Case reports

Radiographic disk height increase after a trial of multimodal spine rehabilitation and vibration traction: a retrospective case series

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Abstract

Objective: Although spinal decompression therapy has been touted as an effective treatment of disk pathologies, there is little existing research that specifically uses disk parameters as an outcome measure after a course of spinal decompression therapy. Our study presents multidimensional outcomes after a structured protocol of multimodal chiropractic rehabilitation and uses a radiographic parameter of disk disease as an indication of the effects of a vibration traction decompression-type table.

Clinical Features: Patients selected for this retrospective cohort reported a medical history of lumbar herniated or bulging disk verified by previous magnetic resonance imaging/computed tomography, history of paresthesia in one or both lower extremities, pain level reported as a minimum of 8/10, and/or history of sciatica or other radicular pain finding.

Intervention and Outcome: A total of 6 patients' outcomes are reported in this study. All patients received a multimodal spinal rehabilitation treatment with vibration traction therapy. Positive and statistically significant outcomes were obtained in radiographic disk height, functional rating index, numeric pain rating, spirometry, and patient height. All patients achieved improved outcomes after treatment.

Conclusion: The multidimensional outcomes reported here were achieved after a structured protocol of multimodal chiropractic rehabilitation. It is unknown which, if any, of these procedures were responsible for the observed improvements.

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Introduction

Spinal decompression therapy has been steadily gaining attention as a nonsurgical alternative for chronic disk pathologies. Recently, its advertised

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effectiveness has been called into question.¹ To date, we found 3 current spinal decompression tables published in PubMed journals: VAX-D therapy (VAX-D Medical Technologies, Oldsmar, FL),²⁻⁸ DRS System (Cluster Technology Corporation, defunct),⁹ and IDD Therapy (North American Medical Corp., Marietta, GA).¹⁰ The common perception is that spinal decompression therapy is effective at treating disk pathologies, according to advertisements in chiropractic trade publications.^{11,12} However, of all the above outcome studies, only 2 have used disk parameters as an outcome assessment.^{6,8} The study by Ramos and Martin⁶ reported the intradiskal pressure in only 3 patients while on a VAX-D table. The authors concluded that they are unsure of how this observation is related to meaningful clinical outcomes. The other study by Deen et al⁸ demonstrated worsening of a lumbar disk protrusion after spinal decompression therapy. The remainder of the above studies all used pain as the primary outcome.

Because of the lack of published literature on the direct effects of decompression-type therapy on disk pathology, we report on a series of cases from a single spine clinic in Ontario, Canada, where a new version of decompression therapy is used in conjunction with multimodal spinal rehabilitation program, using multiple outcomes including radiographic measures of disk pathology.

Clinical features

Patient charts from a single private spine clinic were consecutively selected based upon the presence of specific signs or symptoms. All patients began treatment within the same 3-month period. For inclusion into this analysis, patients were required to fit at least 2 of the following criteria: (1) low back pain, (2) history of paresthesia in one or both lower extremities, (3) pain level reported as a minimum of 8/10 on a numeric pain rating scale, (4) history of sciatica or other radicular pain finding, or (5) lumbar disk bulge/herniations diagnosed on magnetic resonance imaging (MRI) or computed tomography (CT) within the last 9 months. Patients were excluded from the analysis if they had a history of arthrodesis, malignancy, infection, or concurrent treatment. With these inclusion and exclusion criteria in mind, a total of 6 patient files were selected for this retrospective case analysis. All patients also reported a history of nonspecific low back pain, although this was not a prerequisite. Patients selected for this case analysis gave their written consent to allow their findings and information to be published.

It is noteworthy to mention that all of the selected patients reported at least one other musculoskeletal symptom, the most common being weakness in the knees and/or ankles (3 of the 6). Two of the patients did not seek any medical treatment before our treatment. Three of the patients participated in previous trials of chiropractic manipulation unsuccessfully, whereas the remaining patient had tried physical therapy with no benefit.

