RIGHT LATERAL ROTATION PRE TEST | A | 50.13 | 8.81 | 0.0517 | In Significant |
| | B | 46.1 | 8.93 | | |
| GONIOMETER CERVICAL RIGHT LATERAL ROTATION POST TEST | A | 76.71 | 3.86 | 0.0099 | Highly Significant |
| | B | 74.1 | 4.67 | | |



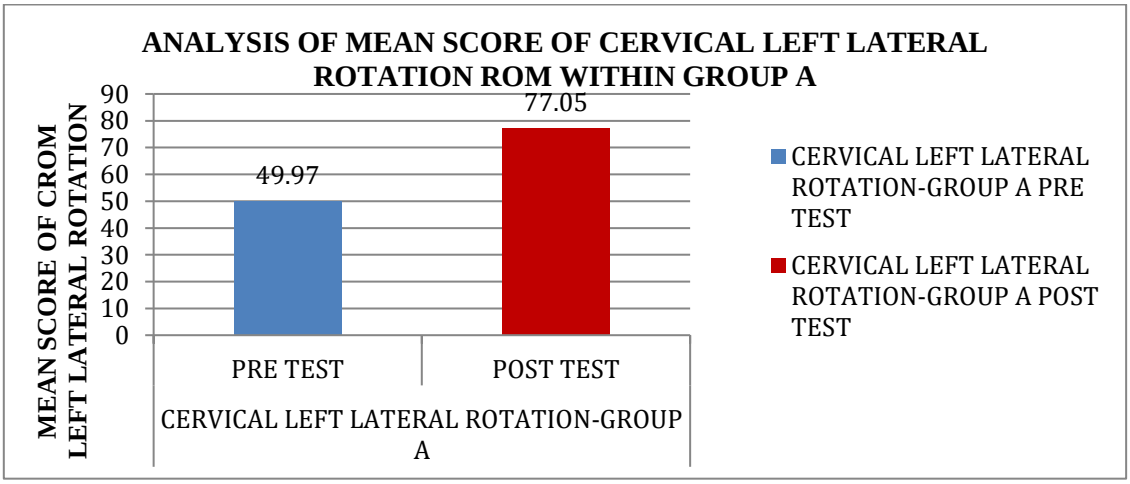

**GRAPH – 21**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of cervical right lateral rotation ROM in between the groups were found statistically highly significant.

## ANALYSIS OF MEAN SCORE OF CERVICAL LEFT LATERAL ROTATION ROM WITHIN GROUP A

**TABLE - 22**

| Group A | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL LEFT LATERAL ROTATION | PRE TEST | 49.97 | 8.52 | 0.0001 | Highly Significant |
| | POST TEST | 77.05 | 3.84 | | |



