



Bracing can lead to a persistent correction in the treatment of Adolescent Idiopathic Scoliosis: A case report

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Abstract

Introduction

Brace treatment during the growth spurt is the primary treatment for patients with scoliosis. The standard of bracing worldwide varies. Patients cannot rely on a certain standard of application among practitioners. From evidence available in literature it has been determined that braces effectively stop curvature progression and some even improve trunk deformity. However, questions still remain about stabilization in the long term. The aim of this case report is to show a case with lasting clinical and radiological correction over time, after weaning.

Case report

A girl with AIS was treated with a Chêneau light brace starting in 2005. At the start of treatment she was 11 years old, Tanner stage was 2 and the Cobb angle of the single thoracic curvature was 38°. After two years of treatment the brace had to be renewed. In the x-ray taken prior to the adjustment of the new brace Cobb angle measurement was 19°. Weaning began at the age of 15 as there was no residual growth expected. Cobb angle at weaning was 14°. Recently, the patient presented at the age of nearly 21 years, five and a half years after brace weaning. There was no change with respect to trunk deformity when compared to the intermediate result achieved 2007. Final Cobb angle was 19°, half of the Cobb angle at the start of treatment. The patient has full functionality and is highly satisfied with the end result.

Conclusion

Bracing scoliosis may be highly efficient and is supported by scientific evidence. Bracing according to the cutting-edge developments can improve the angle of curvature as well as the trunk deformity. Bracing according to cutting-edge developments are able to lead to relevant and lasting improvements of Cobb angle as well as trunk deformity in the long-term.

Introduction

Scoliosis is regarded as a three-dimensional (structural) deformity of the spine and trunk. In a real structural scoliosis, there is usually a certain amount of spinal torsion and a disturbance of the sagittal profile coupled to the lateral deformation. Therefore, scoliosis must be more accurately regarded as a three-dimensional deformity of

the spine and trunk, which may progress quickly during periods of rapid growth.^{1,2,3,4,5,6}

Although scoliosis may be an expression or a symptom of certain diseases, (e.g. neuromuscular, congenital, due to certain syndromes or tumours), the majority of the patients with scoliosis (80 – 90%) are “idiopathic” (Infantile Idiopathic [IIS], Juvenile Idiopathic Scoliosis [JIS] with the majority having Adolescent Idiopathic Scoliosis [AIS]) because a certain underlying cause is not apparent.^{1,6}

Treatment indications for scoliosis are usually dependent on the magnitude of the curvature at presentation and the maturity of the patient.^{6,7}

Treatment of scoliosis historically consists of:

1. Observation in mild curvatures during growth.
2. Physiotherapy in moderate curvatures during growth and for curvatures exceeding 35° after growth.
3. Brace treatment in curvatures exceeding 20° during growth.
4. Spinal fusion surgery.^{4,6}

Long-term follow-ups of untreated patients with AIS indicate that the consequences of AIS over a lifetime are minimal, sometimes moderate in more severe cases, however, never life threatening.⁸ Meanwhile there is evidence for the application of correcting exercises and braces on a higher level (Cochrane reviews and randomized controlled trials)^{9,10,11,12} as well as evidence for successful conservative treatment of curvatures exceeding 50°¹³. Evidence for a beneficial effect after scoliosis surgery has still not been established.^{14,15,16,17,18}

Long-term rates of complication after spinal fusion is high and estimated to exceed 50% due to recent research.^{19,20,21} Brace treatment during the growth spurt is the primary treatment⁷ while physiotherapy as treatment plays a very important role during phases of minimal growth as well as in the adult population with scoliosis when the most recent standard is applied.²²

Bracing standards worldwide vary significantly. Patients cannot rely on the standard of application among practitioners (Figure 1 & Figure 2). Recent literature demonstrates a wide variety of braces presented as ‘state of the art.’ Of those, many lack evidence of effectiveness, but others do correct the deformity and change the natural history a patient might expect when left untreated.²³

The asymmetric Chêneau brace, when applied appropriately, has the very best in-brace corrections compared to symmetric braces.²⁴ The most recent developments of the Chêneau brace are the Chêneau light

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brace^{25,26} and its successor, the Gensingen brace.^{24,27} The latter braces lead to the highest rate of success. While the American standard of TLSO braces¹² has a success rates of 72%¹², an average German standard²⁸ is 76%, while the most recent standard of braces²⁶ has been proven effective at a rate exceeding 95%.

