Article

CLINICAL REHABILITATION

Clinical Rehabilitation
0(0) 1–12

DOI: 10.1177/0269215512446093
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Extension traction treatment for patients with discogenic lumbosacral radiculopathy: a randomized controlled trial

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Abstract

Objective: To investigate the effects of lumbar extension traction in patients with unilateral lumbosacral radiculopathy due to L5–S1 disc herniation.

Design: A randomized controlled study with six-month follow-up.

Setting: University research laboratory.

Subjects: Sixty-four patients with confirmed unilateral lumbosacral radiculopathy due to L5–S1 disc herniation and a lumbar lordotic angle less than 39°, randomly assigned to traction or control group.

Interventions: The control group (n = 32) received hot packs and interferential therapy, whereas the traction group (n = 32) received lumbar extension traction in addition to hot packs and interferential therapy.

Main outcome measures: Absolute rotatory angle, back and leg pain rating scale, Oswestry Disability Index, Modified Schober test, H-reflex (latency and amplitude) and intervertebral movements were measured for all patients three times (before treatment, after 10 weeks of treatment and at six-month follow-up).

Results: There was a significant difference between the traction group and the control group adjusted to baseline values at 10 weeks post treatment with respect to: absolute rotatory angle ($P < 0.001$), Oswestry Disability Index ($P = 0.002$), back and leg pain ($P = 0.009$, $P = 0.005$), Modified Schober test ($P = 0.002$), latency and amplitude of H-reflex ($P = 0.01$, $P < 0.001$), intervertebral movements ($P < 0.05$). At six-month follow-up there were statistically significant differences between the study and control groups for all the previous variables ($P < 0.05$).

Conclusion: The traction group receiving lumbar extension traction in addition to hot packs and interferential therapy had better effects than the control group with regard to pain, disability, H-reflex parameters and segmental intervertebral movements.

Keywords

Assessment, lumbar radiculopathy, randomized controlled trial, rehabilitation, traction

Received: 19 August 2011; accepted: 31 March 2012

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Introduction

Lumbosacral radiculopathy associated with disk herniation is a common clinical problem that involves L5 and S1 nerve roots.[1,2] S1 radiculopathy is a frequent pathology, strongly associated with delayed recovery, persistent disability and increased healthcare utilization and costs.[3,4] Despite the high prevalence of this condition,[5] its conservative treatment remains challenging for spinal specialists.[6,7] Recent systematic reviews reported a lack of clearly effective conservative treatments for lumbar radicular pain, particularly in long-term management.[8,9]

Over the years many studies[10–14] have described the important role of abnormal asymmetrical posture, especially in the sagittal plane, which is considered by some to be an important aetiological factor for low back pain and many other pathological changes. While the previously mentioned studies make a significant contribution to understanding the important role of normal lumbar lordotic curve, reviewing the literature on this topic has shown that the majority of conservative treatments, such as exercises and spinal manipulation, have been found to be ineffective in improving the magnitude of the lumbar curve.[12] The work of Pope was pioneering in this area by drawing attention to the possibility of lumbar sagittal curve correction by two-way lumbar extension traction.[15]

To date, no published randomized controlled trial has investigated the effects of this type of traction. Only one non-randomized trial has investigated this type of traction in patients with non-specific low back pain[12] and one case report has been published about the management of chronic lumbar disc herniation.[13] Despite the importance of these studies, all the attempts to assess the efficacy of this type of traction have largely relied on radiographs to determine the global or segmental magnitude of lordosis and questionnaires to assess pain while ignoring a huge number of aspects that are closely linked to sagittal curvature, especially in cases of lumbar radiculopathy, such as symptoms, disability, flexibility, neurophysiological findings and biomechanical assessment.[16–18]

Accordingly, the present study was designed to evaluate the long-term effects of lumbar extension traction versus a control group in patients who had L5–S1 lumbar radiculopathy, with respect to lumbar lordotic curve, pain, disability, mobility, neurophysiological findings and lumbar segmental motion.

Methods

A prospective, randomized controlled study was conducted in the research laboratory of our university. All of the patients were conveniently selected from our institution's outpatient clinic. The study was approved by the local ethics committee and written informed consent was obtained from all patients prior to data collection. This study was registered in the Australian New Zealand Clinical Trials Registry (ANZCTR), and allocated the following trial number: ACTRN12612000030875.

