



Original Article

The effects of trunk kinesio taping on balance ability and gait function in stroke patients

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Abstract. [Purpose] Kinesio taping is a therapeutic method used in the treatment of various musculoskeletal and neuromuscular deficits, but there is limited evidence of the effects of trunk kinesio taping in neurologic patients. Therefore, this study aimed to determine the effects of trunk kinesio taping on balance ability and gait function in persons after a stroke. [Subjects and Methods] Twenty-five post-stroke patients were included in this study. Kinesio tape was applied to four trunk muscles. Before and after the taping, in all subjects, the balance ability was measured using the Wii Balance Board, and gait function was assessed using the GAITRite system. [Results] The difference in gait function before and after trunk taping was not statistically significant. However, a variability of balance ability showed statistically significant differences. [Conclusion] These results suggest that taping may be a helpful method during rehabilitation programs for stroke patients. Its application to the trunk muscles is especially useful for improving balance ability.

Key words: Stroke, Balance, Kinesio taping

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INTRODUCTION

A stroke is the rapidly developing loss of brain function due to a disturbance in the blood supply to the brain, which is the leading cause of long-term adult disability¹⁻³⁾. Strokes can lead to a combination of muscle weakness or muscle imbalance, decreased postural control, muscle spasticity, poor voluntary control, and body malalignment⁴⁾.

Stroke survivors especially have difficulty in balance and postural control for standing upright because they are impaired by asymmetric posture, abnormal body imbalance, and deficit of weight transfer¹⁾, and these factors have been implicated in the poor recovery of functional ability and an increased risk of falls^{3, 5, 6)}. Moreover, these events have a great impact on the patient's gait function⁷⁾. Therefore, several studies have been conducted with an aim to correct and control these problems^{1-3, 8)}.

Previous studies⁹⁾ reported that trunk muscle weakness in unihemispheric stroke patients can interfere with balance, stability, and functional disability. Chung et al.¹⁾ have demonstrated the importance of trunk control in stable walking and decreasing stroke patients' risk of falling.

Kinesio taping (KT) is a therapeutic method used in the treatment of various musculoskeletal and neuromuscular deficits to relieve pain, correct joint malalignment, decrease swelling, provide support for muscles, and increase or inhibit muscle recruitment^{4, 7, 10, 11)}. Recently, several studies reported that KT can improve postural control and gait ability by not only stimulating the proprioceptive sense but also identifying the right position of the joint⁷⁾. However, in most studies, KT was applied to the ankle region^{7, 11)}.

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Table 1. Characteristics of the subjects

Characteristics	
Gender (Male/Female)	9/16
Age (yrs)	62.8 ± 8.1
Height (cm)	159.4 ± 7.1
Weight (kg)	57.9 ± 7.5
Onset (month)	29.6 ± 14.8
Type of stroke (Hemorrhage/Infarction)	7/18
Affected side (Left/Right)	11/14

Few studies have assessed the effect on trunk stability, balance ability, and gait function in stroke patients¹), and there is limited evidence of the effects of trunk KT in neurologic patients. To the best of our knowledge, no studies to date have investigated the effect of trunk KT on postural control in stroke patients. Therefore, the aim of this study was to determine the effects of trunk KT on balance ability and gait function in patients following a stroke.

SUBJECTS AND METHODS

The subjects of this study were 25 patients of M Hospital in Chang-Won, Korea who had a history of stroke. All patients who met the following criteria participated in the study: duration of onset >6 months, a Mini-Mental State Examination score greater than 21/30, independent gait ability without using a cane for a minimum of 10 m, and ability to understand instructions and communicate. The exclusion criteria were a history of other neurologic diseases or disorders, lower extremity surgery or fracture, low back pain, or allergy to the KT. The general characteristics of the subjects are shown in Table 1.

All subjects understood the purpose of the study and provided written consent prior to participation. This study was compliant with the ethical standards of the Declaration of Helsinki, conducted after receiving an IRB deliberation from Kyungnam University, approval number is 1040450-A-2015-045.

The area to be taped was cleaned with an alcohol swab, and the I-shaped elastic KT was applied to the four trunk muscles from their insertion to their origin with following position by a physical therapist fully trained in KT^{10, 12}). For the rectus abdominis (RA) muscle, the KT was applied from the xiphoid process and the fifth to seventh costal cartilages to near the pubic symphysis in the hooking position. For the external oblique (EO) muscle, the KT was applied from the inguinal region to the T12 spinous process in the side-lying position, and for the internal oblique (IO) muscle, the KT was applied from the xiphoid process to the anterior half of the crest of the ilium in the same position. For the erector spinae muscle, the KT was applied from the ipsilateral transverse process of T12 to the posterior sacrum iliac crest. Before and after the taping, the balance ability was measured in all subjects using the Wii Balance Board (WBB) (Nintendo, Kyoto, Japan) that provided comparable data to a force platform when assessing center of pressure (COP) path length during standing balance trials^{5, 6}). During each trial, the participants were instructed to maintain comfortable distance between their legs, keep their hands placed on their hips, and look at the points marked on the front^{5, 6}). Data were exchanged between the WBB and the laptop using the built-in Bluetooth and Balancia software (Balancia v1.0, Minto systems, Seoul, Republic of Korea)⁵). The data were sampled at 50 Hz, and low-pass filtering (12 Hz) was performed. The average values of COP path length and COP velocity measured three times were used for the analysis.