From the evidence available in literature we may conclude that braces effectively stop curvature progression^{12,24,26} and some even improve trunk deformity.^{13,24,26} However, a question still remains about the long-term efficacy of bracing.²⁹ The aim of this case report is to show a case with persistent clinical and radiological correction in the long term after weaning.

Case report

A girl with AIS was treated with a Chêneau light brace^{25,26} starting in 2005. At the start of treatment she was 11 years old, Tanner stage was 2 and the Cobb angle of the single thoracic curvature was 38°. According to Lonstein and Carlson's progression factor equation³⁰ curvature progression for this girl, untreated, exceeded 99% - a risk factor calculation of 3.5.

After two years of treatment the brace had to be renewed. In the x-ray taken prior to the adjustment of the new brace a Cobb angle of 19° was measured (Figure 3).

Weaning began at the age of 15 as no residual growth was expected. Cobb angle at weaning was 14° (Figure 3).

The patient presented recently at nearly 21 years of age, five and a half years after weaning off the brace. There was no change with respect to trunk deformity when compared to the intermediate result achieved, 2007 (Figure 4 and Figure 5). Final Cobb angle was 19° or 50% of the Cobb angle measurement at the start of treatment.

The patient has full functionality and is highly satisfied with the end result.

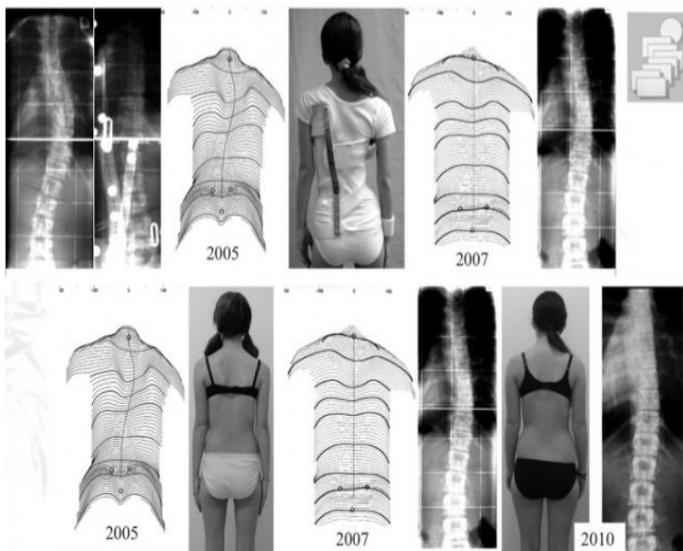


Figure 3: Follow-up during the entire growth spurt: Correction in the brace from 38 to - 14°, interim result 19° after two years, final result 14°, 18 months after brace weaning. In this case, both radiologically as well as clinical straightening was possible (see also Scoliosis 2010, 5:19).



Figure 1: Patient with documented progression after treatment with a variety of different brace types (Milwaukee braces at first).



Figure 2: Patient with documented progression after treatment with a variety of different brace types (a variety of TLSO).

Discussion

The case, as presented within this study, shows that brace treatment of AIS may lead to a significant improvement of both Cobb angle and clinical outcome and results can be maintained over time - five and a half years after concluding brace treatment. This result was achieved by applying the at that time newest German standard of the Chêneau brace.^{24,26} In other studies on scoliosis bracing, final corrections of Cobb angle and trunk deformity are not taken into account.^{12,23,29} Therefore, it may be assumed that the average brace applications do not regularly lead to a correction. Considering the diversity of braces applied today, worldwide, and the vast outcomes that can result, standards must be applied for the patient's protection. From the patients' perspective it is reasonable to assume that improvements of Cobb angle and trunk deformity are highly appreciated. So a question arises about why patients should sacrifice quality of life to a brace that will not lead to the best possible final result.

Clinicians, on the other hand, do not all seem to foster the improvement of bracing standards.²³ Instead of reducing the diversity of braces with vastly different outcomes the opposite seems to occur and inferior brace applications and standards persist. Bracing according to cutting-edge

Competing interests: declared in the article. Conflict of interests: declared in the article. All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript. All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.