Patients were recruited from May 2009 to December 2010 with six months of follow-up. They were screened prior to inclusion by measuring the absolute rotatory angle L1–L5. If the angle was less than 39° (as guided by the Harrison spinal model[19]), the patient was referred to the study.

Further, patients were included if they had a confirmed chronic unilateral lumbosacral radiculopathy associated with L5–S1 lumbar disc prolapse and duration of symptoms more than three months, to avoid acute stage of inflammation. Patients underwent magnetic resonance imaging (MRI), which detected disc lesions corresponding to the S1 nerve root. All patients had unilateral leg pain with mild to moderate disability according to the Oswestry Disability Index (up to 40%).[20] They all had side-to-side H-reflex latency differences of more than 1 ms. Exclusion criteria included previous history of lumbosacral surgery, metabolic system disorder, cancer, cardiac problems, peripheral neuropathy or history of upper motor neuron lesion, spinal canal stenosis, rheumatoid arthritis, osteoporosis, inability to tolerate lumbar extension position, spondylolisthesis, scoliotic deformity and any deformity of lower extremity that may interfere with global alignment.

Patients were randomly assigned into two groups by an independent person who picked one of the sealed envelopes, which contained numbers chosen by random number generator. Randomization was

restricted to permuted blocks of different size to ensure equal numbers being allocated to each group. Each random permuted block was transferred to a sequence of consecutively numbered, sealed, opaque envelopes and these were stored in a locked drawer until required. As each participant formally entered the trial, the researcher opened the next envelope in the sequence in the presence of the patient.

Patients in both groups received hot packs (15 minutes) and interferential therapy to control pain and eliminate the causal role of muscle spasm and or tightness in changing the magnitude of lumbar lordotic curve. The infrared irradiation emitted by hot packs gives only superficial heating; it could only provide a temporary soothing effect.[21] In addition, interferential therapy seems to be more effective in reducing pain than a placebo treatment in the short term,[22] and therefore these traditional treatments are appropriate to act as a control intervention. These conventional treatments were to be repeated three times per week for 10 weeks. Those in the control group received conventional treatments only.

For interferential application, patients were asked to adopt a prone position. Interferential treatment was introduced using an electrotherapy device (Phyaction 787, The Netherlands). The interferential therapy was delivered at the lumbosacral region with an amplitude-modulated constant frequency of 100 Hz and pulse duration of 125 μs due to its analgesic effect. A 20-minute interferential session is widely accepted by physiotherapy practitioners.[22]

In addition, the study group received lumbar extension traction. All the traction procedures were done according to the protocol of Harrison et al.,[12] the only exception being that we used a computerized traction unit (15615 Alfatrac, Fysiomed N.V., Belgium), which ensured gradual increase and decrease of the traction force to make it more comfortable. In this type of traction, there is vertical load applied by a posterior padded strap between the upper torso and lower pelvis, while the upper torso and femur are stabilized by other straps. The patients had traction three times a week for ten weeks. The traction began at 3 minutes/session, increased by 1 minute/session to 20 minutes, at which time traction was applied for 20 minutes/session. Patients in both groups were instructed to avoid any other exercise programmes that could interfere with the results. The therapist telephoned the patients weekly to supervise and guide them.

The primary outcome of this study was the lumbar lordotic angle. It was measured from lateral radiograph by calculating the absolute rotatory angle, which is considered a valid and reliable measurement.[23,24] The posterior superior and posterior inferior vertebral body corners of L1 and L5 were marked on lateral lumbar radiographs to determine the absolute rotatory angle formed by the intersection between the posterior vertebral body tangent lines of L1 and L5. A representative example of absolute rotatory angle at three intervals of measurement is shown graphically in Figure 1.

The secondary outcome measures included disability, symptoms (back and leg pain), lumbar flexibility, mechanical findings (segmental intervertebral movements), neurophysiogical findings (latency and peak to peak amplitude of H-reflex). Disability was measured using the Oswestry Disability Index. It consists of 10 items that refer to activities of daily living that might be disrupted by low back pain. The items are: (1) pain intensity, (2) personal care, (3) lifting, (4) walking, (5) sitting, (6) standing, (7) sleeping, (8) sex life, (9) social life and (10) travelling. Each has 1 of 6 possible answers provided. The total score is transferred onto a scale ranging from 0 to 100, where 0 indicates no disability and 100 indicates worst possible disability.[20,25]

