INCREASING THE LUMBAR LORDOSIS BY SEATED 3-POINT BENDING TRACTION: A CASE SERIES UTILIZING CHIROPRACTIC BIOPHYSICS TECHNIQUE

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ABSTRACT

Objective: To describe the effectiveness of a new method of seated lumbar extension traction which increased the lumbar lordosis in six patients with lumbar hypolordosis, low back pain, disability, and poor health-related quality of life (HRQOL) scores.

Clinical Features: This is a retrospective, consecutive case series of 6 personal injury patients treated in a multidisciplinary spine clinic in Las Vegas, Nevada. Patients were selected who had had a follow-up x-ray, and who started treatment on or after March 15, 2016. All patients had lumbar spine hypolordosis with low back pain.

Intervention and Outcome: All patients were treated with seated 3-point bending lumbar extension traction, spinal manipulation, and exercises at a frequency of 3 to 4 times a week for a total average of 16 visits. An average improvement in lumbar absolute rotation angle was 8°, corresponding with improvements in pain rating, Oswestry score and HRQOL scores.

Conclusion: This method of seated lumbar extension traction adds to the accumulating evidence for lumbar extension traction to become recognized as the primary nonsurgical rehabilitative procedure to increase the lumbar lordosis in those patients who have LBP with hypolordosis. The seated lumbar extension traction warrants further study in randomized trials. (Chiropr J Australia 2017;45:144-154)

Key Indexing Terms: Lordosis; Low Back Pain; HRQOL; Posture; Rehabilitation; Chiropractic Biophysics; Lumbar Traction

INTRODUCTION

The lumbar lordosis has been closely modeled with an ellipsoidal configuration (1,2), where the backwards extension angle between the adjacent segments on a standing neutral radiograph increase from L1-2 down to L5-S1 (1,2).

It has been determined that a loss of the normal lumbar lordosis is associated with low back pain (3-5). Further, it has been demonstrated that discriminant

analysis has correctly predicted patients with or without low back pain by comparing their respective lumbar radiographs to an elliptical norm (6).

Rehabilitation procedures aimed at improving the lumbar lordosis have been advanced within the Chiropractic BioPhysics® technique, aka CBP® (7,8). The first demonstration of an improvement of lumbar lordosis with a supine lumbar hyper-extension traction method was published in the 2002, where the authors stated: "This new method of lumbar extension traction is the first nonsurgical rehabilitative procedure to show increases in lumbar lordosis in chronic LBP subjects with hypolordosis (9)." Other studies using this traction procedure have followed (10-15).

These studies have preliminarily indicated that increasing the lumbar lordosis via extension traction is associated with improved long-term outcomes of patient care, including back and leg pain intensity, disability, flexion/extension kinematics, and neurophysiology (9-15).

Recently, there has been an increase in the variety of clinical lumbar traction equipment available to clinicians including the 'Universal Traction System®' (UTS®, Las Vegas, NV). The UTS enables multiple vectors of pull and treatment of each spinal region; specifically, 1, 2, or 3-point bending traction in a seated, standing or supine position can be performed. To date, no studies on UTS seated lumbar traction exist in the literature and thus, its effect on lumbar hypolordosis is unknown. The current study presents the results from 6 patients having low back pain and hypolordosis of the lumbar spine as treated by chiropractic, exercise, and seated lumbar extension traction in the UTS.

CASE SERIES

This is a retrospective, consecutive case series of 6 personal injury patients who were treated in a multidisciplinary spine clinic in Las Vegas, Nevada. The patients considered to satisfy the selection criteria had to have had a follow-up x-ray and also had to have started treatment on or after March 15, 2016, as this was the start date of employment of the lead author, who treated all cases. All patients also had lumbar spine hypolordosis with low back pain.

All patients were assessed prior to treatment having a consultation, examination, and spinal x-rays. All subjects completed a health history form that included a pain diagram to indicate the location of pain, reported their pain on a numerical rating scale (NRS) from 0 to 10 (0=no pain; 10=worst pain ever), completed a health-related quality of life (HRQOL) questionnaire (16), and a revised Oswestry low Back Disability Questionnaire (17).

Standing lateral lumbar radiographs were taken with the subjects' right side against the grid cabinet at a tube distance of 72". Subjects were asked to stand

straight but relaxed, with their arms resting on a support just slightly anterior to the torso at the height of the iliac crests. Standing lateral radiographs, patient positioning and patient posture analysis have been proven to be both accurate and repeatable over time (18). The radiographs were digitized using PostureRay® mensuration software (Trinity, FL). This software was chosen because it has high inter and intra-examiner reliability utilizing the posterior tangent method for determination of lumbar lordosis (19,20).