Multiple outcome assessments were collected for each patient. These outcomes include a combination of radiographic, pain, functional, and physiologic outcomes in an attempt to fully gauge the total patient response to treatment. Using such multiple outcome assessments is common among those practitioners using the Pettibon System (Pettibon System Inc, Gig Harbor, WA).¹³ Here, a numeric pain rating scale was used, along with a functional rating index, spirometry, and radiographic measurements of lumbar disk height and lumbar lordosis that were taken from digital standing lateral lumbar radiographs. Disk height measurements were taken from the center of each lumbar disk, and each lumbar radiograph was taken at approximately the same time of day to reduce the impact of diurnal changes due to gravitational loading. An illustration of the measurements is shown in Fig 1.

Fig 1. Measurements of disk height changes were taken from the center of each lumbar intervertebral disk. Pre- (A) and posttreatment (B) radiographs were taken at approximately the same time of day.

Intervention and outcome

Each of the 6 patients followed a specific multi-modal treatment protocol consisting of warm-up stretches, percussion massage, repetitive loading and unloading cervical traction, vibration traction therapy, anterior head weighting, chiropractic manipulation, and cryotherapy posttreatment. This treatment lasted for a total of 20 visits over a 7-week span.

To outline a typical treatment, the patient would begin with approximately 5 minutes of lumbar spine warm-up exercises on a Pettibon Wobble Chair, followed by 3 to 5 minutes of repetitive over-the-door cervical traction to warm up the cervical spine. The goal of these warm-up stretches is to lower the hysteresis of the involved spinal ligamentous structures so that the primary intervention, the inversion-vibration traction, has the best opportunity to overcome soft tissue resistance. Examples of these warm-ups are demonstrated in Fig 2. Calf stretching and deep tissue percussive massage of the spine and lower extremity musculature were then performed to address any muscle guarding or tightness before the vibrating traction therapy.

Once these ligamentous and muscular warm-up modalities were complete, the patient was placed on a motorized vibrating traction table for 20 minutes. The table is different from conventional spinal decompression tables in that there is a constant traction force

Fig 3. This figure demonstrates the patient placement for lumbar vibration traction on the P-SRT table.

applied to the patient. However, the vibration component of the table may cause rapid muscle fatigue,^{14,15} thereby overcoming muscular resistance and reflex contraction to promote spinal lengthening. Because the amount of traction force needed to be increased at each 5-minute interval to maintain a constant tension, we postulated that a measurable radiographic increase in intervertebral disk height may have taken place. An illustration of the vibration traction table and patient placement is shown in Fig 3.

Fig 2. Side-to-side and front-to-back stretches are performed on the Pettibon Wobble Chair. The seat of the chair can move 45° inferior in all directions (A). Cervical repetitive traction is then performed for 2 to 3 minutes (B).

After the vibration inversion therapy was finished, the patient again performed the initial wobble chair stretches, but this time while using an anterior head weight device. Our goal was to optimize the vertical alignment of the centers of mass of the head, torso, and pelvis, thus minimizing the gravitational stress on the lumbar spine. Manipulation of the sacrum followed, with the vector of the manipulation aimed to correct a sacral apex posterior. Finally, each patient finished the treatment with 10 minutes of cryotherapy while resting supine on a pelvic block positioned to bring the sacral apex anterior. The placement of this block is pictured in Fig 4.

In addition to the above outline clinic treatment, each patient was given a set of rehabilitation equipment so that the treatment could be continued at home to facilitate patient independence. Each patient received a portable version of the wobble chair and cervical traction device to perform the warm-up stretches at home. The patients also received an anterior head weight to use while performing the wobble chair stretches. Finally, each patient was given a set of high-density foam blocks to perform positional traction each night immediately before bed for 20 minutes, as shown in Fig 5. The positional traction was begun after 2 weeks of the clinic treatment was completed. Throughout the study, patients were continually monitored for compliance of the above protocol. Minor modifications of the frequency or the order of these protocols were made to accommodate each patient's ability levels to facilitate compliance.

The average age of all of 6 patients was 40.3 years, with a mean weight of 155.17 lb. Analysis of all data collected for each of the 6 patients was performed using

Fig 4. This is an illustration of the sacral blocking used at the conclusion of the typical treatment visit. Patients performed this procedure for 10 minutes with concurrent cryotherapy.

Fig 5. Patients were given a pair of high-density foam blocks to perform positional traction at home nightly for 20 minutes immediately before bed.