The back pain and leg pain were measured using the Numerical Pain Rating Scale (NPRS), which is considered a valid and reliable scale.[26] The scale is composed of 0–10 numbers. The patients were asked to place a mark along the line to denote their level of pain; 0 reflecting 'no pain' and 10 reflecting the 'worst pain'. To assess lumbar flexibility, the Modified Schober test was used in this study. A skin mark was drawn at the level of the lumbosacral junction and another two marks were drawn 10 cm above and 5 cm below this first mark. Participants maximally bent their trunk without bending the knees, and the distance between upper and lower marks was measured in centimetres. The mean of three trials was used for data analysis. Intra-rater reliability for this test is high ($r = 0.88$).[27]

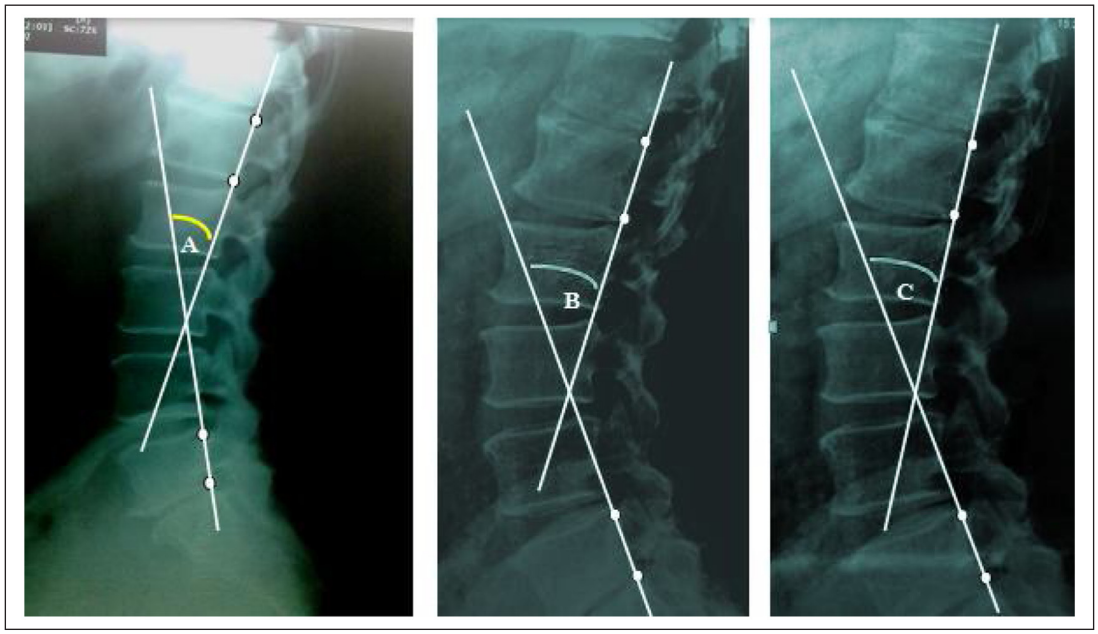

Figure 1. Sample of lumbar lateral radiographs at three intervals of measurement.
(A) Absolute rotatory angle before treatment. (B) Absolute rotatory angle after 10 weeks of treatment. (C) Absolute rotatory angle at six months of follow-up.

Latency and peak-to-peak amplitude of H-reflex, the recommended H-reflex diagnostic criteria for lumbosacral radiculopathy,[18,28] were used in the current study. An electromyogram device (Tonneis Neuroscreen Plus version 1.59, Germany) was used to measure this variable for all patients before starting the treatment, at the end of 10 weeks, and at follow-up period of six months. All testing procedures were done following the protocol proposed by Al-Abdulwahab and Al-Jabrb.[29] From a prone position, a silver/silver chloride surface-stimulating bar electrode was placed longitudinally on the tibial nerve in the popliteal fossa midline. An active recording electrode was positioned over the soleus muscle and 3 cm distal to the bifurcation of the gastrocnemii. A ground electrode was positioned midway between the stimulation and recording electrodes. Two-minute practice trials of elicited H-reflex were obtained to familiarize the patients with the H-reflex stimulation and recordings. Four readings of the maximum H-reflex with minimum and stable M-response were recorded and averaged from the involved leg. The signals were amplified 500–2000× using differential amplification and filtered at 20–10 000 Hz bandwidth, digitized and stored on computer for analysis.

