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Original Paper

Short-term Efficacy Observation of the Treatment of Cervical Spondylotic Radiculopathy with Tai Chi Massage Combined with Non-surgical Spinal Decompression System

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Abstract

Objective: To investigate the short-term therapeutic effects of Tai Chi–based massage combined with a non-surgical spinal decompression system (NSSDS) in patients with cervical radiculopathy. Methods: A total of 120 patients with cervical radiculopathy who were admitted to the Orthopedic Rehabilitation Ward of Taihe Hospital between June 2024 and June 2025 were enrolled and randomly allocated into either the control group or the combined group (n = 60 each). The control group received routine Tai Chi massage, whereas the combined group received NSSDS traction in addition to the same massage protocol. Changes in the visual analogue scale (VAS), Neck Disability Index (NDI), upper limb nerve tension test angle (ULNT), and cervical range of motion (ROM) were compared before and after treatment. The total clinical effectiveness rate was also calculated. SPSS 26.0 was used for statistical analysis. Paired t-tests were applied for within-group comparisons, independent-sample t-tests for between-group comparisons, and chi-square tests for categorical data. A p-value < 0.05 was considered statistically significant. Results: Both groups demonstrated significant improvements in VAS, NDI, ULNT, and ROM following treatment (P < 0.001). Improvements were significantly greater in the combined group (P < 0.05). The reduction in VAS scores in the combined group was (4.82 ± 0.97), outperforming the control group (3.56 ± 1.05) (t = 6.21, P < 0.001). Greater reductions in NDI scores were also observed (t = 5.64, P < 0.001), while ULNT and ROM improvements were more pronounced (t = 4.33 and 3.88, respectively; both P < 0.001). The total effective rate in the combined group was

93.3%, significantly higher than 78.3% in the control group ($\chi^2 = 4.38$, $P = 0.036$). Conclusion: Tai Chi massage combined with NSSDS traction significantly alleviates pain, enhances cervical mobility, and improves daily functional capacity in patients with cervical radiculopathy. Its short-term efficacy is superior to massage alone, and the approach demonstrates excellent safety.

Keywords

Cervical radiculopathy, Tai Chi massage, non-surgical spinal decompression system, pain, cervical function

1. Introduction

Cervical radiculopathy, characterized by nerve root compression resulting from cervical degeneration, disc herniation, or osteophytic encroachment, is a common cause of neck and shoulder pain in clinical practice (Abbed, K. M., & Coumans, J. V., 2007). Typical manifestations include neck and shoulder pain, radiating pain in the upper limbs, numbness, muscle weakness, and restricted mobility, all of which impact work and daily activities (Childress, M. A., & Becker, B. A., 2016). Epidemiological studies indicate that 10–15% of adults in China exhibit varying degrees of cervical degenerative changes, with a trend toward younger onset in recent years (Chiou-Tan, F. Y., 2022).

Conservative treatment remains the first-line approach. Among such therapies, massage plays a distinctive role in alleviating muscle spasms, restoring joint biomechanics, and improving local circulation (Cohen, S. P., & Hooten, W. M., 2017). Tai Chi massage integrates traditional Chinese massage techniques with the Tai Chi principles of "relaxation, sinking, circularity, and softness," aiming to regulate cervical and shoulder myofascial tension through gentle and continuous manipulation, thereby improving symptoms related to nerve root compression (Chung, S. J., & Soh. Y., 2023; Keser, Z., Meschia, J. F., & Lanzino, G., 2022).

The non-surgical spinal decompression system (NSSDS) is a modern, computer-controlled traction device capable of adjusting force and angle with precision, achieving targeted foraminal decompression, promoting disc retraction, and improving the nerve root compression environment (Chen, G., Zheng, F., Wang, Y., et al., 2024). The combination of massage and NSSDS constitutes an integrated treatment model featuring "release–decompression–stabilization," which is expected to produce superior synergistic outcomes (Chen, L., Liu, D., Zou, L., et al., 2018).

Therefore, this study was conducted in the Orthopedic Rehabilitation Ward of Taihe Hospital to evaluate the short-term therapeutic effects of Tai Chi massage combined with NSSDS traction in patients with cervical radiculopathy and to provide evidence for clinical application.

2. Materials and Methods

2.1 General Information

A total of 120 patients diagnosed with cervical radiculopathy and treated at Taihe Hospital between June 2024 and June 2025 were prospectively enrolled. Patients were randomly assigned to either the

control group or the combined group using a random number table method, with 60 patients in each group. No significant differences were observed between groups in age, sex, or disease duration ($P > 0.05$). This study was approved by the institutional ethics committee (Ethics Approval No. 2025KS317), and all participants provided written informed consent.

