



Effectiveness of Posture Correction Girdle as Conservative Treatment for Adolescent Idiopathic Scoliosis: a Preliminary Study



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Abstract

A six-month quasi-experimental pretest-posttest clinical trial has been conducted to assess the ability of a posture correction girdle to control the progression of scoliosis and its corrective effect by comparing when the girdle is donned as opposed to when it is doffed. Comparisons of the Cobb's angle examined by using radiography are carried out to observe pre-intervention versus post-intervention changes as well as pre-intervention versus in-brace correction after 6 months. It is found that the survival rate of the posture correction girdle is up to 90%. More importantly, the results show that there is a significant difference when the girdle is donned as opposed to when it is doffed. These results prove that the use of a pressure garment induces corrective forces onto the spine. This study therefore demonstrates the possibility of using textile materials for spinal or those and for other types of functional garments.

Keywords: Functional garment; Adolescent idiopathic scoliosis; Flexible brace; Posture correction girdle

Introduction

Adolescent idiopathic scoliosis (AIS) is one of the most common spinal conditions with a prevalence of 5.2% in the general population [1]. In the last ten years, flexible braces for treating AIS have been receiving much attention due to their flexibility, air permeability and improved physical appearance.



Figure 1: Posture correction girdle.

Liu et al. [2,3] proposed a flexible brace called the posture correction girdle (Figure 1) for adolescents with early scoliosis based on the corrective principles of a tight-fitting garment that

exerts local pressure onto the spine by using semi-rigid foam padding to control spinal curvature. Nevertheless, there is little evidence based research on the effectiveness of this girdle for controlling scoliosis. The aim of this case study is to therefore investigate the effectiveness of the posture correction girdle in terms of spinal deformity control.

Case Report

During October 2015 to December 2016, a total of 16 AIS patients were recruited for a clinical trial study of the posture correction girdle through a school screening program in local secondary schools or by referral from a physician. The inclusion criteria were adolescents diagnosed with idiopathic scoliotic deformity with a Cobb's angle between 10°-30°, between 10 and 16 years old, Risser grade 0-4 of the apophysis of the iliac crest, and no prior treatment. All subjects were required to wear the posture correction girdle for at least 8 hours a day for 6 months while the rest of the time (16 hours) was allocated for bathing, doing physical exercises, and sleeping.

Standardized anteroposterior radiographs of the entire spine were taken at pre-intervention, 6 months in-brace, and 6 months

post-intervention to assess the degree of spinal deformity. To reduce intentional or unintentional bias, all radiographic measurements were conducted by two independent orthopedic doctors.

Results

Ten out of the 16 subjects completed the wear trial and 6 withdrew from the program. The mean, standard deviation, and range of maturity assessment parameters (chronological age, Risser grade), and the range of the clinical parameters (primary Cobb's angle of various points for each type of curve) are shown in Table 1. In terms of the control of the progression of spinal

deformity after 6 months of wearing the girdle, a Wilcoxon signed-rank test indicated that there is no significant difference between pre-intervention (mean rank=19.0) and post-intervention (mean rank=17.4); $Z=-1.376$, $p=0.169$. Moreover, it was found that one (10%) subject with a Lenke 5 has a curve progression of more than 5° , one subject (10%) with a Lenke 6 has a curve that progressed within an angle of 5° , 8(80%) have a curvature improvement within 5° , and none showed an improvement in curvature that is equal to or greater than 5° . The survival rate (without a curve progression of 5°) of the posture correction girdle over a period of 6 months is 90%.

Table 1: Profile of recruited subjects.

	Lenke 1	Lenke 3	Lenke 5	Lenke 6	Total
Age (years)	12.3±0.6	15	12.3±0.6	15±1.0	13.5±1.4
Risser grade	1.7±1.5	4	2.7±0.6	3.8±0.3	2.9±1.2
Pre-intervention ($^\circ$)	12.3±0.6	28	19.2±7.3	22.3±2.8	19.0±6.4
Wearing girdle on 6 th month ($^\circ$)	9.7±4.0	25	16.8±8.3	18.4±8.4	16.0±7.7
Post-intervention ($^\circ$)	10.3±2.2	25	19.5±9.0	20.0±5.9	17.4±7.3
Number of subjects	3	1	3	3	10

All values are reported as mean ±SD

Regarding the in-brace correction after 6 months of wearing the girdle, a Wilcoxon signed-rank test indicated that the Cobb's angle at the 6th month is statistically significantly lower than that at pre intervention; $Z=-1.988$, $p=0.047$. Furthermore, Table 2 presents the

average degree of in-brace correction after 6 months of wearing the girdle and the percentage of correction. The results show that the posture correction girdle provides a 16% spinal in-brace correction of the spine when the girdle is worn for an average of 6 months.