For kinematic data acquisition of the lumbar spine, three sets of lateral lumbar radiographs in flexion and extension view (pre treatment, 10 weeks post treatment, and at six months follow-up) were analysed according to protocol of Frobin et al.[17] To measure the sagittal rotational movements between segments L1–L2 and L5–S1, we started by defining the midplane, which is the line connecting the midpoints between the corners for each vertebra, and then the angle between two adjacent vertebrae was calculated by the angle between their midplanes. The sagittal rotational motion value of any segment is given by the difference of the angle in extension view minus the angle in flexion view. To measure translational displacements between adjacent vertebrae, we drew perpendicular lines from the centre points, which are the geometric centres of four corners, onto the bisectrix between the midplanes. The difference

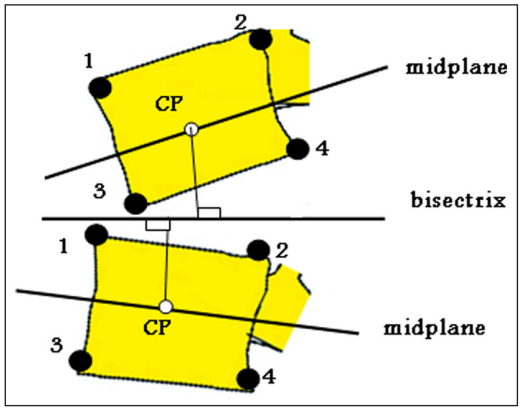

Figure 2. Measurement of segmental motion of lumbar spine. CP, centre point.

between the intersection points in the bisectrix line was defined as translational displacement. To correct for radiographic magnification, the displacement (measured in millimetres) was divided by the mean depth of the caudal vertebra. As previously stated, the value of translational motion is given by the difference of the displacement in extension view minus the displacement in flexion view (Figure 2).

Sample size determination

The sample size calculation was initially performed with G*Power (version 3.1.0)[30,31] to determine the number of samples in this study. Estimates of mean difference and standard deviation for lumbar lordotic angle were collected from a pilot study consisting of nine patients who received the same programme between 1 September 2008 and 30 January 2009. The mean difference value and standard deviation were estimated as 6 and 5.7 respectively, a two-tailed test, an alpha level of 0.05, and desired power of 90%. These assumptions generated a sample size of 24 patients per each group. To account for some drop-out rates, the sample size was increased by 20%.

Data analysis

Both the mean and standard deviation were calculated for each variable. The differences in the baseline data between the study and control group were analysed using *t*-test for the continuous variables and chi-square test for the categorical variables. To compare the traction group and the control group, statistical analysis was based on the intention-to-treat principle and *P*-values less than 0.05 were considered significant. We used multiple imputations to handle missing data. To impute the missing data we constructed multiple regression models including variables potentially related to the fact that the data were missing and also variables correlated with that outcome. We used Stata (Stata Corp, College Station, Texas, USA). Analysis of covariance (ANCOVA) at two follow-up points (after 10 weeks of treatment and at six-month follow-up) was performed for all variables. The baseline value of the outcome as covariates was used to assess between-group differences (baseline outcome in the mode = baseline value – overall mean baseline value).

Results

Baseline and demographic data

One hundred patients were assessed for eligibility. Sixty-four patients underwent randomization. As seen in the flow diagram (Figure 3), 32 patients were allocated to each group. All of them completed the first follow-up after 10 weeks of treatment, and 58 of them completed the study. The clinical and demographic features of the patients at inception are presented in Table 1. The study and control groups were similar with regard to age, height, weight, gender, smoking and using medication for low back pain. Specific measurements of the study (absolute rotatory angle, Oswestry Disability Index, Modified Schober test, back and leg pain, latency and amplitude of H-reflex, segmental intervertebral movements) were also well balanced between the groups at baseline ($P > 0.05$ for all variables).

