Curative Efficacy of Cyclic Flexion Traction on Lumbar Disc Herniation

Yuanyang ZHANG

Tuina Department of Rehabilitation Center, Taihe Hospital (Affiliated Hospital of Hubei University of Medicine), Shiyan 442000

Abstract [**Objectives**] To investigate the clinical efficacy of Cyclic Flexion Traction (CFT) in treating Lumbar Disc Herniation (LDH) and its effects on lumbocrural pain relief, functional improvement, and nerve root decompression. [**Methods**] Seventy LDH patients treated at the orthopedic rehabilitation outpatient and inpatient departments of Shiyan Taihe Hospital from June 2022 to December 2024 were randomly divided into a treatment group (CFT therapy, $n=35$) and a control group (traditional traction, $n=35$). The treatment group received cyclic flexion traction (traction force of 30% - 50% body weight with a cycle of 60 - 30 - 30 sec), while the control group received supine position linear traction. Both groups underwent 4 weeks of treatment, with assessments including visual analog scale (VAS), Oswestry Disability Index (ODI), and straight leg raising test (SLRT) angles. [**Results**] The treatment group showed a significantly greater reduction in VAS scores (from 6.97 to 2.31) compared to the control group (from 6.89 to 3.74) ($P<0.05$). Similarly, ODI improvement (41.62→15.73 compared with 40.98→22.84) and SLRT angle increase (41.23°→76.47° compared with 42.09°→64.19°) were more pronounced in the treatment group (all $P<0.05$). [**Conclusions**] Through dynamic decompression mechanisms, CFT therapy demonstrates superior efficacy to traditional traction in pain relief, functional recovery, and nerve root decompression (effective rate 94.29% compared with 77.14%, $P<0.05$), representing a superior non-surgical treatment option.

Key words Lumbar Disc Herniation (LDH), Traction therapy, Cyclic flexion traction, Dysfunction, VAS score, Straight leg raising test (SLRT)

1 Introduction

Lumbar Disc Herniation (LDH) is a clinically common spinal disease. Its incidence rate has shown a significant upward trend, and it has become a major condition affecting patients' quality of life and work capacity[1-2]. Current treatments for LDH are primarily divided into surgical and non-surgical interventions. Although surgical treatment is applicable to severe cases, some patients find it difficult to accept due to its highly invasive nature, prolonged postoperative recovery period, and certain risks of complications[3]. Consequently, non-surgical treatment has gradually become the preferred choice for most patients. Traction therapy, as a conventional conservative treatment, is widely used in clinical practice and has achieved favorable therapeutic outcomes. It works by increasing the intervertebral disc space height through mechanical tensile forces, alleviating nerve root compression, reducing pain, and improving functional impairments[4]. Traditional traction methods predominantly employ supine linear traction or prone-position traction, but these approaches face challenges such as insufficient decompression and poor patient tolerance[5-6]. Recent studies suggest that Cyclic Flexion Traction (CFT) may further enhance traction efficacy. By alternating cyclic flexion and relaxation maneuvers, CFT induces dynamic anterior flexion motion in lumbar segments, enlarges spinal canal capacity, and reduces intradiscal pressure and intervertebral foramen pressure[7]. In this study, we intended to validate the dual advantages of CFT therapy (postural optimization + dynamic traction), to provide new evidence for non-surgical management of LDH.

Received: March 3, 2025 Accepted: May 23, 2025

Supported by the Hospital-level Program of Shiyan Taihe Hospital (2022JJXM144).

Yuanyang ZHANG, bachelor's degree, chief technologist.

2 Clinical data and methods

2.1 Clinical data A total of 70 patients with Lumbar Disc Herniation who received treatment at the Orthopedic Rehabilitation Outpatient and Inpatient Department of Shiyan Taihe Hospital from June 2022 to December 2024 were selected. They were randomly divided into a treatment group and a control group, with 35 cases in each. There were no statistically significant differences ($P>0.05$) in general data such as gender, age, disease course, and herniated segment between the two groups, indicating comparability (Table 1).

2.2 Diagnostic criteria The diagnostic criteria were established with reference to the *Guidelines for the Diagnosis and Treatment of Lumbar Disc Herniation* (2020 Edition)[8] issued by the Orthopaedic Branch of the Chinese Medical Association: significant lumbocrural pain symptoms, which may be accompanied by lower limb numbness and decreased muscle strength, with a disease course exceeding 4 weeks; lumbar MRI examination showing intervertebral disc herniation compressing corresponding nerve roots; positive Straight Leg Raise Test (SLRT); and consistency between clinical symptoms, signs, and imaging findings.

