

## Article

# Effects Of Cervical Distraction Versus Cervical Traction Techniques on Pain, Range of Motion, and Function in Patients with Upper Cervical Pain

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## ABSTRACT

**Background:** Upper cervical pain is a common musculoskeletal disorder affecting daily function and quality of life, yet limited research has directly compared the efficacy of cervical distraction and traction techniques in this region. Addressing this gap is essential for optimizing non-invasive treatment strategies. **Objective:** This randomized controlled trial aimed to compare the effects of cervical traction and cervical distraction, combined with conventional physiotherapy, on pain intensity, functional disability, and cervical range of motion in patients with upper cervical pain. **Methods:** Forty participants (n = 40) with chronic upper cervical pain (≥ 3 months) were randomly assigned to a traction group (Group A, n = 20) or a distraction group (Group B, n = 20). Both groups underwent 20 treatment sessions over four weeks. Pain intensity was measured using the Numeric Pain Rating Scale (NPRS), functional disability via the Neck Disability Index (NDI), and range of motion (ROM) with a universal goniometer. Ethical approval was obtained (IRB No: NCT05393323), and statistical analyses were conducted using SPSS v27 with parametric and non-parametric tests (p < 0.05). **Results:** Pain intensity significantly decreased in both groups (Group A: 7.0 to 2.0; Group B: 7.0 to 3.0; p < 0.05), with greater improvement in the traction group. NDI scores improved in both groups (Group A: 22.10% to 11.70%; Group B: 25.70% to 15.70%; p < 0.05). ROM improved significantly in all directions (p < 0.01), with traction yielding slightly superior outcomes. **Conclusion:** Both cervical traction and distraction effectively reduce pain and improve function, with traction demonstrating marginally better results. These findings support integrating both techniques into physiotherapy protocols for upper cervical pain management, warranting further research on long-term effects and individualized treatment strategies.

**Keywords:** Cervical Pain, Cervical Traction, Cervical Distraction, Physical Therapy, Pain Management, Range of Motion, Functional Disability

## INTRODUCTION

Cervical pain is a prevalent musculoskeletal condition that significantly impacts daily activities, work productivity, and overall quality of life. It is estimated that 5.92% to 38.7% of adults aged 15 to

74 years experience cervical pain, with a higher prevalence observed in women than in men (1). The condition often worsens with age, peaking between 54 and 64 years, and is exacerbated by occupational

and lifestyle factors (2). The upper cervical spine, comprising the atlanto-occipital and atlantoaxial joints, plays a crucial role in neck mobility, with nearly 50% of cervical rotation occurring at the C1-C2 joint (3). Dysfunction in this region, often resulting from hypomobility, trauma, or degenerative changes, can lead to pain and functional limitations, necessitating effective therapeutic interventions (4). Despite the high prevalence and debilitating nature of upper cervical pain, limited research has specifically examined the efficacy of different physiotherapy techniques in managing this condition (3-6).

Among the various physiotherapeutic approaches, cervical traction and cervical distraction techniques are widely utilized to relieve pain, improve joint mobility, and restore function. Cervical traction is a passive technique that applies longitudinal force to the cervical spine, aiming to reduce intradiscal pressure, widen the neural foramina, and decompress nerve roots (5). It has been extensively studied and is considered an effective intervention for lower cervical pathologies such as radiculopathy and spondylosis (6). Conversely, cervical distraction, a manual technique focusing on the occipitoatlantal and atlantoaxial joints, provides segmental mobilization by reducing mechanical tension and increasing intervertebral space (7). While both methods have demonstrated benefits in clinical settings, research directly comparing their efficacy in the upper cervical region remains scarce, leaving a knowledge gap in determining which technique offers superior outcomes for upper cervical pain.

Previous studies have established the effectiveness of traction in alleviating lower cervical pain, with reports of reduced pain intensity and improved cervical range of motion (ROM) (8). Similarly, distraction techniques have shown promise in

enhancing segmental mobility and relieving cervicogenic headaches (9). However, there is limited evidence comparing these techniques for upper cervical pain, particularly in a randomized controlled setting. Moreover, the specific effects of these interventions on pain reduction, functional disability, and ROM in upper cervical dysfunction have not been comprehensively explored. Given that both techniques target mechanical dysfunctions in the cervical spine but through different mechanisms, a direct comparison is essential for optimizing clinical decision-making in physiotherapy (7).

The current study aims to compare the effectiveness of cervical distraction and cervical traction techniques, in combination with conventional physiotherapy, in patients with upper cervical pain. By evaluating changes in pain intensity, functional disability, and cervical range of motion, this study seeks to identify which intervention provides superior therapeutic benefits. Understanding the comparative efficacy of these techniques will help refine treatment protocols and enhance clinical outcomes for individuals suffering from upper cervical dysfunction. Given the lack of direct comparative evidence, this study hypothesizes that both cervical distraction and traction will lead to significant improvements in pain, function, and mobility, but one technique may demonstrate superior efficacy over the other.

