Brace Treatment Resulting in Overcorrection of Adolescent Idiopathic Scoliosis

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abstract

Brace treatment for idiopathic scoliosis in skeletally immature children is the only effective nonoperative modality for the control of curve progression. The Charleston bending brace is a custom-molded spinal orthosis that holds the patient in a completely corrected or overcorrected position while worn at night.

A 9-year-old girl presented with 10° right upper thoracic and 7° left lower thoracic curves and was Risser sign 0. Nighttime treatment with a Charleston bending brace was initiated when the left lower thoracic curve progressed to 19°. After 27 months of nighttime brace wear, the lower thoracic curve was 21° to the right. Further investigation, including magnetic resonance imaging of the spine, failed to diagnose an identifiable explanation for this atypical occurrence. Conservative treatment may improve radiographic and cosmetic appearance. Overcorrection of the curve, although not likely, is possible when part-time or nighttime bracing is implemented as a means of conservative management.

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Figure: Posteroanterior radiograph after 27 months of Charleston bending brace wear showing a 21° convex curve to the right lower thoracic curve.
The Charleston bending brace is an alternative to the traditional full-time orthosis for the treatment of progressive scoliosis deformities. It is worn at night and imposes a supine side-bending force to correct the major scoliosis curve. Reports on the management of thoracic and lumbar curves have documented the efficacy of this nonoperative treatment method, with success reported as preventing progression of the curves in up to 60% of patients.\textsuperscript{1,3} This article describes a case of a skeletally immature girl who was managed with a Charleston bending brace and developed an over-correction of her scoliotic curve shortly thereafter.

**Case Report**

A 9-year-old girl presented for evaluation of a spinal deformity noted on a well child examination. A full-length standing posteroanterior scoliosis spine radiograph obtained in February 2005 demonstrated spinal asymmetry, a 10° right upper thoracic curve (apex T6), and a 7° left lower thoracic curve (apex T11). A lateral spine radiograph was normal other than hypokyphosis typical of an idiopathic curve. The patient was Risser sign 0, and the tri- radiate cartilage was open.

Two years later, in April 2007, the apex left lower thoracic curve measured 19°, and she remained Risser sign 0 (Figure 1). The progressive left thoracic curve was atypical, prompting spinal magnetic resonance imaging (MRI) prior to the initiation of brace treatment. Magnetic resonance imaging of the entire spine was normal other than the scoliosis. Due to the progression, a nighttime Charleston bending brace was prescribed. Radiographs in the brace demonstrated complete curve correction (Figure 2).

After 7 months of nighttime brace wear, the upper thoracic curve was 10° to the right and the lower thoracic curve was 12° to the left; she was still Risser sign 0. The patient was evaluated by clinical examination and radiographs 2 months after the start of brace wear and at 6-month intervals thereafter. Initial in-brace radiographs 2 months after starting brace wear demonstrated overcorrection of the left thoracic curve to 10° in the opposite direction, which has been previously felt to be a desirable scenario with use of a part-time Charleston bending brace.\textsuperscript{1,2} The parents and the patient confirmed that she was compliant and wore the brace for at least 28 nights per month, and for an average of 7 to 8 hours per night. After 27 months of treatment, the lower thoracic curve, which was originally convex left, was now convex right and measured 21°, indicating that the brace had maintained her correction and had overcorrected her spinal curvature (Figure 3). That radiograph was taken early in the morning, shortly after removing her Charleston bending brace. She was Risser sign 1, and brace wear was discontinued.

In March 2010, 6 months after stopping brace treatment, the patient was Risser sign 3, and the lower thoracic curve was 31° convex right (opposite original curve). A new nighttime Charleston bending brace correcting in the opposite direction of the original brace was started to treat the convex right curve. Repeat MRI of the spine was normal. Radiographs in the new brace demonstrated complete correction of the convex right lower thoracic curve. Standing posteroanterior radiographs in June 2011 demonstrated a 31° convex right curve, and she was Risser sign 4 (Figure 4). She is continuing with nighttime bracing.

**Discussion**

Different brace treatments have been used for the treatment of progressive scoliosis in skeletally immature individuals. The standard goal of brace treatment prevents further curve progression. To our knowledge, no other reports exist of permanent overcorrection of scoliosis with use of a brace exist.

Braces are designed to apply an external force to the trunk that will be transmitted to the spine. Several types of braces exist, each unique in design, curve treatment method, and prescribed wear schedule. The Charleston bending brace is a custom-molded spinal orthosis that attempts to hold the patient in an overcorrected position.\textsuperscript{4} The patient is positioned in a side-bending position opposite the curvature, and a corrective force is applied at the apex of the curve. The Charleston bending brace is intended to be a nighttime brace only.

Several studies have documented the efficacy of the Charleston bending brace as halting curve progression; success has been reported as the avoidance of surg-
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Demonstrated that 83% of also documented that a thoracic curve. 5°, compared with 43% of those treated with the Boston brace. According to the Hueter-Volkmann principle, compressive stresses slow growth, and tensile stresses stimulate growth. The brace could apply the stimulus to modify the growth of the scoliotic portion of the spine. In a similar fashion, the Charleston bending brace may have a negative effect on the compensatory curves, causing them to progress. Price et al demonstrated that asymmetrical loads of the vertebral endplates while in the Charleston brace could cause unwanted forces on the secondary compensatory curves, possibly pushing the compensatory curve to progression. Price et al recommended diligent observation of any compensatory curvatures of the spine when using the Charleston bending brace. We reported that the primary curve may also achieve a permanent overcorrected position with the implementation of nighttime bracing, and this treatment complication should be monitored for when using a hypercorrective night brace.

**REFERENCES**


