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Original Article

Comparative Effect of Nerve Gliding and Mechanical Traction on Cervical Radiculopathy

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ABSTRACT

Background: Cervical radiculopathy is a debilitating condition characterized by pain and neurological symptoms resulting from nerve root compression in the cervical spine. Traditional treatments include mechanical traction and nerve gliding exercises, each with varying degrees of efficacy. Understanding the comparative effectiveness of these interventions can guide clinicians in optimizing treatment strategies.

Objective: This study aimed to compare the effectiveness of mechanical traction and nerve gliding exercises in reducing pain, improving cervical range of motion, and decreasing disability in patients with cervical radiculopathy.

Methods: A randomized controlled trial was conducted with 32 participants diagnosed with cervical radiculopathy, evenly divided into two groups: Group A received nerve gliding exercises, and Group B underwent mechanical traction. Both interventions were administered over a four-week period. Outcome measures included pain intensity (Visual Analogue Scale, VAS), cervical range of motion (flexion, extension), and disability (Neck Disability Index, NDI). Data were analyzed using Friedman tests for within-group comparisons and Mann-Whitney U tests for between-group differences, with a significance level set at $p<0.05$.

Results: Both groups showed significant improvements in VAS and NDI scores post-treatment. Group A (nerve gliding) reported a decrease in VAS from 7.44 (SD=0.73) to 2.31 (SD=0.79) and in NDI from 38.38 (SD=5.38) to 15.94 (SD=5.09). Group B (mechanical traction) showed a reduction in VAS from 7.56 (SD=1.21) to 3.56 (SD=1.21) and in NDI from 39.56 (SD=6.63) to 30.13 (SD=6.88). Improvements in cervical range of motion were more pronounced in Group A. Statistical analysis revealed significant differences between the groups in favor of nerve gliding for enhancing cervical range of motion ($p<0.05$) and reducing disability scores ($p<0.001$).

Conclusion: Both mechanical traction and nerve gliding exercises are effective in managing cervical radiculopathy. However, nerve gliding exercises demonstrated a superior benefit in improving cervical range of motion and reducing disability levels. These findings suggest that nerve gliding exercises may offer a more comprehensive treatment approach for cervical radiculopathy.

Keywords: cervical radiculopathy, mechanical traction, nerve gliding exercises, pain management, cervical range of motion, disability.

INTRODUCTION

Cervical radiculopathy, commonly known as a "pinched nerve," is characterized by neurological impairments resulting from the impingement or inflammation of nerve roots in the cervical spine (1, 2). This condition manifests through various symptoms such as muscle weakness, numbness, and radiating pain, predominantly affecting individuals under the age of 50 due to herniated disks and those in their 50s and 60s due to disc degeneration (3, 4). The prevalence of cervical radiculopathy is estimated at 85 out of 100,000 patients, with the C7 nerve root being the most frequently involved. The condition's complex nature, encompassing mechanical compression, inflammation, and metabolic abnormalities leading to nerve root compression, necessitates a multifaceted approach to diagnosis and treatment (5, 6).

Diagnosis of cervical radiculopathy involves a comprehensive history and physical examination, supplemented by imaging studies such as X-rays and MRI, the latter being considered the gold standard for evaluating soft tissue involvement (7-9). Electromyography and nerve conduction studies may further aid in confirming the diagnosis and distinguishing cervical radiculopathy from other conditions mimicking similar symptoms. Treatment strategies for cervical radiculopathy vary, ranging from conservative approaches,

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including physical therapy and cervical steroid injections, to surgical interventions in severe or non-responsive cases. Physical therapy plays a pivotal role, employing techniques such as ultrasonography, electrical stimulation, and therapeutic exercises to alleviate pain, improve mobility, and restore function. Manual therapy, including joint mobilizations and soft tissue mobilization, alongside nerve gliding exercises, are integral components of the rehabilitation process, aimed at relieving discomfort and enhancing nerve mobility (9, 10).

Recent literature underscores the importance of comparing the effectiveness of different therapeutic modalities in managing cervical radiculopathy (11, 12). Studies have explored the impact of active versus passive upper extremity nerve mobilization, the combination of Kaltenborn-Evjenth nerve mobilisation with intermittent cervical segment traction, and specific measures targeting the enlargement of the intervertebral foramen. Furthermore, research has delved into the comparative effects of neural mobilization techniques, manual versus mechanical traction, and the synergistic application of cervical traction with neural mobilization. The findings from these studies contribute to a growing body of evidence supporting the efficacy of various treatment approaches, yet emphasize the need for further research to optimize patient outcomes (13, 14).

