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Assessment of Spine MED® Traction Effect on Cervical Disc Herniation: Correlation Between MRI and ODI/VAS Score: A Randomized Study

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ORIGINAL ARTICLE

Assessment of Spine MED Traction Effect on Cervical Disc Herniation: Correlation Between MRI and Oswestry Disability Index/Visual Analog Scale Score − A Randomized Study

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Abstract

Background: **Traction, as one of the earliest physical treatment methods, was utilized in the therapeutic approach to address disc herniation in both the cervical and lumbar spine. The work aimed to evaluate the impact of Spine MED traction on symptoms and MRI outcomes of cervical disc herniation in patients with cervical pain.**

Patients and methods: **This prospective cohort randomized study was performed on 100 individuals with cervical pain lasting for at least 6 months and who have cervical disc herniation diagnosed by MRI. The participants were divided randomly into two equal groups: group A, which served as the control group and received full rest as treatment, and group B, which underwent 20 sessions of cervical Spine MED traction therapy.**

Results: **Visual analog scale, the Oswestry disability index had been insignificantly different before between the two groups and was significantly lower after 1 month in group B contrasted group A ($P < 0.001$). The anterior, central, and posterior intervertebral disc spaces, right paracentral, midline, and left paracentral spinal canal diameter were insignificantly different before between the two groups and were significantly higher after 1 month in group B contrasted to group A ($P < 0.001$).**

Conclusions: **Cervical Spine MED traction therapy shows promise as a noninvasive method for efficiently addressing cervical disc herniation. The enhancements in pain relief, reduced disability, and positive changes in MRI results suggest that this treatment may favorably influence the intervertebral disc. Consequently, Spine MED traction is an appealing choice for patients seeking conservative treatment options.**

Keywords: Disability, Herniation, Oswestry, Traction, Visual analog scale

1. Introduction

Cervical discomfort is a healthcare concern with notable medical, epidemiological, and economic repercussions. Neck pain places a considerable burden on both individuals working in offices and the business sector, as it results in expenses associated with treatment and reduced productivity.[1]

The challenge with neck pain is its frequent occurrence as a recurring condition, which has a significant yearly prevalence and incidence, especially among individuals working in office environments.[2]

This emphasis is intended to inform secondary and primary preventive measures. Traction, as an initial physical treatment modality, is employed in the therapeutic administration of herniated discs.[3]

Even though there is no concrete empirical evidence to support it, traction is widely used by a substantial number of therapists, with utilization

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rates ranging from 41 to 76%. It is often combined with other therapeutic approaches, but there is a noticeable lack of consensus on crucial treatment factors such as the type of traction, duration, frequency, applied force, and patient positioning.[4]

Traction is a frequently employed method within the physiatrydomain, particularly in the cervical and lumbar spines. The principal aim of this procedure is to create a division between the joint surfaces, diminish protrusion of discs, elongate soft tissues, stimulate muscle relaxation, and enable motion in the joints.[5]

The process of joint surface separation results in the mitigation of compression within the surrounding tissues. The results indicated that horizontal traction was an effective therapeutic approach, as it increased the height of the cervical discs. Significantly, this ascent was more pronounced in the distal region of the discs.[6]

During conventional traction, the force used to stretch the neck can provoke a natural defensive response in the body's proprioceptive system, causing the neck muscles to resist the stretching force and, consequently, reducing the effectiveness of traction. This resistance from the neck muscles can improve the traction's efficiency because it necessitates less force, thus enhancing both its effectiveness and safety. Intermittent traction has demonstrated its benefits in preventing the formation of adhesions within the dural sleeve by gently stretching and then relaxing the soft tissues in the cervical spine.[6]

Research has demonstrated the beneficial effects of intermittent traction therapy, including improvements in musculoskeletal structure and muscle relaxation, which effectively mitigate pain related to spinal dysfunction.[7]

An advanced computerized system on the Spine MED table permits controlled and precise traction of the intervertebral discs. This novel configuration has been meticulously designed to deliver intermittent diversion to the cervical or lumbar region of the spine.[7]

This work aimed to investigate the effect of Spine MED traction on symptoms and MRI findings of cervical disc herniation in patients with cervical pain.

