

EFFECT OF SPORTS TAPING APPLIED FUNCTIONAL CORRECTION GARMENT FOR ADOLESCENT IDIOPATHIC SCOLIOSIS IMPROVEMENT

Yang-Sun Park¹, Byung-Hoon Woo¹, Moon-Suk Kwon¹, Jae-Jung Kim¹,
Sung-Jung Kim¹, Jong-Moon Kim², Woen-Sik Chae³, Young-Tae Lim¹

¹Division of Sports Science, Konkuk University, Chungju, Korea

²Department of Rehabilitation Medicine, Konkuk University, Chungju, Korea

³Department of Physical Education, Kyungpook National University, Daegu, Korea

The purpose of this research was to analyze the effect of wearing underwear type functional garment for the correction scoliosis by conducting a case study. Two patients wore the garment for 8-week. Cobb's angle and EMG activities during a gait were measured before and after the treatment for the analysis. Both subjects showed that the activities of the right psoas, biceps femoris and gluteus medius were increased. The Cobb's angle was decreased after 8-week period of wearing. These results matched with the purpose of developed functional correction wear that induce the right psoas muscle contraction and the left psoas muscle relaxation. It seems to be useful wear for adolescent scoliosis patients who avoid using orthosis, and to use special functional underwear to improve their posture.

KEY WORDS: idiopathic scoliosis, orthosis, posture, gait, Cobb's angle, electromyography

INTRODUCTION: Musculoskeletal abnormality such as idiopathic scoliosis occurs tentatively and progresses slowly. If this disease is detected early and can be corrected the patient may be available to avoid unnecessary surgery, but also alleviate psychological distress (Hensinger, 1991). It is reported that the successful correction rate of musculoskeletal disorders can be increased with early detection (Eden-Kilgour & Gibson, 1990). However, in Korea, it is the reality that there were not much proper treatments or managements after the scoliosis checks in adolescence even if the symptom has occurred (Park & Park, 2003). The pathogenesis of idiopathic scoliosis is reported, that it is attributed to the disorders of multifidus in the localized vertebral curvature rather than entire contractile protein disorder (Suk, Kim, & Lee, 1994). In addition, multifidus, attached near the vertebral curvature, twitch slowly and increase the volume of muscle fiber compared to the psoas muscle and eventually shortening the length (Fidler & Jowett, 1976). It is also reported that the scoliosis patients in adolescence showed muscle activities of the right latissimus dorsi was decreased and the right psoas was increased compared to those of normal subjects (Park, Woo, Kim & Lim, 2012). Underwear type functional correction garment, with a sports taping principle, was developed for this study (Figure 1). This taping method can improve the sensitivity of proprioception, control muscle tone, and keep the balance among agonist, co-contractile muscle, and antagonist (Kim, Kwon, & Yi, 2001; Refshauge, Kilbreath, & Raymond, 2000). The main purpose of this study was to analyze the effect of wearing a functional garment to the improve posture in adolescents with scoliosis.

METHODS: Since this is a case study only two patients were participated. First subject was a male (age: 17 yrs, height: 162cm, mass: 42.8 kg) and the second subject was a female (age: 15 yrs, height: 152cm, mass: 43 kg). The treatment consisted of both subjects having to wear the taping applied functional garment for eight weeks, for a minimum of 12 hours a day. X-rays and EMG tests were performed before the wearing the garment and after the treatment. X-ray examination for Cobb's angle measurement was carried out at rehabilitation medicine center. Eight pairs of surface electrodes (Delsys Trigno wireless system, USA; 2000 Hz) were placed on the left and right latissimus dorsi, psoas, gluteus medius, and biceps femoris for EMG analysis. A trigger module was used to synchronize between camera and EMG system. EMG data were collected from the standing posture for reference EMG and during gait for 5 s. The raw EMG signals were filtered using Butterworth band pass filter

