Original Article

The effect of chiropractic techniques on the Cobb angle in idiopathic scoliosis arising in adolescence

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Abstract. [Purpose] The purpose of this study was to examine whether chiropractic techniques would reduce the curvature of idiopathic scoliosis, which commonly occurs in elementary school children. [Subjects] The subjects of this study were 5 healthy elementary students who listened to an explanation of the study methods and purpose of the study and agreed to participate in the experiment. [Methods] The Cobb angle was measured by taking an X-ray (FCT-1, Dongmun, Goyangsi, Republic of Korea) taken from the rear, using X-ray film. The method of intervention this study used was application of chiropractic techniques. Spinal correction was carried out for 30 minutes per session, which included soft tissue massage, 3 times a week for 8 weeks. [Results] It was established that the Cobb angle was noticeably decreased after 4 weeks of the intervention. Post Hoc analysis revealed that the Cobb angle noticeably decreased after 4 weeks compared with the Cobb angle before the chiropractic techniques were applied. However, no significant difference in Cobb angle was evident after the fourth week. [Conclusion] This study demonstrated that chiropractic techniques can effectively reduce the Cobb angle within as little as 4 weeks. So, we can confirm that the chiropractic techniques were effective for reducing the curvature of idiopathic scoliosis.

Key words: Scoliosis, Cobb angle, Chiropractic technique

(This article was submitted Nov. 24, 2015, and was accepted Dec. 18, 2015)

INTRODUCTION

Most students today have many posture-related health problems due to academic stress and habits that cause inadequate posture, i.e., using a computer for long hours, incongruent height of a desk and a chair, heavy backpacks, and lack of exercise¹⁾. In particular, even when there is no clear cause, it is easy for spinal deformity to occur in adolescence, and once spinal deformity begins, the spinal curvature consistently becomes more severe. Therefore, it may develop into scoliosis. The word scoliosis was first used by Galen (AD 131-201), and it referred to one or more vertebrae slanting sideways and therefore exhibiting lateral declination and rotation²⁾. Currently, a Cobb angle above 10° is defined as scoliosis³⁾, and in children, idiopathic scoliosis of unknown cause occurs quite commonly⁴⁾. According to domestic and foreign reports, researchers have come up with different results, but it is commonly known that the prevalence rate of scoliosis is about 0.3% to 21.0%⁵⁾. Idiopathic scoliosis occurs slowly and gradually, hence it is hard for the parents and children themselves to discover it until it fully develops into scoliosis⁶⁾. Complications that arise secondarily are malfunction⁷⁾, fatigue and pain⁸⁾, neurological complications, problems with appearance⁹⁾, psychological problems¹⁰⁾, and shortening of life expectancy¹¹⁾. Because of the many of health problems that appear as scoliosis advances, awareness of the need for early diagnosis of scoliosis and early conservative treatment is increasing. In particular, one report demonstrated that early discovery and treatment, and sometimes surgical intervention, are effective in managing scoliosis¹²⁾. In 1981, it was discovered in Sweden that early examination and early treatment can reduce the progress of scoliosis from 40% to 63%¹³⁾. In 15 of the 50 states of the United States, screening for scoliosis in school is required by law. The American Academy of Orthopedic Surgeons recommends that female students

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should be screened twice between the ages of 11 and 13 and that male students should be screened once between the ages of 13 and 14¹⁴⁾.

Both conservative and surgical treatments for scoliosis are available. Conservative treatments include treatment using physical parameters, exercise treatment, physiotherapy including degree revisal, and a support device that is used to restrain scoliosis from progressing further¹⁵⁾. Many studies have been undertaken on exercises that can control the imbalance of muscles around the spine. Studies on the effect of exercise treatments, such as the effect of early exercise treatment on idiopathic scoliosis occurring in elementary school students¹⁶⁾, the effect of core muscle relaxation technique on the Cobb angle in scoliosis¹⁷⁾, the effect of Swiss ball exercise on respiratory function and trunk regulation ability of scoliosis patients¹⁸⁾, and the effect of height exercise, Schroth exercise, and other strengthening exercises on scoliosis¹⁹⁾, have been undertaken. However, studies on the effect of spine correction, which falls in the category of conservative treatments, are lacking. A few studies, such studies of the effect of body correction on structural scoliosis²⁰⁾, the effect of body correction on the Cobb angle of high school female students with scoliosis²¹⁾, the effect of scoliosis angle on center of gravity sway²²⁾, and the good way to assess scoliosis^{23, 24)}, have been performed. However, these studies are few in number in comparison with the studies on the effects of exercise treatment on scoliosis.

