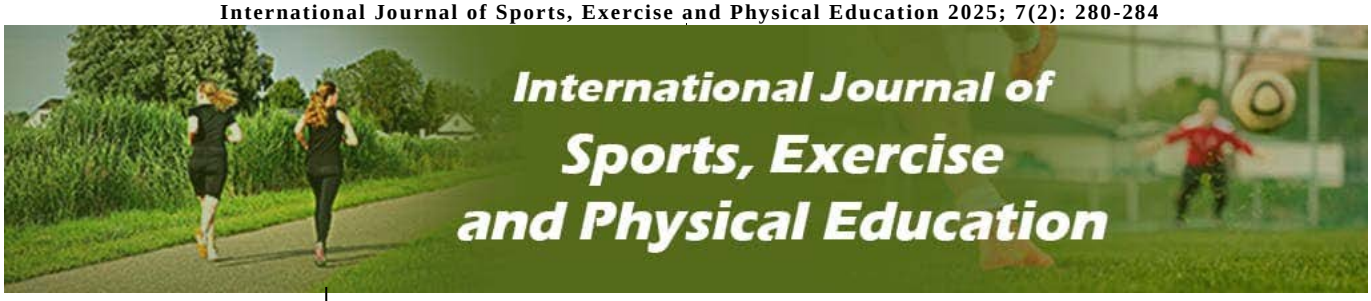

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Effectiveness of intermittent cervical traction along with neural mobilization compared to cervical traction alone in the treatment of cervical radiculopathy

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Abstract
Cervical radiculopathy is a painful condition caused by compression or irritation of the cervical nerve roots, often resulting in neck pain radiating into the upper limb. This condition can impair daily function, reduce mobility, and increase disability. Intermittent cervical traction is commonly used to relieve pressure on the affected nerve roots, while neural mobilization is a therapeutic technique aimed at restoring nerve movement and reducing mechanical sensitivity. This study was designed to compare the effectiveness of intermittent cervical traction combined with neural mobilization versus intermittent cervical traction alone in individuals diagnosed with unilateral cervical radiculopathy. A total of twenty participants were selected and divided into two equal groups. Group A received intermittent cervical traction along with neural mobilization, while Group B received intermittent cervical traction alone. Both groups underwent treatment over a four-week period. Pain intensity, functional ability, disability level, and cervical range of motion were assessed using standardized clinical measures before and after the intervention. The results demonstrated that both treatment approaches were beneficial in reducing symptoms and improving cervical function. However, participants in the group receiving the combined intervention showed significantly greater improvements in pain reduction, functional recovery, and cervical mobility compared to those receiving traction alone. These findings suggest that integrating neural mobilization with intermittent cervical traction enhances therapeutic outcomes in the management of cervical radiculopathy.

Keywords: Cervical radiculopathy, neural mobilization, cervical traction, neck pain, functional improvement

Introduction
Cervical radiculopathy, commonly called as “pinched nerve” [1], is a term used to describe pain radiating into the arm corresponding to the dermatome of the involved cervical nerve root [2]. It was recognized at the beginning of the 20th century and was first associated with disc pathology in the mid-1930s [1]. It mostly occurs because of cervical disc herniation or other space occupying lesions, resulting in nerve root inflammation, impingement or both. It may occur unilaterally or bilaterally [3], and bilateral symptoms are more consistent with arthritis of cervical spine [4]. Radiculopathy is differentiated from radicular pain, where radiculopathy is a neurological condition with limited or blocked conduction, while radicular pain is due to nerve root compression; both can coexist [2]. CR is often associated with chronic pain and limitation in daily life [5]. The incidence and prevalence of cervical radiculopathy is unclear and epidemiologic data are sparse [2]. The prevalence of CR is reported as 3.5 per 1000 people [6].
Radhakrishnan performed a large retrospective population-based study and found an annual age-adjusted incidence rate of 83.2 per 100,000 persons—107.3 for men and 63.5 for women [2].
It has been confirmed that the male has more prevalence [7], with peak incidence in the fourth, fifth and sixth decades for both genders [2, 6, 7]. It is estimated that 50% of the population will experience neck and upper extremity pain at some time in their lifetime [8]. The most commonly involved levels are C5 (2-14%), C6 (66%) and C7 (62%) due to the greater mobility at C5-C6 and C6-C7 levels [2,9]. Physical exertion or trauma is rare (<15%), while automobile accidents account for 3-23%; bilateral involvement is seen in 5-36% [6].

