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Case Study

Reduction of thoraco-lumbar junctional kyphosis, posterior sagittal balance, and increase of lumbar lordosis and sacral inclination by Chiropractic BioPhysics® methods in an adolescent with back pain: a case report

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Abstract. [Purpose] To present the structural improvement of an excessive junctional thoracolumbar kyphosis and related biomechanical parameters in an adolescent. [Participant and Methods] A 16 year old female presented with chronic back pains. Radiographic assessment revealed excessive posterior sagittal balance and thoracolumbar kyphosis and reduced lumbar lordosis and sacral inclination. Chiropractic BioPhysics® technique including mirror image®, anterior thoracic translation and thoracolumbar hyperextension traction was performed as well as spinal manipulation and postural exercises over an 8-week period. [Results] After 24 in-office treatments and a daily home program the patient reported a minimization of back pains and a better mood. Follow-up X-rays demonstrated a 48 mm reduction of posterior sagittal balance, a 22° reduction of thoracolumbar kyphosis, an 11° increase in lumbar lordosis, and a 10° increase in sacral inclination. [Conclusion] This is the first case documenting the non-surgical reduction of excessive thoracolumbar junctional kyphosis and related biomechanical parameters in an adolescent. Precise analysis of radiologic assessment for adolescents presenting with back pains is advised and are safe for the screening of postural disorders. There is a growing evidence base for the Chiropractic BioPhysics® technique approach in the correction of lumbar spine disorders; more research is encouraged to further evaluate this unique treatment.

Key words: Junctional kyphosis, Thoracolumbar spine, Low back pain

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INTRODUCTION

Poor posture is recognized as a silent epidemic[1)]. Recently, the European spine study group published a report on poor posture having significant negative effects on the quality of life (QOL) of affected persons; moreover, in comparison to several other well-known diseases, including arthritis, chronic lung disease, diabetes and congestive heart failure, those with poor posture were more significantly affected by having a lower QOL.

Research has demonstrated that poor posture is not uncommon in children and adolescents[2, 3)], and that this may translate into back pain in adulthood[4–6)]. Since back pain is a leading culprit of adult disability[7)], the correction of poor posture in younger individuals should be a priority.

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Sagittal balance is an important postural parameter associated with back pain and disability[8]. Biomechanical spine alignment data shows that the thoracolumbar spine is relatively straight and is also vertically balanced over the sacrum[8–11]. Although Chiropractic BioPhysics® (CBP®) methods has a growing evidence base demonstrating the non-surgical correction of lumbar spine alignment[12–16], there is a paucity of data showing improvement of thoracolumbar (TL) posture in adolescents.

The purpose of this report is to present the structural improvement in excessive posterior TL sagittal balance as well as the reduction of a TL junctional kyphosis and increase in lumbar lordosis in a 16-year-old female presenting with chronic mid and lower back pain treated by CBP technique methods.

PARTICIPANT AND METHODS

A 16 year old female presented with the primary complaint of mid and low back pains. The pain was described as an ache that was aggravated by standing. The patient also reported difficulty standing for more than an hour at a time, and that it was difficult to sleep through the night resulting from these pains. The pain was experienced several times a week, with a general trend that was increasing in frequency and intensity over the last several months. There was no history of previous injury and no known mechanism of injury. The only reported previous treatment for the back pain was taking Advil. The patient rated her back pain to be on average a 7/10 (0=no pain; 10=worst pain ever).

A full-spine radiographic assessment was performed and measured using the PostureRay software (PostureCo, Inc., Trinity, FL, USA) that uses the reliable and repeatable Harrison posterior tangent line drawing methods[17, 18]. The X-rays (Fig. 1) revealed that the patient had a pronounced posterior sagittal balance as measured as the horizontal distance between the posterior-inferior vertebral body corner of T12 and the vertical line drawn from the posterior-inferior body corner of S1; this was 61 mm (ideal 0 mm[10, 11]). There was also a prominent TL kyphosis as measured from the posterior tangent flexion angle between T10–L3 of 29.8°, with lumbar spine hypolordosis measuring 24.3° (normal=40°[10, 11]) as measured from the posterior tangent lines between L1–L5. The sacral base angle (top of sacral base to horizontal) was also decreased indicating extension (posteriorly rotated pelvis) while in the neutral standing position (32.7° vs. 40° normal[10, 11]).