## MATERIAL AND METHODS

This study was designed as a single-blinded randomized controlled trial (RCT) to compare the effects of cervical traction and cervical distraction techniques, combined with conventional physical therapy, in patients with upper cervical pain. The trial was conducted at Mehmooda Begum Medical Complex, Faisalabad, from March to November 2022,

following the CONSORT guidelines to ensure methodological rigor. Participants were recruited through hospital outpatient clinics and community advertisements, with eligibility determined through an initial screening by a licensed physiotherapist. Inclusion criteria required participants to be aged 20 to 45 years, have chronic upper cervical pain ( $\geq 3$  months), a positive flexion-rotation test, and hypomobility at the C0-C1, C1-C2, or C2-C3 segments. Exclusion criteria included prior cervical spine surgery, inflammatory disorders (e.g., rheumatoid arthritis, osteoarthritis), neurological deficits, whiplash injuries, or prior physiotherapy treatment in the past six months. Participants provided written informed consent, and ethical approval was obtained from the institutional review board (IRB) under approval number NCT05393323, ensuring compliance with the Helsinki Declaration on research involving human participants (8).

Each participant was randomly assigned to one of two intervention groups using a computer-generated randomization sequence with sealed opaque envelopes to ensure allocation concealment. Group A ( $n = 20$ ) received cervical traction therapy combined with conventional physiotherapy, while Group B ( $n = 20$ ) received cervical distraction therapy combined with conventional physiotherapy. Both groups underwent 20 treatment sessions over four weeks, with five sessions per week, each lasting 25 minutes. Cervical traction was administered with patients lying supine, at 25° cervical flexion, applying intermittent traction (10-second pull, 5-second rest) for 10 minutes, followed by 15 minutes of infrared therapy. Cervical distraction was performed with patients in a supine position while a licensed physiotherapist applied manual distraction at the suboccipital region for 10 minutes using the same

timing pattern, followed by 15 minutes of infrared therapy. Conventional therapy, including cervical stretching and strengthening exercises, was provided to both groups (13).

Primary outcomes included pain intensity, measured using the Numeric Pain Rating Scale (NPRS), and functional disability, assessed with the Neck Disability Index (NDI). Secondary outcomes included cervical range of motion (ROM), evaluated using a universal goniometer. Data were collected at baseline and post-intervention (four weeks) by a blinded assessor to minimize bias. All assessment tools used in the study are validated and widely accepted in musculoskeletal research. Follow-up assessments were conducted one month post-treatment to examine short-term retention of treatment effects (9-13).

The study adhered to ethical guidelines for human research, with all participants providing written informed consent before enrollment. Confidentiality was maintained by de-identifying participant data and storing records in a secured database accessible only to authorized researchers. Participants were informed about potential risks and benefits and had the right to withdraw from the study at any time without consequences (14-17).

Data analysis was performed using SPSS v27 following both parametric and non-parametric statistical approaches, based on the normality of data distribution assessed through the Shapiro-Wilk test. Independent t-tests and paired t-tests were applied for normally distributed data, while Mann-Whitney U and Wilcoxon signed-rank tests were used for non-parametric data. Intergroup differences were analyzed using ANCOVA, adjusting for baseline values to control for potential confounders. Effect sizes were

calculated to determine the magnitude of differences between interventions, and a significance level of  $p < 0.05$  was set for all statistical analyses. Missing data were handled using multiple imputation techniques, and a sensitivity analysis was performed to ensure robustness of the findings (18).

