Spine Deformity
www.spine-deformity.org

Spine Deformity 6 (2018) 514–522

Case Series

Effect of the Chêneau Brace in the Natural History of Moderate Adolescent Idiopathic Scoliosis in Girls: Cohort Analysis of a Selected Homogenous Population of 100 Consecutive Skeletally Immature Patients

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Received 12 August 2017; revised 27 January 2018; accepted 28 January 2018

Abstract

Study design: A series study.
Objectives: To evaluate the relationships between the effectiveness of brace in reduction of scoliosis angle, axial trunk rotation (ATR), and patients' compliance, in skeletally immature females with moderate adolescent idiopathic scoliosis (AIS), treated with Chêneau brace for a minimum of three years.
Summary of Background Data: According to some authors, braces are ineffective, whereas others find that braces stop scoliosis progression and that the outcome has been related to patient's compliance.
Methods: From the 100 patients who were initially recruited, 88 patients were included in the final analysis. The average ± SD primary scoliosis angle before brace application was 36.8° ± 9.9°, 32.7° ± 6.3°, and 33.5° ± 11.5° for major thoracic, thoracolumbar, and lumbar curvatures, respectively. All patients were aged ⩾10 years at treatment initiation, and their Risser index varied from 0 to II. Eighty-eight patients were followed for at least three years with brace treatment, whereas 43 patients were reevaluated 31 ± 7 months after brace weaning. In baseline and while in brace, the scoliosis Cobb angle, Risser index, menarche age, ATR, and patient's compliance were recorded.
Results: In the 88 patients, the brace reduced the major thoracic, thoracolumbar, and lumbar scoliosis one month after brace onset while "in brace" to 26° ± 11° (29% ± 18%, p = .0006), 23° ± 8° (31% ± 20%, p = .00001), and 24° ± 11° (34% ± 21%, p = .00043), respectively; thereafter, no significant decrease of the curves was recorded. Total bracing time averaged at 45 ± 19 months (range 36-96) and brace weaning averaged at 17 ± 2 years (range 15-19). Six of the 88 (6.8%) individuals underwent surgery for scoliosis progression.
In the 43 patients who were reevaluated 31 ± 7 months after brace weaning, scoliosis angle and ATR increased insignificantly, compared to the three years' values.
Conclusions: Chêneau orthosis reduced while "in brace" AIS in girls with sufficient compliance, with a low rate (6.8%) of patients who underwent surgery.
Level of Evidence: Level 3.

Keywords: Chêneau; Brace; Adolescent idiopathic scoliosis; Axial trunk rotation; Compliance

Introduction

Some authors have shown that braces are ineffective in changing the natural course of adolescent idiopathic scoliosis (AIS), whereas others believe that brace stops the progression of scoliosis [1,2]. Randomized multicenter studies [3] have confirmed that brace treatment can help

Author disclosures: PK (none), VS (none), VT (none), KV (none), PF (none). IRB approval: This study was reviewed and approved by the General Hospital of Patras Ethics Committee # 1_13/06/2012.

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https://doi.org/10.1016/j.jspd.2018.01.006

decrease the progression of scoliosis to the threshold for surgery. Brace treatment outcome has been linked to patient's compliance. Some authors [4,5] reported a direct relationship between outcome and patient's compliance with brace treatment for AIS. Weinstein et al. [3] showed an association between patients' compliance suffering from AIS and the likelihood of a successful outcome. Landauer et al. [4] underlined the importance of compliance, showing patients suffering from AIS with good initial correction can expect a final 7° improvement in the Cobb angle. However, bracing may be a stressful and traumatic experience for adolescents, and compliance with an orthotic treatment protocol likely depends on the patient's physical, emotional, and social well-being.

Nonetheless, researchers have shown that the best guideline for predicting the results of brace treatment is the response of the spinal curve to the brace, especially during the first year of treatment. The effectiveness of brace treatment therefore should be evaluated within the in-brace correction.

This study was designed on a prospective basis to explore potential correlations between patients' compliance, reduction of scoliosis while "in brace," and axial trunk rotation (ATR) by the Chêneau orthosis over a minimum of a 3-year period and then after a minimum of 24 months after brace weaning.