The patient was treated using CBP technique[19, 20]. CBP methods incorporate the concept of applying mirror image postural rotations and translations in order to stress the spine and posture towards a more normal configuration by exercises, spinal traction and postural adjustments. Specifically, for this patient the corrective exercises and traction were customized to the patients posture as seen on the X-rays to precisely anteriorly translate the thoracic cage as well as to hyperextend the TL region.

Mirror image exercises were performed for 10 minutes and featured the holding of an anteriorly translated thoracic position while performing functional movements such as leaning back and forth in a chair, raising the legs while sitting in a chair, and performing the sit-to-stand maneuver. Initially, the patient was simply taught to hold the anteriorly translated trunk posture and perform repetitions; as the patient became more proficient, these activities were performed to the discretion of the patient, for both maneuver and number of repetitions, as long as they switched up exercises throughout the time period. Mirror image spine traction was performed while the patient was standing in a frame where the upper thighs were secured with a belt while a pulling strap was placed at the TL junction (the apex of the deformity), and a strap across the front of the shoulders ensured the patient remained vertical and not pulled forward (Fig. 2). This traction anteriorly translated the thorax as well as hyperextended the TL junction and was performed initially for 8 minutes, progressing to a continuous 15-minute duration at each visit.

Spinal manipulation via high velocity, low amplitude thrusts were introduced bilaterally to the TL and lumbar regions and were performed each visit. Additionally, mirror image drop-table postural adjustments consisting of the patient laying in a prone position, where the table pelvic piece was tilted up forcing the patient into a reverse postural position, where the pelvis is rotated forward and the thorax is positioned anteriorly to the pelvis causing an extension to the thoracolumbar spine. A drop piece mechanism was engaged in the table above the pelvic piece, causing a section of the thoracic support to drop. This was performed every session, takes only a few seconds and is thought to stimulate the mechanoreceptors within the spinal joints to reset the tone of the postural muscles.

A home treatment routine was to be performed on a daily basis which consisted of the mirror image exercises for 10 minutes per day, as described, as well as home spinal blocking. The patient was instructed to lay supine on a lumbar Denneroll™ (Denneroll Spinal Orthotics, Wheeler Heights, NSW, Australia) with a 3-inch flat block supporting the upper back to increase the anterior translation; this was performed initially for 3 minutes, progressing to 15 minutes daily. The Denneroll is a firm foam material that does not yield to the weight of the patient, it is meant to mimic the spinal traction that was performed in clinic. The patient and parents provided verbal and written consent for the publication of these results including the repeat X-ray images.

RESULTS

The patient received 24 treatments over an 8-week period, and reported that the home program of care was strictly followed. A re-assessment, at this time confirmed the reduction in back pains following treatment (average of 1/10 vs. 7/10), as well as the ability to stand for prolonged periods and sleep throughout the night without pain, and also reported the general increase of mood. Measurement on the follow-up lateral spinal X-rays showed a significant reduction in posterior T12–S1

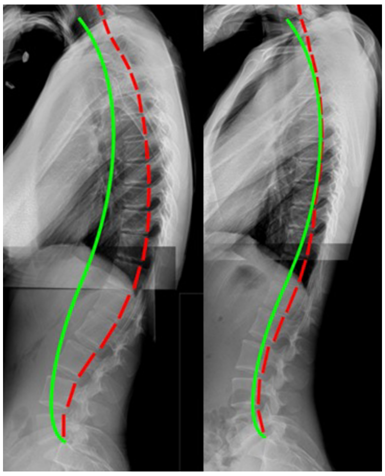

Fig. 1. Lateral full spine X-rays. Left: the patient demonstrates poor posterior sagittal balance with accompanying thoracolumbar kyphosis, loss of lumbar lordosis, and a posteriorly rotated pelvis (decreased sacral base angle). Right: correction of all biomechanical parameters after 24 treatments over 8-weeks. See text for values.

