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ORIGINAL STUDY

Difference between Spinecor brace and Thoracolumbosacral orthosis for deformity correction and quality of life in adolescent idiopathic scoliosis

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Although there are several conservative treatment options, only bracing has been found to be effective in preventing curve progression and a subsequent need for surgery in adolescent idiopathic scoliosis. The objective of this study is to compare the results of SpineCor brace and thoracolumbosacral orthosis (TLSO) for treatment of adolescent idiopathic scoliosis radiologically and clinically.

Sixty-four patients with adolescent idiopathic scoliosis treated with brace included in this study. Height, T1-Coccygx distance, and gibbosity were measured. Rib hump deformity was evaluated with a scoliometer. An SRS-22 questionnaire was used to determine the quality of life of patients after the first year of brace treatment.

Differences in Cobb angles and gibbosity were insignificant for both groups. SRS-22 questionnaire results showed significant differences in pain, self-image and function/activity subgroups. Patients' mental health and satisfaction scores were insignificant.

These braces have a similar effect on deformity correction. The surgery rates and success rates of braces are approximately equal. The major difference between SpineCor and TLSO is health-related quality of life.

Keywords : scoliosis, braces, quality of life.

INTRODUCTION

Treatment options for adolescent idiopathic scoliosis (AIS) consist of observation, bracing and surgery. Although there are several conservative treatment options including physical therapy, exercise, and electrical stimulation, only bracing has been found effective in preventing curve progression and subsequent need for surgery. For this reason bracing should be the first step in treatment of adolescent idiopathic scoliosis *(11,13,16,18)*.

Throughout the developments in brace technologies, an effort was directed to make patients wear the brace optimally. As a result of these efforts, alternative braces were invented as night-time braces, bending braces and non-rigid braces (*5,6,15*). SpineCor brace is a non-rigid brace which is applied according to the curve specific corrective movement

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principle and aims neuromuscular re-education of the body (*4*,*5*). Despite the effectiveness of the brace, there is no exact comparative study with rigid braces. The objective of this study is to compare the results of SpineCor brace and TLSO (thoracolumbosacral orthosis) in adolescent idiopathic scoliosis in terms of curve progression and quality of life.

MATERIALS AND METHODS

Adolescent idiopathic scoliosis patients who were older than 10 years of age and younger than 15 years with no history of previous treatment for scoliosis were included in this study. Female patients were premenarchal or less than one year postmenarchal. A total of 64 AIS patients treated with braces were included in this study. Before chosing the brace type, general information about SpineCor brace and TLSO were explained to the families and decision of which the brace type to choose was left to them (Figure 1). Patients who had begun TLSO treatment in other centers continued using their existing braces and were counted in the TLSO group (including all custom made thoracolumbosacral braces) (Figure 2). In both groups, patients were asked to wear the braces for 23 hours a day. Three patients with primary curve magnitude over 40 degrees prior to treatment, six patients with irregular follow-up, and one patient with Prader-Willi syndrome were excluded from the study. The Institutional Review Board of the relevant institution approved this study, and a written informed consent was obtained from each patient.

Height, T1-Coccygx distance, and gibbosity was measured without a brace for clinical examination. Gibbosity was evaluated with scoliometer while the patient flexed forward at the hips and back the greatest magnitude of the incline of the back was noted as well as the apical level.

Radiological evaluation was done with standing x-rays showing the whole spine. The spinal deformation was measured with the Cobb technique. The Turkish version of the SRS-22 questionnaire, which has proved to be reliable and valid, was used to determine the quality of life of patients. This questionnaire was given to patients after the first year of brace treatment.

Fig. 1. — SpineCor Brace

We used the SPSS software package (version 15.0, SPSS, Chicago, IL) and expressed categorical variables as percentages and continuous variables as mean± standard deviation (SD) or median (quartiles). The Wilcoxon signed rank test was used to evaluate height, T1-Coccygx distance, gibbosity, and Cobb angle differences and the Mann-Whitney U-test used to evaluate the difference between the groups. Statistical significance was set at $p < 0.05$.

RESULTS

S group consisted of 49 patients (44 female, 5 male), while the TLSO group consisted of 19 patients (15 female, 4 male). Mean age was 12,8±1,5 in the S group and 12,3±1,4 in TLSO group. Mean follow-up periods were 29,4±10,6 and 28,9±10,2 respectively.

Fig. 2. — Thoracolumbosacral orthosis (TLSO)

In clinical examination before brace treatment in the SpineCor group average height was 151±14,4 cm, T1-Coccygx distance was 47,25±5,6 cm. Gibbosity measured with a scoliometer found 10,4±3,8° and Cobb angle was 35,1±8,2°. In TLSO group average height was 144±13 cm, T1-Coccygx distance was 45,16±5,4°. Gibbosity found 8,68±2,2° and Cobb angle was 33,5±7,5°. There were no statistical difference found between the groups before the treatment except for height. After the brace treatment, the average height of patients was 158,1±12,3 cm in S group and 151,3±10,7 cm in TLSO group (p=0,008). T1-Coccygx distance became 51,2±4,8 cm in S group and 48,6±4,5 cm in TLSO group (p=0,056). Cobb angles decrease to 33,6±13° in S group while increase to 34,6±77° in TLSO group (p=0,444). Gibbosity measured 9,7±4,4° in S group and 9±2,4° in TLSO group (p=0,637). Differences in height and T1-Coccygx distance after the treatment were significant but differences in Cobb angles and gibbosity were not statistically significant in both groups. (Table I)

After the first year in brace treatment patients were asked to fill out the SRS-22 questionnaire. Nineteen the patients in TLSO group and 45 patients in S group answered the questions properly. Four patients in S group did not want to share their opinions and thus were excluded from this part of the study. SRS-22 questionnaire results of the groups showed significant differences in measures of pain, self-image and function/activity subgroups. These subgroup results were better for S group (p= 0,017, 0,003 and 0,004 respectively). Mental health and satisfaction scores of patients were not significant (p=0,148 and p=0,705 respectively) (Table II).