The intervertebral disc is causative in 22% of cases; 68% arise from combined discogenic and spondylotic causes [6]. Radiculopathy from a herniated disc is seen in 21.9%, and from bone spur or foraminal narrowing in 68% [1].

Cigarette smoking, axial load bearing, and prior lumbar radiculopathy may predispose individuals [8]. Common causes include disc herniation, osteophytes, loss of disc height, bone spurs, facet joint issues, spondylosis, instability, trauma, or tumours [11-13]. Disc herniation may result in intra foraminal (sensory) or posterolateral (motor) impingement [14]. Spondylarthrosis narrows foraminal space, compressing roots mainly at the entrance zone [7], with uncovertebral arthritis affecting the anterior and facet joint arthritis the posterior root [7, 14]. The diagnosis of radiculopathy is based on information received during the subjective (history taking) and physical examination, which is then confirmed via diagnostic imaging [7]. The most commonly used physical tests include tendon reflexes, manual muscle testing of key muscles for weakness or atrophy, testing for sensory deficits, the assessment of range of motion (ROM), and some provocative tests [2]. The provocative tests for cervical radiculopathy are the foraminal compression test or Spurling test, shoulder abduction test, upper limb tension test or upper limb neural tension test, neck traction/distraction test, and Valsalva maneuver [2]. CR has shown that conservative treatment is more effective than surgical options [21]. Nonsurgical treatment includes soft cervical collar, traction, medications, manipulation, etc [8]. Physical therapy, especially cervical traction and neural mobilization, plays a significant role in symptom improvement [8, 9]. Cervical traction is frequently used in CR [18] and involves applying force to the neck to decompress the nerve root by separating cervical segments [19]. Its effects include widening the intervertebral foramen, vertebral separation, facet distraction, ligament tensing, spinal curve straightening, and muscle stretching. Intermittent cervical traction (ICT), which alternates traction and rest, reduces pain and disability, though no standard parameters exist [19]. Neural mobilization is a manual therapy recommended to improve pain and disability and acts as an analgesic treatment [9]. It uses joint movements to mobilize peripheral nerves, enhancing gliding and reducing mechanosensitivity through tensioning and sliding techniques [9, 19]. This decreases disability and hypoalgesia in musculoskeletal and neural disorders and helps rehabilitate nervous system function [20].

Materials & Methods

- **Study Design:** Quasi-experimental study was used as the study design.
- **Study setting:** The study was conducted at department of physiotherapy, Sri Ramakrishna Hospital, under the supervision of the guide, college of physiotherapy, SRIPMS, Coimbatore.
- **Study duration:** The study was conducted for the duration of 6 months.
- **Treatment duration:** The duration of treatment was 30 minutes per session, 1 session per day and 3 times per week for 4 weeks.
- **Sampling method:** The patients assigned for the study were sampled as non-probability purposive sampling method.
- **Sample size:** 20 patients were included in this study and they were divided into two groups–Group A and Group B.
  Group A (10 patients) receives neural mobilization along with intermittent cervical traction.
  Group B (10 patients) receives intermittent cervical taction alone.