Between-group analysis

Results are summarized and presented as mean (SD) in Tables 2–4. After 10 weeks of treatment, the

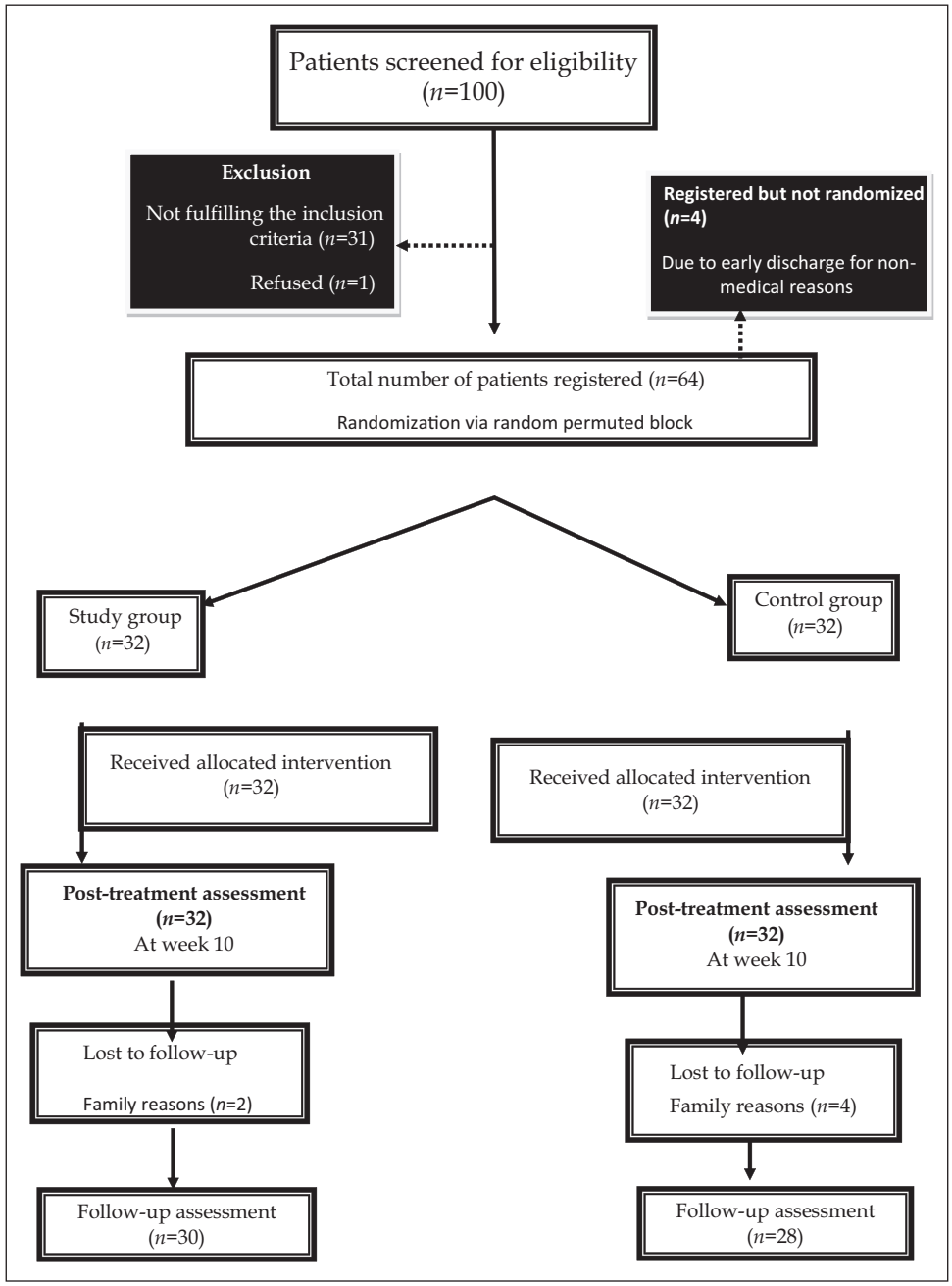

Figure 3. Flow of study participants.

analysis of covariance (ANCOVA) revealed a significant difference between the traction and control groups adjusted to baseline value of outcome for all measured variables; absolute rotatory angle (F = 58.5, P = <0.001), Oswestry Disability Index (F = 11.8, P = 0.002), back and leg pain (F = 7.5,

Table 1. Baseline participant characteristics

	Study group (n = 32)	Control group (n = 32)	P-value[a]
Age (year)	43.9 ± 1.7	43.2 ± 2.4	0.4
Height (cm)	175.6 ± 4.5	173.5 ± 6.6	0.3
Weight (kg)			
Before treatment	84 ± 5.4	87.8 ± 5.5	0.07
After 10 weeks	86.8 ± 4.3	83.3 ± 7.6	0.1
At 6 months follow-up	89.8 ± 4.4	84.9 ± 7.2	0.07
Gender			
Male	19 (59%)	17 (53%)	0.6
Female	13 (41%)	15 (47%)	
Smoke cigarettes currently			
Yes	12 (37.5%)	8 (31%)	0.1
No	20 (62.5%)	24 (69%)	
Using medication for low back pain (yes/no)			
Pre treatment	12/24	14/22	0.6
At first follow-up	6/26	9/23	0.4
At second follow-up	3/27	6/22	0.2

Values are mean (SD) for age, height, weight.
SD, standard deviation.
[a]Statistical different at $P < 0.05$.