Therefore, this study examined whether chiropractic techniques applied to elementary school children who were confirmed to be suffering from idiopathic scoliosis would reduce the spinal curvature at an early stage.

SUBJECTS AND METHODS

In order to select participants for this study, a forward bending test was carried out on training students at a Taekwondo gym of H-gu, Busan, Republic of Korea. Out of 20 students that showed a positive result from the test, 12 students understood the purpose and aim of this study and voluntarily wanted to participate. This study complied with the ethical standards of the Declaration of Helsinki, and written informed consent was received from each participant. After receiving written informed consent, a radiograph was taken on the following day. Five students with a Cobb angle above 10° were selected as final study participants. Table 1 shows the results of analysis on general characteristics of study participants²⁵⁾. The average age of the study participants was 11.8, the average height as 144.4 cm, and the average weight was 40.4 kg. The average Cobb angle before the intervention was 11.2° (Table 1).

The Cobb angle was measured by taking an X-ray (FCT-1, Dongmun, Goyangsi, Republic of Korea) from the rear, using X-ray film. Lines were drawn on the film connecting the upper spine at the top of the concave part of the curvature with the lower spine at the bottom of the curvature, and then a perpendicular line was drawn from each line, and the angle where the perpendicular lines intersected was the Cobb angle²⁶⁾.

The method of intervention this study used was application of chiropractic techniques. In application of chiropractic techniques, the part of the spine that does not maintain correct alignment is identified, and the spine is adjusted with force to achieve proper alignment. Sudden, momentary pressure is administered against the spinal area, and if muscles around the spine are tense, there is a possibility of muscle damage, so it is necessary to relax soft tissues around the vertebrae before applying chiropractic techniques. For this reason, a soft tissue massage was given to the subjects prior to chiropractic treatment. The chiropractic techniques used in this study were correction techniques for the iliac and mammillary processes of lumbar vertebrae, which are pelvic and lumbar correction methods. Thoracic vertebral correction techniques for the transverse processes of thoracic vertebrae were performed utilizing the therapist's hands. Furthermore, the correction techniques for the transverse processes of the atlas and articular processes of the cervical vertebrae, which are cervical vertebra correction methods, were used²⁷⁾. Spine correction was carried out for 30 minutes per session including soft tissue massage, 3 times a week for 8 weeks²⁵⁾.

Normality of the data for 5 study participants was tested and verified by Shapiro-Wilk test. In order to quantify the decrease in Cobb angle after 4 weeks and again after 8 weeks compared with the Cobb angle before the intervention, repeated measures ANOVA tests were performed. The statistical program used for this study was IBM SPSS Statistics for Windows (ver. 21.0), and the significance level used was set as $\alpha=0.05$.

Table 1. Characteristics of the subjects (n=5)

Subjects	Age (years)	Height (cm)	Weight (kg)	Cobb angle
1 (M)	13	155	47	10°
2 (M)	13	158	48	10°
3 (M)	12	137	35	13°
4 (M)	10	138	40	11°
5 (F)	11	134	32	12°
Mean±SD	11.8±1.3	144.4±2.1	40.4±7.8	11.2±1.3

F: female; M: male

RESULTS

Table 2 shows the results regarding the changes in Cobb angle in each participant. In male 1, the Cobb angle was 10° before the intervention, 0° after intervention for 4 weeks, and 0° after intervention for 8 weeks. Male 2 had a Cobb angle of 10° before the intervention, 0° after intervention for 4 weeks, and 0° after intervention for 8 weeks. In male 3, the Cobb angle was 13° before the intervention, 7° after intervention for 4 weeks, and 0° after intervention for 8 weeks. In male 4, the Cobb angle was 11° before the intervention, 5° after intervention for 4 weeks, and 5° after intervention for 8 weeks. In female 1, the Cobb angle was 12° before the intervention, 0° after intervention for 4 weeks, and 0° after intervention for 8 weeks (Table 2).

As a result of identifying statistically significant differences in the above results, it was determined that the Cobb angle had noticeably decreased after 4 weeks and 8 weeks. Post Hoc analysis with the Bonferroni test showed that the Cobb angle noticeably decreased after 4 weeks compared with the Cobb angle before applying chiropractic techniques, but there was no significant difference in Cobb angle after 4 weeks or 8 weeks. Therefore it was demonstrated that chiropractic techniques can effectively reduce the Cobb angle within as little as 4 weeks (Table 3).