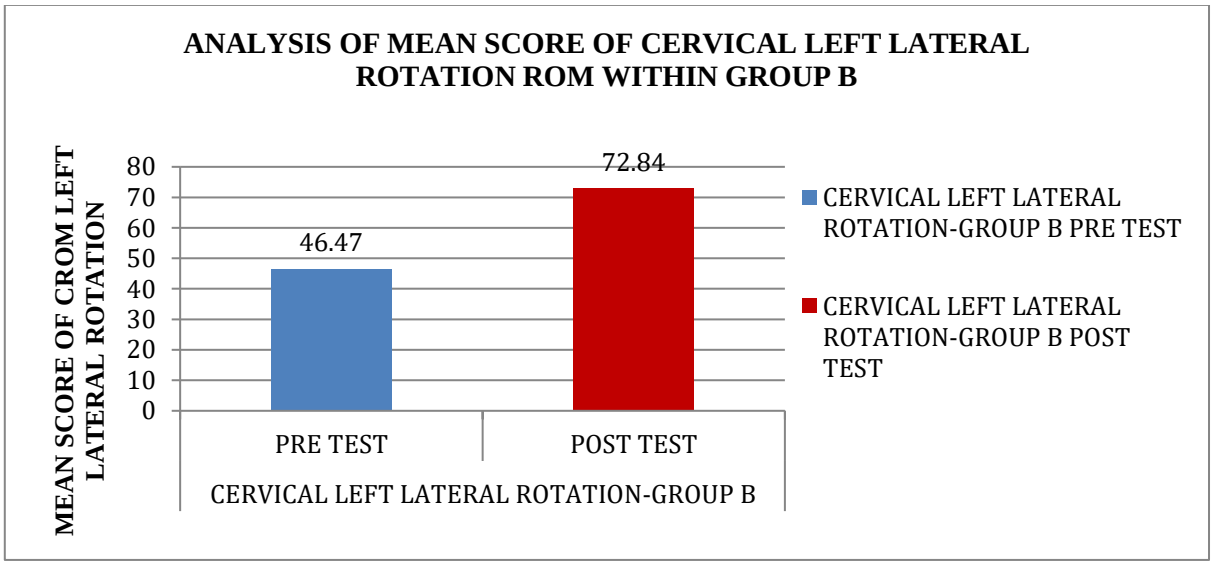

**GRAPH - 22**

**RESULTS:** The above table and graph shows that the mean score of cervical left lateral rotation ROM changes from pre - test to post - test values with in group A were found to be statistically highly significant ($p<0.005$).

**ANALYSIS OF MEAN SCORE OF CERVICAL LEFT LATERAL ROTATION ROM WITHIN GROUP B**

**TABLE - 23**

| Group B | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL LEFT LATERAL ROTATION | PRE TEST | 46.47 | 7.21 | 0.0001 | Highly Significant |
| | POST TEST | 72.84 | 3.23 | | |




**GRAPH - 23**

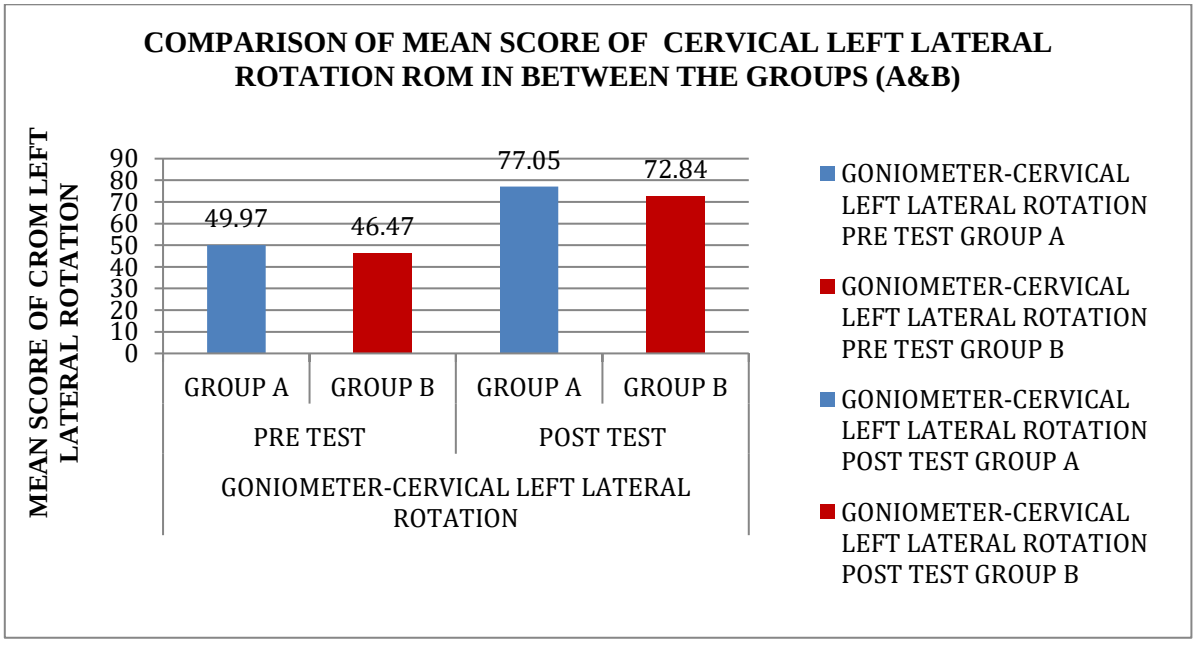
**RESULTS:** The above table and graph shows that the mean score of cervical left lateral rotation ROM changes from pre - test to post - test values with in group B were found to be statistically highly significant ($p<0.005$).

