

# Radiological and cosmetic improvement 2 years after brace weaning—a case report

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Accepted for publication: 29 September 2003

**Keywords** Adolescent idiopathic scoliosis, Rigo-system Chêneau (RSC) brace, physiotherapy, cosmetic improvement, curve correction

## Summary

In the early international literature, up to now only very few cases are reported with adolescent idiopathic scoliosis (AIS) and a significant improvement of Cobb angle after conservative management. In the recent literature the possibility of an improvement of Cobb angle at skeletal maturity after brace treatment is mentioned no more. The application of physiotherapy and braces is widely rejected while the standards of conservative measures differ greatly worldwide. So it seems necessary more than ever to present the possibility of successful conservative measures nowadays. More detailed case reports with long-term follow-up using defined protocols are needed to provide appropriate standards for replication by others. The purpose of this presentation is to demonstrate the possibility of significant improvement of curvature angle and cosmesis after the application of long-term physiotherapy and brace treatment in a girl with a curve of more than 50° where spontaneous resolving is not usual. A pre-menarchial girl (although being Risser 2) with a Cobb angle of 53° was treated by exercises and curve-specific bracing for more than 3 years. Two years after the start of the weaning period, the Cobb angle was 36° with a marked and stable cosmetic improvement at the age of 18 years. This case report shows that conservative treatment can improve both cosmesis and curvature in immature patients with AIS. The results of such treatment is appreciated by the patients because of the significant reduction of the truncal deformity as documented by surface topography.

## Introduction

In 1987 Nachemson and La Rocca [1] suggested following Blochs criteria [2] with regard to study design

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and study evaluation of clinical investigations. The latter author has published the criteria described below to support the evaluation of studies about the treatment of low back pain. So an instrument was developed to justify the conclusions from studies of different study design. Case reports allow the conclusion that the phenomenon described exists; case series show that the phenomenon described is not unusual; cohort studies and case control studies allow a conclusion; but randomized controlled studies allow a quantitative judgement in its strictest form.

The effectiveness of brace treatment is still a subject of discussion. While bracing concepts published in the international literature up to now do not seem to change the incidence of surgery in patients with adolescent idiopathic scoliosis (AIS) [3, 4], there is evidence that treatment strategies with braces and physiotherapy of a different standard of excellence do so [5]. While there is little description [6, 7] of curvature improvements of > 5° 2 years after brace weaning in American cohort studies published recently [8–14], improvements of > 5° are described for patients with a primary correction in the brace of at least 40% and with good compliance [15–18].

While the brace is regarded effective if the curve does not increase to more than 10° after weaning at some places in the USA [19, 20], European braces are regarded effective when there is no progression at all [16–18, 21, 22].

Many reports on bracing in the recent US literature do not report the primary correction effect in the brace [10, 11, 13, 14, 23]. But without any measure for the quality of the treatment applied, the studies are not comparable and the conclusions drawn remain assumptions. Even if the progression may be reduced by American braces [6], cosmetic appearance and the rib hump may not always be influenced positively, nor may a successful course as shown by X-ray always be appreciated as a successful treatment by the patient [24].

To our knowledge, until now no case is presented with a significant improvement of Cobb angle *and*

cosmesis. On the contrary, the effectiveness of brace treatment seems to be questioned even more [3]. In a reply to a letter to the editor [25] the authors state: ‘best efforts are still devoted to putting nonprogressive and skeletally mature adolescents into uncomfortable orthoses and calling it successful treatment’ [26]. This applies to braces of lower standard that do better the older the patient treated is [20]. Contrary to that, best efforts in a brace according to higher standards of excellence are devoted to skeletally immature patients [21, 22].

The purpose of the following case report is to show that curvature correction *and* significant improvement of the trunk deformity can be achieved when physiotherapy and braces of a certain standard are applied.

**Case report of a girl with AIS of 53° Cobb treated with a Rigo-System Chêneau brace (RSC-Brace) and Schroth exercises**

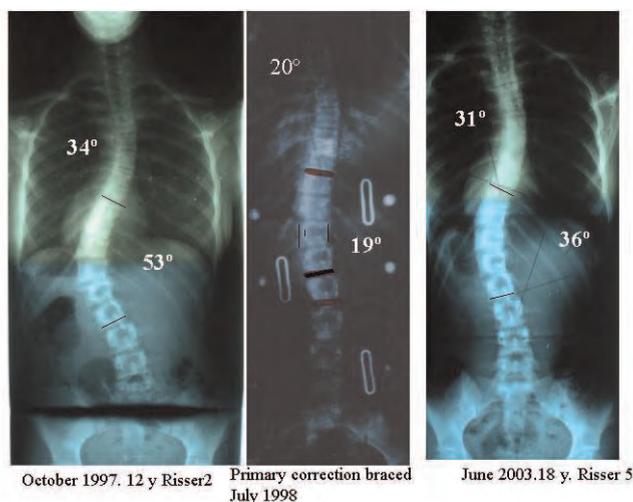
The patient is a girl aged 12 years, 10 months who attends our rehabilitation clinic in Barcelona for clinical evaluation and medical counsel. She was diagnosed 1 month before her first consultation at our centre as suffering from AIS. A standard anterior-posterior radiograph showed a left convex thoracolumbar curve of 53° Cobb (> 30° rotation-Perdriolle), combined with a secondary right thoracic curvature of 34° Cobb (figure 1). Initial evaluation evidenced no neurological abnormalities or specific signs suggesting other aetiolo-