The patients included in this series had an initial average absolute rotation angle (ARA) from L1-L5 of -25.4° [where 40° is the normal (7)], an initial mean NRS score for low back pain of 5.2/10, and an initial mean revised Oswestry Low Back Pain Disability score of 17% (moderate disability).

Patient 1, a 36-year-old male, and patient 2, a 31-year-old male, were both hit from behind and had no degenerative changes evident on x-ray. Patient 3, a 38-year-old male, was struck on the left front of his vehicle by an oncoming car at an oblique angle. Multi-level moderate degenerative changes were present on lumbar x-ray. Patient 4, a 64-year-old male was hit from behind and diagnosed with lumbar radiculopathy to the right leg and lumbar disc displacement and had mild disc height loss evident on lumbar x-ray, and a disc bulge at L3-4 as evident on MRI. Patient 5, a 24-year-old female was side-swiped while traveling 70mph on a freeway. No degenerative changes were present on x-ray. Patient 6 is a 74-year-old male who sought care after being involved in a head-on collision. He received treatment and then was discharged. He was referred back to the office by his attorney at a later date, at which point he had a re-evaluation and was started on structural corrective care (lumber extension traction). Mild degenerative changes were noted throughout the lumbar spine on x-ray.

Treatment Protocol

Seated 3-point bending lumbar extension traction was performed using the UTS unit according to CBP protocols (7-9). During each treatment mirror-image® exercises, therapeutic exercises and chiropractic adjustments were also performed.

Four patients received 12 treatment sessions, and 2 patients received 24 treatments, with the average number of treatments being 16. Follow-up x-rays were taken on a separate day at least 24 hours following the last treatment session.

For the 3-point bending traction in the seated position, an anterior pull was applied between the upper torso and lower pelvis (Figure 1). Tension was applied up to the individual patient's tolerance. The angle of the anterior force relative to vertical varied, depending on the subject's area of maximum deviation from the normal lumbar elliptical shape (1,2). If the patient's sagittal balance (vertical line through posterior-inferior S1) measured posterior displacement of

T12, then a firm foam block was placed behind the patient's ribcage. This induced anterior displacement of the ribcage while the traction force was applied. Straps restrained the femurs if the sacral base angle (SBA) was below average to allow the pelvis to tilt anteriorly during traction or were placed on the ASIS if the SBA was within normal limits (7).

The traction duration began at 6 minutes per session, with the tension being re-tightened up to the patients' tolerance half way through or at 3 minutes. The duration was increased at least 2 minutes per session with the tension being re-applied at the half way mark to account for any possible viscoelastic creep deformation. A maximum of 16 minutes per session was performed with the tension being re-tightened at 8 minutes.

Mirror-image exercises were performed by those with posterior thoracic translation (as well as lumbar hypolordosis) either standing with a block behind the thorax and pulling the pelvis back towards the wall or seated on a workout ball shifting the thorax forward while having a resistance band pulling posteriorly. Therapeutic core stability exercises prescribed including abdominal crunches and back extensions on an exercise ball.

Figure 1. Seated, 3-point bending lumbar extension traction.

Outcome

The mean ARA, initially -25.4°, increased to -33.4°, an average increase of 8° over an average of 16 treatment sessions (Figure 2). The mean NRS score for low back pain, initially 5.2/10, decreased to 1/10; the mean revised Oswestry Low Back Pain Disability score, initially 17% (moderate disability), decreased to 5% (mild disability) for these 6 treated patients.

A variety of health-related quality of life improvements were also noted. Patient 3 reported a 30% loss of ability to sleep, lay down and drive. He reported a full resolution of these complaints after treatment. Patient 4 initially reported loss of sexual performance as well as the inability to walk 1/2 mile, where after treatment both of these issues resolved. Patient 5 initially had difficulty sitting and working, but later had full resolution. Patient 6 initially reported loss of sexual function and frequent urination. It was not initially quantified except for the revised Oswestry social life rating , noted as a "significant loss of ability to perform social functions." On his discharge he rated his improvement in function as 9 out of 10 and his revised Oswestry social category showed no impairment at all.

Many subjects reported a loss of sleep each night of between 1-3 hours. All subjects reported an improvement in the quality of sleep. Most reported that they slept through the night without pain while 1 reported that he lost <1 hour of sleep during the night due to pain at the end of treatment.

DISCUSSION

This retrospective, consecutive case series demonstrates that the improvement of the lumbar lordosis by seated lumber extension traction, as well as spinal manipulation and rehabilitation exercises was associated with a reduction in pain and improvement in functional activity. These results are in agreement with other studies that have recently added to the accumulating evidence of lumbar extension traction methods in treating low back conditions (9-15).

