Case Study

Relief of exertional dyspnea and spinal pains by increasing the thoracic kyphosis in straight back syndrome (thoracic hypo-kyphosis) using CBP® methods: a case report with long-term follow-up

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Abstract. [Purpose] To present the clinically significant improvement of straight back syndrome (SBS) in a patient with spinal pain and exertional dyspnea. [Subject and Methods] A 19 year old presented with excessive thoracic hypokyphosis and other postural deviations. A multimodal CBP® mirror image® protocol of corrective exercises, traction procedures and spine/posture adjusting were given over an initial 12-week course of intensive treatment followed by a 2.75 year follow-up with minimal supportive treatment. [Results] The patient had significant postural improvements in all postural measures and specifically a 14° increase in the thoracic kyphosis that was maintained at long-term follow-up. The postural improvements were consistent with relief of exertional dyspnea and pain, as well as increases in both antero-posterior thoracic diameter and the ratio of antero-posterior to trans-thoracic diameter, measurements critical to the wellbeing of patients with SBS. [Conclusion] Long-term follow-up confirmed stable improvement in physiologic thoracic kyphosis in this patient. Nonsurgical correction in thoracic hypokyphosis/SBS can be achieved by mirror image traction procedures configured to flex the thoracic spine into hyperkyphosis as well as corrective exercise and manipulation as a part of CBP technique protocols.

Key words: CBP, Straight back syndrome, Exertional dyspnea

(INTRODUCTION

Straight back syndrome (SBS) was first described by Rawlings in 19601, 2). It is the congenital loss of the normal physiologic mid-upper thoracic kyphosis. This thoracic deformity biomechanically decreases the distance between the spine and sternum, compressing the internal structures, namely the heart. As Raggi et al. states: “the heart appears trapped in a chest cavity too small for its size, and its anatomic architecture is seemingly altered in an attempt to accommodate these insufficient dimensions3.”

SBS mimics congenital heart disease as it rarely presents without either false heart enlargement or mechanical heart murmurs3). The false enlarged cardiac sign on the PA chest radiograph, the so-called ‘pancake' cardiac silhouette configuration simulates cardiomegaly4), and the systolic murmurs can mimic atrial septal defect, idiopathic pulmonary artery dilation, or mild pulmonary stenosis5). Thoracic spine imaging including lateral thoracic radiography6, 7) or thoracic CT scanning3, 5) are diagnostic for SBS.

Although the diagnostic features of systolic murmur consistently present in patients with SBS and are considered benign in nature5), Spapen et al. has suggest that its association with mitral valve prolapse, a condition associated with significant morbidity and mortality may be underestimated5). The incidence of SBS is not known but is thought to be ‘not rare’5).
The surgical correction of thoracic hypokyphosis (lordotic thoracic kyphosis) has been described in the literature\textsuperscript{10–12} where it is only recommended for those having cardiopulmonary symptoms with severe structural thoracic lordosis of greater than 25–30°\textsuperscript{10}. The nonsurgical correction of thoracic hypokyphosis is very rare and we could only identify one case in the literature\textsuperscript{13}. Brooks et al.\textsuperscript{13} reported on the nonsurgical improvement in increasing thoracic kyphosis in a female patient having concomitant scoliosis. Treatment was over several years and involved deep tissue massage, outpatient psychological therapy, daily exercise focusing on mobilization of the chest wall, and manipulation. There was a 16° improvement in thoracic kyphosis and a greater than 10° reduction in scoliosis over a 4 year time span.

This report documents the increase in thoracic kyphosis in a patient having hypokyphosis/SBS and the improvement of various symptoms related to having thoracic and other spinal/postural deviations.

**SUBJECT AND METHODS**

A male patient aged 19 presented to a spine clinic in Boise, Idaho, USA. He reported to have a primary complaint of exertional dyspnea and a history of several lung collapses with surgical interventions. The patient also reported having neck, middle and lower back pain.

All directions of range of motion for the cervical and lumbar spine were decreased. There was a visual obvious ‘flat back’ throughout the thoracic spine that made the scapulae stick out. A full spine radiographic series was performed (Fig. 1). All radiographs were analyzed using the Harrison posterior tangent method for analysis of lateral images\textsuperscript{14–16} and the modified Risser-Ferguson method for the AP images\textsuperscript{17}. These methods are reliable and repeatable as is standing posture\textsuperscript{14–18}.

The patient was determined to have a complete loss of the normal cervical lordosis (C2–C7: −1° vs. normal −34 to −42\textsuperscript{19,20}), a reduced atlas plane line (APL) (−7° vs. normal −24 to −29\textsuperscript{19}), thoracic hypokyphosis (T3–T12: 14° vs. normal 37°\textsuperscript{21}), lumbar hypolordosis (L1–L5: −28° vs. normal −40°\textsuperscript{22}), reduced sacral base angle (SBA) (24° vs. normal 40°\textsuperscript{23}) (Table 1). The patient also had a decreased antero-posterior diameter (APD) of the thorax (80 mm vs. normal 142 mm\textsuperscript{19}) and a reduced APD to transthoracic diameter ratio (APD:TTD: 27% vs. normal 47%\textsuperscript{19}) (Table 1).