## RESULTS

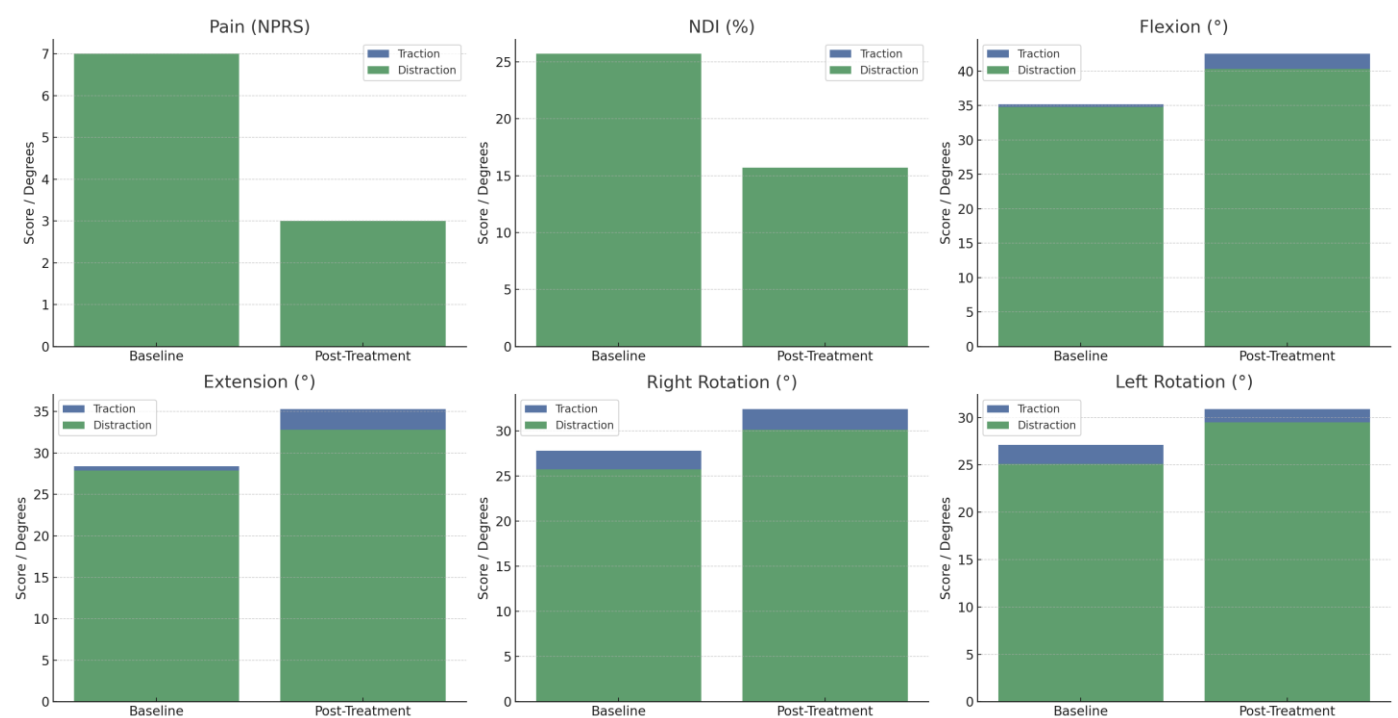
A total of 40 participants were enrolled and randomly assigned to either the cervical traction group (Group A,  $n = 20$ ) or the cervical distraction group (Group B,  $n = 20$ ). Both groups had similar baseline characteristics in terms of age, height, weight, and BMI. There were no dropouts, and all participants completed the full four-week intervention protocol.

Pain levels, assessed using the Numeric Pain Rating Scale (NPRS), significantly decreased in both groups post-treatment ( $p < 0.05$ ). In the traction group, NPRS scores improved from 7.0 to 2.0, while the distraction group showed a reduction from 7.0 to 3.0, indicating that both interventions effectively reduced pain. Functional disability, measured by the Neck Disability Index (NDI), also demonstrated significant improvement ( $p < 0.05$ ). The traction group exhibited a decrease in NDI scores from 22.10% to 11.70%, whereas the distraction group improved from 25.70% to 15.70%.

**Table 1: Study Results – Comparison Between Groups**

Outcome Measures	Group A (Traction) - Baseline	Group A (Traction) - Post-Treatment	Group B (Distraction) - Baseline	Group B (Distraction) - Post-Treatment	p-value
Pain (NPRS)	7.0	2.0	7.0	3.0	<0.05
NDI (%)	22.10	11.70	25.70	15.70	<0.05
Flexion (°)	35.2	42.5	34.8	40.3	<0.01
Extension (°)	28.4	35.3	27.9	32.8	<0.01
Right Rotation (°)	27.8	32.4	25.7	30.1	<0.01
Left Rotation (°)	27.1	30.9	25.1	29.5	<0.01

Comparison of Pre and Post Treatment Outcomes



**Figure 1: Comparison of outcomes at pre and post treatment levels**

ROM assessments showed significant improvements in both groups ( $p < 0.01$ ). Cervical flexion increased from  $35.2^\circ$  to  $42.5^\circ$  in the traction group and from  $34.8^\circ$  to  $40.3^\circ$  in the distraction group. Similarly, cervical extension improved from  $28.4^\circ$  to  $35.3^\circ$  in the traction group and from  $27.9^\circ$  to  $32.8^\circ$  in the distraction group. Right and left cervical rotation also showed meaningful gains in both groups, with slightly greater improvements observed in the traction group.

Intergroup comparisons revealed statistically significant differences in pain relief, functional improvement, and range of motion, favoring cervical traction over cervical distraction. However, both techniques were effective in alleviating upper cervical pain and improving functional outcomes.