2. Patients and methods

This prospective cohort randomized study was performed on 100 individuals aged 18–60 years old, both sexes.

Inclusion criteria: cervical pain lasting for at least 6 months and cervical disc herniation diagnosed by MRI.

The work was performed following permission from the Ethics Committee Helmia Armed Forces Hospital, Cairo, Egypt. All participants provided informed written consent.

Exclusion criteria were scoliosis, stenosis, cervical surgical procedures, significant cervical infection or trauma, cervical tumor, cervical spondylolisthesis or instability, cervical spondylosis, lack of cooperation because of severe cervical pain, and claustrophobia.

2.1. Randomization and blindness

The participants were randomly divided into two groups using computer-generated numbers, and their assignment codes were concealed in sealed, opaque envelopes as part of a parallel allocation method. Group A was designated as the control group and received full rest as their treatment, while group B underwent 20 sessions of cervical Spine MED traction therapy.

All participants were evaluated for sociodemographic factors, a detailed medical history review, extensive clinical examinations, and various laboratory assessments. The laboratory tests encompassed a complete blood count, assessments of kidney and liver function, as well as measurements of C-reactive protein levels.

The traction force commenced at 4 lb and was incrementally raised by 1 lb in each session, reaching 12 lb for females and 15 lb for males by the conclusion of the sessions. All participants received intermittent motorized traction, with a 60-s distraction phase followed by a 30-s relaxation phase where the force applied during relaxation was 50% of the force during the distraction phase.

Each session lasts 30 min, and the sessions are conducted at a frequency of four to five sessions per week, totaling 20 sessions in the program. The combined effect of each session in the Spine MED program can significantly reduce pain and improve functionality as participants progress through the program.

2.2. MRI

The study employed an MRI scanner, specifically the Philips Achieva/Intera (Jaipur, India) 1.5 T model, and a specialized 5-channel SENSE spine coil. MRI tests were performed before and after the patient completed all intervention sessions. The scanning procedures were as follows.

The imaging protocol consisted of sagittal turbo spin echo T1-weighted and T2-weighted sequences

with the following parameters: repetition time (TR)/echo time (TE) = 500/8 ms for T1-weighted and 2602/120 ms for T2-weighted. The field of view was set at 304 × 160 × 39 mm^3, with a slice gap of 0.4 mm and a slice thickness of 4 mm. A total of nine slices were acquired during the scan, resulting in a scanning time of 2.04 min for T1-weighted images and 2.15 min for T2-weighted images. The axial turbo spin echo T2-weighted sequences were obtained with the following parameters: TR/TE = 2032/100 ms; field of view = 200 × 200 × 13 mm^3; no slice gap; slice thickness = 4 mm; 12 slices acquired; and a scanning time of 2.14 min [8].

2.3. Assessment method

The Oswestry disability index (ODI) questionnaire and visual analog scale (VAS) score are frequently utilized in the assessment of individuals with cervical discomfort who are having physical rehabilitation or nonoperative therapy. Before the traction group commenced traction, the ODI and VAS scores were evaluated 3 days beforehand, and at the commencement of the rest period for the control group. Subsequently, the scores were examined again following all traction sessions for the traction group, and 1 month later for the control group.

2.4. Outcome evaluation

The participants had training to accurately document their pain levels, functioning limits, and any potential consequences or restrictions. The evaluation was done within 3 days after the end of intervention and the pain level was evaluated based on VAS and ODI.

2.5. Visual analog scale

Used to assess the level of pain experienced by the individual. This included using a horizontal bar of 10 cm in length, with the participant indicating their pain intensity by marking a point along the axis ranging from 0 to 10 cm. The recorded time intervals were obtained before the implementation of the intervention and subsequently, after the intervention was completed.