The comparative analysis of nerve gliding and mechanical traction in the management of cervical radiculopathy represents a critical area of investigation, addressing the gap in knowledge regarding the combined impact of these modalities. The objective is to elucidate the differential effects of these interventions, thereby guiding clinical practice towards more effective management strategies for cervical radiculopathy (15, 16). This research endeavor aims to provide a deeper understanding of the mechanisms underlying the therapeutic benefits of nerve gliding and mechanical traction, offering insights into their potential synergies and paving the way for enhanced treatment protocols that can significantly improve the quality of life for individuals afflicted with this debilitating condition (16, 17).

MATERIAL AND METHODS

The research was conducted following a Randomized Controlled Trial design over a period of four months (18). The study setting encompassed DHQ Hospital Faisalabad, Allied Hospital Faisalabad, and Fatima Medical Complex, focusing on a population of patients exhibiting symptoms of cervical radiculopathy. These patients were confirmed through objective evaluations including the Spurling test, upper limb tension test, and distraction test. Employing a simple randomised sampling technique, participants were chosen and then randomly assigned into two groups to ensure an equal allocation ratio of 1:1 (19).

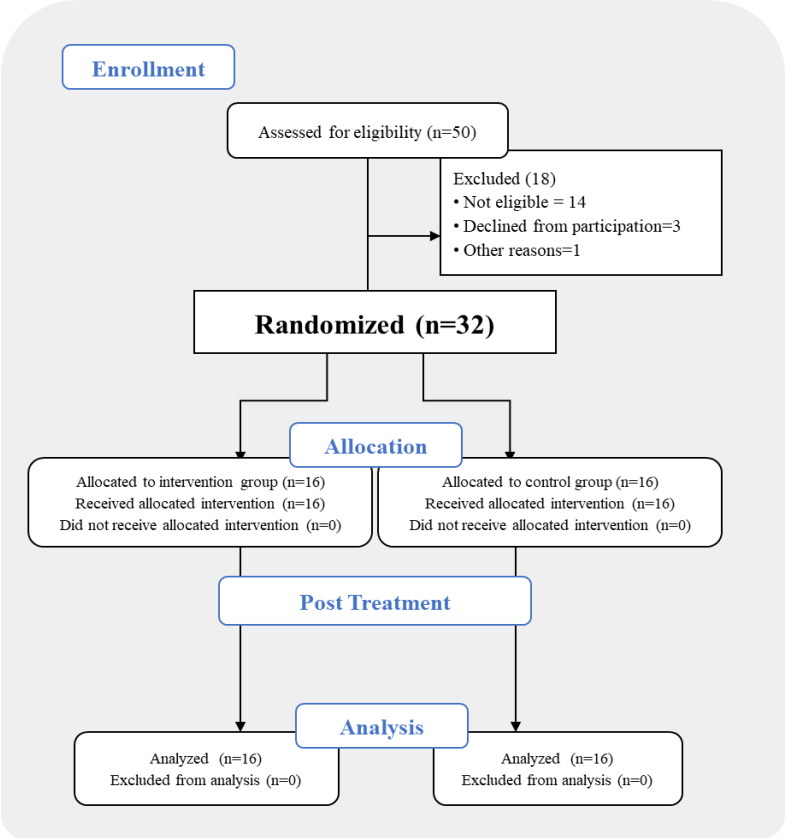

Figure 1 CONSORT FLOWCHART

The total sample size determined for the study was 32, with 16 participants in each group, calculated using the Open Epi tool based on previous studies' data. The inclusion criteria were men and women aged 30-45 years, presenting a positive Spurling's test, subacute pain lasting more than two weeks but less than three months, radiating pain into the upper limb, and not currently on medication (20, 21). Exclusion criteria included patients with pain from previous surgeries, post-traumatic conditions, congenital or acquired abnormalities, osteoarthritis, osteoporosis, significant pathology, active infections, hyper laxity, and calcium deposition in soft tissues (22, 23).

Informed consent was a crucial step before participation, where individuals were briefed verbally on the study's purpose and procedures, and consent was documented through a signed form. The study aimed to assess neck discomfort, range of motion, and impairment as its primary parameters. For outcome measures, pain was quantified using the Visual Analogue Scale (VAS), and neck range of motion and disability were evaluated using a goniometer and the Neck Disability Index (NDI), respectively (24).

Data collection followed a structured approach where participants, upon recruitment, underwent

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conventional therapy including a 10-minute application of a hydrocollator wet heat pack. The intervention for Group A involved nerve gliding exercises targeting the median or ulnar nerves, performed in a specific oscillatory manner. Group B received mechanical traction using a standardized traction unit, with treatments administered three times weekly for four weeks for both groups (25, 26).