2.3 Inclusion criteria[3] Meeting the above diagnostic criteria; aged 20 - 55 years, first onset or no prior surgical treatment; no traction or other physiotherapy treatments received within the past 4 weeks; absence of contraindications to traction therapy (*e.g.*, osteoporosis, vertebral fractures, spinal tumors, severe cardiovascular/cerebrovascular diseases); patients who signed informed consent forms and could cooperate to complete the treatment protocol.

Table 1 Comparison of general data between the two groups ($n=35$)

Group	Gender//cases		Age//years old	Disease course//months	Herniated segment		
	Male	Female			L4-5	L5-S1	L5-S1
Treatment	18	17	36.9 ±7.5	8.2 ±3.1	21	11	3
Control	19	16	37.2 ±7.8	7.9 ±2.8	22	10	3

2.4 Exclusion criteria Combined with severe lumbar spondylolisthesis, spinal stenosis, or other related conditions; combined with severe cardiovascular/cerebrovascular diseases or malignant tumors; combined with severe osteoporosis, spinal infections, or spinal tuberculosis; pregnant or breastfeeding women; patients who had undergone recent lumbar spine surgery or other traction therapies; presence of mental disorders or cognitive impairments affecting treatment cooperation or evaluation.

2.5 Treatment methods

2.5.1 Control group. Patients in the control group received traditional supine linear traction therapy. Patients were placed in a supine position with lower limbs extended and lumbar region naturally relaxed. Traction was administered using a computer-controlled traction bed (Model: JYZ-II electric traction bed). The traction force was adjusted according to the patient's body weight and clinical condition, generally set at 30% to 50% of body weight. The initial traction force was relatively low (approximately 20% –30% of body weight) and gradually increased to maximum tolerance. Each traction session lasted 20 – 30 min, administered 5 times each week, with a continuous 4-week treatment course.

2.5.2 Treatment group. Patients in the treatment group received Cyclic Flexion Traction (CFT). Patients were placed in a supine position with knees flexed, hips flexed at 90°, and the lumbar spine in a flexed posture. Cyclic traction was performed using a computer-controlled multifunctional traction bed (Model: JYZ-III multifunctional electric traction bed). The traction weight was similarly set at 30% to 50% of the patient's body weight, with specific traction parameters flexibly adjusted based on individual tolerance. The traction process consisted of three phases: "traction-maintenance-relaxation", with traction applied for 60 sec, maintained for 30 sec, and relaxed for 30 sec, cyclically repeated. The total traction time was similarly controlled at 20 – 30 min, administered 5 times each week, with a continuous 4-week treatment course. Both groups were instructed to avoid strenuous exercise, prolonged standing, or sitting during treatment. After treatment completion, patients were guided to perform daily lumbar and back muscle functional exercises to consolidate therapeutic effects.

2.6 Methods for evaluating therapeutic efficacy Therapeutic efficacy assessments were conducted before treatment and at the end of the 4-week treatment course. Specific evaluation metrics are described in detail as follows:

2.6.1 Pain assessment. Pain intensity was evaluated using the Visual Analogue Scale (VAS). Patients were provided with a 10 cm straight line marked "0" (no pain) at one end and "10" (the most severe pain imaginable) at the other. Patients subjectively marked their pain level on the line based on their perception. VAS scores were recorded before treatment and after the treatment course for comparative analysis.

2.6.2 Functional disability assessment. The Oswestry Disability Index (ODI) was used to comprehensively evaluate the degree of lumbar functional disability. The ODI questionnaire includes indicators such as pain intensity, daily activities (*e. g.*, personal care, dressing), lifting objects, walking ability, sitting tolerance, standing capacity, sleep quality, sexual activity, social participation, and traveling ability. Each item is scored from 0 to 5 points, with a total possible score of 0 – 50 points, converted into a percentage system. Higher percentage scores indicate more severe lumbar dysfunction. Assessments were carried out before treatment and at the end of the treatment course to compare functional changes.