Previously, there have been two case reports (10,11), one small case series (12), one non-randomized clinical trial (9), and 3 randomized clinical trials (13-15) on extension lumbar traction – all being in the supine position.

In the first non-randomized clinical control trial of lumbar extension traction combined with traditional chiropractic SMT methods (9), Harrison et al. (2002) found clinically and statistically significant increases in lumbar lordosis and reductions in chronic pain intensity in 48 prospectively selected treatment subjects compared to no changes in a prospectively selected control group of 30 subjects. Subjects were middle aged adults who were matched for age, weight,

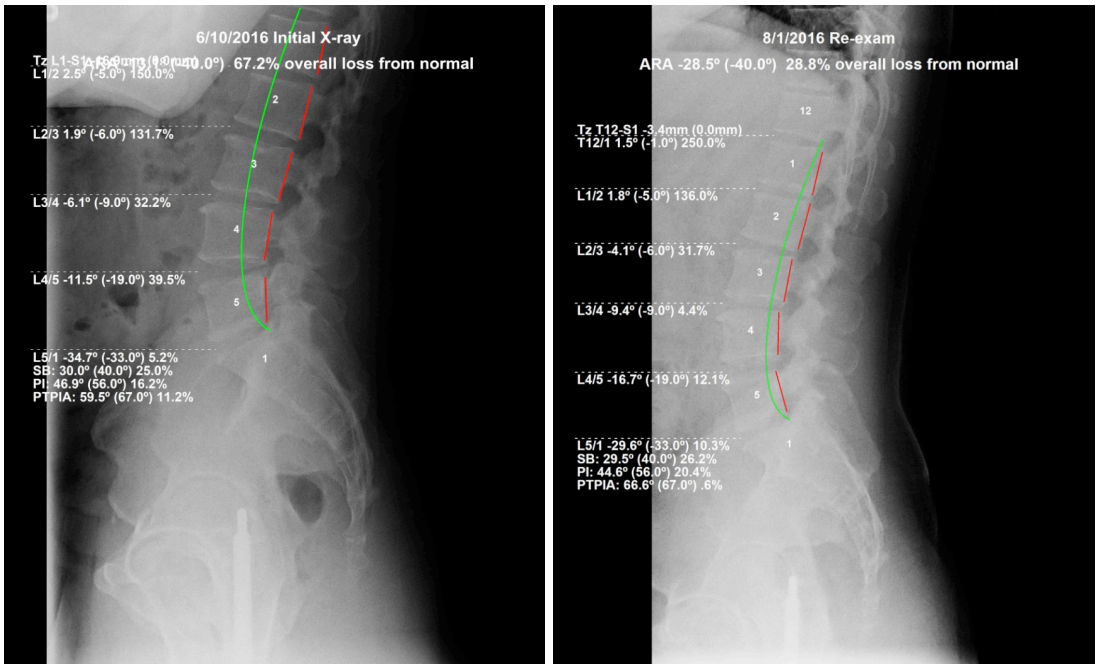

Figure 2. Pre- and post standing lateral lumbar radiograph of initial (Left) and post-treatment (12 traction sessions) of seated lumbar extension traction, spinal manipulation, and exercises for one subject. Note the better congruency of the red line (patient) to the green line (normal) after treatment (Right).

height, and gender and had chronic low back pain without radiculopathy of a moderate intensity, hypolordosis, and were free from moderate-severe spine pathology. Treatment was applied 3 times per week for an average of 12 weeks or 36 visits and treatment subjects had an initial starting lumbar lordosis L1-L5 of 22.5^{o} (ideal is 40 ^{o}). Importantly, at 1.5 year follow-up after treatment, the pain and lumbar lordosis improvements in the treatment group (ARA L1-L5 = 11.3°) were stable in the 34/48 subjects who were available for follow-up.

In the first randomized clinical control trial of lumbar extension traction combined with hot packs and interferential therapy (13), Moustafa et al. found clinically and statistically significant improvements in lumbar lordosis, Oswestry Disability Index, back and leg pain, Modified Schober test, latency and amplitude of H-reflex, and intervertebral movements. The control was treated with hot packs and interferential therapy only. Both groups were treated at a frequency of 3 times per week for 10 weeks. These differences between treatment and control groups were found after the 10 weeks of treatment as well as being maintained at a 6-month follow-up. There were 32 patients in each group, matched for age, height, weight, gender, smoking, and use of medication for low back pain.