**COMPARISON OF MEAN SCORE OF CERVICAL LEFT LATERAL ROTATION ROM IN BETWEEN THE GROUPS (A&B)**

| GROUPS | | MEAN | SD | P VALUE | INFERENCE |
|---|---|---|---|---|---|
| GONIOMETER CERVICAL LEFT LATERAL | A | 49.97 | 8.52 | 0.0572 | In Significant |
| | B | 46.47 | 7.21 | | |

| | | | | | |
|---|---|---|---|---|---|
| ROTATION PRE TEST | | | | | |
| GONIOMETER CERVICAL LEFT LATERAL ROTATION POSTTEST | A | 77.05 | 3.84 | 0.0001 | Highly Significant |
| | B | 72.84 | 3.23 | | |

**TABLE – 24**




**GRAPH - 24**

**RESULTS:** The above table and graph shows that the pre - test and post - test measurements of cervical left lateral rotation ROM in between the groups were found statistically highly significant.

## DISCUSSION

The aim of the present study was to evaluate the effectiveness of Instrument Assisted Soft Tissue Mobilization (Group-A) and Autogenic Inhibition Technique (Group-B) on pain, cervical Range of motion and Function in subjects with Mechanical Neck Pain in this study the subjects were assessed for Pain, Range of motion, Function using VAS, Universal Goniometer, NDI respectively.

In this study both groups (A and B) Instrument Assisted Soft Tissue Mobilization and Autogenic Inhibition Technique showed statistically significant differences within the group and between the group from pre-test to post-test values on reducing Pain, improving ROM, and Function in subjects with Mechanical Neck Pain. But Instrument Assisted Soft Tissue Mobilization with conventional physiotherapy is more effective than Autogenic Inhibition Technique with conventional Physiotherapy.

According to previous studies Matthew Lambert et al., in his systemic review concluded that IASTM is an effective treatment intervention for reducing pain and improving function. Another study by Konstantinos Mylonas et al., stated that combining IASTM with neuromuscular re training exercises is more effective in reducing pain and improving function in patients with Mechanical Neck Pain.[36]

Myofascial flexibility in the neck area could be significantly increased with the Ergon IASTM Technique. Our research was similar to that of Hebatella M. Said Zaghloul et al., who found that the Ergon IASTM Technique was useful for treating pain and dysfunction in the cervical spine in patients suffering from Mechanical Neck Pain. The use of myofascial techniques could lead to improved neck disability, decreased myofascial tone, increased cervical flexion, extension, and rotation range of motions, and generalised body relaxation.[37]

According to a different study by Mohamed N.H. Abdelhamid et al., patients who underwent IASTM by M2T blade experienced increased range of motion and a decrease in soft tissue consistency as a result of the skin scraping process, which also caused scar tissues and adhesions to loosen and be removed. Additionally, it caused microvascular haemorrhage and a vasodilation response, which improved pain threshold by supplying oxygen and nutrients and removing inflammatory mediators and metabolic waste products. Fibroblast proliferation is enhanced, which results in higher collagen deposition, maturation, and healing process promotion.[38]

