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Case Study

Reduction of lumbar hyperlordosis in a pediatric: a Chiropractic Biophysics® case report

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Abstract. [Purpose] To demonstrate the reduction of lumbar hyperlordosis, sacral base angle and anterior thoracic translation posture in an 11-year-old female. [Participant and Methods] A pediatric patient presented with lumbar hyperlordosis and underwent Chiropractic BioPhysics® treatment protocols to reduce her spinal deformity and correlated symptoms. Symptoms included thoracolumbar, hip, knee and ankle pains and lower extremity weakness. Radiographs confirmed lumbar hyperlordosis, increased sacral base angle and a forward translated thoracic posture. Spinal traction as well as corrective exercises and spinal manipulative therapy was performed over an 11-month period. [Results] After 57 treatments, there was a 13.4° reduction in L1-L5 lordosis, an 11.8° reduction in sacral base angle and a 13.8 mm reduction in anterior thoracic translation. The improved structural changes correlated with improved symptoms. [Conclusion] Lumbar hyperlordosis can be reduced in pediatric patients presenting with hyperlordosis and associated symptomatology. Routine radiography may be warranted in the diagnosis of lumbar spine deformities in pediatrics. Further research into the non-surgical reduction of lumbar spine hyperlordosis is needed.

Key words: Lumbar hyperlordosis, Lumbar spine, Traction

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INTRODUCTION

The prevalence of low back pain (LBP) in children is relatively common[1, 2)] and some studies have shown it to be increasing[2)]. Although the risk factors of LBP in childhood are varied[2)], children are often unaware of their posture while performing common tasks such as sitting and wearing a schoolbag[3)] which can be a direct cause of back strain. Regardless of causes of childhood LBP, without proper intervention as a child, there is a possibility that the LBP will progress and may increase in severity as the child ages[4)].

Harrison et al. discovered that the healthy lordosis of the lumbar spine may be modeled by an elliptical curve where the curvature increases from L1 to L5; two-thirds of the curvature is L4-L5[5, 6)]. Using this lumbar model, patient populations were successfully discriminated from healthy normal subjects and found to have either too much curvature or too little[7)]. In lumbar hyperlordosis, there is a tendency for a simultaneous increase in sacral base angle (SBA) as well as a forward thoracic translation posture[8)].

Chiropractic BioPhysics® (CBP®) rehabilitation techniques have shown evidence of reducing postural distortions including hyperlordosis of the lumbar spine[9–11)]. Three case reports demonstrate emerging evidence these methods can non-surgically reduce lumbar hyperlordosis, thus, more cases are needed. This case represents the successful application of CBP techniques to reduce lumbar spine hyperlordosis, SBA and forward thoracic translation in an 11-year-old child suffering from hip and LBP.

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PARTICIPANT AND METHODS

An 11-year-old female presented complaining about thoraco-lumbar back pain. The patient also complained about bilateral hip, knee and ankle pain as well as muscle weakness in the lower extremities. The hip pain was chronic whereas the knee and ankle pains were sporadic. These pains were not induced by any trauma but slowly evolved over the last five years. The patient reported no previous history outside of horseback riding that may contribute to her current ailments.

Physical examination revealed the presence of pain and tightness upon palpation of the low back. Active range of motion (ROM) was normal with slight discomfort with bilateral rotation and flexion-extension. Active and passive ROM in the hips triggered slight discomfort. Other orthopedic tests were normal. On a numerical pain rating scale (NPRS), the patient rated her back pain to average a 5/10 (0=no pain; 10=severe pain with the patient bed ridden).

Radiographic images were digitized and analyzed using the PostureRay software (Trinity, FL, USA) that uses the Harrison posterior tangent (HPT) method to quantify the lordosis for lateral spine images. The HPT method uses the superior-posterior and inferior-posterior body corners and their intersected tangents to create relative rotational angles (RRAs) between adjacent vertebrae. The summed RRAs from L1 to L5 equate to the absolute rotational angle (ARA). The standard error of measurement is small (<2°)[12)].

The patient demonstrated a lumbar spine lordosis of −61.3° L1-L5 ARA (Fig. 1). Considering children have slightly smaller lumbar lordosis than adults[13)], and knowing that the typical adult T12-S1 Cobb angle ranges from 55–65° which approximately equates to a 40° L1-L5 ARA[6)], the patient definitively was diagnosed with lumbar spine hyperlordosis. The patient also had a forward translation of the torso (i.e. horizontal distance of T12 over vertical line from posterior-inferior S1) of 20.6 mm and a sacral base angle (SBA) of 52.2°.