Table 2. Mean and standard deviations of lordotic angle, pain, disability and flexibility variables

Dependent variables	Pre-treatment values		10 weeks post treatment		P-value (95% confidence interval)	After 6 months of follow-up		P-value (95% confidence interval)
	Study	Control	Study	Control		Study	Control	
Absolute rotatory angle	11 ± 2	11.4 ± 2.5	19.7 ± 4.4	11.9 ± 2.5	<0.001* (6.1 to 10.1)	19.1 ± 4.2	11.6 ± 2.5	<0.001* (5.9 to 9.7)
Oswestry Disability Index	32.4 ± 3.2	31.7 ± 4.4	19.8 ± 3.7	23.7 ± 3.8	0.002* (–6.8 to –1.7)	23.1 ± 2.8	31.2 ± 2.9	<0.001* (–10.3 to –6.3)
Back pain	6.2 ± 1	5.9 ± 1.6	2.3 ± 1.6	3.5 ± 1.04	0.006* (–2.2 to –0.4)	2.4 ± 0.9	4.6 ± 1.3	<0.001* (–2.9 to –1.6)
Leg pain	6.3 ± 0.4	6.4 ± 0.5	3.5 ± 0.8	4.3 ± 0.9	0.005* (–1.5 to –0.27)	3 ± 0.8	5.2 ± 0.83	<0.001* (–2.8 to –1.7)
Schober tests	4.8 ± 0.2	4.6 ± 0.5	5.7 ± 0.4	5.3 ± 0.3	0.002* (6.5 to 0.77)	5.6 ± 0.5	4.8 ± 0.4	<0.001* (0.4 to 1.2)

*Significantly different.

$P = 0.009$), ($F = 9.02$, $P = 0.005$), Modified Schober test ($F = 5.9$, $P = 0.002$), latency and amplitude of H-reflex ($F = 7.7$, $P = 0.01$), ($F = 19.3$, $P < 0.001$), segmental intervertebral movements in terms of translational displacements and rotational movements ($P < 0.05$) for all measured levels. The only

Table 3. Mean and standard deviations of neurophysiological variables

Dependent variables	Pre-treatment values		10 weeks post treatment		*P*-value (95% confidence interval)	After 6 months of follow up		*P*-value (95% confidence interval)
	Study	Control	Study	Control		Study	Control	
H-reflex latency	32.6 ± 1.9	33.2 ± 17	29.6 ± 1.7	31.7 ± 2.2	0.01* (–2.97 to –0.44)	29.3 ± 1.6	32.2 ± 2.1	<0.001* (–3.1 to –1.3)
H-reflex amplitude	3.1 ± 0.5	3.07 ± 0.4	4.1 ± 0.9	3.2 ± 0.5	<0.001* (0.45 to 1.2)	4.1 ± 0.7	3.1 ± 0.4	<0.001* (0.58 to 1.3)

*Significantly different.