According to previous studies Autogenic Inhibition (MET) is more beneficial than Reciprocal Inhibition (MET) in improving pain, neck functional disability and neck range of motion in patients with Mechanical Neck Pain by Mahrukh Siddiqui et al., Another study by Yuliana et al., concluded Autogenic Inhibition Technique MET with participatory ergonomic approach is more effective in reducing pain and improving neck functional ability in employees with Mechanical Neck Pain in a private company in west kalimantan.[39]

Inhibition of Ia and IIa afferents from muscle spindles and Ib afferents from the Golgi tendon organ to the central nervous system may be the source of decreased pain sensitivity with the MET. In addition, a spinal reflex mechanism for the alleviation of muscle spasms may possibly contribute to pain reduction with MET. It might reduce pain by equating the length of sarcomeres in the affected muscle. Stretch tolerance, viscoelastic alterations, and reflex relaxation are possible causes of the MET component's impacts on an increase in CROM after the intervention.

Muscle reflex it has been suggested that relaxation that occurs after contraction is caused by the Golgi tendon organs being activated and their inhibitory effect on the pool of α-motor neurons. Greater pressures may result in increased viscoelastic change and passive extensibility, therefore a combination of contractions and stretches in MET may be more successful at producing viscoelastic change than passive stretching. Our research was comparable to that of Gaurav Bhatnagar et al., who measured neck pain, functional impairment, and CROM in a randomised controlled experiment using the MET and strain-counterstrain approach Mechanical Neck Pain.[40] Researchers Burns and Wells found significant improvements in CROM in all three planes (flexion/extension, side bending, and rotation) after comparing the impact of MET on CROM in asymptomatic participants.[41]

IASTM is more effective than AI Technique because due to its mechanical advantage deeper tissue penetration by applying deeper pressure with specially designed instruments it is useful in targeting specific areas it stimulates neurological responses and increases blood flow to the affected area and improves healing and reduce inflammation, AI Technique mainly focused on muscle relaxation it is beneficial for reducing muscle tension and pain, AI Technique is mainly depended on the patients ability to perform the isometric contraction of the targeted muscle. According to previous study Long- Huei Lin et al., on MET to reduce pain and disability in cases of non-specific neck pain in a systemic review meta-analysis concluded MET used in combination with other treatments provided better pain and disability relief than that associated with MET monotherapy.[42]

This study supports earlier research that found that using IASTM in conjunction with conventional Physiotherapy and Autogenic Inhibition Technique in conjunction with conventional Physiotherapy leads to decrease in pain on VAS, an increase neck function by reduction of neck disability on NDI, and an increase in neck range of motion, as demonstrated by the improvement in the Goniometer score. When the mean values of the two groups are compared statistically to determine which is more effective, it becomes clear that Instrument Assisted Soft Tissue Mobilisation is superior to Autogenic Inhibition Technique. Hence, we conclude that IASTM can be opted as the preferred treatment of choice for reducing pain, improving cervical range of motion, and improving neck function in patients with Mechanical Neck Pain.

## LIMITATIONS

- Small sample size
- Lack of long – term follow up
- Lack of control group
- Short intervention duration

## RECOMMENDATONS FOR FURTHER RESEARCH

- Sample size can be increased with inclusion of a greater number of subjects togeneralize the effects of these techniques in larger population.
- In the present study only, Mechanical Neck Pain was taken. Hence in further studiesother musculoskeletal conditions that affect the cervical muscles can be studied.
- Increase intervention duration and include long term follow up
- Add control group and compare with other manual therapy techniques
- The duration of the study can be increased to 8 weeks or 12 weeks.

## CONCLUSION

The present study concluded that four weeks of interventions of IASTM and Autogenic Inhibition Technique were shown statistically significant difference in reducing Pain and improving Cervical Range of Motion and Function. However more percentage of improvement was found in subjects received IASTM when compared to Autogenic Inhibition Technique. From the findings of the current study, it can be recommended that IASTM maybe opted as a treatment of choice for reduction of pain, increasing the Cervical Range of Motion and reduction of Neck Disability in subjects with Mechanical Neck Pain.

