

**Trunk orthoses manufactured with  
the aid of CAD techniques**

**According to the pattern classification of Rigo**

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## Summary

The reliability of the medical treatment of scoliosis using braces must be improved. Different treatment designs exhibit excellent correction effects with individual curve patterns, but fail with others. Up until now, most braces have been manufactured in a stereotypical manner, as if there were only one curve pattern; the original Chêneau treatment is still based on two different curve patterns. Moreover, the use of the 5-curve patterns from the King classification has not been successful in every case. The result is a certain need for research with regard to the reliability of treatment.

The Rigo classification can lead to a better reliability of treatment, especially since 15 different curve patterns are taken into consideration here. The reliability of treatment is also increased when the specialist himself uses CAD techniques to select the brace.

This paper shall document the procedure.

Key words: scoliosis, brace treatment, treatment safety, Rigo classification

## Introduction

GOLDBERG et al. (2001) have verified that the American treatment strategy cannot significantly reduce the incidence of surgery in the treatment of scoliosis. In their study, they showed that not only the Milwaukee brace treatment, but also the American TSLO treatment was not able to significantly influence the percentage of patients undergoing surgery. Therefore, it rightly questions the examined treatment strategies.

Although verified as ineffective in comparison to other orthoses (ROWE et al., 1997; HOWARD et al., 1998), the Charleston Bending Brace is still being aggressively marketed today as well (TRIVEDI and THOMSON 2001; GEPSTEIN et al. 2002; BOWEN et al., 2001). The authors indicate success rates of about 60%, but cannot produce any control groups. Furthermore, the primary correction effect for the brace is not mentioned in any of the works cited. Therefore, there is no objective quality control for the treatment. An additional treatment using a night brace (D'AMATO et al., 2001) shows a moderate treatment success of just over 63% in thoracic and double major curves, while braces for lumbar and thoracolumbar curves obviously exhibit clearly better treatment results. In this paper, excellent correction effects are described for the assessment of quality, although the final results of this treatment with a night brace cannot be compared with the final results of the Central European braces (WEIß 1995; LANDAUER 1999; WEIß et al. 2000; WEIß et al. 2002). Unfortunately, other American studies on brace treatment also lose their significance when the documentation of the primary correction effect in the brace is dispensed with (HOWARD et al. 1998; KAROL 200; KATZ and DURRAN, 2001).

On the other hand, the reliability of treatment appears to be significantly greater in Central Europe. In a review of the literature (WEIß, 1995), it was verified that the primary correction effects of the Central European braces were superior to the American treatment methods and led to clearly better end results.

LANDAUER (1999) verified that the degree of compliance and the correction effect for the brace are of prime importance for the final result. This increased reliability of treatment with the Central European braces leads to a highly significant lower rate of surgical intervention (WEIß, 2002).

All medical practices and centers with a large amount of treatment experience are familiar with the problem in which sometimes excellent and sometimes only poor effects are achieved with similar braces. The unfavorable results are not publicized!

The results were quite good for the original Chêneau style, as well as for the deflection brace, from a statistical point of view (Weiß et al. 200; Landauer 1999), but it could not always be explained in the individual case, with both the original Chêneau treatment and the deflection brace, why some braces worked and other didn't!

Surgeons have abandoned the King classification because of frequent bad designs, and now use the Lenke classification, from which Rigo derived the 15 curve patterns of the Rigo classification.

The question is: How can the reliability of treatment with braces be improved?

The answer may be: By improving the specificity of the pattern.

Chêneau: 3-/4-curve (Lehnert-Schroth 1981)

2 curve patterns

Weiß: King classification (King et al. 1983)

5 curve patterns

Rigo: Rigo classification

15 curve patterns

Chêneau uses only two functional curve patterns for brace design, which does not offer sufficient treatment reliability. Also, the use of the King classification has not significantly improved the reliability of the treatment. Now the Rigo classification is available for the design of a specific brace treatment, which is derived from the Lenke classification used by surgeons, but tailored to the needs of the brace mechanic.

### **Procedure for treatment using trunk orthoses manufactured with the aid of CAD techniques, according to the pattern classification of Rigo**

To fit a Chêneau brace by using the ORTHOLUTIONS CAD technology according to the RIGO system, we need certain static and dynamic measurements that describe the deformity and the degree to which it can be straightened, a current x-ray (full-length photograph in the standing position), and photographs of the trunk (back view, possibly also front view and side views). After this, the data are sent via email to the experts, who then first determine the curve pattern according to the pattern classification of Rigo, which allows them then to pick out the most suitable model for this curve pattern, for the patient's age, and for the existing formation of the curve. Only after this is a foam model created using the static and dynamic patient measurements that were taken, and which are the basis for the final production of the brace.