2.6. Oswestry disability index

Each of the 10 items is rated on a scale from 0 to 5, yielding a maximum total score of 50. To obtain a percentage score, the acquired score may be multiplied by a factor of 2. Occasionally, a participant might not respond to a specific question. In such cases, the sum of the scores from the completed items is combined with those from the unanswered items.[9] The first report presented score intervals for interpretation in the following manner: 0–4 = no disability, 5–14 = mild, 15–24 = moderate, 25–34 = severe, above 34 = complete.

2.7. Statistical analysis

The statistical analysis was conducted using, version 26 of SPSS (IBM Inc., Chicago, Illinois, USA). To assess the normality of the data distribution, histograms, and the Shapiro–Wilks test was utilized. Utilizing an unpaired Student's t test, the statistical analysis entailed a comparison of the mean and SD of quantitative parametric parameters between the two groups. The research inquiry utilized quantitative nonparametric data, and the findings were reported as the interquartile range and median. The data mentioned above had been subjected to analysis using the Mann–Whitney test. The frequencies and percentages that constituted the qualitative parameters were analyzed using the χ^2 test or Fisher's exact test, as the case was. We considered a two-tailed P value below 0.05 to indicate statistical significance.

3. Results

An assessment was conducted to determine the suitability of 121 individuals to partake in the study. Twelve of these participants failed to meet the predetermined criteria, and nine more declined to participate in the study. The remaining participants were randomized into two equal groups, with 50 participants in each group. The participants subsequently allocated to specific cohorts were observed and analyzed statistically. Patient characteristics were insignificantly different between the two groups (Fig. 1, Table 1).

ODI and VAS were insignificantly different between the two groups before and were significantly lower after 1 month in group B than in group A ($P < 0.001$) (Table 2).

The anterior, central, and posterior intervertebral disc spaces, right paracentral, midline, and left paracentral spinal canal diameter were insignificantly different before between the two groups and were significantly higher after 1 month in group B than group A ($P < 0.001$) (Table 3).