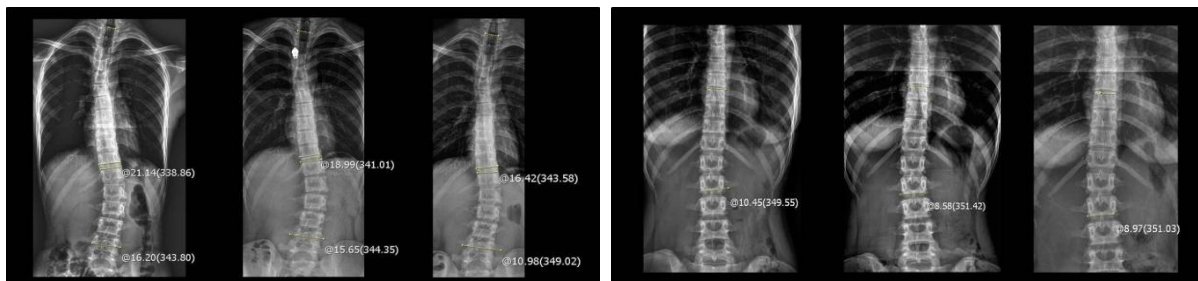
(5-500 Hz) and normalized with reference EMG as % reference voluntary contraction (RVC) (Lehman & McGill, 1999).



Figure 1: Underwear type sport taping applied functional correction garment

Seven events and 6 phases during a gait were identified for further analysis: the left foot heel strike to the ground (LHS), the right foot toe off the ground (RTO), the left foot mid-stance during a support phase (LMS), the right foot heel strike to the ground (RHS), the left foot toe off the ground (LTO), the right foot mid-stance during a support phase (RMS), the second left foot heel strike to the ground (LHS2). Each phase consisted of adjacent two events.

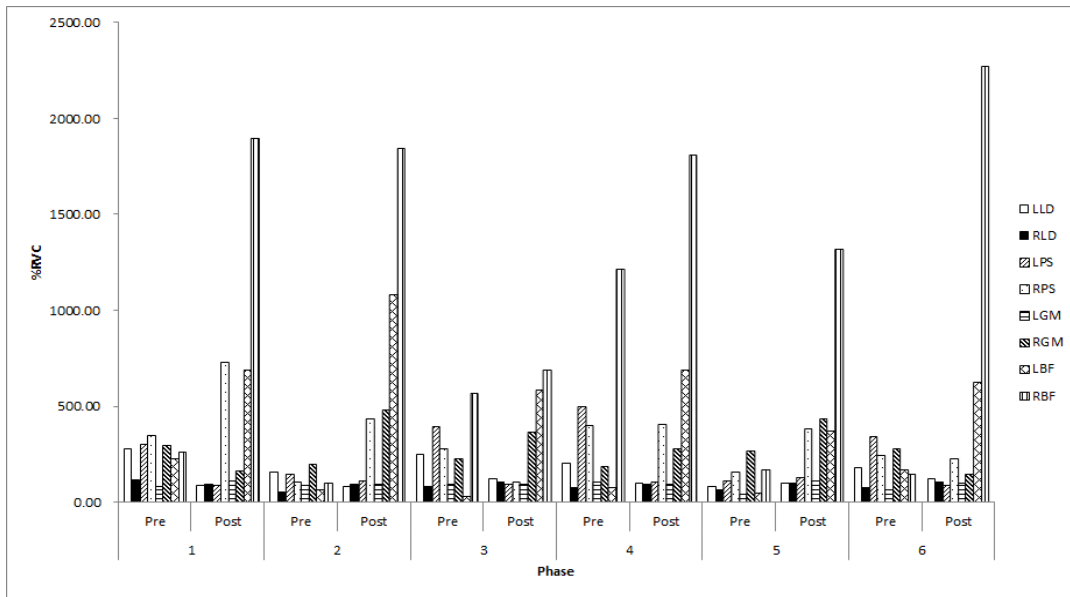
RESULTS: The upper Cobb's angle of the first subject decreased from 21.14° before to 16.42° after the treatment. Similarly the lower Cobb's angle of the first subject decreased from 16.20° to 10.98°. The Cobb's angle of the second subject also decreased from 10.45° before wearing the garment to 8.97° after 8-week wearing the garment (Figure 2).



subject 1 - A B C subject 2- A B C
Note. A: before wearing the garment, B: during wearing, C: after 8-week wearing