gies than idiopathic. Height and weight were 152 cm and 41.5 kg respectively. The scoliometer value at the thoracolumbar region was 17° taken in a forward-bending position (0° at main thoracic area). Back asymmetry and imbalance was notable (figure 3). A formetric picture (figure 4) showed a trunk imbalance of 21.7 mm to the left, with 13.8 mm of lateral deviation (rms) and 4.8° of rotation (rms). She had a pre-menarchial status even though she was Risser 2 in her last X-ray.

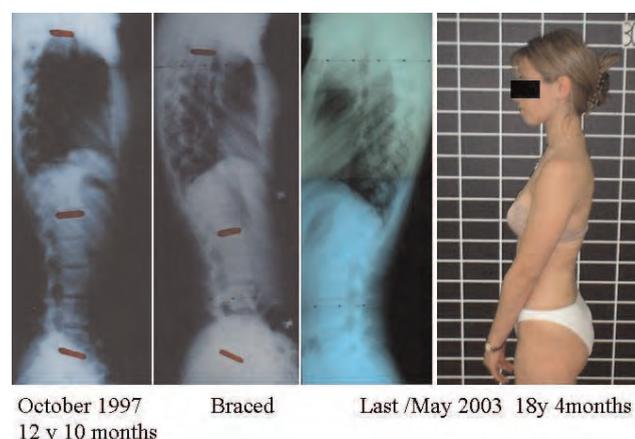
Her orthopedic surgeon recommended an operation as the treatment of choice but she refused it. She was braced first using a Classical Chêneau brace [27] with a poor primary correction effect (the main curve just dropped down to 45° Cobb, 25° Perdriolle, increasing the upper thoracic secondary curve). She had her first menstruation at 13 years, 0 months. It was decided to start an intensive scoliosis out-patient rehabilitation programme of 40 sessions (2 hours per session) immediately, according to the protocol of the Asklepios Katharina Schroth Centre.

A second brace (figure 3), very close in time with the first one, was designed by the author according to the modified principles of the Rigo-System Chêneau brace (RSC-Brace) [28]. Primary correction was then excellent, dropping the main curvature down to 19° Cobb (10° Perdriolle) and the secondary thoracic to 20° Cobb (figure 1). Sagittal alignment also was improved with the brace (figure 2).

In February 2001, 3 years and 3 months after we started treatment, the girl was Risser 4 and compliant (wearing the brace for 23 hours per day). We decided to start the weaning phase and to reduce the treatment

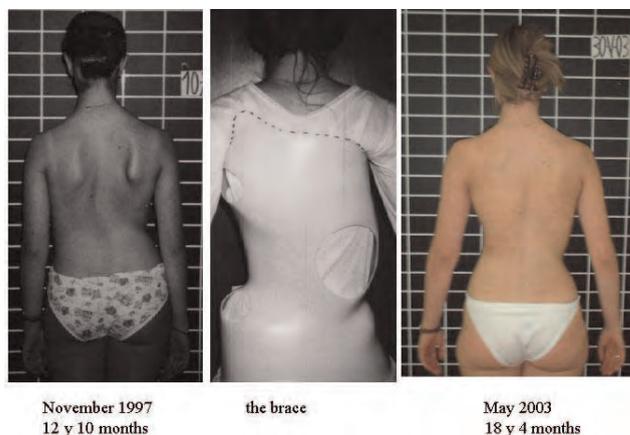


**Figure 1** Pre-treatment standing radiograph showing a 53° Cobb left convex thoracolumbar scoliosis corrected temporarily by the brace to 19° Cobb. Almost 2 years after to start of the weaning period she has a stable scoliosis 36° Cobb.



**Figure 2** Standing lateral radiograph pre-treatment, with the brace and after the treatment. No deterioration of the sagittal profile was produced by the brace. Posture and sagittal profile of the girl is normal.