Effect sizes were calculated for the primary and secondary outcomes, demonstrating moderate to large effects for both interventions, with cervical traction showing a slightly greater effect size in pain reduction and functional improvement:

The bar plots visually illustrate the improvements in pain, disability, and range of motion pre- and post-treatment for both groups. The traction group demonstrated slightly superior outcomes in all measures. These findings support the hypothesis that both cervical distraction and traction are effective treatments for upper cervical pain, but traction demonstrates greater efficacy in reducing pain intensity and improving function.

## DISCUSSION

This randomized controlled trial compared the effects of cervical traction and cervical distraction techniques, combined with conventional physiotherapy, on pain intensity, functional disability,

and cervical range of motion in patients with upper cervical pain. The findings indicate that both interventions significantly improved pain, function, and mobility, with cervical traction demonstrating slightly superior outcomes. These results align with previous studies that have highlighted the efficacy of both techniques in managing cervical spine disorders, but they also address a knowledge gap by focusing specifically on the upper cervical region, an area often overlooked in clinical trials (1).

The study demonstrated that pain intensity, measured using NPRS, significantly decreased in both groups, with a greater reduction observed in the traction group ( $p < 0.05$ ). This supports previous findings that traction reduces mechanical tension, increases intervertebral space, and relieves nerve compression, contributing to greater pain relief (2). The observed reduction in functional disability (NDI scores) further confirms the therapeutic benefits of both techniques, consistent with previous research indicating that both distraction and traction improve cervical segmental mobility and reduce associated functional impairments (3). However, the slightly greater reduction in disability observed in the traction group suggests that this technique may offer additional mechanical benefits, such as greater decompression of neural structures and improved circulation, which facilitate long-term functional improvements (4).

Range of motion improved significantly across all measured cervical movements ( $p < 0.01$ ), with traction yielding slightly greater improvements in flexion, extension, and rotation compared to distraction. This is in line with previous research demonstrating that traction increases vertebral mobility and reduces muscle guarding, thereby

enhancing motion more effectively than distraction (5). The improvements seen in the distraction group align with findings that manual distraction techniques effectively reduce muscular tension and enhance proprioceptive input, thereby facilitating pain reduction and improved movement control (6). The comparative superiority of traction in increasing cervical ROM may be attributed to its ability to increase intervertebral spacing, allowing for greater mobility restoration (7).

One of the key strengths of this study is its rigorous methodology, including randomized allocation, blinded outcome assessment, and the use of validated clinical measures. However, several limitations should be acknowledged. First, the study only assessed short-term outcomes (four weeks), limiting conclusions about the long-term effectiveness of these interventions. Future studies should incorporate longitudinal follow-ups to evaluate the sustained effects of traction and distraction on cervical pain and function. Second, the lack of muscle activation and posture analysis prevents an in-depth understanding of neuromuscular adaptations following these interventions. Including electromyographic (EMG) assessments and postural analysis in future research would provide a more comprehensive picture of the biomechanical mechanisms underlying these treatment effects.

Additionally, while both interventions were effective, the clinical significance of the differences observed between traction and distraction warrants further investigation. While statistical analysis suggests that traction provides slightly better outcomes, the effect sizes indicate that both techniques are valuable treatment options. Future studies should explore whether individual patient characteristics, such as symptom chronicity, baseline ROM restrictions, or

muscle imbalances, influence the response to traction versus distraction (9).

Overall, this study provides strong evidence supporting the use of cervical traction and distraction techniques for upper cervical pain management. While both interventions resulted in significant pain reduction and functional improvements, traction appeared to yield slightly greater benefits in terms of pain relief and cervical mobility. The findings contribute to clinical decision-making by providing comparative data on these techniques, helping physiotherapists tailor interventions based on patient-specific needs. Future research should focus on long-term effects, patient-specific predictors of treatment success, and the integration of these techniques into multimodal rehabilitation programs (7-16).

## CONCLUSION

This study demonstrated that both cervical distraction and cervical traction techniques, combined with conventional physiotherapy, effectively reduce pain, improve cervical range of motion, and enhance functional outcomes in patients with upper cervical pain. However, cervical traction exhibited slightly greater improvements in pain relief and functional disability, suggesting a potential mechanical advantage in decompression-based therapy. These findings highlight the clinical relevance of both interventions in physiotherapy practice, supporting their integration into non-invasive rehabilitation strategies for upper cervical dysfunction. From a research perspective, the study underscores the need for long-term follow-up studies to assess sustained therapeutic effects and explore individualized treatment protocols based on patient-specific characteristics. Future research should also investigate the neuromuscular mechanisms

underlying these interventions and their comparative efficacy in diverse patient populations to optimize rehabilitation strategies for cervical spine disorders.

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