Criteria for Sampling

Inclusion criteria

- Patient presenting with cervico-brachial pain along with upper limb symptoms over 3 months period, diagnosed (by orthopaedic doctors) with unilateral CR.
- Age – 40-60 years.
- Unilateral upper limb pain, along with sensory and ⁄ or motor symptoms.
- 3 of 4 tests of clinical prediction rule positive: Spurling test, Distraction test, Upper limb tension test 1, Ipsilateral cervical rotation < 60°

Exclusion criteria

- Bilateral CR or other musculoskeletal conditions in the affected limb.
- Evidence of central nervous system involvement.
- Surgical interventions in the head and neck region.
- History of recent fracture in the head and neck region.
- History of any medical red flags (ie, tumor, metabolic disease, rheumatoid arthritis, osteoporosis etc.)
- Current use of any prescription over the counter analgesia or anti-inflammatory medications or in the last two weeks.

Measurement Tools

- Neck disability index
- The numerical pain rating scale.
- Cervical spine active range of motion is measured with goniometer.

Variables

Dependent variables

- Pain
- Function
- Disability
- Cervical active range of motion

Independent variables

- Neural mobilization
- Cervical traction

Materials Used For Study

- Cervical traction unit with its accessories.
- Treatment table.
- Pencil and paper.
- Pillow.
- Covering sheet.
- Neck disability index sheet.
- Consent form.
- Assessment chart.
- Inch tape.
- Goniometer (Universal).
- Mirror.

Procedure

Selection of participants has done by purposive sampling method. A total of 20 patients were selected for the study and assigned to group A and group B. All patients who matched the inclusion criteria were selected after giving informed consent to the study. Standardized evaluation protocol is used and management given.

Group A was treated with neural mobilization along with intermittent cervical traction. Group B was treated with intermittent cervical traction. Both groups were recorded for their pain by the numerical pain rating scale and functional disability by Neck Disability Index scale. The gathered data is tabulated and interpreted.

Technique of Intermittent Cervical Traction (ICT)

Position of patient: supine lying. Traction in supine produces relaxation, greater intervertebral separation, decreased muscle guarding and increased stability.

Traction force: 1/7 of the patient's body weight at least 4.5 to 6.8kgs force is required initially for vertebral separation.

Hold time: 20 seconds.

Rest time: 5 seconds.

Duration of traction: 15 minutes.

Angle of pull of traction:

Traction in flexion- maximum pull and vertebral separation occurs at lower cervical spine.

Traction in neutral- maximum pull and vertebral separation occurs at mid cervical spine.

Traction in hyperextension- maximum pull and vertebral separation occurs at upper cervical spine.

Technique of neural mobilization (NM)

The slider neural mobilization is applied concurrently with cervical traction.

Begin the glide in position with the palm facing the face and the shoulder abducted at 45°.

Position 2: the shoulder is gently extended to 0° flexion. The shoulder is kept at 90° of abduction and external rotation.

Position 3, the elbow is fully extended.

Position 4, the wrist is extended.

Position 5, the fingers and thumb are extended. If symptoms have not yet developed, the patient can further extend the shoulder.

The position that marks the beginning of neurological symptoms is considered to be the provocative position.

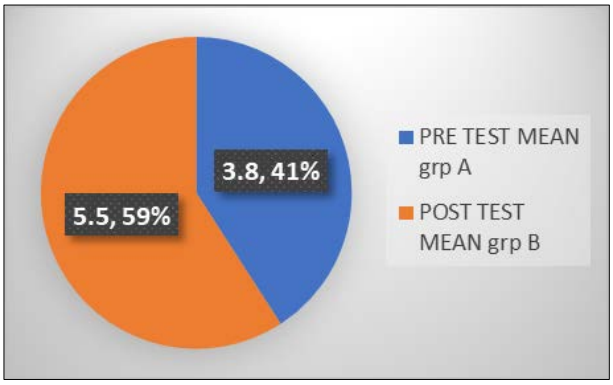
The position should be hold for 10 seconds.

After holding, it is important for the patient to return to the starting position before performing the next reception.