Treatment involved CBP mirror image® methods which aims to reduce spinal deformities by utilizing exercises and spinal traction as well as postural adjustments[14–16)]. CBP methods are a full spine rehabilitation approach which has much evidential support[17, 18)]. Patients are seen frequently (e.g. 2–4 ×per week) typically for blocks of care such as 3 ×per week for 12 weeks, where a re-assessment and radiograph are performed to monitor treatment efficacy[15, 16)].

The patient received full spine manipulative therapy as well as mirror image exercises (Fig. 2) and traction. The exercises involved the patient standing with a block placed half way down the buttocks while leaning against a wall. The patient leaned back so the shoulders touched the wall and then attempted to retract the lumbar spine to touch the wall. These exercises were held for 3 seconds and repeated. The patient performed 50 repetitions while attending the clinic and was instructed to perform a minimum of 50 repetitions on a daily basis at home.

The spinal traction (Fig. 3) involved the patient to lay supine with a strap over approximately the 9–11th ribs in order to keep the thoracic cage from being translated anteriorly. A second strap was placed across the anterior superior iliac spine (ASIS) of the patient, and lastly, two overlapping straps of even length were placed just cephalad to the ischial tuberosities that lifted the patient from underneath causing the pelvis to rotate posteriorly which reduced the lordotic curve and also translated the pelvis forwards placing the patient into the mirror image of their presenting posture (Fig. 3). Consent from the patient's parent was given prior to her first session and to the publication of these results.

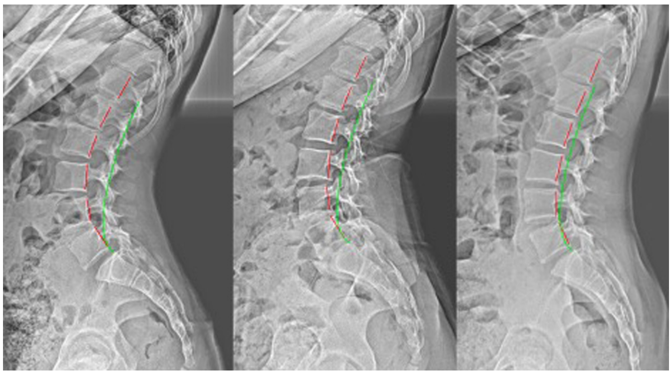

Fig. 1. Lateral lumbar radiographs. Left: Initial showing lumbar hyperlordosis, increased sacral base angle and forward translation of the thorax; Middle: First follow-up; Right: Second follow-up.

Fig. 2. Mirror image exercises. See text for description.

RESULTS

The first re-assessment after 24 treatments over 3 months showed a 6.3° reduction in lordosis (−55° vs. −61.3°) and a 5.3° reduction in SBA (46.9° vs. 52.2°). The forward translation of the thorax remained (19 mm vs. 20.6 mm). The patient showed signs of improved active ROM of her hips and lower back, with no pain elicited throughout any movement. Due to the young age of the patient and the malleability of her spine, her mother opted to continue treatment encouraged by the initial positive outcome. The patient continued treatment on a less frequent basis.

A second re-assessment was performed after a further 33 treatments (57 treatments overall), over a further 8-months (11-months overall); whereas, the treatment protocols remained consistent with the exception that the patient discontinued performing the home exercises. The patient's improved active ROM about her hips and lumbar spine without pain remained. Follow-up lateral radiographs of the lumbar spine showed a further decrease in L1-L5 ARA lumbar lordosis of 7.1°, giving an overall change of 13.4° (−47.9° vs. −61.3°). There was also a further reduction in SBA of 6.5°, an overall change of 11.8° (40.4° vs. 52.2°) and a reduction in forward thoracic translation of 13.8mm, an overall 15.4 mm change (5.2 mm vs. 20.6 mm) (Table 1).

DISCUSSION

This case documents the non-surgical reduction in lumbar hyperlordosis, SBA and forward thoracic translation in a pediatric patient. The improved sagittal lumbopelvic alignment correlated with relief from low back and extremity discomforts.

The patient's LBP and secondary complaints (hip pain, knee pain, ankle pain and muscle weakness) were completely resolved as of the 57th treatment. It is likely the progressive reduction of subluxation in the spine led to the improvement in flexibility, consequently reducing muscle strain and tightness. Deformities affecting the lumbar spine may result in the impingement of major nerve branches from the lumbosacral plexus, these major nerves include the obturator and sciatic nerves. Impingement of these nerves may have been causing the muscular weakness in the lower limbs and was resolved as a result of realigning the spine.

