Determination of the influence of the Chêneau brace on quality of life for adolescent with idiopathic scoliosis

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Abstract

Objective. – The main objective is to determine the influence of treatment by Chêneau brace on the quality of life (QoL) of adolescents with idiopathic scoliosis.

Material and method. – We used the QoL scale of Climent et al. “the Quality of Life Profile for Spine Deformities” (QLPSD, in which a higher score means a worse QoL) and visual analogue scales (VAS) for pain and for QoL ranging from 0 to 100 mm. The study includes 108 subjects divided in three groups, a control group of 32 patients without brace, a full-time treated group (wearing a Chêneau brace 23/24 hours) of 41 patients, and a part-time treated group (wearing the brace during the night only) of 35 patients.

Results. – The QoL is significantly worse in the full-time treated group than in the group with night treatment and in the group without brace for the psychosocial functioning, the sleep disturbances, the back flexibility ($P < 0.001$), the body image ($P < 0.01$), as well as the overall score ($P < 0.001$). On the other hand, there was no difference for the back pain. Among patients wearing the brace, the girls had an average QLPSD score higher than the boys for the psychosocial functioning, the body image, the overall score ($P < 0.05$) and the back flexibility ($P < 0.01$). Whereas there was no significant difference between the sexes for the sleep disturbances and the back pain. The QoL of patients who wear the brace was significantly correlated with degrees corrected wearing the brace and the patient’s satisfaction on his or her health status. However, this correlation was very weak. On the other hand, there was no correlation between the quality of life and the age, the duration of brace treatment or the skeletal maturity (Risser sign). On VAS, the patients without brace have the highest score of QoL, followed the part-time treated patients while the full-time treated patients have the lowest score.

Conclusion. – The wearing of the Chêneau brace involves a significant reduction in the QoL whatever instruments of evaluations of QoL, QLPSD or VAS. The QoL of the full-time treated patients was the lowest followed part-time treated patients while the QoL of the patients without brace was the highest. However, the brace does not influence the back pain in idiopathic scoliosis at teenage.

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Keywords: Quality of life; Scoliosis; Chêneau brace

1. Introduction

The braces stop the evolutionary process of the idiopathic scoliosis most of the time during the length of their application. However, the results obtained are very disparate according to the studies. The available models of trunk orthosis in this indication are numerous. For the Chêneau brace, they retain a stabilization of the curves in approximately eight of 10 cases, the other results are divided equally into improvement and aggravation [3]. Treatment of the scoliosis impossible to circumvent, the brace however has always a pejorative connotation. The wearing of the brace brings many visible disadvantages and few visible advantages [17]. Indeed, it should be noted various complications such as:

- pain;
- digestive disturbances;
- skin disturbances;
- change of the curves and balance;

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• restriction of respiratory volumes;
• psychological;
• relational and functional difficulties;
• change of the muscular activity [21].

Moreover, the idiopathic scoliosis will modify considerably the rhythm of life of the adolescent. It will be necessary to live, to sleep, and to eat with the brace during several years. The stress is not limited only to the adolescent, it involves all the family. Nevertheless, the impact on the daily life of the orthotic treatment for a scoliosis is still poorly evaluated. Our goal is to determine the influence of the treatment by Chêneau brace on quality of life.

The concept of quality of life is relatively recent and includes three dimensions:

• the physical function;
• the psychological function;
• the social function [12].

The questionnaires of evaluation gather information on the state general, the emotional well-being, the limitation of competences, the sleep, the energy, the vitality and the general satisfaction of life. The majority of the diseases but also of their treatments involve a decrease of the quality of life. In cases of different orthoses of proven similar effectiveness in controlling the scoliotic curves, the use of bracing with the lowest impact on the quality of life should be recommended [6]. Various measuring instruments are available. The generic questionnaires apply to a large field of pathologies, but their use leads to a loss of sensitivity of the evaluation. This is why the majority of the health economists and clinical pharmacological associations include suggestions recommend the use of the specific questionnaires [25]. We thus chose a specific scale intended for the scoliotic adolescent, the questionnaires of quality of life “the Quality of Life Profile for Spine Deformities” (QLPSD).