Statistical analysis of the collected data was performed using SPSS version 25. The analysis included calculations of mean and standard deviation for quantitative variables such as age and gender. The Shapiro-Wilk test assessed the normality of the data, and non-parametric tests were applied where necessary. Intra-group comparisons were made using the Friedman test, while inter-group comparisons were determined by the Mann-Whitney U test, considering a p-value ≤ 0.05 as significant.

The research was conducted adhering to the ethical guidelines of the Declaration of Helsinki, ensuring the confidentiality and rights of all participants were protected throughout the study. The GANTT chart outlined the timeline for data collection, analysis, interpretation, and the final submission of the thesis over the four-month period. The study's structure and flow were documented in a CONSORT flow diagram, providing a clear visual representation of participant progression through the phases of the trial.

RESULTS

In the study, demographic characteristics across two groups, Group A (Nerve Gliding) and Group B (Mechanical Traction), were analyzed to understand the distribution of age, gender, affected side, and BMI categories among the participants [Table 1]. The age group distribution revealed a higher percentage of older participants (56.3%) in the 42-47 age range for Group A, compared to a larger proportion of younger participants (43.8%) in the 30-35 age range for Group B. Gender distribution showed a slight female majority (56.3%) in Group A, whereas males were more prevalent (62.5%) in Group B. Regarding the affected side, a significant difference was observed; only 6.3% of participants in Group A reported symptoms on the right side compared to 43.8% in Group B. Conversely, Group A had a majority of participants (56.3%) affected on the left side. The BMI category distribution was similar across both groups, with a notable percentage of participants classified as Obese Class I (43.8%) in each group.

The Visual Analogue Scale (VAS) assessments [Table 2] presented noteworthy findings. Before treatment, the pain levels were comparable between the two groups, with means of 7.44 for Group A and 7.56 for Group B, yielding no significant difference (p = .922). However, a significant reduction in pain was observed in Group A after the 2nd week (mean = 4.19) and after treatment (mean = 2.31), compared to Group B (mean = 5.00 after the 2nd week and 3.56 after treatment), with the differences becoming statistically significant (p = .035 and p = .004, respectively). This indicates a more pronounced effect of nerve gliding exercises on reducing pain levels among the participants.

Table 1 Demographic Characteristics

Category	Subcategory	Group A Frequency (%)	Group B Frequency (%)
Age Group	30-35	2 (12.5%)	7 (43.8%)
	36-41	5 (31.3%)	4 (25.0%)
	42-47	9 (56.3%)	5 (31.3%)
Gender	Male	7 (43.8%)	10 (62.5%)
	Female	9 (56.3%)	6 (37.5%)
Affected Side	Right Side	1 (6.3%)	7 (43.8%)
	Left Side	9 (56.3%)	6 (37.5%)
	Both	6 (37.5%)	3 (18.8%)
BMI Category	18.5-24.9 Normal	3 (18.8%)	2 (12.5%)
	25-29.9 Overweight	4 (25.0%)	4 (25.0%)
	30-34.9 Obese	2 (12.5%)	3 (18.8%)
	35-39.9 Obese Class I	7 (43.8%)	7 (43.8%)

Table 2 Comparative Visual Analogue Scale (VAS) Assessments

Assessment Point	Group A Mean (SD)	Group B Mean (SD)	p-value
Before Treatment	7.44 (0.73)	7.56 (1.21)	p = .922
After 2nd Week	4.19 (1.87)	5.00 (1.41)	p = .035
After Treatment	2.31 (0.79)	3.56 (1.21)	p = .004

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Table 3 Comparative Neck Disability Index (NDI) Assessments

Assessment Point	Group A Mean (SD)	Group B Mean (SD)	p-value
Before Treatment	38.38 (5.38)	39.56 (6.63)	p = .583
After 2nd Week	19.13 (5.81)	32.63 (10.74)	p = .010
After Treatment	15.94 (5.09)	30.13 (6.88)	p < .001

Table 4 Comparative Cervical Flexion Range of Motion (ROM)

Assessment Point	Group A Mean (SD)	Group B Mean (SD)	p-value
Before Treatment	23.44 (4.97)	27.44 (6.11)	p = .036
After 2nd Week	42.31 (11.59)	34.75 (8.15)	p = .020
After Treatment	46.56 (8.70)	40.94 (8.67)	p = .005

Table 5 Comparative Cervical Extension Range of Motion (ROM)

Assessment Point	Group A Mean (SD)	Group B Mean (SD)	p-value
Before Treatment	48.50 (5.27)	51.81 (5.09)	p = .106
After 2nd Week	59.44 (8.04)	57.44 (6.60)	p = .075
After Treatment	63.19 (7.36)	59.81 (4.78)	p = .033

Furthermore, the Neck Disability Index (NDI) assessments [Table 3] highlighted the impact of treatments on disability reduction. Initially, both groups presented similar disability levels, with Group A at a mean of 38.38 and Group B at 39.56 (p = .583). Significant improvements were seen in Group A, which reported a decrease to 19.13 after the 2nd week and further down to 15.94 after treatment. In contrast, Group B showed a slower reduction in disability scores (32.63 after the 2nd week and 30.13 after treatment), with the differences between the groups becoming statistically significant (p = .010 and p < .001, respectively).