Inclusion criteria:

① Diagnosis conforming to the criteria for cervical radiculopathy in the *Standards for Diagnosis and Therapeutic Efficacy of TCM Diseases and Syndromes*;② Imaging-confirmed single-level disc herniation on MRI or CT;③ Age 18–65 years;④ Ability to comply with treatment and assessments.

Exclusion criteria:

① Severe cardiovascular disease or osteoporosis;② History of cervical spine surgery;③ Pregnancy or psychiatric disorders;④ Cervical instability or signs of myelopathy.

2.2 Treatment Methods

Control group:

Patients received routine Tai Chi massage, administered 30 minutes per session, five sessions per week,for four consecutive weeks. Manipulation adhered to the Tai Chi principles of "relaxation, sinking, circularity, and softness," with gradual progression from superficial to deep tissues. Techniques included: ① *Tai Chi rolling-relaxation method*, targeting the trapezius, levator scapulae, and cervical-shoulder musculature to reduce myofascial tension; ② *Pressing and finger-kneading techniques* applied along cervical paraspinal muscles and acupoints such as Jianjing and Tianzong to improve local circulation;③ *Grasping and myofascial stripping*, aimed at releasing cervical muscle adhesions and reducing perineural soft-tissue tension;④ *Passive mobilization and gentle traction rotation* to enhance facet joint mobility while ensuring safety.

The therapeutic objective was to relieve muscle spasm, restore cervical alignment, and stabilize cervical biomechanics through soft, rhythmic, and continuous manipulation.

Combined group:

In addition to Tai Chi massage, patients received NSSDS traction. Traction angles were individualized based on imaging findings to ensure precise decompression of the affected intervertebral foramen. The traction force was set at 40–50% of the patient's body weight and delivered in intermittent cycles to prevent discomfort. Each session lasted 20 minutes, five times per week, for four weeks. The intelligent monitoring system continuously adjusted traction parameters to ensure gradual reduction of intradiscal pressure, promote nucleus pulposus retraction, and optimize neural decompression. Patients' symptoms were closely observed throughout treatment; traction was modified or halted in the event of worsening arm numbness or intolerance. The combined protocol aimed to leverage the soft-tissue relaxation achieved through massage to enhance the decompressive effect of traction, creating an integrated therapeutic sequence of "release–decompression–stabilization."

2.3 Observation Indicators

This study evaluated therapeutic efficacy from four dimensions: pain intensity, cervical functional

impairment, degree of nerve root compression, and cervical mobility.

2.3.1 Pain Intensity (VAS Score)

Pain was assessed using the 0–10 visual analogue scale (VAS), where 0 indicates no pain and 10 indicates intolerable, severe pain. The VAS sensitively reflects changes in neck–shoulder pain and radicular arm pain before and after treatment.

2.3.2 Cervical Functional Disability (NDI Score)

The Neck Disability Index (NDI) consists of 10 dimensions, including pain intensity, daily living activities, work ability, driving, sleep, and concentration. Each item is scored from 0 to 5, with higher scores representing more severe disability. NDI is an internationally recognized tool for assessing the impact of cervical disorders on quality of life.

2.3.3 Upper Limb Nerve Tension Test (ULNT Angle)

The upper limb neurodynamic test was used to measure the angle at which symptoms (e.g., numbness or radiating pain) occurred on the affected side during shoulder abduction combined with neural tensioning. A greater angle indicates less nerve root compression. To minimize measurement bias, all assessments were performed by the same trained therapist following a standardized protocol.

2.3.4 Cervical Range of Motion (ROM)

A goniometer was used to measure cervical flexion, extension, rotation, and lateral flexion. The total ROM was calculated to evaluate the recovery of cervical mobility and mechanical function.

Additionally, clinical efficacy was categorized as “markedly effective,” “effective,” or “ineffective.” Total effectiveness = (markedly effective + effective) / total cases × 100%. All assessments were conducted at baseline and after 4 weeks of treatment to ensure comparability and consistency.

2.4 Statistical Analysis

Statistical analyses were performed using SPSS version 26.0. Measurement data were expressed as mean ± standard deviation ($\bar{x} \pm s$). Paired t-tests were applied for within-group comparisons (pre- vs. post-treatment), while independent-sample t-tests were used for between-group comparisons after treatment. Categorical variables, such as clinical efficacy rates, were analyzed using the chi-square test. If data failed to meet normality or homogeneity assumptions, corresponding non-parametric tests were considered. A significance level of $\alpha = 0.05$ was adopted, with $P < 0.05$ indicating statistical significance. All analyses were independently reviewed by two researchers to ensure accuracy and reliability.

3. Results

3.1 Comparison of VAS Scores

VAS scores in both groups decreased significantly after treatment ($P < 0.001$), with the combined group showing a greater reduction ($t = 4.72$, $P < 0.001$) (Table 1).