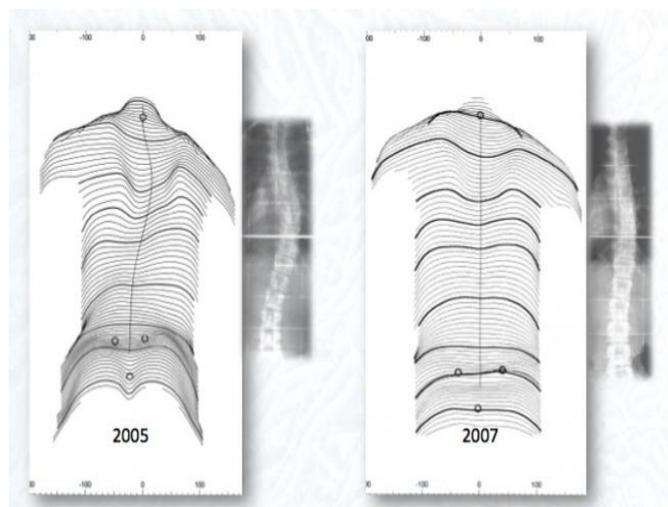


Figure 4: Intermediate result after two years of brace treatment with the precursor of the Gensingen-Chêneau brace (2005: 38° / 2007: 19° Cobb) with impressive cosmetic improvement.

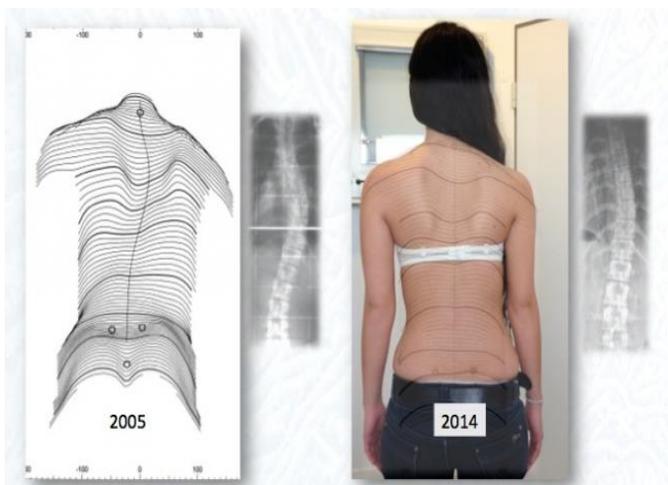


Figure 5: Final result after four years of brace treatment with the precursor of the Gensingen Chêneau brace at the age of nearly 21 years (2005: 38° / 2014, 5.6 years after weaning: 19° Cobb). The clinical improvement has been stable since the intermediate result, 2007. The surface profile from 2007 matches the final clinical result 5.6 years after weaning.

technology is available. These standards enable time in brace to be reduced, an improved quality of life - in the brace and later in life,³¹ and the highest proven clinical and radiological outcomes. Worldwide, clinical practices do not yet appear to be aligned with patients' needs.

On the other hand, since bracing has been proven effective^{11,12} discussion among the community of spine surgeons indicates that the RCT¹² has raised the issue of potential overtreatment with braces and this is proving problematic.³² Yet, at the same time, surgical overtreatment has never been debated as a relevant issue within the community. An additional point to discuss is the long-held philosophy that bracing exists only to halt curvature progression. Instead, bracing should aim to improve Cobb angle and trunk deformity. Therefore, patients with benign deformities could regularly improve

the deformity via the application of the most advanced brace developments. As a result, bracing may potentially be seen as a reasonable method of treatment in cases with a more benign prognosis.

Some surgeons appear to compartmentalize the patient by the Cobb angle.³³ One problem are surgeons who are detached and treat the x-ray rather than the patient. When one takes into account that there is no indication for surgery at all,^{14,15,16,17,18} and also the vast long-term risks of surgery,^{19,20,21} no surgeon should claim an indication for surgery in scoliosis management. The fact is, surgery for scoliosis is solely cosmetic and/or psychological and the decision should be deferred to the patient who may then opt for a spinal fusion after full disclosure of the high potential risks and unknowns regarding how long cosmetic improvements may last.¹⁴

Conclusion

- Bracing scoliosis maybe highly efficient and is supported by scientific evidence.
- Bracing according to the cutting-edge developments has been shown to be able to improve the angle of curvature as well as the trunk deformity.
- Bracing according to the cutting-edge developments appear able to lead to relevant and lasting improvements of the Cobb angle and trunk deformity in the long term.

Conflict of interests and Competing interests

HR Weiss is advisor of Koob GmbH & Co KG

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Competing interests: declared in the article. Conflict of interests: declared in the article. All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript. All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.



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Competing interests: declared in the article. Conflict of interests: declared in the article.
All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript.
All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.