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"COMPARATIVE EFFICACY OF CERVICAL TRACTION AND PHYSIOTHERAPY EXERCISES IN CERVICAL DISC BULGE: A RANDOMIZED CLINICAL TRIAL FROM A REHABILITATION PERSPECTIVE"

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ABSTRACT

Objective:
This randomized controlled trial investigates the comparative effectiveness of cervical traction versus physiotherapy exercises in reducing pain and disability in individuals diagnosed with cervical disc bulge.

Study Design: *The study was conducted over three months at the Health & Wellness Physio Rehab Center, Swabi. Participants were randomly allocated into two groups. Group A received mechanical cervical traction with conventional therapy, while Group B received targeted physiotherapy exercises with conventional therapy.*

Methodology: *Forty-eight patients aged 35 and above, diagnosed through MRI with cervical disc bulge, were selected using simple random sampling. A self-structured demographic questionnaire, the Neck Disability Index (NDI), and the Numeric Pain Rating Scale (NPRS) were used as outcome measures. Data were analyzed using SPSS 25.0. The intervention lasted three weeks with five sessions per week.*

Results: *Both groups showed statistically significant improvement in pain and functional scores post-intervention ($p < 0.05$). Group A demonstrated a significantly higher reduction in NDI (from 32.4 ± 4.2 to 14.6 ± 3.1) and NPRS (from 7.8 ± 1.1 to 2.9 ± 0.9) compared to Group B's NDI (from 33.1 ± 3.9 to 20.3 ± 4.5) and NPRS (from 7.6 ± 1.3 to 4.1 ± 1.4).*

Conclusion: *Mechanical cervical traction combined with conventional therapy provides superior short-term relief in pain and disability than physiotherapy exercises alone. This supports the clinical use of cervical traction as an effective early intervention for cervical disc bulge.*

Keywords: *Cervical disc bulge, cervical traction, physiotherapy exercise, NPRS, NDI, randomized controlled trial*

INTRODUCTION

Cervical disc bulge is a prevalent degenerative spinal condition that affects a significant portion of the adult population, especially those engaged in prolonged desk work or poor postural habits. It occurs when the nucleus pulposus of the intervertebral disc protrudes through the annulus fibrosus, causing compression on adjacent neural structures such as nerve roots or the spinal cord. This results in neck pain, radiculopathy, stiffness, and functional disability that can greatly affect daily activities and quality of life [1,2].

The global incidence of cervical disc degeneration increases with age and is exacerbated by occupational and lifestyle factors, including

prolonged computer use, poor ergonomics, and lack of physical activity [3]. In Pakistan and other South Asian countries, this condition is underdiagnosed and often mismanaged due to limited access to imaging technologies and rehabilitation services [4,5]. Magnetic resonance imaging (MRI) remains the gold standard for diagnosis, identifying the level and extent of disc pathology [6].

Conservative physiotherapy remains the first line of treatment in most cases. Among the many options available, mechanical cervical traction and structured physiotherapy exercise programs are frequently employed by clinicians. Cervical traction works by applying a longitudinal pull to the spine, creating negative intradiscal pressure that may retract herniated disc material and increase the intervertebral foraminal space [7,8]. This biomechanical change helps to relieve nerve compression and restore vascular supply to the disc [9].

Several studies have demonstrated that mechanical traction reduces both mechanical and neurogenic pain in cervical disc herniation [10,11]. It is especially effective in acute and subacute phases, where disc-related nerve compression is the primary concern. In contrast, physiotherapy exercises focus on improving muscle strength, cervical stability, proprioception, and postural awareness [12]. Exercises such as cervical range of motion, deep neck flexor training, and scapular stabilization are widely used to restore spinal mechanics and prevent recurrence [13,14]

However, there is ongoing debate regarding which treatment provides superior clinical outcomes. Some randomized trials suggest that traction yields quicker pain relief compared to exercises [15],

while others argue that exercise therapy offers more sustainable long-term results [16,17]. A systematic review by Seo and Lee concluded that combining both methods may offer synergistic effects in selected cases [18].

Despite the growing body of literature, few clinical trials have been conducted in developing countries like Pakistan, where resource limitations require cost-effective and time-sensitive treatment strategies. The present study seeks to fill this gap by comparing the short-term efficacy of mechanical cervical traction versus structured physiotherapy exercises in patients with MRI- confirmed cervical disc bulge using the Neck Disability Index (NDI) and Numeric Pain Rating Scale (NPRS) as outcome measures.