2.6.3 Straight Leg Raise Test (SLRT). Patients were instructed to maintain a supine position. The examiner slowly elevated the affected lower limb while keeping it straight until the patient reported pain or discomfort, and the maximum leg elevation angle was recorded. SLRT was used to objectively assess improvements in sciatic nerve compression. Measurements were taken before treatment and at the end of the treatment course to evaluate the effectiveness of nerve root decompression.

2.7 Criteria for assessment of therapeutic efficacy Based on the *Guidelines for the Diagnosis and Treatment of Lumbar Disc Herniation* (2020 Edition)[8] issued by the Orthopaedic Branch of the Chinese Medical Association and combined with the practical circumstances of this study, the following criteria for therapeutic efficacy were established: Cured: disappearance of clinical symptoms and signs, complete restoration of lumbocrural function, VAS score reduced by ≥90% compared with that before treatment, ODI score improved by ≥90%, and SLRT angle restored to the normal range (70° – 90°). Markedly effective: significant alleviation of clinical symptoms and signs, minimal impact on daily life and work, VAS score reduced by 70% – 89% compared with that before treatment, ODI score improved by 70% – 89%, and SLRT angle improved by ≥50%. Effective: moderate improvement in clinical symptoms and signs, functional enhancement with residual limitations, VAS score reduced by 30% – 69% compared with that before treatment, ODI score improved by 30% – 69%, and SLRT angle improved by 20% – 49%. Ineffective: minimal or no improvement in clinical symptoms and signs (or even worsened), VAS score reduction < 30%, ODI score improvement < 30%, and SLRT angle improvement < 20%.

Calculation formula for efficacy: Effective rate = (Number of cured cases + Number of markedly effective cases + Number of effective cases)/Total number of cases × 100%.

2.8 Statistical methods SPSS 28.0 statistical software was used for data analysis. Measurement data such as patient age, course of disease, VAS score, ODI score, SLRT angle and other indicators were expressed as mean ± standard deviation ($\bar{x} \pm s$), paired t test was used to compare between groups before and after treatment, and independent sample t test was used to compare the

difference in efficacy between different groups; Enumeration data such as efficacy classification and gender distribution were expressed by rate (%), and χ^2 test was used for comparison between groups. All statistical tests were statistically significant at $P<0.05$.

3 Results and analysis

3.1 Comparison of pain scoring (VAS) There was no significant difference in VAS score between the treatment group and the control group before treatment ($P>0.05$), but the VAS score decreased significantly in both groups after treatment, and the decrease in the treatment group was greater. After treatment, the VAS score in the treatment group was significantly lower than that in the control group, and the difference was statistically significant ($P<0.05$), as shown in Table 2.

Table 2 Comparison of efficacy indicators between the two groups ($n=35$, $\bar{x}\pm s$)

Group	VAS score//points				ODI score//points				SLRT angle change//°			
	Before treatment	After treatment	t	P	Before treatment	After treatment	t	P	Before treatment	After treatment	t	P
Treatment	6.97±0.84	2.31±0.75	21.12	<0.05	41.62±5.48	15.73±4.12	20.46	<0.05	41.23±7.85	76.47±6.34	22.87	<0.05
Control	6.89±0.91	3.74±0.83	15.23	<0.05	40.98±5.31	22.84±4.76	17.02	<0.05	42.09±8.01	64.19±7.28	16.84	<0.05

3.2 Changes in Oswestry Disability Index (ODI) After treatment, the ODI scores of patients in both groups decreased significantly, suggesting that the lumbar dysfunction improved significantly, and the decrease in the treatment group was more significant. The difference in ODI scores between groups after treatment was statistically significant ($P<0.05$), as shown in Table 2.

3.3 Improvement of Straight Leg Raise Test (SLRT) There was no significant difference in SLRT angle between the treatment group and the control group before treatment, and both groups improved after treatment, but the improvement in the treatment group was greater, and the increase in SLRT angle was significantly better than that in the control group, and the difference between the two groups was statistically significant ($P<0.05$), as shown in Table 2.

3.4 Overall efficacy analysis The cure rate was significantly higher in the treatment group (42.86%, 15/35) than in the control group (28.57%, 10/35) ($\chi^2=4.12$, $P=0.042$). There were significant differences in the markedly effective rate (37.14% in the treatment group compared with 25.71% in the control group) and the total effective rate (94.29% compared with 77.14%) between the two groups ($P<0.05$).