Table 4. Mean and standard deviations of mechanical variables

Dependent variables		Pre-treatment values		10 weeks post treatment		*P*-value (95% confidence interval)	After 6 months of follow-up		*P*-value (95% confidence interval)
L1–L2	T	0.14 ± 0.03	0.11 ± 0.01	0.19 ± 0.06	0.11 ± 0.02	0.03* (3.3 to 7.1)	0.17 ± 0.04	0.11 ± 0.008	0.03* (3.4 to 6.4)
	R	10.6 ± 2.02	10.8 ± 2.08	13.2 ± 2.3	12.02 ±1.7	0.001* (0.64 to 2.1)	12.9 ± 2.2	10.4 ± 1.6	<0.001* (1.7–3.5)
L2–L3	T	0.11 ± 0.03	0.118 ± 0.03	0.19 ± 0.2	0.12 ± 0.03	0.2 (–5.2 to 0.19)	0.27 ± 0.30	0.108 ± 0.02	0.055* (–3.4 to 0.32)
	R	9 ± 2.3	10.2 ± 2.1	11.4 ± 2.6	11.5 ± 1.8	0.01* (0.4 to 2.1)	11.4 ± 2	9.9 ± 1.5	<0.001* (1.9 to 3.3)
L3–L4	T	0.051 ± 0.028	0.067 ± 0.025	0.094 ± 0.03	0.091 ± 0.03	0.07* (–1.7 to 3.7)	0.079 ± 0.02	0.06 ± 0.02	0.008* (5.3 to 3.2)
	R	7.2 ± 1.3	7.6 ± 1.2	9.6 ± 1.3	9.3 ± 1.2	0.1 (–0.18 to 1.3)	9.06 ± 1.3	7.4 ± 1.7	0.001* (0.9 to 2.9)
L4–L5	T	0.068 ± 0.034	0.079 ± 0.03	0.11 ± 0.04	0.08 ± 0.04	0.001* (1.8 to 6.1)	0.09 ± 0.04	0.081 ± 0.02	0.002* (1.1 to 4)
	R	10.6 ± 2.1	10.8 ± 1.6	12.6 ± 1.5	11.4 ± 1.4	0.003* (0.48 to 2.1)	12 ± 1.5	10.3 ± 1.7	<0.001* (0.79 to 2.6)
L5–S1	T	0.042 ± 0.02	0.053 ± 0.02	0.07 ± 0.019	0.06 ± 0.02	0.001* (9.4 to 3.4)	0.07 ± 0.017	0.046 ± 0.02	<0.001* (2.2 to 4.3)
	R	7.9 ± 1.1	8.2 ± 1.1	9.1 ± 1.05	8.5 ± 0.8	0.01* (0.12 to 1.3)	8.3 ± 1.2	7.3 ± 1.06	<0.001* (0.64 to 1.8)

*Significantly different. T, translation displacement; R, rotational movement.

exception was translational displacements for L2–L3, where the *F*-value was 1.4 with associated probability of 0.2 and translational and rotational movements for L3–L4 where the *F*-values were 3.5, 2.3 with associated probability of 0.07, 0.1. At six-month follow-up, the analysis showed that there were still significant differences between the study and control groups for all the measured variables without any exception; absolute rotatory angle ($F = 56.3$, $P < 0.001$). Oswestry Disability Index ($F = 72.8$, $P < 0.001$), back and leg pain ($F = 33.6$, $P < 0.001$), ($F = 67.2$, $P < 0.001$), Modified Schober test ($F = 17.6$, $P < 0.001$), latency and amplitude of H-reflex ($F = 19.2$, $P < 0.001$), ($F = 31.8$, $P < 0.001$), segmental intervertebral movements in terms of translational displacements and rotational movements ($P < 0.05$ for all measured levels).

Discussion

This study demonstrates that the group receiving lumbar extension traction in addition to interferential therapy and hot packs showed more improvement than the control group in clinical, mechanical and neurophysiological parameters based on the decrease in leg and back pain scores, disability and latency of H-reflex and increase in the amplitude of H-reflex, lumbar mobility and segmental intervertebral movements. Furthermore, at six-month follow-up, these significant changes favouring the study group's outcomes were maintained. These results provide objective evidence that biomechanical dysfunction in terms of sagittal curve malalignment, and not just pathoanatomy, influences outcome measures.

The improvement in lumbar lordosis recorded by the study group is similar to that reported in a case study that showed the effectiveness of this type of traction on restoring lumbar sagittal spinal configuration.[13] Stretching of the viscous and plastic elements of the longitudinal ligament and intervertebral disc may be the possible explanation for restoring the normal lumbar lordosis. The pain scores for back and leg evaluated by the Numerical Pain Rating Scale were also significantly improved in the traction group compared with the control group. Overall, our results are conceptually in agreement with other studies that have identified the strong association between sagittal alignment and back pain.[12,32–34] In contrast, these findings contradicted those of many authors who investigated the relationship between lumbar lordosis and pain and reported no significant correlation between them.[35–37] The reasons for these differences may be related both to the initial selection of patients with relatively small numbers, and to the fact that all of these studies were correlational studies and not true experimental studies; that is, they look for a degree of association between variables without the ability to ascribe cause and effect.