2. Population and method

2.1. Population studied

The study includes 108 idiopathic scoliosis followed in the Rehabilitation Centre Marc-Sautelet. The patients were recruited at all the phases of their scoliotic treatment. They were divided into three groups:

• a control group of 32 patients without brace;
• a full-time treated group (wearing a Chêneau brace 23/24 h) of 41 patients;
• a part-time treated group (wearing the brace during the night only) of 35 patients.

The orthotic trunk was in all the cases of Chêneau brace.

2.2. Material and method

The QLPSD (Table 1) is addressed to the adolescents or preadolescents age from 10 to 20 years. These items include five areas respectively evaluating the psychosocial functioning, the sleep disturbances, the back pain, the body image and back flexibility (flexibility of the trunk). This questionnaire contains 21 evaluated items from 1 to 5 points, 5 correspond with the worst (strongly agree), and 1 with the best (strongly disagree). A high score means a bad quality of the life. The maximum score is 105. An evaluation of 5 points (very good) to 1 point (very poor) was used for the questionnaire of the patient’s satisfaction on his or her health status. We also used a visual analogue scale (VAS) of pain and a VAS of quality of life graduated from 0 to 100 mm. The questionnaire was given to the patient at the time of a medical examination of surveillance within the framework of the orthopedic treatment. In the group without brace, it was given during the moulding, the fitting or the delivery of the brace, in the group with full-time wearing, it was given at the time of a periodic control after at least three months. Finally, the part-time wearing corresponded to the period of weaning. All the subjects filled themselves these questionnaires and the analogical visual scale, after they were given rigorous explanations.

2.3. Statistics

The statistical analysis has been done with the help of the software SPSS 11.5. The test t for independent samples was
carried out for the comparison of two averages observed and analyzes of variances (Anova) was applied for the comparison of more than two averages observed. The coefficients of correlation of Pearson between the scores of each area, the overall score of quality of the life and the age, skeletal maturation (Risser sign), the degrees corrected wearing the brace, the duration of the brace treatment and the patient’s satisfaction has been calculated. A level of significance of 0.05 was selected.

3. Results

The characteristics of our population are presented in Table 2. The scoliosis are the most often double major curves, then lumbar curves, thoracolumbar curves, and finally thoracic curves. The groups are significantly different ($P < 0.001$) for the following characteristics:

- skeletal maturation (Risser sign);
- age;
- Cobb angle;
- degrees corrected wearing the brace;
- duration of the treatment.

The Risser sign, the average age at the beginning of treatment and the duration of the brace treatment in the part-time treated group are higher than those of full-time treated group. On the other hand, the average value of the Cobb angle and the degrees corrected wearing the brace are higher in the full-time treated group than those of the part-time treated group. The subjects that do not wear yet the brace present the lowest values for all these characteristics.

Except for the sleep disturbances, the score of each area of quality of life is higher in the full-time treated group than in the group with part-time wearing. These scores are lowest for the group without brace (Fig. 1). The overall score of quality of life followed the same distribution, by descending order that of the full-time treated group, then part-time treated group and finally of the group without brace (Fig. 2). There was a significant difference between the three groups for the psychosocial functioning, the sleep disturbances, back flexibility ($P < 0.001$), the body image ($P < 0.01$) as well as the overall score of quality of life ($P < 0.001$). On the other hand, there was no significant difference between the three groups for back pain.

For the 76 patients (66 girls and 10 boys) wearing the brace full-time or part-time, we noticed that the girls had scores of quality of life higher (worse) than the boys. This difference was statistically significant for the psychosocial functioning, the body image, the overall score ($P < 0.05$) and back flexibility ($P < 0.01$). There was no significant difference between the sexes for the sleep disturbances and the back pain (Table 3).