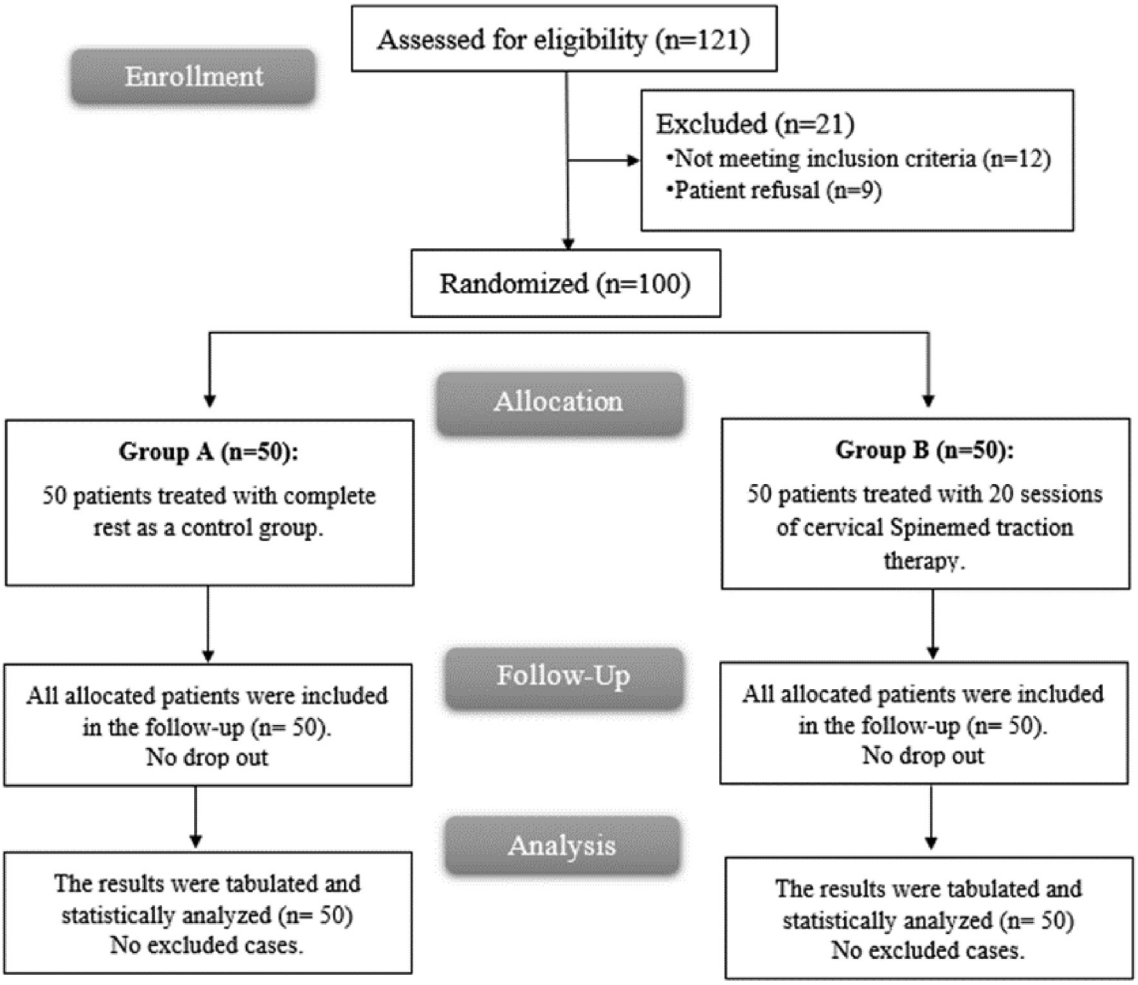

Fig. 1. CONSORT flowchart of the enrolled patients.

Table 1. Patient characteristics and cervical pain duration of the studied groups.

	Group A ($N = 50$)	Group B ($N = 50$)	*P* value
Age (years)	40.58 ± 9.52	41.7 ± 8.19	0.530
Sex			
Male	32 (64)	35 (70)	0.523
Female	18 (36)	15 (30)	
Weight (kg)	69.34 ± 8.66	70.86 ± 7.05	0.338
Height (m)	1.68 ± 0.07	1.69 ± 0.07	0.392
BMI (kg/m^2)	24.74 ± 3.92	24.91 ± 3.38	0.819
Residence			
Urban	31 (62)	34 (68)	0.529
Rural	19 (38)	16 (32)	
Smoking	14 (28)	17 (34)	0.517
Cervical pain duration (m)	45.94 ± 20.3	48.24 ± 21.93	0.588

Data are presented as mean ± SD or *n* (%).

Table 2. Oswestry disability index, visual analog scale of the studied groups.

	Group A ($N = 50$)	Group B ($N = 50$)	*P* value
ODI (%)			
Before	49.88 ± 17.81	55.26 ± 16.68	0.122
After 1 month	46 ± 14.11	13.96 ± 12.73	<0.001[a]
VAS			
Before	7 (6–8)	7 (7–8)	0.343
After 1 month	5 (4–6)	1 (0–2)	<0.001[a]

Data are presented as mean ± SD or range.
ODI, Oswestry disability index; VAS, visual analog scale.
[a] Significantly different as *P* value less than or equal to 0.05.

4. Discussion

Herniation of a cervical disc is a prevalent spinal disorder that can result in considerable physical suffering, distress, and incapacity. Recent years have seen an increase in the popularity of nonsurgical treatment options, including spinal traction, which has emerged as a promising therapeutic approach. One of the techniques that have garnered interest is Spine MED traction, which has been recognized for its potential to mitigate symptoms related to cervical disc herniation.[10]

Table 3. Anterior, central, and posterior intervertebral disc space (mm), right paracentral, midline, and left paracentral spinal canal diameter of the studied groups.