In a second randomized clinical trial for chronic mechanical low back pain (14), Diab et al. compared a control group getting stretching exercises and infrared radiation to a treatment group getting the same plus lumbar extension traction.

There were 40 subjects in each group and treatment was given 3 times per week for 10 weeks, with a 6-month follow-up. Interestingly, Pain levels and intervertebral movement improved for both groups at the termination of care (10 weeks); however, by the 6-month post-treatment check-up, the control group had values recede toward baseline values whereas the treatment group did not. The treatment group receiving lumbar extension traction had increased their lordosis at the 10-week check-up, while the controls did not, and this lordosis improvement was also maintained at the 6-month post-treatment follow-up.

In another trial (15), Diab et al. performed a randomized trial on chronic mechanical low back pain subjects that mirrored the last trial discussed (14) but evaluated indicators of sagittal alignment including the lumbar lordosis, thoracic kyphosis, sacral slope, and positioning of C7 plumb line, as well as pain. Interestingly, after the initial 10-week treatment period, only pain was not different between the groups, whereas all the postural parameters were significantly different as increasing the lumbar lordosis improved the other postural parameters. Again, at the 6-month follow-up, the control group had pain levels digress toward baseline, and the treatment group maintained their pain relief and postural improvements as measured from x-ray.

Paulk and Harrison (11), and Oakley and Harrison (12) each present a case report describing the successful application of lumbar extension traction as well as manipulation in treating patients with lumbar herniation and radiculopathy. Paulk treated the patient for 5-months, giving 65 treatments for an improvement in lordosis of 11° (25° to 36°) with alleviation of symptoms. Oakley treated the patient for 6-months, giving 26 treatments over the initial 9-weeks with pre-post MRI revealing complete resolution of disk herniation and sequestration.

Finally, Harrison et al. (10) reported on the successful improvement in lumbar lordosis in 3 patients with ‘flat back syndrome.’ The patients were treated with supine lumbar traction as well as manipulation at a frequency of 3-5 times per week for 12-20 weeks. All 3 subjects had their pain reduced, with an increase in lumbar lordosis, pelvic tilt, and Ferguson’s sacral base angle.

The current case series adds to the literature about lumbar extension traction for those with various low back ailments who also have hypolordosis. Since on average, patients with low back pain have hypolordosis of the lumbar spine (6), and generally speaking since most low back treatments seem to offer limit benefit (21), lumbar extension traction methods deserve serious consideration for continued scientific evaluation, including in the seated position.

In the current series of 6 patients, lumbar extension traction was performed in a seated position, with an average improvement of 8° over an average of 16 treatments. Although the limited results from a series of 6 patients is not sufficient enough evidence to make any concrete conclusions, the improvement in lumbar lordosis may, in further study, prove to be at least as comparable to the

traditional supine lumbar extension traction methods. Seated lumbar extension traction seems to be a viable option for increasing lumbar lordosis. Further investigation, including prospective studies with randomization, is necessary to fully evaluate the seated lumbar extension traction method.

Limitations of this study were the small sample size (n=6). Other limitations include that which is inherent in any case series, that of non-randomization.

Also these cases were retrospectively selected from personal injury cases; therefore, the acute nature of the injuries might have some effect on the outcome. For example, Troyanovich et al. (22) presented a small case series of improving the cervical lordosis in motor vehicle injury subjects with use of the 'Activator Adjusting Instrument™,' an instrument not typically expected to produce an increase in lordosis (23). In a letter to the editor, Harrison et al. (24) pointed out that it was more likely the nature of patients being in an acute phase of injury that lead their cervical curves to rebound back toward 'pre-collision lordosis' with an improvement in head flexion position due to the release of tension in the muscles and soft tissue with treatment (and time), and not resulting from 'activator' treatment specifically. Therefore, the seated lumbar extension traction method needs to be evaluated on a population of chronic low back pain patients to avoid this same criticism.

In addition, subjects received a comprehensive treatment protocol that included exercise and chiropractic adjustments and not lumbar traction exclusively. Regarding exercise, as to the author's knowledge, no study has shown that an exercise protocol can increase the lumbar lordosis; particularly core exercises as done in this case. Regarding chiropractic manipulation, this procedure also has not been demonstrated to routinely increase the curves of the spine in general (25,26), or increase the lumbar lordosis specifically (27).

CONCLUSION

This method of seated lumbar extension traction adds to the accumulating evidence for lumbar extension traction to become recognized as a primary nonsurgical rehabilitative procedure to increase the lumbar lordosis in those patients who have LBP with hypolordosis. The seated lumbar extension traction in this series shows promise and warrants further study in prospective, randomized trials.

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