With regard to the functional outcome, the improvement of functional parameters and lumbar mobility compared with the control group are in agreement with those of Miyakoshi et al., who reported that lumbar lordosis restoration was an important factor in improving spinal function.[38] In contrast, the systematic review of Christensen and Hartivigsen does not support the association between sagittal spinal curve and health, including daily function and pain.[39] This contradiction may be attributed to different reasons: first, the low methodological quality of included studies. The systematic review of Christensen and Hartivigsen included all types of sagittal plane curvature measurement methods. We found that several studies were using a flexicurve (flexible ruler) to measure lumbar lordosis via sagittal skin contour. Interestingly, flexicurve measurement of lumbar lordosis is not externally valid and not useful for making legitimate decisions regarding the state of lumbar lordosis.[40] The second issue relates to the vague inclusion and exclusion criteria for patient selection.

Another outcome assessment that has been investigated in the present study was the kinematic analysis of lumbar vertebrae. Our findings that lumbar extension traction had a significant and stable effect on intervertebral movements for the most levels compared with the control group are in agreement with those of Darnell,[41] who reported that 'proper mechanical alignment is essential for joint function'. These findings are aligned with those of White and Panjabi, who indicated that spinal posture is one of the most common factors affecting the coupled movements of spinal vertebrae.[42] This concept was further supported by Keorochana et al., who stated that 'sagittal alignment, disc degeneration, and segmental mobility likely have a reciprocal influence on one another'.[43]

Neurophysiologically, the significant and persistence changes in H-reflex parameters (decrease in H-reflex latency and increase in H-reflex amplitude) in the traction group compared with the control group could indicate that a normal lumbar lordotic curve is essential for normal neural function. Restoring the normal mechanics for the nervous system and decreasing the abnormal stresses and strains on neural elements are the likely explanation for significant improvement in H-reflex parameters. This concept is supported by Harrison et al.[44] who showed how loss of the sagittal curve alters the mechanical properties of the spinal cord and nerve root that may change the firing patterns of involved neurons.

The unique contribution of our study is that it evaluated the independent effects of structural rehabilitation in the form of lumbar lordosis correction on kinematic analysis, pain, functional activity and neurophysiological findings, which to our knowledge have not been previously reported. In conclusion, the findings of the current study serve to reinforce the importance of using structural rehabilitation in the form of restoring the normal lumbar lordotic curvature in management of lumbosacral radiculopathy with associated disc prolapse. Interestingly, restoring the normal curve introduces yet another treatment option to a list that already includes physical agent modalities and manual therapies such as massage and myofascial stretch. Its unique appeal lies in its long lasting effect. These observed effects should be of value to clinicians and health professionals involved in the treatment of spinal disorders.

Certain limitations of the present study are worthy of mention. The primary limitation was the invasive nature of the radiological assessment and repeated exposure to X-ray at three stages. Furthermore, due to the type of intervention, it was not possible to blind the physiotherapist who provided the interventions. With regard to the initial selection of the patients, they probably represented a convenient sample rather than a random sample of the whole population. The control group did not receive the same form of time-consuming treatment. Since this trial was conducted in a clinical setting with the majority of participants referred by medical practitioners for physiotherapy treatment, it was not possible to incorporate a control group that did not receive physiotherapy intervention. The patients were selected according to absolute rotatory angle only, ignoring the role of relative rotatory angle between adjacent vertebrae. This may be the main cause for the inconsistency of results for certain levels such as L3–L4. No attempt was made to control for medications taken by participants, which included opioid and non-opioid analgesics and non-steroidal anti-inflammatory drugs. However, medication use was similar at baseline and no significant difference was found between the groups for number of participants who were managing their pain with medication immediately after the 10-week intervention or at six-month follow-up. Future randomized trials should be conducted on a randomly selected sample using non-invasive methods such as a motion analysis system.

This study had several strengths, including that it was analysed using the intention-to-treat principle and that participants were assigned randomly to experimental and control groups. Also, interventions were provided by the same experienced physiotherapist. In addition, participants in both intervention groups received the same number of interventions. A further merit of the study was the high follow-up rate (greater than 90%).

Clinical messages

- Lumbar extension traction is beneficial in restoring lumbar lordosis.
- Restoring of lumbar lordosis seems to be effective in patients who have lumbosacral radiculopathy, with respect to pain, mechanical, clinical and functional status outcomes.
- Follow-up measurement revealed stable improvement in all measured variables.

Acknowledgement

We express our sincere gratitude to all the patients who kindly participated in the study. We are grateful to the management and staff of El-Farouk Hospital, Cairo, Egypt, for supporting this trial.

Conflict of interest

None.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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