	Group A ($N = 50$)	Group B ($N = 50$)	P value
Anterior			
Anterior	4.66 ± 0.22	4.66 ± 0.19	0.918
After 1 month	4.57 ± 0.22	5.2 ± 0.24	<0.001[a]
Center			
Center	4.91 ± 0.2	4.92 ± 0.15	0.687
After 1 month	4.81 ± 0.2	5.04 ± 0.15	<0.001[a]
Posterior			
Posterior	4.82 ± 0.2	4.84 ± 0.14	0.712
After 1 month	4.71 ± 0.21	5.02 ± 0.17	<0.001[a]
Right paracentral			
Anterior	4.66 ± 0.22	4.66 ± 0.19	0.918
After 1 month	4.57 ± 0.22	5.2 ± 0.24	<0.001[a]
Midline			
Center	4.91 ± 0.2	4.92 ± 0.15	0.687
After 1 month	4.81 ± 0.2	5.04 ± 0.15	<0.001[a]
Left paracentral			
Posterior	4.82 ± 0.2	4.84 ± 0.14	0.712
After 1 month	4.71 ± 0.21	5.02 ± 0.17	<0.001[a]

Data are presented as mean ± SD.
[a] Significantly different as P value value less than or equal to 0.05.

In our study, ODI was insignificantly different between the groups and was significantly lower after 1 month in group B than group A ($P < 0.001$). Improvement of the studied groups was substantially greater in group B contrasted to group A ($P < 0.001$).

In agreement with our results, Soual and Gaudy[3] demonstrated a substantial enhancement in more than 80% of the individuals. Significant pain reductions, a substantial decline in disability status, and an increase in functional status have been documented among these individuals because of the observed improvement in the capacity to perform daily tasks.

In accordance with our results, Ma and Kim[11] demonstrated that when combined with additional physical rehabilitation techniques, motorized spinal decompression utilizing the Spine MED system demonstrates a viable and efficacious strategy for the treatment of spinal radiculopathy in patients. This form of noninvasive treatment appears to be effective and safe.

An additional research inquiry was initiated to assess the impact of decompression therapy, combined with spinal spine stabilization exercise and joint mobilization, on a cohort of thirty patients afflicted with discogenic back pain. The results of the study revealed notable improvements in the ODI.[11]

Moreover, recent investigations conducted by Arumugam and Midha[12] have shown substantial improvements in the Neck Disability Index and Numeric Pain Rating scale for the two categories of participants.

However, Koçak *et al.*[13,14] have previously shown that the ODI score of individuals with LBP exhibited a drop following traction therapy, although this reduction did not reach statistical significance when compared to the first measurement.

Comparable to the results obtained in our investigation, in comparison to placebo treatments and sham interventions, traction did not produce any effect or significant difference, the absence of therapy or alternative therapeutic approaches, according to additional clinical studies.[15,16]

In our study, VAS was insignificantly different between the two groups and was significantly lower after 1 month in group B than group A ($P < 0.001$).

This also agrees with Liu *et al.*,[17] who reported that the participants' symptoms enhanced following ten sessions of traction. The average reduction in VAS score was 2.32. Furthermore, exceeding 25% of the participants in terms of VAS score achieved minimum clinically important difference MCID.

This is also in line with Arumugam and Midha,[12] who reported that when incorporated into a standard physiotherapy regimen, spinal decompression therapy improved pain and disability significantly in patients with cervical intervertebral disc herniation.

In our study, the anterior, central, and posterior intervertebral disc spaces were insignificantly different between the two groups and were significantly higher after 1 month in group B than group A ($P < 0.001$).

In our study, right paracentral, midline, and left paracentral spinal canal diameters were insignificantly different between the two groups and were significantly higher after 1 month in group B than group A ($P < 0.001$).

This is consistent with Liu *et al.*[17] Variations in both the ODI score and the VAS score are strongly correlated with changes in the average NP T2 value of five intervertebral discs per participant. Additionally, on the subsequent 6-month period, no significant amelioration in clinical symptoms was observed. While this was noted, it was discovered that changes in the mean NP T2 value of five intervertebral discs per participant were significantly and positively correlated with changes in both the ODI and VAS scores (correlation coefficients of 0.822 and 0.793, respectively).