## REFERENCES

1. Akgüller T, Coşkun R, Analay Akbaba Y. Comparison of the effects of cervical thrust manipulation and exercise in mechanical neck pain: a randomized controlled trial. Physiotherapy Theory and Practice. 2024 Apr 2;40(4):789-803.
2. Masaracchio M, Kirker K, States R, Hanney WJ, Liu X, Kolber M. Thoracic spine manipulation for the management of mechanical neck pain: a systematic review and meta-analysis. PloS one. 2019 Feb 13;14(2):e0211877.
3. Nandita E, Praveen D, Asif Hussain KS. Effectiveness of Pilates as an Adjunct toConventional Therapy in Chronic Mechanical Neck Pain: A Randomized ControlledTrial.JNov Physiother.2018;8(1):381.

4. González Rueda, V., López de Celis, C., Barra López, M.E., Carrasco Uribarren, A.,Castillo Tomás, S. and Hidalgo García, C., 2017. Effectiveness of a specific manualapproach to the suboccipital region in patients with chronic mechanical neck pain androtation deficit in the upper cervical spine: study protocol for a randomized controlledtrial.BMC musculoskeletal disorders, 18(1), pp.1-8.
5. .Malik R, Anwar K, Arshad H, Kayani NM, Malik A, Khalid S, Khan LG. Effects of sub-occipital muscles inhibition technique and cranio-cervical flexion exercise for mechanical neck pain. Pakistan Journal of Medical & Health Scieesnc. 2023 May 6;17(04):49-.
6. MohamedEE,kotbAbdElrazikR.SustainedNaturalApophysealGlidesversusPositionalReleaseTherapyinntheTreatmentofChronicMechanicalNeckDysfunction.InternationalJournalofHumanMovementandSportsSciences.2020;8(6):384-94.
7. Al-Najjar HM, Mohammed AH, Mosaad DM. Effect of ice massage with integratedneuromuscular inhibition technique on pain and function in subjects with mechanicalneck pain: randomized controlled trial. Bulletin of Faculty of Physical Therapy. 2020Dec;25:1-7.
8. Guzman J, Haldeman S, Carroll LJ, Carragee EJ, Hurwitz EL, Peloso P, Nordin M,Cassidy JD, Holm LW, Côté P, van der Velde G. Clinical practice implications of theBone and Joint Decade 2000–2010 Task Force on Neck Pain and ItsAssociatedDisorders: from concepts and findings to recommendations. European Spine Journal.2008Apr;17:199-213.
9. Elliott J, Jull G, Noteboom JT, Galloway G. MRI study of the cross-sectional area for the cervical extensor musculature in patients with persistent whiplash associated disorders (WAD). Manual therapy. 2008 Jun 1;13(3):258-65.
10. Lee JH. Effects of forward head posture on static and dynamic balance control. Journal of physical therapy science. 2016;28(1):274-7.
11. Dimitriadis Z, Kapreli E, Strimpakos N, Oldham J. Respiratory weakness in patients with chronic neck pain. Manual therapy. 2013 Jun 1;18(3):248-53.
12. MKaroufi N, Ahmadi A, Mousavi Khatir SR. Comparison of neck muscle activity between healthy & chronic neck pain patients using electromyography. Journal of Mazandaran University of Medical Sciences. 2011 Dec 10;21(85):38-46.
13. Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain.Bmj.2017 Aug14;358.
14. CôtéP,vanderVeldeG,CassidyJD,CarrollLJ,Hogg-JohnsonS,HolmLW,CarrageeEJ,HaldemanS,NordinM,HurwitzEL,GuzmanJ.Theburdenanddeterminants of neck pain in workers: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. Journal of manipulativeandphysiological therapeutics. 2009 Feb 1;32(2):S70-86.
15. Waqas S, Shah SH, Zafar U, Akhtar MF. Comparison of Mulligan Sustained NaturalApophyseal Glides Versus Mulligan Natural Apophyseal Glides in Mechanical NeckPain.Annals of KingEdwardMedical University. 2017 Dec5;23(3).
16. El-Gendy M, Lasheen Y, Rezkalla W. Multimodal approach of electrotherapy versusmyofascialreleaseinpatientswithchronicmechanicalneckpain:arandomizedcontrolledtrial. PhysiotherapyQuarterly. 2019Oct 1;27(4):6-12.
17. IbrahimME,Hananse,AbdelsalamS.CervicalStabilizationExercisesVersusScapular Stabilization Exercises in Treatment of Chronic Mechanical Neck Pain. TheMedicalJournal of CairoUniversity. 2022 Sep1;90(9):1729-35.