Statistical Analysis

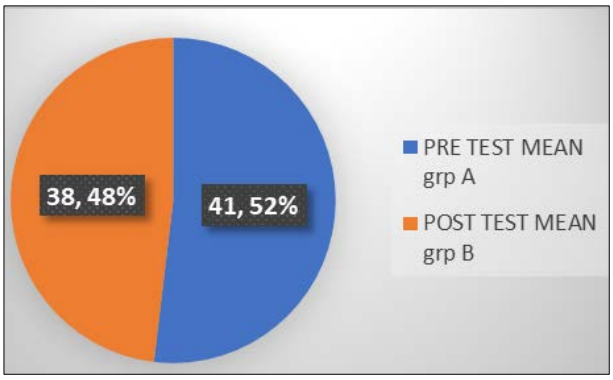
Pre-test and post-test values of the study were collected and assessed for variations in improvement and their results were analysed using independent t test and parried t test. The statically analysis of the study showed that there is a significant difference between the group in pain, function, disability and cervical ROM with a t value of NPRS, neck disability index and cervical ROM is 4.045.

Result



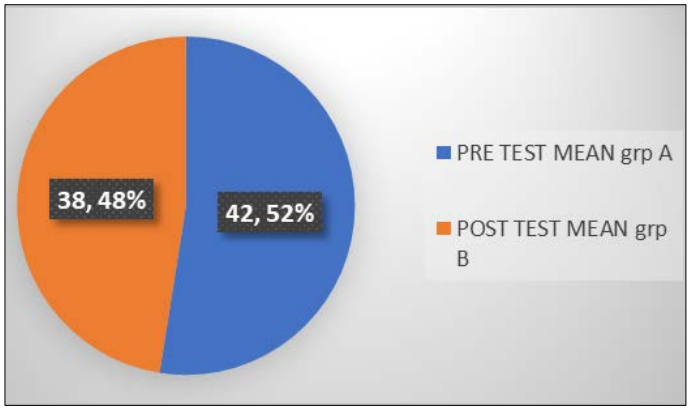
Graph 1: Comparison of pain with NPRS in Group A and B

When measured with numerical pain rating scale of groups with paired 't' test, for group-A the mean values of pre and post-test is 6.6 and 3.8 and the standard deviation is 1.316. The calculated t value is 6.727 and the table 't' value is 1.833. For group-B the mean values of pre and post-test is 7.1 and 5.5 and the standard deviation is 0.483. The calculated t value is 11.129 and the table 't' value is 1.833. With unpaired 't' test the mean values of group A is 3.8 and the mean value of group B is 5.5 and the standard deviation is 0.558. The calculated 't' value is 2.868 and the table 't' value is 1.734. The null hypothesis is rejected. There is a significant changes between the group A and group B. Group A shows significant improvement in NPRS.



Graph 2: Comparison of neck disability index in Group A and B

When measured with neck disability index of groups with paired 't' test, for group-A the mean values of pre and post-test is 44.4 and 39 and the standard deviation is 5.228. The calculated t value is 3.266 and the table 't' value is 1.833. For group-B the mean values of pre and post-test is 46.6 and 44 and the standard deviation is 2.357. The calculated t value is 3.487 and the table 't' value is 1.833. With unpaired 't' test the mean values of group A is 39 and the mean value of group B is 44 and the standard deviation is 2.390. The calculated 't' value is 2.092 and the table 't' value is 1.734. The null hypothesis is rejected. There is a significant changes between the group A and group B. Group A shows significant improvement in function.



Graph 3: Comparison of cervical ROM in Group A and B

When measured with cervical ROM - extension of groups with paired 't' test, for group-A the mean values of pre and post-test is 34.6 and 42 and the standard deviation is 7.393. The calculated t value is 3.164 and the table 't' value is 1.833. For group-B the mean values of pre and post-test is 34.5 and 38 and the standard deviation is 3.231. The calculated t value is 3.327 and the table 't' value is 1.833. With unpaired 't' test the mean values of group A is 42 and the mean value of group B is 38 and the standard deviation is 0.989. The calculated 't' value is 4.045 and the table 't' value is 1.734. The null hypothesis is rejected. There is a significant changes between the group A and group B. Group A shows significant improvement in cervical ROM.