According to Liu *et al.*,[17] following lumbar traction, the T2 value of the NP increased for Pfirrmann grades II–IV. Furthermore, for Pfirrmann grade II, the annulus fibrosus exhibited an enhanced T2 value. Particularly in the NP region, these results indicate that motorized traction may increase the T2 value of the intervertebral disc.

As a result, it was hypothesized that lumbar traction could lead to an elevation in the water content of the intervertebral disc. It is noteworthy to mention that after all traction sessions, individuals with Pfirrmann grade II exhibited a more substantial increase in the NP T2 value, in comparison to those with Pfirrmann grades III and IV. As a result, it was hypothesized that the potent restorative properties of water molecules might be more pronounced in the early phases, characterized by reduced water loss. In patients with Pfirrmann grades III or IV, there was no statistically significant difference in the AF T2 value between pretraction and posttraction measurements. The absence of a significant difference in results may be explained by the small sample size and the decreased water content in the atria of patients with Pfirrmann grades III and IV, which signifies a more advanced stage of degeneration in comparison to those with Pfirrmann grade II. Conversely, a regimen comprising merely 10 sessions of motorized traction might not be sufficient to facilitate disc healing.[17] The results of this study are consistent with those documented in other scientific investigations.[18,19]

Several favorable outcomes have been associated with spinal traction, including an enlargement of the intervertebral disc space, a reduction in mechanical stress on the disc, enhanced circulation, and relief from facet joint adhesions, despite the fact that the precise mechanisms underlying this treatment are still unknown.[20] Following this, it is possible to deduce that water percolates into the intervertebral disc via the capillaries or adjacent cartilage endplates of the vertebral body's, facilitated by the negative intradiscal pressure. This has demonstrated the improvement of metabolism, resorption mediated by inflammation, and nutrition delivery within the intervertebral disc.[21]

Multiple studies have shown a progressive decline in water and proteoglycan levels throughout disc degeneration.[22,23]

Additionally, the synthesis of matrix macromolecules responsible for maintaining water content may be disrupted, leading to diminished signals on T2WI imaging.[24]

The application of traction in animal experiments has been the subject of numerous studies documenting pathological or biochemical alterations in intervertebral discs. Decompression or traction may increase the nutritional supply to the disc, stimulate cell growth, and activate genes associated with the extracellular matrix, according to these findings. This, in turn, may encourage the production of collagen and specific types of proteoglycans, ultimately enhancing the disc's capacity to retain water and facilitate water intake. Furthermore, research has identified specific discs exhibiting mild to early degeneration may display histological signs of improvement when subjected to decompression.[25,26]

This study has several limitations, including the fact that only patients with cervical pain lasting at least 6 months were included; therefore, the findings may not be applicable to patients with acute pain or other underlying spinal conditions. Due to the relatively small sample size, the generalizability of the results may be limited. The absence of an extended follow-up period renders the long-term sustainability of the treatment's effects uncertain. A comparison to alternative noninvasive treatment modalities, which could have offered additional insight into the efficacy of cervical Spine MED traction therapy, was omitted.

4.1. Conclusions

The results of this study indicate that cervical Spine MED traction therapy holds promise as a noninvasive method for effectively addressing cervical disc herniation. The improvements observed in terms of pain relief, reduced disability, and positive changes in MRI results suggest a potential beneficial influence on the intervertebral disc. As a result, Spine MED traction emerges as an appealing choice for patients seeking conservative treatment options.

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Authors' contributions

M.M.S. conceived and supervised the study; A.A.G. was responsible for data collection. A.A.H. and B.M.G. analyzed and interpreted the data. All authors provided comments on the manuscript at various stages of development. All authors read and approved the final manuscript.

Conflicts of interest

There are no conflicts of interest.

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The manuscript has been read and approved by all the authors, the requirements for authorship as stated earlier in this document have been met, and each author believes that the manuscript represents honest work, if that information is not provided in another form.

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