18. Erden A, Şenocak E, Kalaycıoğlu A, Aktürk A. Effectiveness of instrument assisted soft tissue mobilization in myofascial pain syndrome: preliminary results of a randomized controlled trial. Sports Medicine Journal/Medicina Sportivâ. 2020 Jan 1;16(1).
19. Javeria H, Rasool D, Mallick U. the effectiveness of instrument-assisted soft tissuemobilizationtechniqueonmusculoskeletalsofttissueinjuries:asystematicreviewandmeta-analysis. Pakistan Journal of Rehabilitation.2023 Jan 4;12(1).
20. Martin RL, Davenport TE, Reischl SF, McPoil TG, Matheson JW, Wukich DK, McDonough CM, Altman RD, Beattie P, Cornwall M, Davis I. Heel pain—plantar fasciitis: revision 2014. Journal of Orthopaedic & Sports Physical Therapy. 2014 Nov;44(11):A1-33.
21. Cheatham SW, Lee M, Cain M, Baker R. The efficacy of instrument assisted soft tissue mobilization: a systematic review. The Journal of the Canadian Chiropractic Association. 2016 Sep;60(3):200.
22. Phadke A, Bedekar N, Shyam A, Sancheti P. Effect of muscle energy technique andstatic stretching on pain and functional disability in patients with mechanical neckpain: A randomized controlled trial. Hong Kong Physiotherapy Journal. 2016 Dec1;35:5-11.
23. Hindle K, Whitcomb T, Briggs W, Hong J. Proprioceptive neuromuscular facilitation(PNF): Its mechanisms and effects on range of motion and muscular function. Journalofhuman kinetics. 2012Mar1;31(2012):105-13.
24. Sharman MJ, Cresswell AG, Riek S. Proprioceptive neuromuscular facilitation stretching: mechanisms and clinical implications. Sports medicine. 2006 Nov;36:929.
25. Sbardella S, La Russa C, Bernetti A, Mangone M, Guarnera A, Pezzi L, Paoloni M, Agostini F, Santilli V, Saggini R, Paolucci T. Muscle energy technique in the rehabilitative treatment for acute and chronic non-specific neck pain: a systematic review. InHealthcare 2021 Jun 17 (Vol. 9, No. 6, p. 746). MDPI.
26. Lambert M, Hitchcock R, Lavallee K, Hayford E, Morazzini R, Wallace A, Conroy D, Cleland J. The effects of instrument-assisted soft tissue mobilization compared to other interventions on pain and function: a systematic review. Physical Therapy Reviews. 2017 Mar 4;22(1-2):76-85.
27. Nandita E, Praveen D, Asif Hussain KS. Effectiveness of Pilates as an Adjunct to Conventional Therapy in Chronic Mechanical Neck Pain: A Randomized Controlled Trial. J Nov Physiother. 2018;8(1):381.
28. Begum MR, Hossain MA. Validity and reliability of visual analogue scale (VAS) for pain measurement. Journal of Medical Case Reports and Reviews. 2019;2(11).
29. Won YK, Latip HF, Aziz MS. The reliability and validity on measuring tool of cervical range of motion: A review. Sport Med. Inj. Care. 2019;1(001).
30. MacDermid JC, Walton DM, Avery S, Blanchard A, Etruw E, Mcalpine C, Goldsmith CH. Measurement properties of the neck disability index: a systematic review. Journal of orthopaedic & sports physical therapy. 2009 May;39(5):400-17.
31. Zaghloul HM, Ghally SA, Abdelkhalek MM, Mohamed MT, Mahmoud LS, Ghaly LA. Comparison between upper thoracic spine mobilization and the Ergon technique in the treatment of mechanical neck pain. SPORT TK-Revista EuroAmericana de Ciencias del Deporte. 2022 Jul 29:3-.
32. Siddiqui M, Akhter S, Baig AA. Effects of autogenic and reciprocal inhibition techniques with conventional therapy in mechanical neck pain–a randomized control trial. BMC Musculoskeletal Disorders. 2022 Jul 25;23(1):704.2.
33. Osama M, Rehman S. Effects of static stretching as compared to autogenic and reciprocal inhibition muscle energy techniques in the management of mechanical neck pain: A randomized controlled trial.