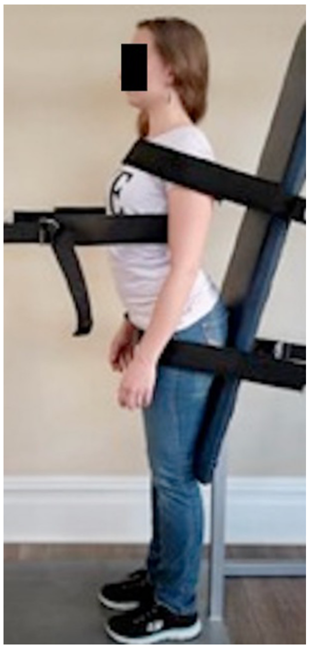

Fig. 2. Mirror image traction. The patient was standing in a frame where the upper thighs were secured with a belt while a pulling strap was placed at the thoracolumbar junction (the apex of the deformity), and a strap was placed across the front of the shoulders to ensure the patient remained vertical and not pulled forward. This traction anteriorly translated the thorax as well as hyperextended the thoracolumbar junction and was performed initially for 8 minutes, progressing up to 15 minutes.

sagittal balance (13 mm vs. 61mm), a decrease in the TL junctional kyphosis (7.9° vs. 29.8°), an increase in lumbar lordosis (35.5° vs. 24.3°), and increase in sacral base angle (42.5° vs. 32.7°).

DISCUSSION

This case demonstrates the dramatic reduction of back pains corresponding to the reduction of a TL junctional kyphosis, improvement in TL sagittal balance and the increase in lumbar lordosis and sacral inclination in a 16 year old adolescent.

The structural correction was achieved by the mirror image application of exercises and traction techniques as determined by the CBP approach.

As previously mentioned, an evolving evidence base for CBP technique methods exists supporting the non-surgical improvement in lumbar alignment;[12)] precisely, there are 2 randomized trials[13–15)], 1 non-randomized trial[16)], 2 case series[21, 22)], and 6 case reports[23–28)] documenting lumbar lordosis increase in adult patients having various lumbosacral symptomatology. This is the first case documenting the increase in lumbar lordosis and correction of TL posture by CBP methods in an adolescent.

Harrison et al. presented an important paper on TL spinal coupling that occurs with a posteriorly translated thoracic posture[29)]. They determined, that as compared to an ideal neutral position, when a subject posteriorly translated their thorax the lumbar spine changes from the normal neutral elliptical configuration to an S-shape, where the lower lumbar spine hyperextends, and the upper lumbar and TL spine flexes[29)]. The sacral base angle also reduces as the pelvis is rotated posteriorly. This is precisely the postural presentation of the current patient, with the exception of the large junctional TL kyphosis (Fig. 1).

Mathematically, the most effective movement in the attempt to correct such a deformity is the mirror image, or an anteriorly translated thoracic position which would reverse the pelvic tilt and spinal coupling towards normal. Thus, this was the approach taken in terms of applying this corrective position in terms of exercises, traction, and drop-table spinal adjustments. As demonstrated in this case, CBPs mirror image approach may prove to be an effective method to correct poor sagittal balance, but more research is necessary to verify its efficacy for postural improvements in the adolescent population.

A limitation to the current case is that it is reporting on the successful outcome of only a single patient. Further, there is no long-term follow-up. Additionally, the patient received multiple treatments seemingly obscuring which treatment component contributed to the spine and postural correction. In the randomized trials by Moustafa et al.[14–16], two groups of patients received the same therapeutic treatment, while only the study group additionally received lumbar extension traction. These studies have shown that only the traction groups achieve lumbar spine structural improvement, whereas the control groups not receiving the traction do not show spine alignment improvements. This demonstrates the unique spine traction methods incorporated by CBP methods are essential to restore spinal alignment.

A final note of interest is in regards to the use of spine imaging by radiography. Although traditionally it is thought that radiation from X-rays should be avoided due to radiogenic concerns, these ideas have been increasingly challenged[30–33]. It is known that spinal X-rays are a small fraction; in fact, as little as 1,000 times less than the dose threshold for the induction of leukemia[34], the cancer which would first present after pathologic exposures. Another misconception is the collective dose concept which states that repeated radiation doses on separate occasions are cumulative—this is untrue[35–37]. The body has an abundance of redundant and sophisticated adaptive protection systems that mitigate any chromosomal damages from low-dose radiation exposures[37]; in fact, the most noxious attack on the genetic material on a daily basis is the inescapable aerobic metabolism (breathing air)[35, 36]. For these reasons, there should be no hesitation to perform comprehensive radiological assessments on adolescents to get a precise biomechanical diagnosis of the postural subluxation in order to entertain adequate treatment strategies.

Conflict of interest

PAO is paid by CBP NonProfit, Inc. for writing the manuscript; DEH teaches chiropractic rehabilitation methods and sells products to physicians for patient care as used in this manuscript.

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