History of soft brace treatment in patients with scoliosis: a critical appraisal

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Abstract

Introduction

Soft/dynamic braces today are used all over the world under the name of SpineCor. The marketing concept is very effective in promoting the soft brace as the first and only ‘dynamic’ brace. A short review has been undertaken, investigating the history of dynamic braces and devices available today.

Short communication

The use of soft braces to treat scoliosis has been documented by Schanz as early as 1904. In his book, various soft and hard braces with soft add-ons are described as state of the art in the nineteenth century. Many of these soft braces were developed by Fischer.

Today, shortcomings of the dynamic brace have been revealed in literature in comparison with hard braces; however, the concept of improving the quality of life while under brace treatment should be considered further. The purpose of this review is to highlight the history of soft braces and to present recent developments.

Conclusion

There is more than one soft brace used today and the history of soft bracing is long (over 120 years). Claims made by a company to distribute the first and only soft/dynamic brace may be misleading.

Introduction

Soft/dynamic braces today are prescribed all over the world. The marketing concept of the most popular device (SpineCor) is very effective. After a brief certification course, the device is sold predominantly to chiropractors, while other scoliosis specialists have stopped prescribing it. The device is simple to attach, and unlike hard bracing no construction is necessary. It can be fit to the patient in a short period of time, and the patient believes to have received a wonder—free mobility and comfort. However, later they may recognize problems when using the restroom. This matter has always been played down by the authors. The marketing strategy promotes this soft brace as the most widely worn and the first and only ‘dynamic’ brace. Therefore, a short review has been undertaken, reviewing the history of dynamic braces and the devices available today.

Short communication

The author has referenced some of his own studies in this short communication. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964), and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed. All human subjects, in these referenced studies, gave informed consent to participate in these studies.

The use of soft braces to treat scoliosis has been documented by Schanz as early as 1904.1 In his book, various soft braces (Figure 1) and hard braces with soft add-ons are described as state of the art in the nineteenth century (Figure 2). Many of these soft braces had been developed by Fischer. Also, when reviewing other bracing concepts, we find the precursor of the Milwaukee brace in the textbook by Schanz1 (Figure 3).

One of these soft braces to treat scoliosis as described by Fischer (1876, cited by Schanz2) looks very similar to a product sold today under the name of SpineCor. With the application of elastic straps, as the authors Rivard and Coillard suggest, a corrective movement for individual curve patterns should be maintained in order to inhibit curve progression (Figure 4).

However, soft braces have been obsolete for quite some time: hard braces had been proposed by Wallstein (1902) not long after the first publications on soft braces.3 Later, the Milwaukee brace had been proposed, then the Chêneau brace4 and the Boston brace5, all hard braces with reasonable impact on the patients’ quality of life.

While the Milwaukee brace was less effective,6 early outcome studies have described the Chêneau brace7,8 and the Boston brace as effective in the prevention of curve progression during growth.9 Prospective controlled multicenter7 and long-term studies8 have shown the Boston brace to be effective. In addition, there were outcome studies on the Chêneau brace, clearly demonstrating that in-brace correction and compliance are crucial to the outcome of brace treatment.

During the late 1980s and early 1990s in France, soft braces with the three-point pressure approach had been described. These would include the St. Etienne brace and the Olympe,10,11 but these have not been further investigated. During the late 1990s, soft brace treatment was re-developed12. The soft brace as presented by

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Risk for progression (first signs of maturation, premenarchial) had the least positive effects\textsuperscript{14}.

In two independent prospective controlled studies, the soft brace as presented by Coillard\textsuperscript{12–14} has been shown to be less effective than hard braces\textsuperscript{15,16}. This fact has been analysed, and the unsatisfactory correction of the sagittal profile in the soft brace as presented by Coillard\textsuperscript{12–14} was pointed out as the cause\textsuperscript{17}.

Relordosation of the lumbar spine is not induced when using the soft brace as presented by Coillard\textsuperscript{12–14}. Therefore, the compressive forces generated in this application may destabilize the spine, while a restoration of the sagittal profile can stabilize and even correct scoliosis as has been described by van Loon in 2008\textsuperscript{18}. To improve the results of soft braces during the high-risk phase of the pubertal growth spurt, focus must be on the sagittal plane since this is important in order to improve treatment results.

Furthermore, a soft brace for treating scoliosis aimed at curve correction on the basis of a three-point pressure system had been introduced in 2002\textsuperscript{19–21}. This device called the Triac can solely be used for certain single-curve patterns and has not been proven to be effective in patients during the growth spurt with a high risk for progression.

A soft Boston brace has also been described for patients with neuromuscular scoliosis, but this has not been mentioned in recent literature\textsuperscript{22,23}.

Discussion
The concept of using soft braces and reducing the impact braces have on patients is appreciated. However, there appears to be certain shortcomings; these should be ruled out to increase patients’ safety and enlarge the range of indications.

Coillard\textsuperscript{12–14}, comparable to the brace described by Schanz\textsuperscript{1} (see Figure 4), was introduced in the 1990s of the last century, and the first results were published in 2003\textsuperscript{13}. Later, more positive results were published\textsuperscript{14}. However, as Coillard and Rivard have pointed out, the group of patients at risk for progression (first signs of maturation, premenarchial) had the least positive effects\textsuperscript{14}.