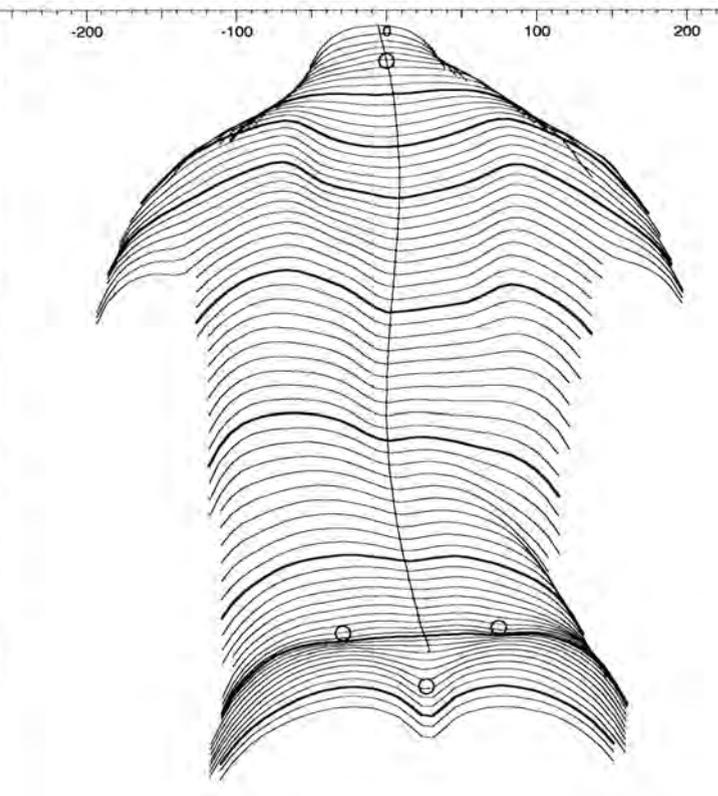
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**Figure 3** Dorsal view of the girl when she was first evaluated. Back asymmetry and trunk imbalance to the left is notable. The brace was specially designed considering her scoliosis pattern in order to achieve the best spinal correction by using specific pads and rooms. Back shape and trunk imbalance is still corrected 2 years after ending the treatment.

time to 16 hours first and to 8 hours afterwards. Six months later she had a stable scoliosis of 34° Cobb and 31° Cobb, thoracolumbar and thoracic respectively. She was asked to leave the brace and to follow a short routine of exercises at home. In June 2003, almost 2 years after the start of the weaning period, a new AP radiograph showed a stable thoracolumbar curvature of 36° Cobb (20° Perdriolle) combined with a thoracic curvature of 31° Cobb at Risser 5, which can be considered the end result (figure 1). Sagittal profile has not been significantly deteriorated (figure 2). New photos and formetric picture show a notable improvement of the back shape, posture and trunk balance (figures 3 and 4). The patient's last recorded height was 157cm and weight 46 kg. The scoliometer value was 6.5° at the thoracolumbar region (0° at thoracic). She is not referring pain and just when she feels overloaded after an exhaustive day she eventually uses her brace to sleep.

| JENOPTIK *** formetric                                  |                       |
|---|-----------------------|
| INSTITUTO ELENA SALVA - BARCELONA Tel/Fax: 93-20 91 330 |                       |
| Name:   | [REDACTED]            |
| First name:   | [REDACTED]            |
| born  | 18.01.85              |
| Rec. No.:   | 4488                  |
| Date:   | 10.11.97              |
| trunk length VP-DM                                      | = 388.2 mm            |
| trunk length VP-SP                                      | = 456.0 mm            |
| dimple distance DL-DR                                   | = 103.5 mm            |
| trunk imbalance (VP-DM)                                 | = -21.7 mm            |
| trunk imbalance (VP-DM)                                 | = -3.2 °              |
| pelvis tilt (DL-DR)                                     | = 4.0 mm              |
| pelvis tilt (DL-DR)                                     | = 2.2 °               |
| pelvis torsion (DL-DR)                                  | = 3.7 °               |
| error of axes (VPDM/DLDR)                               | = 1.0 °               |
| lateral deviation (rms)                                 | $\sigma x = 13.8$ mm  |
| lateral deviation (max)                                 | $\delta x = -23.2$ mm |
| rotation (rms)  | $\sigma r = 4.8$ °    |
| rotation (max)  | $\delta r = 6.9$ °    |



**Figure 4** Formetric picture showing back shape and the spinal midline virtually reconstructed. After the treatment lateral deviation has improved highly significantly, surface rotation has not changed and sagittal profile seems to be just more vertical. In cases of treated patients showing no impressive change in back symmetry, the symmetry line is not really on the spine itself and the surface rotation graphic and lateral projection result as artefact. Radiograph in figure 2 shows the true shape of the spine in the lateral plane and figure 1 also shows rotation to be improved.