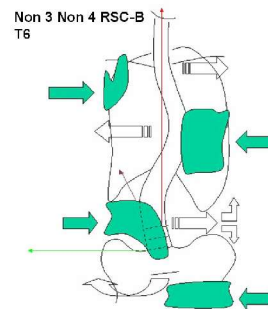
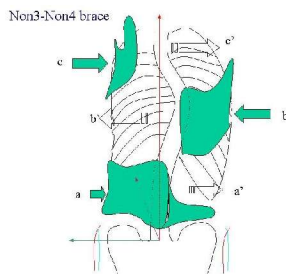
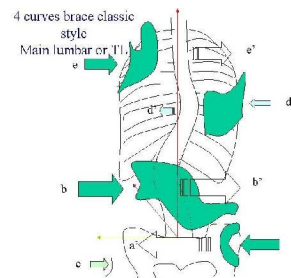
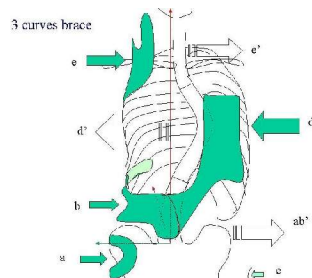
The manufactured brace is delivered and then there are adjustments and amendments to the brace in the context of the usual team discussions in the orthopedic practice. In this context,

problems must be solved that are not always covered in the usual orthopedic or orthopedic-technical training.

Since higher degree scoliosis needing treatment is a rarity in the orthopedic practice anyway, the conservative management of scoliosis should remain the domain of treatment teams that have the appropriate experience, an appropriate number of patients and the appropriate continuing education in this field at their disposal. A course has been designed in order to impart the necessary knowledge.

The course is intended for complete treatment teams that want to care for their scoliosis patients on the highest level. For this, it is also necessary that the complete treatment team (orthopedic specialist, orthopedic technician and physical therapist -- with Schroth training, if possible) complete the course and bring along one or more patients currently undergoing treatment. The patients brought along should possess indications for a brace and the diagnosis of an idiopathic adolescent scoliosis. Patients with other scoliosis are also welcome, so that their conservative management can also be discussed at the same time.

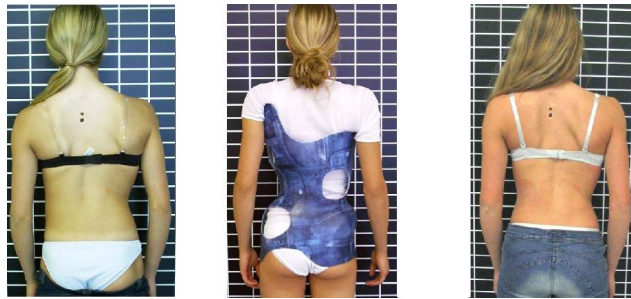
### Frequent curve pattern © M. Rigo



## Quality control



Middle: Thoracic right convex curve with static decompensation and shoulders lopsided to the left; left: The RSC model (Rigo-System-Chêneau), which visibly corrects decompensation and lopsided shoulders; right: clinical picture after 10 minutes of wearing the brace



Left: thoracic right convex curve with static decompensation and shoulders lopsided to the left; middle: Patient in the RSC brace that was made using the ORTHOLUTIONS CAD technique (Rigo-System-Chêneau), lopsided shoulders and decompensation are characteristic for the RSC brace, corrected, the hunching of the ribs is derotated, right: clinical picture after 3 Month

## Discussion

The King classification has been abandoned for planning surgery since the five curve patterns are not sufficient for a specific planning of surgery. In the meantime, the Lenke classification (LENKE et al. 2001) has become the standard for planning surgery. The Rigo classification, developed by Rigo from the Lenke classification with 15 different curve patterns, seems clearly more specific and may lead to an improved reliability of treatment in the future. The first results show that the correction effect is significantly better when taking the Rigo classification into consideration, that these braces are nevertheless more comfortable, and that the primary precision of fit can be significantly increased, in contrast to handmade braces.

The brace treatment is an effective measure for halting an increase in curvature. The correction effect and compliance determine the final result. With regard to the treatment standard, quality assurance is needed, which must lead to a greater reliability of treatment. The quality of life, which is significantly affected during the period of brace treatment, must pay off for the affected patients by permanently improving the cosmetic problem and avoiding surgery with the greatest reliability!

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