Figure 2: Cobb's angle of the first and second subjects

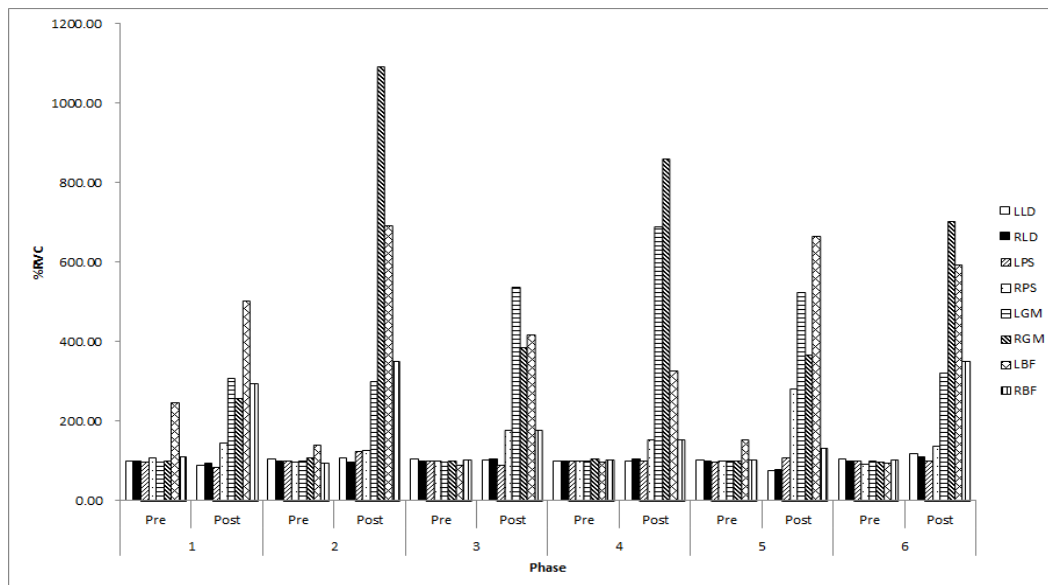
EMG results indicated that the activities of both the right and the left biceps femoris and gluteus medius increased dramatically after the treatment for the first subject. During phase 1, 2, and 6 which the left foot was in stance phase the EMG activities of the right biceps femoris were found as 1895%RVC, 1843%RVC, and 2269%RVC, respectively. The right psoas muscle was very active compared to the left one after the treatment. High activity of the right psoas was found as 730%RVC, 437%RVC, and 384%RVC during phase 1, 2, and 5, respectively (Figure 3).



Note. LLD; Left Latissimus Dorsi, RLD; Right Latissimus Dorsi, LPS; Left Psoas, RPS; Right Psoas, LGM; Left Gluteus Medius, RGM; Right Gluteus Medius, LBF; Left Biceps Femoris, RBF; Right Biceps Femoris

Figure 3: Mean EMG value of selected muscles for each phase during a gait (subject 1)

The EMG results of the second subject also found that the activities of both the right and the left gluteus medius and biceps femoris increased after the treatment. In particular, the right gluteus medius showed 1091%RVC, 859%RVC, and 702%RVC during the phase 2, 4, and 6, respectively. The left gluteus medius showed 689%RVC and 367%RVC during phase 4 and 5. In addition, the right psoas was more active than that of the left during the swing phase of the right foot. The activities were found as 127%RVC, 177%RVC, and 280%RVC during phase 2, 3, and 5, respectively (Figure 4).



Note. LLD; Left Latissimus Dorsi, RLD; Right Latissimus Dorsi, LPS; Left Psoas, RPS; Right Psoas, LGM; Left Gluteus Medius, RGM; Right Gluteus Medius, LBF; Left Biceps Femoris, RBF; Right Biceps Femoris

Figure 4: Mean EMG value of selected muscles for each phase during a gait (subject 2)