We noted a significant relation between the patient’s satisfaction and all the areas of quality of life. On the other hand, there is not significant correlation between the Risser sign

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Full-time</th>
<th>Part-time</th>
<th>Without brace</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n$</td>
<td>41</td>
<td>35</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>36</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Risser</td>
<td>1.2 ± 1.2</td>
<td>2.9 ± 1.3</td>
<td>0.7 ± 1.2</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Age</td>
<td>13.3 ± 1.4</td>
<td>15.1 ± 1.0</td>
<td>12.5 ± 1.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Cobb</td>
<td>30.5 ± 3.1</td>
<td>29.2 ± 4.3</td>
<td>26.5 ± 2.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Degrees corrected</td>
<td>12.7 ± 2.3</td>
<td>11.0 ± 2.7</td>
<td>0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Duration (months)</td>
<td>9.2 ± 4.5</td>
<td>18.6 ± 4.2</td>
<td>0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Type of curve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoracic</td>
<td>7 (41.2%)</td>
<td>4 (23.5%)</td>
<td>6 (35.3%)</td>
<td></td>
</tr>
<tr>
<td>Thoracolumbar</td>
<td>7 (33.3%)</td>
<td>8 (38.1%)</td>
<td>6 (28.6%)</td>
<td></td>
</tr>
<tr>
<td>Lumbar</td>
<td>7 (29.2%)</td>
<td>9 (37.5%)</td>
<td>8 (33.3%)</td>
<td></td>
</tr>
<tr>
<td>Double major</td>
<td>20 (43.5%)</td>
<td>14 (30.4%)</td>
<td>12 (26.1%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

Characteristics of patients treated

Fig. 1. Subscales of the quality of life of three groups.

Fig. 2. Overall score of the quality of life of three groups.

<table>
<thead>
<tr>
<th>Subscales of the QoL</th>
<th>Boys</th>
<th>Girls</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychosocial functioning</td>
<td>10.3 ± 1.2</td>
<td>13.0 ± 3.8</td>
<td>0.033</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>9.0 ± 3.4</td>
<td>10.4 ± 3.9</td>
<td>0.264 (NS)</td>
</tr>
<tr>
<td>Back pain</td>
<td>7.5 ± 1.4</td>
<td>7.5 ± 2.6</td>
<td>0.958 (NS)</td>
</tr>
<tr>
<td>Body image</td>
<td>5.7 ± 1.4</td>
<td>7.9 ± 2.9</td>
<td>0.021</td>
</tr>
<tr>
<td>Back flexibility</td>
<td>5.9 ± 1.1</td>
<td>8.8 ± 3.3</td>
<td>0.007</td>
</tr>
<tr>
<td>Overall score</td>
<td>38.4 ± 3.5</td>
<td>47.7 ± 11.2</td>
<td>0.012</td>
</tr>
</tbody>
</table>

Table 3

Score of quality of life (QoL) of the boys and the girls of 76 brace treated patients
and all these areas. The overall score of the quality of life of patients who wear the brace was significantly correlated with the degrees corrected wearing the brace, and the patient’s satisfaction on their health. However, these correlations were very weak. On the other hand, there was no correlation between the quality of life and the age, the duration of the brace treatment or the Risser sign of the patient (Table 4).

Composed of three questions, the score “back pain” of the questionnaire can vary from 3 to 15. The patients were separate in two groups:

- those with a back pain score lower than 8 were regarded as without back pain;
- the others as back pain.

We did not find any significant association between the magnitudes of the Cobb angle and the back pain whatever the type of the curve (Table 5).

The presence of pain was announced in 49 cases (45.4%) whose intensity of the pain is of 45.4 ± 6.2 mm on the VAS for the full-time treated group, of 41.9 ± 6.7 mm for the part-time treated group and of 40.6 ± 6.2 mm for the group without brace (Table 6). This difference between the three groups is not significant.