Materials and Methods

In this study, 100 consecutive female adolescents with AIS, aged ⩾10 years at the start of the brace treatment, were recruited for bracing. Thirty-four (34%) subjects had Risser 0 skeletal maturity, 18 (18%) had Risser I, and 48 (48%) had Risser II maturity at baseline. The onset of menarche was reported by the age of 12.7 ± 1.02 (range 10–14 years; Table 1). There were 27 thoracic, 60 thoracolumbar, and 13 primary lumbar scoliosis curves (Table 1).

Table 1
Cumulative data on 100 consecutively recruited patients with adolescent idiopathic scoliosis treated with Chêneau brace.

Age at orthosis start, years (range)	12.6 ± 1.4 (10–14)
Age at onset of menarche, years (range)	12.7 ± 1.02 (10–14)
Risser sign at orthosis start, n (%)	
0	34 (34)
I	18 (18)
II	48 (48)
Thoracic curve pre-brace in 27 subjects (Cobb angle), degrees	34.5 ± 7.6
Thoracic ATR* in 27 subjects, degrees	9 ± 3
Thoracolumbar curve pre-brace in 60 subjects (Cobb angle), degrees	30.2 ± 5.1
Thoracolumbar ATR* in 60 subjects, degrees	8 ± 3
Lumbar curve pre-brace in 13 subjects (Cobb angle), degrees	31.3 ± 9.4
Lumbar curve ATR* in 13 subjects, degrees	7 ± 4

ATR, axial trunk rotation.
Values are mean ± standard deviation unless otherwise noted.
* Maximum ATR measured with scoliometer.

None had undergone prior orthosis or other treatment for scoliosis. A generic thoracolumbosacral orthosis (TLSO, underarm orthosis), named Chêneau brace, was used for major thoracic scoliosis curves with curve apex below T8, in the thoracolumbar and/or lumbar region. The indication for bracing was a major scoliotic curve >20° with an observed progression of 5° between two consequent observations and skeletal maturity of Risser index II or lower. The maximal ATR was measured at the apex of the scoliosis by an experienced spine surgeon (V.S.) using the OSI Scoliometer (Orthopaedic System Inc, USA), which is a nonradiative, inexpensive, method that, although not a generally accepted for measuring scoliosis, accurately measures the maximal degree of trunk rotation [6,7].

In this article, *compliance* refers to patients' compliance with brace wearing under the supervision of their parents: brace wearing for 23 hours daily is considered as 100% compliance. No pressure pads or other direct bracing measuring devices were used in this study to justify the reported brace compliance.

The wearing of the brace was assessed by one orthopaedic surgeon (V.S.) and scored on a standardized form that was based on questioning the patient and the parents. A team comprising one spine surgeon (V.S.) and an experienced orthotist (K.V.) was responsible for brace fit and informing the young patient and parents about the brace wear. Patients were advised to participate in sports and ordinary physical activity at school. The effectiveness of the Chêneau brace on improving coronal radiographic and ATR parameters, in correlation with patients' compliance and skeletal maturity (Risser index) plus menarche status (pre- and postmenarche) on treatment commencement, were assessed over the first 3 years of bracing initiation. The approval of the study was obtained from the IRB at the authors' institution. Anteroposterior and lateral standing radiographs were taken with a full-body cassette before brace application at baseline and thereafter while in brace, until brace weaning. The patients were estimated one month after the application of the brace with the aforementioned radiographs wearing the brace, if the patient had reached full compliance, and then every 6 months until brace weaning. The purpose of this study was to prospectively evaluate, in a 3-year period, the association between compliance with Chêneau orthosis wear and reduction of the scoliosis curve while "in brace," reduction of ATR, skeletal maturity, and menarche status in consecutive selected adolescent female patients with moderate idiopathic scoliosis. The above parameters were measured and recorded at each visit, but roentgenograms were taken one month after brace commencement and then once per six months in-brace and after a minimum of 24 months after brace weaning.

From 100 patients with AIS who were initially enrolled in the study to be treated with Chêneau orthosis, 12 patients