For 15 patients in the S group, posterior instrumentation and fusion performed due to progression of the curves with the success rate of SpineCor brace found 68% (correction or stabilization). But when five patients were excluded because they had been candidates for surgery before the brace treatment and then used the brace for delaying surgery, the success rate turned out to be 79%. In the R group the curve progressed for four patients and they required surgery. Success rate of R group was found 73%.

DISCUSSION

Although brace is the most accepted conservative treatment of AIS, its effectiveness has not been proven convincingly. Negrini (*14*) expressed that the bracing is not the best possible treatment but alternatives are more challenging. Contrary to that view, Goldberg et al. (*8*) reported similar surgery rates for unbraced and braced patients of AIS. However brace treatment was found to be the only effective mode of nonoperative treatment on a full-time or night-time basis (*16*). The SpineCor brace is an alternative to rigid braces and can be more tolerable for some patients. But its efficiency compared to rigid braces is not well documented in the literature.

In this study the deformity of the patients was evaluated with Cobb angles and rib hump. Before the brace treatment the groups were similar. Following

Table I. — Clinical and radiological evaluation before and after the treatment

	Before Treatment			After Treatment		
	SpineCor	**Rigid**	**p**	**SpineCor**	**Rigid**	**p**
Height (cm)	151±14,4	144±13	0,032	158,1±12,3	151,3±10,7	0,008
T1-Coccygx distance (cm)	47,25±5,6	45,16±5,4	0,167	51,2±4,8	48,6±4,5	0,056
Cobb (^{0})	35,1±8,2	33,5±7,5	0,556	33,6±13	34,6±7,7	0,444
Gibosity (^{0})	10,4±3,8	8,68±2,2	0,076	9,7±4,4	9±2,4	0,637

Table II. — SRS-22 results after one year brace treatment

	n	**Pain**	**Self Image**	**Function/ Activity**	**Mental health**	**Satisfaction**
SpineCor	45	4,47±0,6	3,7±0,6	4,5±0,6	3,8±0,5	3,6±0,7
Rigid	19	4,1±0,5	3±0,9	3,9±0,7	3,5±0,8	3,5±0,8
p		0,017	0,003	0,004	0,148	0,705

treatment there were small changes in average angles, but no significant difference was found. The success rate of S group (correction or stabilization) was 79% and the group members' surgery rate was 21%. In their first study about post-treatment results of SpineCor, Coilard et al. *(5)* found a correction rate of more than 55%, stabilization of 38% and progression of 7%. With these results, they found SpineCor brace was 92% satisfactory for curves less than 30°, and 88% satisfactory for greater curves. In their subsequent study, Coilard and colleagues found a surgery rate of 22,9% which was almost the same as with this study. In our TLSO group the success rate was 73% and surgery rate 27%. In the previous studies the surgery rate was found 6,1-28,1% in the rigid braces *(9,13)*. In this study the surgery rate of TLSO brace group did not differ from the earlier literature nor from our S group. In their recent study Guo et al. demonstrated that when a higher curve progression rate in SpineCor was compared to a rigid brace and found that changing SpineCor to a rigid brace for patients who showed curve progression >5° while receiving the SpineCor treatment was effective *(10)*. In this study progressions overcame with brace modifications.

Height and spinal height of both groups increased during the brace treatment. Although height and T1-Coccgx distance of the groups before and after the treatment were not similar. There were no difference in the increase rates of height and T1-Coccgx distance (p=0,918 and p=0,676 respectively). There are no studies on the effects of different scoliosis braces on height or spinal height in the literature but according to this study there were no differences were found between SpineCor and TLSO.

Quality of life is one of the main problems of AIS patients during brace treatment and it could affects success of the treatment. There are many questionnaires evaluating health related quality of life and some of them are specific to scoliosis *(2,3,7,12,17)*. The SRS-22 questionnaire was developed to assess the medical condition and self-image of scoliosis patients. The overall high performance of this questionnaire is due to its reliability, concurrent validity, discrimination validity, and responsiveness to change associated with the treatment in the English-speaking countries. The Turkish version of this questionnaire was developed and found reliable and valid to determine quality of life of scoliosis patients in the Turkish population *(1)*. In this study, the SpineCor brace was found to be better than TLSO in terms of pain, self-image and function/activity according to the SRS-22 questionnaire. Although our expectation was to achieve better results in all subgroups of the SRS-22 questionnaire, mental health and satisfaction resuls were similar. SpineCor

theoretically limits movement less than rigid braces and can be worn under a dress. For these reasons our expectations were raised. Similar results between the groups in terms of mental health and satisfaction from the treatment were thought to be related to the similarity of the deformity correction during treatment.

There were some limitations of the current study. The most noticeable was the difference in the number of patients. The reason for this was the lack of randomization of the study. The decision to choose the brace type was left to the patients' parents. Although it is more expensive than TLSO, more families chosed the SpineCor brace. The other limitations were small sample size and failure to evaluate the effects of braces according to different types of curves.

In conclusion the SpineCor brace and rigid braces had a similar effect on deformity correction in AIS. Surgery rates and success rates of braces were approximately equal. The major difference between patients using SpineCor and TLSO was health-related quality of life. SpineCor brace had a better self-image better, felt more active in daily life and experienced less pain according to SRS-22 results.

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