Discussion

Cervical radiculopathy is used to describe pain radiating into the arm corresponding to the dermatomes of the involved nerve root. It mostly occurs because of cervical disc herniation and other space occupying lesions, resulting in the nerve root inflammation, impingement or both. It is associated with chronic pain and limitation in the daily life.

The study was aimed to compare the effect of intermittent cervical traction along with the neural mobilization with intermittent cervical traction alone.

In this study, sample size is 20. Group A were treated with Intermittent cervical traction along with neural mobilization. Group B were treated with Intermittent cervical traction alone. While comparing the mean values of Group A and Group B, there is a significant difference existing between two groups. Thus, making the mean values into consideration it can be concluded that Intermittent cervical traction along with neural mobilization shows more significant improvement than Intermittent cervical traction. It is important to find the most effective treatment program to treat cervical radiculopathy.

A good number of numerous studies (eg., Omer Sevgin *et al* (2024), Christos Savva *et al* (2021), Giannis Giakas *et al* (2016), provide substantive evidence for a pain relief effect of neural mobilization. Neural mobilization promotes the elongation and sliding of nerves within their surrounding tissues, reducing tension or compression and also reduces the neural mechanosensitivity. Decreasing neural tension helps normalize nerve function and reduces pain perception [9].

Various studies have reported the benefits of intermittent cervical traction (eg., Sana Tahir *et al* (2022), Hamid Ali *et al* (2015), Muhammad Umar *et al* (2012), Mohammad Taghi Joghataei *et al* (2004). Cervical traction causes gentle mobilization of the Zygapophyseal joints and may cause analgesic effect by stimulating mechanoreceptors. Mechanoreceptor impulses arriving in the spinal cord may tend to inhibit recognition of nociceptive impulses, resulting in some degree of analgises. Cervical traction causes stretching of the small neck muscles and increase relaxation and reduces pain [19].

The obtained data was stastically analysed. Paired 't' test was used to compare pre and post-test values and differences within the group. Unpaired 't' test was used to compare the difference of group A and group B. The results of NPRS, NDI and cervical ROM, the data were tabulate with their mean, mean difference, standard deviation, t table and table 't' value. Group A showed a reduction in NPRS from 6.6 to 3.8 (t = 6.727), while Group B reduced from 7.1 to 5.5 (t = 11.129), with an unpaired t-value of 2.868. NDI scores improved from 44.4 to 39 in Group A (t = 3.266) and from 46.6 to 44 in Group B (t = 3.487), with an unpaired t-value of 2.092. Cervical flexion increased from 34 to 41 in Group A (t = 3.180) and from 34.1 to 38 in Group B (t = 3.323), with an unpaired t-value of 3.401. Cervical extension improved from 34.6 to 42 in Group A (t = 3.164) and from 34.5 to 38 in Group B (t = 3.327), with an unpaired t-value of 4.045. In all measured outcomes, the null hypothesis was rejected, indicating statistically significant differences between the groups. Group A consistently showed greater improvements in pain, function, disability, and cervical range of motion compared to Group B. These findings confirm that combining neural mobilization with intermittent cervical traction is more effective than using traction alone and support the need for optimizing treatment protocols for cervical radiculopathy.

Conclusion

This quasi-experimental study showed that Intermittent cervical traction along with neural mobilization for Group A & Intermittent cervical traction alone for Group B are highly efficient in relieving symptoms of cervical radiculopathy on NPRS, NDI and ROM scores on individual basis. But comparatively Intermittent cervical traction along with neural mobilization is more effective than Intermittent cervical traction alone as there is significant difference found between the results of these treatments. So ICT combined with NM is effective in treating Cervical Radiculopathy patients.

Declaration by Authors

Ethical Approval

Ethical approval was obtained from the institutional review board of Sri Ramakrishna institute of paramedical sciences.

All respondents agreed to participate in the study and informed consent was obtained from all the subjects. The privacy of the participants information was maintained, and there was no disclosure of their names or any information that could identify them.

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Conflict of Interest: The authors declare no conflict of interest.

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