DISCUSSION

Although scoliosis has various causes, once it occurs, it consistently progresses and leads to changes in the level of tension in muscles around the spine. If this kind of change is allowed to continue, the muscles on either side of the spine do not develop in balance, and this causes muscles on one side to shorten abnormally and muscles on the other side to stretch abnormally, hence causing the spine to displace in one direction, causing curvature of the spine. Thus, the main body of the spine getting displaced in one direction rotates, exacerbating the curvature further to the point that it becomes visible. Scoliosis results in spine displacement sagittally, spine centrifugal distortion horizontally, and an abnormal curvature. All of these things cause pain, restrictions to spinal movement, and degeneration. Regarding this matter, McMorland and Suter²⁸⁾ stated that abnormal stresses arise around the affected joints when vertebrae are displaced and that the pain and restrictions to range of motion consequentially occur. Park²⁹⁾ reported that as a result of identifying the relationship between spinal instability, vertebral displacement and vertebral degeneration, spinal instability, vertebral displacement, and increased arthritis were demonstrated to be associated with scoliosis of the spine. Since scoliosis causes pain and motion restriction, thereby deteriorating the quality of life, it is important to discover and treat it at an early stage.

The general principles of scoliosis treatment include correction of transformed spine curvature, and strengthening of related soft tissues. Hence in order to treat scoliosis, it is necessary to adjust spinal rotation, push the spine towards the opposite direction of its abnormal bending to align the vertebrae correctly, and balance the muscles around the spine that have developed asymmetrically.

Lee¹⁴⁾ stated that exercises for strengthening muscles around the spine were effective in prevention and treatment of scoliosis. Choi¹⁶⁾ reported that as a result of implementing exercises to cure elementary school students with idiopathic scoliosis in the early stages, the Cobb angle decreased. Cho and Jang³⁰⁾ reported that as a result of applying an exercise program to strengthen the trunk and extremity muscles in adolescents, the Cobb angle improved along with improvement of muscular strength and muscular endurance. These kinds of results imply that if the balance of muscles on either side of the

Table 2. The changes in Cobb angle in each subject (Unit: degrees)

Subjects*	Before intervention	After 4 weeks	After 8 weeks
1 (M)	10	0	0
2 (M)	10	0	0
3 (M)	13	7	0
4 (M)	11	5	5
5 (F)	12	0	0
Mean±SD	11.2±1.3	2.4±3.4	1.0±2.2

F: female; M: male *Adapted from Byeon, 2008

Table 3. The changes in Cobb angle after 4 and 8 weeks of the intervention (Unit: degrees)

Variables	Before intervention	After 4 weeks	After 8 weeks
Cobb angle**	11.2±1.3 ^a	2.4±3.4 [†]	1.0±2.2 [‡]

^aMean±SD **p<0.01

[†] Before intervention > After 4 weeks

[‡] Before intervention > After 8 weeks

spine is fixed through muscle strengthening exercises, scoliosis could be improved.

However, when the level of scoliosis is moderate or severe, the benefits of exercise³¹⁾ are limited. For that reason, interest in degree correction methods as methods of scoliosis treatment to correct vertebral alignment is increasing. Park et al.²¹⁾ reported that as a result of implementing manipulative therapy combining the Gonstead technique and Cox technique in female high school students with scoliosis, the Cobb angle improved. Romano and Negrini³²⁾ reported that as a result of systematic review, chiropractic techniques, and manipulation, positive effects on reduction of the angle in scoliosis were achieved. In application of chiropractic techniques, a specific area of the vertebrae and joint is identified, and a rapid, low-amplitude stimulus is applied to correct the joint by applying force to it so that the joint moves into the physiological range and past the elastic range, which is the normal motion range of the joint³³⁾. Therefore, chiropractic techniques are known to correct a twisted spine, restore muscle imbalance, help restore functions of spinal nerves³⁴⁾, and stimulate the Golgi tendon organ located around tendons to relax muscle and expand motion range³⁵⁾. However, even though chiropractic techniques have a positive effect on spine correction, studies on the effect of chiropractic techniques in the correction of scoliosis in growing adolescents are lacking. Hence, this study aimed to identify the effect of chiropractic techniques on scoliosis in elementary school students. The results showed that the spinal curvature in the subjects was reduced significantly in 4 weeks, although there was no significant difference between 4 weeks and 8 weeks. These results imply that chiropractic techniques performed on children with idiopathic scoliosis can achieve a near-normal spinal alignment within 4 weeks. On the other hand, since the number of study participants was small, this study is too limited in scope to be able to predict results in a larger population. Therefore, a study that applies chiropractic techniques to a larger number of participants and observes and records the effects should be performed. Nevertheless, the results of this study imply that in clinical practice, a direct correction to the spine is necessary for treating scoliosis. Hence spinal correction should be included as a part of the program for treatment of scoliosis.

ACKNOWLEDGEMENT

The data, subjects, and methods in this study were based on the master's thesis of Sung-Hak, Byeon in 2008.

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