DISCUSSION: This case study verified the effect of a developed functional garment for the correction of posture, using taping techniques applied for idiopathic scoliosis patients in adolescent. Cobb's angle measurement through the X-ray examination and EMG testing were performed before and after the treatment. EMG results of subject 1 showed that the activities of gluteus medius and biceps femoris increased after the treatment. Activity of the left psoas decreased but the activity of the right psoas increased at the same time. This is deemed to be due to the effect of the garment, which induces the right latissimus dorsi and the left psoas to relax while the right psoas is in tension (Park, Woo, Kim, & Lim, 2012). For subject 2, although there were not much different activities found between psoas and latissimus dorsi, the level of activation for gluteus medius was increased during a gait. This might be due to the need to produce propulsion during a swing phase. The results of Cobb's angle also indicated that the scoliosis angles decreased by 4.72° and 1.48° for subject 1 and 2 after the treatment. During the wearing of the garment, the Cobb's angles of both subjects decreased instantly (18.99° and 15.65° for subject 1; 8.58° for subject 2). This is another proof that the garment itself was effective tool to influence the scoliosis angle. In idiopathic scoliosis, it is recommended that posture correction and manual therapy for up to 20°, 24 hour wearing correction orthosis gear for 20~40°, and surgical treatment for more than 60° (Lenssinck et al., 2005). Although clinicians may recommend wearing correction orthosis gear for those who have a Cobb's angle of less than 20° in adolescent, they often refuse to wear it due to the discomfort, changes in body image, and interpersonal relationships evasion (Moon, Yoon, & Lee, 2003). Accordingly, this study developed an underwear type functional garment for the improvement of scoliosis correction and could indicate a positive effect in improving the degree of scoliosis for adolescent scoliosis patients without the usual burden of wearing as a form of orthosis.

CONCLUSION: Analysis of the Cobb's angle and EMG activities during a gait indicate that the use of this garment for the correction of posture may be useful. Further study with more patients for both sexes is needed to verify the usefulness of this type of treatment for patients with scoliosis.

REFERENCES:

- Eden-Kilgour, S., & Gibson, D. E. (1990). Nursing management of children with scoliosis. *Journal of Practical Nursing*, 40, 34-38.
- Fidler, M. W., & Jowett, R. I. (1976). Muscle imbalance in the etiology of scoliosis. *Journal of Bone and Joint Surgery*, 58(B), 200-201.
- Hensinger, R. N. (1991). Congenital anomalies of the cervical spine. *Clinic Orthopedic*, 264, 1638
- Kim, C. I., Kwon, O. Y., & Yi, C. H. (2001). The Effect of taping on the Range of motion and proprioception at the ankle joint. *Journal of Korean Academy of University Trained Physical Therapists*, 8(3), 43-52.
- Lenssinck, M. L., Frijlink, A. C., Berer, M. Y., BiermanZeinstra, S. M., Verkerk, K., & Verhagen, A. P. (2005). Effect of bracing and other conservative interventions in the treatment of idiopathic scoliosis in adolescents: a systematic review of clinical trials. *Physical Therapy*, 85(12), 1329-1339.
- Moon, S. H., Youn, Y. S., & Lee, J. S. (2003). Change of lumbar lordotic angle by taping therapy on low back pain patient with lumbar hyperlordosis; A case report. *The Journal of Korea CHUNA Manual Medicine*, 4(1), 157-165.
- Park, M. J., & Park, J. S. (2003). Effect of a posture training program on cobb angle and knowledge of posture of elementary school students. *Journal of Korean Society of Nursing Science*, 33(5), 643-650.
- Park, Y. S., Woo, B. H., Kim, J. M. & Lim, Y. T. (2012). Development of wearing of musculo-skeletal functional garment for adolescents' Idiopathic Scoliosis -with the principle of sports taping applied-. *Korean Journal of Sport Biomechanics*, 22(3), 365-371.
- Refshauge, K. M., Kilbreath, S. L., & Raymond, J. (2000). The effect of recurrent ankle inversion sprain and taping on proprioception at the ankle. *Medicine & Science in Sports Exercise*, 32, 10-15.
- Suk, S. I., Kim, Y. H., & Lee, C. K. (1994). A study on contractile proteins of muscles and platelets in idiopathic scoliosis patients. *Journal of Korean Orthopedic Association*, 29(4), 1087-1096.

Acknowledgement

This work was supported by the Korea Research Foundation Grant funded by the Korean Government (NRF-2011-32A-G00048)