4 Discussion

4.1 Current status of LDH treatment and CFT principles The treatment of LDH is clinically divided into two main categories: surgical and non-surgical. Most patients (particularly those without significant cauda equina syndrome or motor impairment) can achieve symptom relief and functional improvement through conservative treatment, giving non-surgical approaches higher clinical applicability and acceptance. Among various non-surgical therapies, traction therapy has been widely adopted due to its clear mechanism, simple operation, non-invasive nature, and broad applicability. As an improved version of traditional traction, CFT places the lumbar spine in flexion by flexing the hip and knee joints, achieving dynamic traction through "traction-maintenance-relaxation" cycles. This can expand the anteroposterior diameter of the spinal canal and the volume of intervertebral foramina while reducing pressure on intervertebral discs and nerve roots. Simultaneously, its cyclical relaxation helps alleviate muscle spasms, promote blood circulation, reduce nerve root edema, and enhance patient comfort and treatment compliance.

4.2 Advantages of CFT in multiple dimensions The study results demonstrated the following: in terms of pain relief, CFT significantly reduced VAS scores more effectively than traditional traction. This benefit stems from its specific posture that achieves effective decompression of the L4-S1 segments and alleviates soft tissue tension. The dynamic traction process relieves muscle spasms, improves adhesion of paravertebral soft tissues, and enhances the pain tolerance threshold. Regarding functional improvement, CFT induced a greater reduction in ODI scores, indicating its capacity not only to alleviate symptoms but also to effectively restore lumbar function through promoting blood circulation, reducing intervertebral disc tension, and improving tissue oxygenation. In neurological function, the CFT group showed more substantial improvement in SLRT angles, demonstrating its superior advantage in nerve root decompression by enlarging the intervertebral foramen, increasing mobility space for nerve roots, and relieving inflammatory adhesions. Furthermore, its rhythmic stimulation may potentially inhibit pain pathways through spinal cord reflexes and enhance neural tissue repair capabilities.

4.3 Comprehensive efficacy and mechanism of action of CFT The study results revealed that the CFT treatment group achieved a total effective rate of 94.29%, significantly higher than the control group's 77.14% ($P<0.05$), with a combined cure and marked effectiveness rate reaching 80%. This confirms that CFT not only rapidly alleviates symptoms but also demonstrates sustainable effects on functional recovery and quality of life improvement. Mechanistically, the lumbar flexion position better aligns with neuroanatomical structures, increasing the anteroposterior diameter of the intervertebral foramen, reducing nerve root tension, and improving local blood supply[9]. Meanwhile, CFT's dynamic pressure variations facilitate annulus fibrosus repair and nucleus pulposus repositioning, embodying the physiotherapeutic concept of "traction during movement". In summary, CFT demonstrates significant superiority over traditional traction in alleviating nerve root compression, relieving pain, and improving functional outcomes through optimized traction posture and biomechanical rhythm. With confirmed clinical efficacy, it warrants broader application in rehabilitation therapies.

(To page 83)

nism of Guizhou tall gastrodis tuber in treating hypertension based on transcriptomic analysis[J]. Information on Traditional Chinese Medicine, 2024, 41(11): 23-28. (in Chinese).

[11] REN FJ, ZHANG YN. Characteristics of Chinese medicinal materials used by YE Tianshi in treatment of collateral disease from "analogy" [J]. Journal of Tianjin University of Traditional Chinese Medicine, 2019, 38(5): 442-444. (in Chinese).

[12] JI ZZ, QI XZ, YU ZQ. Yu Zhiqiang's clinical experience in using vine medicines[J]. Inner Mongolia Journal of Traditional Chinese Medicine, 2020, 39(12): 68-69. (in Chinese).

[13] JIANG H, XIE Q, WANG L, *et al.* Research progress of liver-yang suppressing medicines in hypertension[J]. Lishizhen Medicine and Materia Medica Research, 2019, 30(12): 2965-2967. (in Chinese).

[14] PENG YX, WANG X, YANG J, *et al.* Influence of polysaccharide of tall gastrodia tuber on absorption of effective components in medicine suits of tall gastrodia tuber and gambir plant nod[J]. Global Traditional Chinese Medicine, 2015, 8(12): 1452-1454. (in Chinese).

[15] MIAO HC, SHEN YS. Antihypertensive effect of polysaccharides substracted from *Gastrodia elata* Blume[J]. Chinese Journal of Hypertension, 2006, 14(7): 531-534. (in Chinese).