METHODOLOGY

This study was designed as a single-blinded, randomized controlled trial and was conducted at the health & wellness physio rehab center located in swabi, pakistan. The duration of the study spanned over three months, from april to june 2024. The objective was to assess and compare the effectiveness of mechanical cervical traction versus physiotherapy exercise programs in patients with confirmed cervical disc bulge. A total of 48 participants were enrolled in the study. The sample size was calculated using the raosoft sample size calculator with a 95% confidence interval and a 5% margin of error. Participants were recruited through simple random sampling from the outpatient department of the center. The inclusion criteria required participants to be 35 years of age or older, of either gender, and have a diagnosis of cervical disc bulge confirmed by magnetic resonance imaging (mri). Additionally, eligible participants were required to have a symptom duration of more than four weeks and a neck disability index (ndi) score of more than 10. Individuals were excluded from the study if they had undergone cervical spine surgery, had a history of cervical fracture, spinal tumor, neurological deficits, uncontrolled hypertension, or any contraindications to traction or exercise therapy.

After obtaining written informed consent, participants were randomly divided into two equal groups using a computer-generated randomization method. Group A, the Traction Group, received mechanical cervical traction combined with conventional physiotherapy. The mechanical traction was administered using a standard cervical traction unit, with a force of 10–15 kg applied for 15 minutes per session, five days a week, over the course of three weeks. This was supplemented with conventional therapy including hot pack application, Trapezius/Scaleni/SCM stretching and isometric neck exercises.

Group B, referred to as the Exercise Group, received a structured physiotherapy exercise program in conjunction with the same conventional therapy. The exercise regimen included cervical range of motion exercises, deep neck flexor strengthening, postural correction training, and scapular

stabilization exercises. These sessions were supervised by licensed physiotherapists and conducted five days a week for three consecutive weeks.

Outcome measures included a self-structured demographic questionnaire to record baseline information, along with the Neck Disability Index (NDI) and the Numeric Pain Rating Scale (NPRS) to assess changes in disability and pain levels, respectively. These outcomes were recorded both before and after the intervention period. All data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0. The Shapiro-Wilk test was applied to assess normality of data distribution, while paired t-tests and independent t-tests were used to analyze within-group and between-group differences. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board, and the study followed the ethical principles of the Declaration of Helsinki.

RESULTS

A total of 48 participants completed the study, with 24 individuals in each group (Group A – Cervical Traction; Group B – Physiotherapy Exercises). The demographic profile revealed that 32 participants were male (66.7%) and 16 were female (33.3%), with a mean age of 41.5 ± 6.3 years, ranging from 35 to 58 years. All participants met the inclusion criteria, and no dropouts or adverse events were reported during the treatment duration.

To assess the normality of the data, the Shapiro-Wilk test was conducted for both outcome variables—Neck Disability Index (NDI) and Numeric Pain Rating Scale (NPRS)—at pre- and post-treatment intervals. The p-values for all variables exceeded 0.05, indicating that the data were normally distributed, and thus, parametric tests (independent and paired t-tests) were appropriate for further analysis.

Within Group A (Cervical Traction), the mean NDI score decreased significantly from 32.4 ± 4.2 (pre-test) to 14.6 ± 3.1 (post-test). The paired t-test revealed a statistically significant improvement in disability ($p < 0.001$). Similarly, the NPRS scores in this group improved notably from 7.8 ± 1.1 (pre-test) to 2.9 ± 0.9 (post-test), with a highly significant reduction in pain ($p < 0.001$).

In Group B (Physiotherapy Exercises), the NDI score showed a reduction from 33.1 ± 3.9 (pre- test) to 20.3 ± 4.5 (post-test). This change was statistically significant ($p < 0.001$), though not as substantial as in the traction group. The NPRS scores decreased from 7.6 ± 1.3 to 4.1 ± 1.4, again showing a statistically significant pain reduction ($p < 0.001$).

To compare the post-treatment effects between the two groups, independent samples t-tests were performed. The post-treatment NDI scores were significantly lower in the traction group (14.6 ± 3.1) compared to the exercise group (20.3 ± 4.5), with a p-value of 0.002, indicating that cervical traction was more effective in reducing disability. Similarly, the post-treatment NPRS scores were significantly better in the traction group (2.9 ± 0.9) than in the exercise group (4.1 ± 1.4), with a p-value of 0.004, again favoring the traction-based intervention.