SPSS (Chicago, IL) software version 16.0. Paired *t* tests were used to determine if any of the observed improvements reached statistical significance. A 95% CI for each of the above outcome assessments produced a statistically significant *P* value ($P < .05$) for the following parameters: functional rating index; numerical pain scores; patient height; spirometry; as well as L2, L4, and L5 disk heights. Table 1 shows the analysis results for all of the outcome assessments.

In an effort to make the patient population more homogenous, the analysis was also performed using only the 5 female patients. The single male patient also made bigger improvements in multiple categories; therefore, his information was excluded to prevent skewing of the overall averages of each outcome, given the small sample size. Omitting the male patient's data did not significantly change any of the values. However, those already statistically significant reached significance below a *P* value of .02.

It is important to discuss the limitations inherent within this study. In clinical practice, it is important to obtain as complete a patient history as possible. Likewise, it is imperative to perform a thorough patient examination to determine the probable diagnosis and subsequent treatment. Because of the clinical nature of this investigation, we chose inclusion criteria that would provide the most complete picture of each patient's presentation. Although the criteria are broad based, the focus of this article was to report the resultant outcomes in patients fitting these criteria, not necessarily to treat the inclusion criteria themselves. It is unknown from the design of this investigation whether or not the treatment outlined could correct any of our inclusion criteria.

Table 1 Paired *t* tests for all 6 subjects

Paired-samples test								
	Paired Differences					<i>t</i>	<i>df</i>	Significance (2-Tailed)
	Mean	SD	SEM	95% CI of the difference				
				Lower	Upper			
FRIPre-FRIPost	9.667	5.538	2.261	3.855	15.478	4.276	5	.008
NPRSPre-NPRSPost	4.333	1.633	.667	2.620	6.047	6.500	5	.001
HeightPre-HeightPost	-1.11167	.48210	.19681	-1.61760	-.60574	-5.648	5	.002
LumCrvePre-LumCrvePost	-.2167	8.2147	3.3536	-8.8375	8.4042	-.065	5	.951
SpiroPre-SpiroPost	-733.333	196.638	80.277	-939.693	-526.974	-9.135	5	.000
L1Pre-L1Post	-1.13333	1.36333	.55658	-2.56406	.29739	-2.036	5	.097
L2Pre-L2Post	-3.28333	1.09255	.44603	-4.42989	-2.13677	-7.361	5	.001
L3Pre-L3Post	-2.36667	2.80476	1.14504	-5.31008	.57675	-2.067	5	.094
L4Pre-L4Post	-2.73333	1.87474	.76536	-4.70076	-.76591	-3.571	5	.016
L5Pre-L5Post	-1.85000	.81670	.33342	-2.70707	-.99293	-5.549	5	.003

The loss of intervertebral disk height is a common sequela to degenerative disk disease. Three of the patients in this study had pretreatment MRIs or CTs demonstrating disk bulging or herniations. However, because posttreatment MRI/CT studies were not performed, we cannot directly conclude that the treatment corrected or reduced any present disk bulge or herniation. This preliminary observational study only serves to report on the radiographic disk height increase and other functional outcomes we observed in these patients after a specific course of treatment. Measures of radiographic disk height before and after treatment have been extrapolated by clinicians to evaluate the effectiveness of certain lumbar spine surgical procedures.¹⁶⁻¹⁹ Here we observed radiographic disk height changes, in concert with other functional outcomes, after a nonsurgical approach to intervertebral disk treatment.

The treatment outlined here is comprehensive in nature and does not simply focus on the symptomatic area(s) of the spine. Although the observed results reported in this study are encouraging, the multimodal aspect of the treatment diminishes our ability to determine which specific modalities may have had the greatest impact on the observed results.

Conclusion

All 6 patients who participated in this study were able to increase functional status; they increased in overall height; they experienced improved pulmonary function; they reported lower numeric pain scores and

achieved improved disk height in 3 of 5 lumbar disks on plain film radiography. Eliminating the single male patient did not affect the outcome of our statistical analysis, despite having some of the largest improvements. These outcomes were achieved after a structured protocol of multimodal chiropractic rehabilitation involving spinal manipulation, motion-based therapy, vibration traction therapy, and dietary supplementation. It is unknown which, if any, of these procedures were responsible for the observed improvements. The results of this case series cannot be generalized because of the small sample size. However, the magnitude and consistency of the results warrant further testing to determine whether or not the treatment outlined here can be applied to a larger and more diverse population, compared with matched controls.

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