Overall, after 11-months and 57 treatments this patient had a 13.4° reduction in hyperlordosis, a 11.8° reduction of SBA and a 15.4 mm reduction in forward thoracic translation. In comparison, Oakley et al.[9] reported on an 8° reduction in hyperlordosis, a 5° reduction in SBA and a 17.4 mm reduction in forward thoracic translation in an adult female after 74 treatments over a 13-month duration. Cardwell et al.[10] reported a 6° reduction in hyperlordosis and a 2° reduction in SBA in a 34-year-old male after 33 treatments over 9-months. Fedorchuk et al.[11] reported an 8° reduction in hyperlordosis in a 7-year-old male after 21 treatments over 7-weeks. This present case demonstrates the largest hyperlordosis reduction documented and serves as only the second report of the CBP rehabilitation for this spinal condition in a pediatric patient.

Recent randomized controlled trials have demonstrated the superiority of spine treatment programs that include customized treatment considerations by accounting for patient-specific biomechanical alignment from standing screening radiographs[17, 18]. These studies have shown that many conventional physiotherapeutic treatments only provide limited

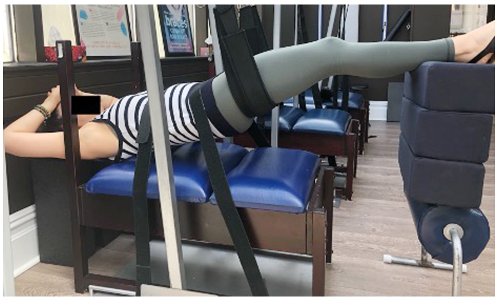

Fig. 3. Mirror image traction. See text for description.

Table 1. Radiographic metrics over treatment duration

	X-ray 1	X-ray 2	X-ray 3	Overall change
Date	04-12-2021	07-12-2021	03-16-2022	11 months
L1-L5 ARA (degrees)	−61.3	−55	−47.9	13.4
T12-S1 Translation	20.6 mm	19.0 mm	5.2 mm	15.4 mm
SBA (degrees)	52.2	46.9	40.4	11.8

symptomatic relief that regresses after treatment cessation[17–22]. This is true for applying extension traction to either the neck (e.g., Moustafa et al.[19, 20]) or the low back (Diab et al.[21, 22]) to restore its lordotic alignment. At this point in time there are no clinical trials documenting the reduction of lumbar spine hyperlordosis via CBP approaches, thus the few case reports that exist[9–11] are of disproportionate significance for the practitioner. This is because practitioners are heavily pressured to abide by spine care guidelines, however, when evidence is lacking, they must seek out lower forms of evidence including case reports.

Since most monotherapeutic low back treatments have limited effectiveness[23], more effective treatments are needed. The unique application of applying corrective spine procedures (i.e., mirror image exercises, traction, etc.) is a precise treatment approach for the patient diagnosed with lumbar spine hyperlordosis. Other popular treatment approaches, such as massage therapy, muscle stretching and mobilization, for example, may provide temporary relief but will not lead to spinal structural realignment as reported in the current case and for which has been shown to provide longer-term relief[17–22].

To apply CBP patient-specific customized treatment, radiographic screening and biomechanical assessment of the spinal parameters are essential. This raises the issue of radiation exposure to the patient, and in this particular case it is the pediatric patient. It should be known that much recent literature has brought light to the fact that low-dose radiation (plain film X-rays and CT scans) are not carcinogenic[24–26]. For this reason, as well as the fact that plain X-rays remain a most efficient method to screen and diagnose spinal biomechanical patterns[27], it is recommended that LBP patients, regardless of age are screened by X-ray for biomechanical assessment.

Limitations to this case is that it is only a single case. The similarity of structural correction in this case as compared to the few other reports documenting non-surgical reduction in lumbar hyperlordosis[9–11] shows promise that CBP methods employed to reduce lumbar hyperlordosis may be equally effective in adults and children. In fact, one issue that needs to be unveiled is what standard treatment protocol needs to be adopted for children vs. adults in the application of CBP methods considering their unique differences (i.e. flexibility, etc.). Indeed, further research is warranted for all age groups.

Conflict of interest

Dr. Paul Oakley (PAO) is a paid consultant for CBP NonProfit, Inc.; Dr. Deed Harrison (DEH) teaches chiropractic rehabilitation methods and sells products to physicians for patient care as used in this manuscript.

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