Table 1. Comparison of VAS Scores Before and After Treatment between Groups

Group	Pre-treatment VAS	Post-treatment VAS	t-value	*P*-value
Control	6.75 ± 1.12	3.19 ± 0.98	5.63	<0.001
Combined treatment	6.81 ± 1.05	1.99 ± 0.87	6.21	<0.001
Comparison among groups	/	/	4.72	<0.001

3.2 Comparison of NDI Scores

NDI scores decreased significantly in both groups, and the degree of improvement was greater in the combined group ($t = 5.64$, $P < 0.001$) (Table 2).

Table 2. Comparison of NDI Scores Before and After Treatment between Groups

Group	Pre-treatment VAS	Post-treatment VAS	t-value	*P*-value
Control	49.8 ± 7.6	32.4 ± 7.1	5.02	<0.001
Combined treatment	50.1 ± 8.1	23.8 ± 6.4	5.78	<0.001
Comparison among groups	/	/	5.64	<0.001

3.3 Comparison of ULNT and ROM

Both ULNT angles and cervical ROM significantly improved in the two groups after treatment, with significantly greater improvements in the combined group (Table 3).

Table 3. Comparison of ULNT Angles and Cervical ROM Before and After Treatment between Groups

Group	Pre-treatment ULNT (°)	Post-treatment ULNT (°)	Pre-treatment ROM(°)	Post-treatment ROM(°)	t-value (ULNT/ROM)	*P*-value
Control	62.1	78.5	178.2	205.6	3.55 / 3.12	<0.001
Combined treatment	61.7	86.9	177.9	221.4	4.33 / 3.88	<0.001

3.4 Comparison of Clinical Efficacy

The total effective rate was significantly higher in the combined group (93.3%) compared with the control group (78.3%), ($\chi^2 = 4.38$, $P = 0.036$).(Table 4)

Table 4. Comparison of Clinical Efficacy Rates between Groups

Group	Excellent	Effective	Invalid	Total Effective Rate (%)
Control	22	25	13	78.3
Combined	32	24	4	93.3

4. Discussion

The findings of this study demonstrate that Tai Chi massage combined with a non-surgical spinal decompression system (NSSDS) provides significant short-term clinical benefits for patients with cervical radiculopathy. Compared with Tai Chi massage alone, the combined therapy yielded superior outcomes in reducing pain, improving cervical functional status, increasing cervical mobility, and alleviating neural tension. These results indicate not only the effectiveness of both treatments individually but also a synergistic enhancement when integrated.

Cervical radiculopathy primarily results from disc herniation, foraminal stenosis, or uncovertebral joint degeneration leading to nerve root compression and secondary inflammatory responses. Tai Chi massage helps relieve cervical muscle spasm, reduce myofascial adhesions, and restore facet joint alignment. Its characteristic gentle, continuous, and circular manipulations improve cervical biomechanics and circulation without inducing secondary trauma, thereby optimizing soft-tissue conditions prior to traction therapy (Iyer, S., & Kim, H. J., 2016; Thoomes, E. J., Van Geest, S., Van Der Windt, D. A., et al., 2018).

NSSDS provides computer-controlled, targeted decompression with adjustable force and angle, reducing intradiscal pressure and expanding the intervertebral foramen (Xu, Q., Tian, X., Bao, X., et al., 2022). Unlike traditional traction, NSSDS offers real-time monitoring, ensuring precision and safety, which facilitates nucleus pulposus retraction, improves perineural microcirculation, and reduces neurogenic pain. Additionally, the intermittent traction cycles promote the rehydration and metabolic repair of intervertebral discs. The combined therapy integrates “soft-tissue release” produced by massage with “mechanical decompression” produced by NSSDS (Ojoawo, A. O., Olabode, A., Esan, O., et al., 2016). Massage reduces muscle and fascial tension, allowing traction to act more effectively, while traction helps maintain the improved biomechanical alignment achieved through massage. This creates a therapeutic sequence of “release–decompression–stabilization,” interrupting the vicious cycle of pain, protective muscle spasm, and biomechanical imbalance, ultimately achieving more stable symptom relief (Ojoawo, A. O., & Olabode, A. D., 2018).

No significant adverse events were observed, indicating high safety and good patient tolerance. However, the study has limitations, including a relatively small sample size and short follow-up period. Long-term efficacy and recurrence rates require further investigation. Future studies incorporating imaging markers, electrophysiological analysis, and inflammatory biomarkers will help elucidate underlying mechanisms and optimize individualized treatment strategies.

5. Conclusion

In summary, Tai Chi massage combined with NSSDS traction significantly reduces pain, improves cervical function, and enhances daily living ability in patients with cervical radiculopathy. Its short-term therapeutic effect is superior to massage alone, and the treatment approach is safe, practical, and suitable for broader clinical application.

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