The assessment of cervical flexion and extension range of motion (ROM) provided additional insights into the physical outcomes of the interventions [Tables 4 and 5]. Before treatment, both groups had comparable baseline measures for cervical flexion and extension. However, significant improvements were observed in Group A, with cervical flexion increasing from a mean of 23.44 to 46.56 and cervical extension from 48.50 to 63.19 after treatment. Group B also showed improvements but to a lesser extent, with cervical flexion reaching a mean of 40.94 and extension 59.81 after treatment. The differences between the groups were statistically significant at various assessment points, underscoring the efficacy of nerve gliding exercises in enhancing cervical mobility.

DISCUSSION

In this investigation, the efficacy of mechanical traction and nerve gliding as treatment modalities for cervical radiculopathy was meticulously compared. The study unveiled insightful findings regarding the potential of these management strategies, evaluating their effects through various outcome measures such as pain intensity, disability ratings, and cervical range of motion. Both mechanical traction and nerve gliding were found to be effective in reducing pain and disability in patients with cervical radiculopathy, indicating their viability as therapeutic options for this condition. However, nuanced differences emerged between the treatment approaches, shedding light on their distinct therapeutic benefits (5, 13, 20).

Mechanical traction demonstrated superior improvements in impairment scores, suggesting its greater efficacy in ameliorating disability levels in individuals with cervical radiculopathy. Conversely, nerve gliding exhibited a more pronounced effect on enhancing cervical range of motion, particularly in flexion and extension movements. This differentiation underscores the importance of tailoring treatment strategies to individual patient needs and treatment goals, considering the specific advantages of each modality (9, 16).

The study's findings are in line with previous research, such as the work of Afsah et al., which reported beneficial outcomes using both active and passive neural mobilization approaches. This similarity reinforces the notion that various forms of mobilization, alongside cervical traction, can contribute to pain alleviation, neck impairment reduction, and improved cervical mobility. Such evidence advocates for a comprehensive approach to managing cervical radiculopathy, emphasizing the need for personalized treatment plans that reflect the patient's unique clinical profile and therapeutic objectives.

Despite the promising results, this study was not without limitations. The relatively small sample size and the short duration of the study may affect the generalizability of the findings and limit the understanding of long-term treatment effects. Additionally, the study focused primarily on immediate outcomes, leaving a gap in knowledge regarding the sustainability of treatment benefits over time. Future research should aim to address these limitations by incorporating larger sample sizes, extended study durations, and

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long-term follow-up assessments. This would provide a more robust dataset for evaluating the efficacy of mechanical traction and nerve gliding, offering deeper insights into their long-term impacts on cervical radiculopathy (4, 10, 23).

In light of the findings and the identified limitations, it is recommended that future studies expand their geographic scope to include a more diverse population and explore the effects of combining different intervention modalities. Such research could unveil synergistic treatment effects that further enhance patient outcomes (24). Moreover, recording participants' activities of daily living and how these activities might influence the progression or alleviation of cervical radiculopathy symptoms could offer valuable context to the observed treatment effects, enriching the understanding of these therapeutic modalities' practical implications (18, 19).

In conclusion, this study contributes valuable knowledge to the body of evidence supporting the use of mechanical traction and nerve gliding in the treatment of cervical radiculopathy. By highlighting the specific benefits and limitations of each treatment approach, it underscores the necessity for individualized, patient-centered care strategies that optimize therapeutic outcomes. The promising results of this study pave the way for further research, which is crucial for validating the findings and exploring additional outcome measures that can inform clinical practice in managing cervical radiculopathy (12, 13).

CONCLUSION

This study underscores the efficacy of both mechanical traction and nerve gliding in alleviating symptoms of cervical radiculopathy, highlighting the importance of selecting appropriate treatment modalities based on individual patient needs and clinical objectives. While mechanical traction showed superior results in reducing disability levels, nerve gliding was more effective in enhancing cervical range of motion. These findings suggest a potential for integrating these therapies in a personalized treatment plan to maximize therapeutic outcomes. Consequently, the study reinforces the necessity for tailored, patient-centered approaches in clinical practice, encouraging further research to explore long-term effects and broader applicability of these treatments in managing cervical radiculopathy.

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