| Institute E. Salva Dr. Manuel Rigo |                |          |            |
|------------------------------------|----------------|----------|------------|
| name:                              |                |          |            |
| first name:                        |                |          | ♀          |
| born                               | 18.01.1985     | code:    | 1001       |
| record:                            | 21:42:50       | date:    | 01.06.2003 |
| trunk length VP-DM                 | =              | 442.0 mm |            |
| trunk length VP-SP                 | =              | mm       |            |
| dimple distance DL-DR              | =              | 104.7 mm |            |
| trunk imbalance VP-DM              | = L            | 7.3 mm-  |            |
| trunk imbalance VP-DM              | = L            | 0.9° -   |            |
| pelvic tilt DL-DR                  | = L            | 4.0 mm-  |            |
| pelvic tilt DL-DR                  | = L            | 2.2° -   |            |
| pelvic torsion DL-DR               | =              | -0.9°    |            |
| error of axes VPDM/DLDR            | =              | 3.1°     |            |
| lateral deviation (rms)            | $\sigma x$ =   | 4.1 mm   |            |
| lateral deviation (max)            | $\delta x$ = L | 7.4 mm-  |            |
| surface rotation (rms)             | $\sigma r$ =   | 5.8°     |            |
| surface rotation (max)             | $\delta r$ =   | 11.8°    |            |
| rel. spine length (cf. Weiss)      | =              | 1.011    |            |

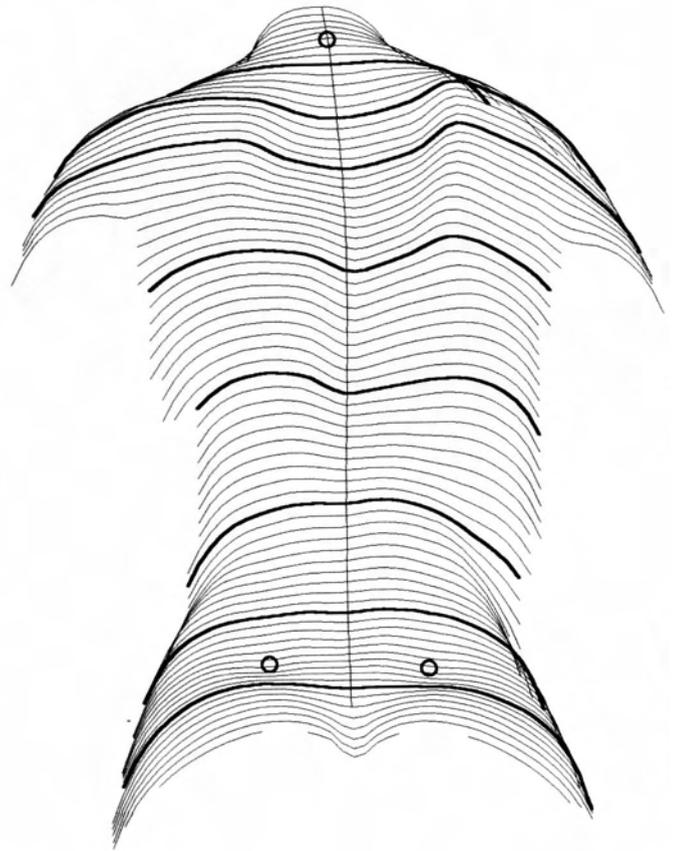


Figure 4 Continued.

The sagittal Cobb angles were: pre-treatment: 15° thoracic kyphosis, -25° lumbar lordosis (clear thoracic hypokyphosis and lumbar hypolordosis); in-brace: 23° and -37° respectively; and at follow-up: 19°, -35° respectively.

### Discussion

Initial in-brace correction was noted to be superior for lumbar and thoracolumbar curves in one of the few well-documented papers [6]. So it is reasonable to assume that also the curve of the patient from this case report should be corrected more easily than a patient with a thoracic or double major curve pattern. However Emans *et al.* found that 'the three patients with pre-brace curve values exceeding 50° failed treatment and required surgery before the end of bracing' [6]. Thus, the prognosis of any curve pattern with more than 50° has to be regarded as poor.

Loss of correction after brace weaning is somewhat greater for curves with pre-brace values greater than 30° with a strong coefficient of correlation [6]. Our patient had a loss of correction from initial in-brace correction until weaning, but the curve remained stable after weaning until the last follow-up. There was no deterioration of the sagittal profile by the brace applied.

This case report shows that, contrary to the paradigm in the international literature, an improvement of both cosmesis and curvature is possible in immature patients with AIS when conservative treatment of a certain standard is applied. The results of such treatment are appreciated by the patients because of the significant reduction of the truncal deformity as demonstrated by surface topography.

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