Finally, for 108 studied patients, the patients without brace have the highest score of quality of life on the VAS, followed by part-time treated patients while the full-time treated patients have the lowest score of quality of life. This difference was statistically significant \( (P < 0.001) \). This distribution of the VAS quality of life according to the wearing of the brace is noted in the groups back pain \( (P < 0.001) \) and without back pain \( (P < 0.01) \).

### 4. Discussion

The impact of the brace on quality in life of adolescent with idiopathic scoliosis was the subject of many studies with opposite results. Many authors noted that the wearing of the brace did not decrease the quality of life [7,15,19,24]. On the other hand, a lot of other studies [5,9,10,15,22] showed that the brace constitutes a psychological obstacle with deleterious effects on the quality of life.

In our study, it appears clearly that the wearing of the brace did not have the same effects on the quality of life, and on certain specific areas (psychosocial, sleep disturbances, body image, back flexibility) by using questionnaire QLPSD. These results are confirmed with the VAS quality of life, which is higher among patients who do not have the

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**Table 4**

Correlation coefficients between scores in quality of life and the characteristics of 76 brace treated patients

<table>
<thead>
<tr>
<th>Subscales of the QoL</th>
<th>Age ( (R, P) )</th>
<th>Risser ( (R, P) )</th>
<th>Degrees corrected with brace ( (R, P) )</th>
<th>Duration of brace treatment ( (R, P) )</th>
<th>Patient’s satisfaction ( (R, P) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychosocial functioning</td>
<td>-0.16 (NS)</td>
<td>-0.16 (NS)</td>
<td>0.28 (0.014)</td>
<td>-0.25 (0.031)</td>
<td>-0.55 (&lt; 0.001)</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>0.13 (NS)</td>
<td>-0.12 (NS)</td>
<td>0.057 (NS)</td>
<td>0.13 (NS)</td>
<td>-0.42 (&lt; 0.001)</td>
</tr>
<tr>
<td>Back pain</td>
<td>-0.02 (NS)</td>
<td>-0.01 (NS)</td>
<td>0.05 (NS)</td>
<td>-0.13 (NS)</td>
<td>-0.38 (&lt; 0.01)</td>
</tr>
<tr>
<td>Body image</td>
<td>-0.04 (NS)</td>
<td>-0.14 (NS)</td>
<td>0.28 (0.01)</td>
<td>-0.19 (NS)</td>
<td>-0.35 (&lt; 0.01)</td>
</tr>
<tr>
<td>Back flexibility</td>
<td>-0.3 (0.008)</td>
<td>-0.22 (NS)</td>
<td>0.26 (0.025)</td>
<td>-0.4 (&lt; 0.001)</td>
<td>-0.5 (0.008)</td>
</tr>
<tr>
<td>Overall score</td>
<td>-0.11 (NS)</td>
<td>-0.11 (NS)</td>
<td>0.28 (0.015)</td>
<td>0.16 (NS)</td>
<td>-0.6 (&lt; 0.001)</td>
</tr>
</tbody>
</table>

---

**Table 5**

Back pain and average value of the Cobb angle of brace treated patients \( (n = 76) \)