Gait function was measured using GAITRite system (GaitRite, CIR system Inc., USA, 2008). The standard GAITRite walkway contained six sensor pads encapsulated in a rolled-up carpet with an active area of 3.66 m in length and 0.61 m in width. As the subject walked along the walkway, the sensors captured each footfall as a function of time and transferred the gathered information to a personal computer for processing into footfall patterns. The parameters evaluated were gait velocity, cadence, and step length, and the mean of three repetitions was used^{1, 13, 14}).

The SPSS software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The Shapiro-Wilk test was used to check the normal distribution of data before analysis. The paired t-test was used to examine the change in balance ability and gait function after trunk taping. The significance level was set at 0.05.

RESULTS

The difference in gait function before and after trunk taping was not statistically significant in velocity ($t(1,24)=-0.9$, $p=0.42$), cadence ($t(1,24)=-1.6$, $p=0.13$), and stride length ($t(1,24)=-1.3$, $p=0.07$). However, the variables of balance ability showed statistically significant differences in both COP velocity ($t(1,24)=3.2$, $p=0.04$) and COP path length ($t(1,24)=3.4$, $p=0.02$) (Table 2).

Table 2. Comparison of balance and gait measures just before (pre) and after (post) the tape application

		Pre	Post
Balance	COP velocity (cm/s) *	3.3 ± 0.7	3.0 ± 0.6
	COP path length (cm) *	80.6 ± 16.3	74.4 ± 13.5
	Velocity (cm/s)	45.9 ± 14.1	46.3 ± 12.0
Gait	Cadence (steps/min)	76.6 ± 13.7	78.7 ± 13.0
	Stride length (cm)	59.5 ± 15.9	60.5 ± 14.8

*p<0.05. Values are means ± SD.

COP: center of pressure

DISCUSSION

Patients with stroke usually have difficulty maintaining balance at all stages after stroke⁹⁾, and postural instability is one of the important mobility problems after stroke⁷⁾. Therefore, rehabilitation of balance ability has often been identified as an important goal of stroke rehabilitation³⁾.

The purpose of this study was to determine the effects of trunk KT on balance ability and gait function in patients following a stroke. According to our results, balance ability showed a significant change in terms of COP velocity and COP path length after application of trunk KT (p<0.05).

The function of the trunk muscles is an essential factor for balance, transfer, and gait, and is a crucial component to perform activities of daily living^{9, 15)}; however, there are a few studies focusing on trunk stability. According to Karatas et al.⁹⁾, trunk muscle weakness in unihemispheric stroke patients can interfere with balance and stability. Recently, Chung et al.¹⁾, reported that their core stabilization exercise program caused a significant change in dynamic balance ability. Moreover, Yu & Park¹⁶⁾ showed that a core stability enhancing exercise is effective in improving the muscle activity of the lower trunk that is affected by hemiplegia. Most studies have suggested the feasibility and suitability of core stabilization exercise for stroke patients' postural control^{1, 16)}.

In essence, the muscular control required around the lumbar spine for maintenance of functional stability¹⁾, and Karatas et al.⁹⁾, have demonstrated weakness of trunk flexion and extension and bilateral rotatory muscles in unihemispheric stroke patients⁹⁾. Therefore in this study, to promote trunk stability, we applied KT to the RA, EO, IO, and erector spinae muscles, because these muscles play an important role in stability¹⁶⁾.

Most studies have reported that constantly taping over the skin stimulates cutaneous mechanoreceptors, thus providing more sensory signals to the central nervous system for information integration⁷⁾. Kouhzad Mohammadi et al.¹⁷⁾ have suggested that KT increase sensory feedback of the taped region through the skin. Therefore, joint position sense will improve, and with it, the ability of the neuromuscular system to control movements will also improve⁷⁾. According to Jaraczewska & Long⁴⁾, KT has an effect on the sensorimotor and proprioceptive systems, as seen in its benefit in the treatment of various neurological conditions. We consider that all these components were duplicated and the ability to balance was improved in stroke patients.

Unfortunately, we did not find any differences in gait ability among stroke patients after trunk KT (p>0.05). However, in another study, by Choi et al.¹⁸⁾, they found statistically significant differences in 10 meter walking times after application of proprioceptive neuromuscular facilitation combination patterns and KT. These results suggest that KT in conjunction with other therapeutic activities facilitates improvement in functional ability among stroke patients⁴⁾.

But this study has some limitation that the number of sample is small and there is no interventions in lower extremity.

Further investigation is required to determine the effects of trunk KT in conjunction with other therapeutic activities.

This study investigated the effect of trunk KT on balance ability and gait function in stroke patients. Although the differences in gait function were not statistically significant, the balance ability was improved immediately after application of the KT. We suggest that taping may be a helpful method during rehabilitation programs for stroke patients. Its application to the trunk muscles is especially useful for improving balance ability.

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