[16] GU J. Study on chemical characteristic spectrum and content changes of active components in Gastrodia-Uncaria herb pair[J]. Journal of Clinical Medical Literature, 2019, 6(97): 188-190. (in Chinese).

[17] ZHOU ZN, DUAN JR, TENG ZY. Clinical efficacy of Tianma Gouteng decoction combined with enalapfil maleate folate tablets and vitamin B12 in the treatment of vascular dementia with H-type hypertension[J]. Sichuan Journal of Physiological Sciences, 2024, 46(1): 157-160. (in Chinese).

[18] GAO XH, CHEN DY, LIU XS, *et al.* Effect of serum containing Tianma Gouteng Decoction on expressions of serum inflammatory factors and apoptosis related factors in brain tissue around hematoma in rats with intracerebral hemorrhage[J]. Chinese Archives of Traditional Chinese Medicine, 2022, 40(3): 232-235, 259. (in Chinese).

[19] PAN JW, PAN Q, LUO XF. Mechanism and efficacy of Tianma Gouteng Decoction in treating hypertension by regulating mitochondrial protein pathway[J/OL]. Chinese Archives of Traditional Chinese Medicine, 1-8[2025-04-15]. http://kns.cnki.net/kcms/detail/21.1546.R.20241205.1403.012.html. (in Chinese).

[20] LIU R, BIAN XH, XU JY, *et al.* Study on the vasodilator effect of components combination of Chinese materia medica[J]. West China Journal of Pharmaceutical Sciences, 2011, 26(6): 551-553. (in Chinese).

[21] LI XQ. Study on distribution of active components in large blood vessels and gene expression before and after compatibility of Uncaria and Gastrodia[D]. Chengdu: Southwest Jiaotong University, 2012. (in Chinese).

[22] WU LH, HOU J, WANG J, *et al.* Effect of combination of gastrodia and uncaria on pharmacokinetics of gastrodin and rhynchophylline[J]. China Journal of Chinese Materia Medica, 2017, 42(13): 2577-2582. (in Chinese).

(From page 71)

References

[1] DING K, LANG BX, LI T. Clinical study on micro-needle-knife therapy combined with abdominal acupuncture and traction for lumbar disc herniation[J]. New Chinese Medicine, 2025, 57(1): 121-126. (in Chinese).

[2] LI SZ, GUO J, LIU WP, *et al.* Observation on selection of traction weight in the treatment of lumbar disc herniation with electric traction [J]. Chinese and Foreign Medical Research, 2024, 22(34): 161-164. (in Chinese).

[3] YI BX. Effects of electropuncture and moxibustion combined with lumbar traction in treatment of patients with lumbar disc herniation[J]. Medical Journal of Chinese People's Health, 2024, 36(21): 117-119, 123. (in Chinese).

[4] ZHANG Y, SUN SX, HAN F, *et al.* Clinical effect observation of acupuncture combined with traction rehabilitation training on lumbar disc herniation[J]. China Journal of Traditional Chinese Medicine and Pharmacy, 2024, 39(11): 6259-6262. (in Chinese).

[5] YANG JG, DING JX, LIN XZ, *et al.* Clinical efficacy of electroacupuncture point stimulation combined with lumbar traction in the treatment of lumbar disc herniation[J]. Shenzhen Journal of Integrated Traditional Chinese and Western Medicine, 2024, 34(20): 43-46. (in Chinese).

[6] CHEN FT, WU FY. Influence of Tuina traction combined with lumbar back muscle rehabilitation training on patients with lumbar disc herniation[J]. Shenzhen Journal of Integrated Traditional Chinese and Western Medicine, 2024, 34(16): 50-53. (in Chinese).

[7] YANG XY, ZHOU BB, SU T, *et al.* A meta-analysis of the effect of shockwave therapy on lumbar disc herniation[J]. Clinical Journal of Chinese Medicine, 2024, 16(24): 121-127. (in Chinese).

[8] XU XW, LYU LL. Effect of lumbar traction combined with physiotherapy in the treatment of lumbar disc herniation[J]. Chinese Journal of Urban and Rural Enterprise Hygiene, 2024, 39(7): 102-104. (in Chinese).

[9] ZHAO WF. Influence of traditional Chinese medicine orthopedic Tuina combined with lumbar traction intervention on lumbar function and pain degree of patients with lumbar disc herniation[J]. Modern Diagnosis and Treatment, 2024, 35(13): 1921-1923. (in Chinese).