<table>
<thead>
<tr>
<th>Type of curve</th>
<th>Back pain QLPSD ≥ 8</th>
<th>Without back pain QLPSD &lt; 8</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( n )</td>
<td>Cobb angle ± S.D.</td>
<td>( n )</td>
</tr>
<tr>
<td>Thoracic</td>
<td>9</td>
<td>30.7 (26–41)</td>
<td>2</td>
</tr>
<tr>
<td>Thoracolumbar</td>
<td>4</td>
<td>27.5 (23–30)</td>
<td>11</td>
</tr>
<tr>
<td>Lumbar</td>
<td>9</td>
<td>28.6 (23–34)</td>
<td>7</td>
</tr>
<tr>
<td>Double major</td>
<td>19</td>
<td>31.2 (26–42)</td>
<td>15</td>
</tr>
<tr>
<td>Overall score</td>
<td>41</td>
<td>30.2 (23–42)</td>
<td>35</td>
</tr>
</tbody>
</table>
brace yet and lower at those treated full-time, the part-time treated patients having an intermediate score ($P < 0.001$). This confirms that the wearing of the Chêneau brace involves a significant reduction on the quality of life in spite of its advantages (lightness, discretion under clothing, little embarrassment in the gestures of the daily life, manufacture into ambulatory not involving neither school absenteeism nor distance of the home environment [8]), which does the Chêneau orthosis one of the best tolerated braces [3]. Our results are in good concordance with those of many studies related to other types of braces. The brace would be “a psychological burden” [17], because it would influence the perception of the body image [9,11,22]. Climent et al. by using like us the QLPSD found for the patients treated by brace a significant change of the overall score on quality of life, psychosocial functioning and back flexibility. The type of brace was not indicated in their study [5]. The wearing of the brace is more difficult to support than the surgery: the work of Fallstrom et al. concerns a series of 157 patients treated by surgery and/or by Milwaukee brace, (all the patients had profited from brace treatment) the authors found a greater anxiety, a worse attitude with the brace, a worse acceptance of the brace, a worse experience in the hospital, the more important signs of negative body image for the group only treated by brace compared with the operated group, independently of the angulation’s degree [9]. Noonan et al. [18] evaluated the psychological functioning in the long term of 95 patients treated by Milwaukee brace of which 30 were finally arthrodesis, and compared it with a group control of 49 female volunteers without antecedent of scoliosis or another spinal deformation. They found that there was a significant difference for perception of differences and satisfaction of appearance. Themar-Niel and Diméglio consider it necessary to have a multidisciplinary team with assist of a psychologist to lead to good for a long and constraining treatment [23]. For many authors [11,18,19,22], the deleterious effects of the brace on the quality of life increase with the aggravation of the scoliosis. Climent et al. reported that the negative impact of the brace treatment on the quality of life in patients with severe disease (Sheuermann’s disease, idiopathic scoliosis) is larger than in patients with less severe curves (transitional scoliosis, postural cyphosis and lordosis) [6].

On the opposite, MacLean et al. studied in a retrospective study the psychological, functional and family impact of 31 preadolescent and adolescent (ranging in age from eight to 16 years) treated by Boston brace (87%) and Milwaukee brace (13%). Apart from the initial bracing period in stressful terms by 84% of the patients, establishing a daily routine facilitated coping with brace wear treatment [15]. Ugwonali et al. [24] found that the brace wearing did not decrease the quality of life, Olafsson et al. [19] concluded that wearing the Boston brace does not affect negatively the self-image of adolescents with idiopathic scoliosis and Cochran and Nachemson [7] had reexamined 85 patients treated by Milwaukee brace and had noted that these patients had the same level concerning marriage, children, activities of leisure, and professional activities that the group controls, the average age of the patients at the time of the study was 24 years and 11 months.

We noticed that for the patients wearing brace, the impact on the quality of life (overall score, psychosocial functioning, body image and back flexibility) was more severe in the girls than the boys. Climent et al. noted also that the girls had the scores with the QLPSD higher than the boys for the overall score and dorsal flexibility [5]. These results are also coherent with those of Olafsson et al. [19], Sapountzi-Krepia [22] which confirmed that the boys with scoliosis had a better perception of body image than the girls with scoliosis. For Bocquet [2], there would be a female competitiveness on the aesthetic level, which does not exist between men. Payne et al. indicated that the scoliosis is a significant risk factor for the psychosocial issues and that gender differences exist [20].