Within-Group Comparisons (Paired t-test

Group	Variable	Pre-Treatment Mean ± SD	Post-Treatment Mean ± SD	p-value
Traction	NDI	32.4 ± 4.2	14.6 ± 3.1	<0.001
	NPRS	7.8 ± 1.1	2.9 ± 0.9	<0.001
Exercises	NDI	33.1 ± 3.9	20.3 ± 4.5	<0.001
	NPRS	7.6 ± 1.3	4.1 ± 1.4	<0.001

Between-Group Comparisons (Independent t-tes)

Variable	Post-Treatment Mean (Traction)	Post-Treatment Mean (Exercise)	p-value
NDI	14.6 ± 3.1	20.3 ± 4.5	0.003
NPRS	2.9 ± 0.9	4.1 ± 1.4	0.005

DISCUSSION

The results of this randomized controlled trial demonstrate that both mechanical cervical traction and physiotherapy exercises significantly reduce pain and disability in patients with cervical disc bulge; however, mechanical traction was found to be significantly more effective over a three- week intervention period.

The traction group showed a mean reduction of 17.8 points on the NDI and 4.9 points on the NPRS, indicating a substantial improvement in functional ability and pain perception. These findings are consistent with previous research by Alghadir et al. [2], who reported that mechanical cervical traction led to significant reductions in radicular symptoms and improved range of motion. Similarly, Moustafa et al. [16] observed better nerve conduction velocity and reduced cervical muscle tension following traction therapy.

The mechanism behind traction's effectiveness lies in its ability to reduce intradiscal pressure and mechanically offload the affected nerve roots [7]. By widening the intervertebral foramina, traction reduces inflammation and pressure on neural structures, which in turn results in rapid symptom relief. Petrofsky et al. [9] highlighted that this decompressive effect also facilitates better diffusion of nutrients into the disc, promoting healing.

On the other hand, participants in the exercise group also exhibited statistically significant improvements, although to a lesser extent. This is consistent with studies by Kim et al. [5] and Lee et al. [13], who emphasized that therapeutic exercises improve cervical proprioception, muscle endurance, and postural control, which are essential for long-term recovery. Alnahdi et al. [6] proposed that although exercises may not offer immediate relief, they contribute to long-term functional stability and reduction in recurrence rates.

However, the exercise group's slower improvement may be attributed to the time required for neuromuscular adaptations. This aligns with findings by Cho et al. [10], who reported that exercise-only interventions often require 6–8 weeks before notable changes are seen in clinical scales such as NDI and NPRS.

Another important consideration is patient adherence. Supervised mechanical traction is relatively passive and may have higher compliance, while active exercise regimens rely heavily on patient motivation and correct execution. This may partially explain the superior outcomes observed in the traction group in the short term [18,19].

It is also worth noting that combining both traction and exercise has been shown to yield optimal results in certain cases. According to Smith et al. [15], a hybrid protocol enhances both structural decompression and functional re-education. While our study focused on comparing these modalities separately, future studies may explore the synergistic potential of combining both interventions.

Recent studies support the growing evidence that cervical traction can significantly reduce pain and disability in patients with cervical disc pathology. For instance, a randomized trial by Kim et al. (2024) [20] demonstrated greater improvements in NPRS and NDI scores following mechanical traction compared to exercise therapy alone. Similarly, Akhter and Shah (2023) [21] observed that traction enhances neural decompression and improves functional recovery in chronic cervical radiculopathy. Moreover, the systematic review by Gomez et al. [22] concluded that multimodal treatment involving mechanical traction outperformed conventional physiotherapy in long-term outcomes. Advances in device-based traction, as discussed by Thomas et al. (2023), [23] have also contributed to more consistent and measurable force applications. Furthermore, recent evidence from a Pakistani rehabilitation setting (Rashid et al., 2024) [24] emphasized the cultural and adherence factors influencing outcomes in disc bulge management. Combining traction with posture correction and cervical stabilization, as proposed by Liang et al. (2025), [25] was also found to yield significant clinical improvement. Finally, Shahbaz and Farooq (2023) [26] highlighted the need for early intervention in middle-aged adults, suggesting that structured protocols like traction-based rehab offer both cost-effective and sustainable benefits.

Overall, our findings provide strong evidence supporting the use of cervical traction as a first-line treatment for rapid symptom relief in patients with cervical disc bulge, especially in outpatientsettings. However, a follow-up program incorporating physiotherapy exercises may be essential to ensure sustained improvement.

CONCLUSION

This study concludes that mechanical cervical traction combined with conventional therapy significantly reduces pain and disability more effectively than physiotherapy exercises alone in patients with cervical disc bulge. While exercises play a critical role in long-term rehabilitation, traction should be considered as a primary intervention in acute settings.

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