The corrective movement in the frontal plane as described by Fischer\textsuperscript{1} and later by Coillard\textsuperscript{12–14}
corrected movement. In principle, the materials should be of endelastic entity (similar to the material used in a Spinealite®-soft brace/biofeedback device) and should not lose the tension force after a few weeks in order to achieve a sustainable correction. The correction is maintained by constant traction on the shoulder on the thoracic convex side. However, there is no unlimited freedom of movement like in the SpineCor\textsuperscript{12–14}; this new soft brace/biofeedback device (Spinealite®) is not as comfortable to wear\textsuperscript{24}. Also, less comfort is outweighed by a constant force of correction, leading to the best possible results as achievable with soft braces (Figure 7). Consider the evidence-based fact that curvature correction in brace treatment is crucial to the outcome\textsuperscript{9}.

In light of the lack of independent evidence for the application of soft (dynamic) braces, there seems to be no indication for a regular application in the treatment of progressive scoliosis. It has been demonstrated that after the progression of a curve in the SpineCor, a real in-brace correction could be achieved with a hard brace of current standard (Figure 5). This can be considered proof that unlimited mobility in a brace is not compatible to correction urgently needed to preserve a beneficial outcome. During the pubertal growth spurt, soft braces should not be used unless in combination with a high-correction hard brace when compliance otherwise cannot be gained. The RCT from Hong Kong (also including postmenarchial girls) has shown that hard braces are clearly superior to SpineCor soft bracing\textsuperscript{16}. Even worse results were obtained in our prospective controlled study because, as pointed out within the article, the sample of patients was in the most risky phase of growth (all premenarchial, Risser 0 with the first signs of maturation\textsuperscript{15}). All SpineCor adjustments in our group of patients were made under the

Figure 3: A distraction brace like the Milwaukee brace was also described in the textbook by Schanz 1904\textsuperscript{1}.

Figure 4: The soft brace as described by Fischer 1876 (left) and a soft brace of current standard as distributed today (middle and right). Unfortunately, no picture from the rear exists for the Fischer brace; however, the adjustment of the corrective ribbon from the front seems rather identical. (With kind permission by Pflaum, Munich.)

should be improved (Figures 5 and 6), while lumbar lordosis should be augmented with the help of a newly designed device. This approach has been described in a paper published recently\textsuperscript{24} but was retracted by the publisher\textsuperscript{25} due to a complaint by Spinecorporation, the company distributing the SpineCor\textsuperscript{12–14}.

Contrary to the elastic ribbon material used in the SpineCor as presented by Coillard\textsuperscript{12–14}, materials have to be applied with much less elasticity in order to maintain the
Figure 5: Patient from Macedonia starting SpineCor treatment at the age of 10 with the first signs of maturation and a curve of approximately 30° Cobb. No real correction visible in the SpineCor (upper line). After 2 years of SpineCor treatment, the curve had progressed to 60°. She was treated with a hard brace of actual standard with a significant in-brace correction, although the curve now is bigger and more stiff (lower line).

Unfortunately there are failures possible with every brace.

Negrini has pointed out the use of SpineCor as an adjunct to physiotherapy26; however the author dares to doubt that the payment of $3,500 is needed for efficient Physical Therapy (PT). In contrary, it has been shown that the latest approaches of PT in scoliosis management are effectively performed without the need of additional devices29,30.

Conclusion

There is more than one soft brace used today, and the history of soft bracing is long (over 120 years). Claims made by a company to distribute the first and only soft/dynamic brace may be misleading. Soft braces according to the latest evidence should be used with caution and never without part-time hard brace treatment in patients with a high risk for progression.

Competing interests

HRW is advisor of Koob-Scolitech, Abtweiler, Germany (Director Grita Weiss) which holds the patent application PA DE 10 2011 055 333.9 of the Spinealite® Biofeedback device (Inventor of this device is HRW).

Conflict of interests

HRW is advisor of Koob-Scolitech, Abtweiler, Germany (Director Grita Weiss) which holds the patent application PA DE 10 2011 055 333.9 of the Spinealite® Biofeedback device (Inventor of this device is HRW).

Consent

Written informed consent was attained by the patients and parents to permit the publication of the clinical pictures.

Acknowledgements

I thank Pflaum Company for permitting the publication of pictures taken or modified from the book with the title Weiss HR. Best practice in conservative scoliosis care. 4th edition.

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Short communication

Figure 6: Left immature patient with a curvature of 41° Cobb. Middle, no visible correction, obviously the curve has not changed in the SpineCor, but the angle measured was 24°, which was also documented into the patient’s history (right).

Figure 7: A patient in a Spinealite™ biofeedback device. Spinealite™ device was leading to an overcorrection. The initial angle of curvature was 27° and in device correction was −16°. The lumbar counter curve in frontal plane does not seem to be corrected much; however, the axial load of this system when applied to the maximum correction leads to increased rotation. Therefore, this system should not be implemented alone. A hard brace should be worn in conjunction with this system, and we will always propose regular clinical controls.

References