In our study, there was no correlation between the overall score of quality of life and the age, the duration of the treatment or the Risser sign among the patients wearing a brace. On the opposite, Climent et al. found that the quality of life was significantly correlated with the age, skeletal maturity, the months of brace treatment and degrees corrected by wearing the brace on a sample of 102 adolescents from 10 to 19 years which were wearing either the Milwaukee brace, the Boston brace, the TLSO or the Charleston brace [6]. Moreover, Margo concluded that the longer the brace treatment is, the more the quality of life decreases [17].

The differences on quality of life according to the treatment seem independent of the existence of back pain. In our study, the pain is signalled in 45.4% of the cases and seems independent of the severity or the localization of the scoliosis. The frequency and the intensity of the back pain of patients with idiopathic scoliosis were reported by Mayo et al. [16]. This study compared a group of patients with idiopathic scoliosis and a healthy control group. Forty-four percent of the scoliotic patients suffered from back pain compared to 24% at the controls group. Pain continues in adulthood, Joncas et al. [13] carry out a study with 239 patients presenting scoliosis of left right and lumbar thoracic type and found the existence of pain in 54% of the cases with an average intensity was of 49 ± 20 mm with the VAS. They did not find an association between the existence of back pain and the severity of the scoliosis, the weight, the size or the age.

The wearing of the brace does not influence the back pain in our study. Bernard et al. carried out an evaluation of the tolerance of CMCR brace (a monovalve brace in carbon, designed to keep the respiration free) by an autoquestionnaire; they noted that the majority of the children had accepted well with the brace, physically as well as the psychologically. Some patients had presented with the sleep disturbances and skin problems at the beginning of the treatment, which were quickly regulated after correction and adjustment of the brace [1].

Our work includes some methodological aspects, which deserve to be discussed. Our three groups are significantly different as regards skeletal maturation, age, Cobb angle, degrees corrected wearing the brace and duration of the brace treatment. This is explained by the fact that the patients were recruited with all the phases of brace treatment, from the manufacture period to the wearing period. It was not possible to randomize strictly the study and not to propose any treatment during several months to adolescents whose scoliotic evolution justified an orthopedic
treatment. Our study, transversal, reflects nevertheless the evolution on the quality of life of the adolescents during the treatment of their scoliosis. The improvement of the quality of life of the group “partial time” is undoubtedly not only related to the duration of wearing the brace, but also to the fact that this lightening of the wearing announces the end of the treatment. It would have been useful to know the evolution of the quality of life in adolescence with the advance in age of healthy subjects. Indeed, the adolescents present more difficulties on the psychological plan that the young children in particular because of the modifications of the body. The young children do not have the body preoccupations, their image of the body being incomplete, as their development is underway [2]. The QLPSD includes items adapted to the children aged from 10 to 20 years. However, this questionnaire does not take in account of important fields of the adolescent’s life, like the sports activities, the schooling, brace treatment compliance and the role of the parents in the acceptance of the disease and its treatment. However, according to various authors [7,9,18], it seems to exist a limitation of the physical and social activities during the treatment by brace. The role of the parents in the acceptance of the brace in addition seems to have importance. To be felt the treatment by the child related to be felt by parents [4]. A bad strategy can lead to school failures, refusal brace.

Kahanovitz and Weiser thus have 72 patients followed for an idiopathic scoliosis treated by electric stimulation of surface, brace, surgery, or only supervised, the attitude of the mothers in relation to the disease of their child strongly influenced the attitude and the stress of the child in relation to his disease [14].

5. Conclusion

The wearing of the Chéneau brace with the adolescent idiopathic scoliosis involves a significant reduction on the quality of life whatever are the instruments of evaluations on the quality of life, a scale of “the Quality of Life Profile for Spine Deformities” or a visual analogical scale graduated from 0 to 100 mm. This deterioration is higher when the brace is wearing full-time. Finally, this orthopedic treatment does not influence the back pain. Globally, the scale of quality of life of Climent et al. QLPSD is a tool reliable and easy to use in daily practice.

Acknowledgements

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References