Table 2: Comparison of Cobb's angle between pre-intervention and after 6 months of girdle wear.

	Lenke 1	Lenke 3	Lenke 5	Lenke 6	Total
In-brace correction (Girdle worn from pre-intervention to 6 th month) ($^\circ$)	2.7	3	2.4	3.9	3
In-brace correction (%)	22%	11%	13%	17%	16%

All values are reported as mean

Discussion

This case report demonstrates that the posture correction girdle can control the progression of scoliosis with a 90% survival rate. More importantly, the statistical analysis further supports that the Cobb's angle when the girdle is worn at the 6th month is significantly lower than at pre-intervention. This shows that there is a positive short-term effect from girdle wear in terms of spinal correction. These results validate the work of Liu et al. [2]: a girdle design which is a tight fitting undergarment and induces localized pressure for controlling scoliosis. The corrective principles of the posture correction girdle for AIS are derived from using resin bones and elastic bands with a high modulus of elasticity, which create circumferential compressive forces onto the body. In addition, the installation of semi-rigid ethylene vinyl acetate (EVA) foam paddings that are inserted into the apex region of the deformed spine provide additional pressure onto the convex side of the scoliotic spine. The uneven pressure distribution causes the scoliotic vertebrae to shift from the convex to the concave side.

Nevertheless, when the results are compared with those of another flexible brace, SpineCor, the effectiveness of the posture correction girdle on controlling spinal curvature is still inadequate in terms of the survival rate, percentage of spinal correction at the end of the treatment, and percentage of in-brace correction. The survival rate at the 6th month of orthotic intervention with the girdle is 90% while that of the Spine Cor is 95% [4]. The percentage of spinal correction (1-post-intervention/pre-intervention) at the end of the treatment with the girdle is 8.4% while that with the Spine Cor is 12.9% [5]. The percentage of in-brace correction when the girdle is donned is 16% while that of the Spine Cor is 21.3% [6].

Nevertheless, the findings here open the possibility of using functional textile materials for orthotics. Although the performance of the posture correction girdle in controlling scoliosis is still lacking compared to the SpineCor, this means that there is still room to improve its design. It is therefore recommended that future studies further examine different materials for the rigid supporting bones and consider highly elastic webbing, as well as an



asymmetrical design for more effective spinal correction with the posture correction girdle.

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References

1. Konieczny M, Senyurt H, Krauspe R (2013) Epidemiology of adolescent idiopathic scoliosis. *J Child Orthop* 7(1): 3-9.
2. Liu PY, Yip J, Yick KL, Yuen CWM, Tse CY, et al. (2014) An Ergonomic Flexible Girdle Design for Preteen and Teenage Girls with Early Scoliosis. *Journal of fiber bioengineering and informatics* 7(2): 233-246.
3. Liu PY, Yip J, Yick KL, Yuen CWM, Tse CY, et al. (2015) Effects of a tailor-made girdle on posture of adolescents with early scoliosis. *Textile Research Journal* 85(12): 1234-1246.
4. Wong MS, Cheng JC, Lam TP, Ng BK, Sin SW, et al. (2008) The effect of rigid versus flexible spinal orthosis on the clinical efficacy and acceptance of the patients with adolescent idiopathic scoliosis. *Spine* 33(12): 1360-1365.
5. Coillard C, Circo A, Rivard CH (2008) A new concept for the non-invasive treatment of Adolescent Idiopathic Scoliosis: The Corrective Movement principle integrated in the Spine Cor System. *Disabil Rehabil Assist Technol* 3(3): 112-119.
6. Guo J, Lam TP, Wong MS, Ng BK, Lee KM, et al. (2014) A prospective randomized controlled study on the treatment outcome of SpineCor brace versus rigid brace for adolescent idiopathic scoliosis with follow-up according to the SRS standardized criteria. *Eur Spine J* 23(12): 2650-2657.