Journal of the Pakistan Medical Association. 2020;70(5):1.
34. Al-Najjar HM, Mohammed AH, Mosaad DM. Effect of ice massage with integrated neuromuscular inhibition technique on pain and function in subjects with mechanical neck pain: randomized controlled trial. Bulletin of Faculty of Physical Therapy. 2020 Dec;25:1-7.
35. Tariq M, Sarfraz N, Gilani H. Comparative efficacy of isometric exercises and active range of motion exercises in mechanical neck pain of female sewing machine operators. Isra Medical Journal. 2018 Sep 1;10(5):301-5.
36. Mylonas K, Angelopoulos P, Billis E, Tsepis E, Fousekis K. Combining targeted instrument-assisted soft tissue mobilization applications and neuromuscular exercises can correct forward head posture and improve the functionality of patients with mechanical neck pain: a randomized control study. BMC musculoskeletal disorders. 2021 Dec;22:1-9.
37. do Carmo Carvalhais VO, de Melo Ocarino J, Araújo VL, Souza TR, Silva PL, Fonseca ST. Myofascial force transmission between the latissimus dorsi and gluteus maximus muscles: an in vivo experiment. Journal of biomechanics. 2013 Mar 15;46(5):1003-7.
38. YOUSSEF EF, MOHAMED NA, MOHAMMED MM, AHMAD HA. Trigger point release versus instrument assisted soft tissue mobilization on Upper Trapezius trigger points in mechanical Neck Pain: a Randomized Clinical Trial. The Medical Journal of Cairo University. 2020 Dec 1;88(December):2073-9.
39. Yuliana Y, Purnawati S, Muliarta IM. The Efficacy Of Adding Muscle Energy Technique To A Participatory Ergonomic Approach To Reduce Pain And Improve Functional Ability In Employees With Mechanical Neck Pain In A Private Company In West Kalimantan. Jurnal EduHealth. 2024 Jul 6;15(03):25-40.
40. Bhatnagar G, Ghule S, Sheikh SB, Basha AS. Effectiveness of Met and Strain-Counterstrain in Treating Acute Myofascial Upper Trapezius Trigger Points in Patients with Mechanical Neck Pain-A Comparative Study. Int J Cur Res Rev| Vol. 2021 Dec;13(24):46.
41. Burns DK, Wells MR. Gross range of motion in the cervical spine: the effects of osteopathic muscle energy technique in asymptomatic subjects. Journal of osteopathic medicine. 2006 Mar 1;106(3):137-42.
42. Lin LH, Lin TY, Chang KV, Wu WT, Özçakar L. Muscle energy technique to reduce pain and disability in cases of non-specific neck pain: A systematic review and meta-analysis of randomized controlled trials. Heliyon. 2023 Nov 17.