The patient was treated with Chiropractic BioPhysics® (CBP\textsuperscript{®}) technique\textsuperscript{24–27}. This technique involves the use of the mirror image\textsuperscript{9} concept developed by Dr. Don Harrison\textsuperscript{23}. ‘Corrective’ exercises, adjustments, and traction procedures are utilized stressing the patient in the mirror image, or opposite to the presenting posture and spinal pattern. Specifically, the patient was trained to perform thoracic hyperkyphosis exercises, where he was to posteriorly translate his thorax and hold for 30 seconds, taking 10 seconds break and repeating for 10 minutes (Fig. 2). The patient was treated in three different traction set-ups for 10 minutes each. The patient was put in a hyperkyphosis positioned traction due to the thoracic hypokyphosis.
Table 1. Postural sagittal curves, vertical axis, and thoracic diameter values as measured initially, at 3 months and at 2.75 months follow-up

| Values       | Normal | Initial | 3 m° follow-up | 2.75 yr follow-up |
|--------------|--------|---------|----------------|-------------------|
| APL (C2–C7) | −29°   | −7°     | −28°           | −28°             |
| ARA (C2–C7) | −(34−42)° | −1°   | −30°           | −22°             |
| Tz (C2–C7)  | −(0–15) mm | 13 mm | 0 mm           | 4 mm             |
| ARA (T3–T10)| −37°   | 14°     | 28°            | 27°              |
| ARA (L1–L5) | −40°   | −28°    | −38°           | −29°             |
| Tz (T12–S1) | 0 mm   | 4 mm    | −14 mm         | −16 mm           |
| SBA          | 40°    | 24°     | 40°            | 40°              |
| APD          | 142 mm | 80 mm   | 92 mm          | 110 mm           |
| APD:TTD     | 47%    | 35%     | 48%            |                  |

APL: atlas plane line; ARA: absolute rotation angle; Tz: horizontal translation; SBA: sacral base angle; APD: antero-posterior diameter; APD:TTD: ratio of antero-posterior to trans-thoracic diameters.

(Fig. 3); a hyperlordosis positioned cervical extension traction due to the straight neck\textsuperscript{25,27} (Fig. 4); and a lumbar hyperlordosis extension traction due to the lumbar hypolordosis\textsuperscript{26,28–31} (Fig. 5). Spinal manipulation and mirror image posture adjustments were also performed.

The patient received 37 treatments over approximately 3 months. Following this, the patient continued at approximately 1 time per month for a year before discontinuing care. A follow-up assessment was also performed at 2 years and 9 months after initial presentation, and the patient consented to publication.
RESULTS

Upon re-assessment after 37 treatments over the course of 12 weeks, the patient reported substantial decreases in pain throughout the back and neck as well as significant improvement in the primary complaint of exertional dyspnea.

The patient also demonstrated improvements in virtually all posture measurements as measured from radiographs (Fig. 1; Table 1). The patient had a 14° increase in thoracic kyphosis (28° vs. 14°), a 29° increase in cervical lordosis (−30° vs. −1°), an increase in APL (−28° vs. −7°), a decrease in forward head posture (0 mm vs. 13 mm), a 10° increase in lumbar lordosis (−38° vs. −28°), and an increase in SBA (40° vs. 24°). The measures directly related to SBS both improved, the APD increased by 12 mm (92 mm vs. 80 mm), and the APD:TTD ratio improved by 8% (35% vs. 27%).

The long-term 2 year, 9 month follow-up after twelve further treatments demonstrated that symptomatic improvements were stable as the patient remained well. Follow-up radiographic assessment showed a general maintenance of most postural measures with the exception of some loss of lumbar lordosis (Table 1). Of note, the APD and APD:TTD ratio continued to improve (Table 1).

DISCUSSION

This report demonstrates the improvement in thoracic hypokyphosis in a patient having many postural and spine deviations including SBS suffering from back and neck pains and exertional dyspnea.

Considering the lack of literature on SBS disorder and the even greater lack of evidence of nonsurgical correction of this disorder13, this case reveals that a posture-specific intensive program of mirror image directed traction, exercises, and adjustments may be successful in correcting thoracic hypokyphosis in a subgroup of SBS cases. Several recent reports have revealed that Harrison’s mirror image approach to postural disorders are successful at correcting many postural faults including lumbar hypolordosis28–31, cervical hypolordosis27, 32–35, and thoracic hyperkyphosis6–38.

The 2.75 year follow-up assessment revealed that virtually all of the postural measures were maintained with minimal treatment, particularly the increase in thoracic kyphosis. Of note was the continued improvements in both the APD and the ratio of APD:TTD. Thus, human posture seems relatively stable as has been demonstrated in several clinical trials27–34. Further, the continued improvements in thoracic dimensions may indicate that once an individual’s posture is corrected to within a certain threshold, homeostasis and healing will continue.

Although surgical procedures are available for excessive thoracic lordosis10–12, it is suggested that nonsurgical approaches be employed when there is obvious thoracic hypokyphosis that precipitates surgical urgency. Harrison’s mirror image application of corrective exercises and postural traction procedures may be the panacea for postural disorders as postural-specific treatments are now showing superiority over generalized treatments for the same patient population including treatment for correction of scoliosis39, 40, cervical lordosis33, 34, and lumbar lordosis29–31.

Long-term follow-up confirmed stable improvement in physiologic thoracic kyphosis in this patient. Nonsurgical correction in thoracic hypokyphosis/SBS was achieved by traction procedures configured to flex the thoracic spine into hyperkyphosis as well as exercise and manipulation as a part of CBP technique methods. One important aspect of this case is that the adjacent and opposite curves of the spine, cervical and lumbar lordoses were simultaneously treated along with increasing the thoracic kyphosis; this may be an essential element to achieve success in changing the thoracic alignment in those with SBS.

The limitations to this study are that it is a single case; there was no CT scan data that would have offered more detailed information related to SBS; finally, several procedures were performed including exercise, traction and manipulation. Manipulation has been shown to not affect the spinal configuration41, 42. Exercise, particularly custom, patient-specific exercise may have contributed to the correction achieved, as well as the traction. Further studies should be done to verify the results obtained in this case and to distinguish the contribution of the exercise from the contribution of traction.

Conflict of interest

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

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