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Original Article

Correlations between measurement time and different expansibility of the elastic tape on the rectus femoris and body sway index with plyometric exercise

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Abstract. [Purpose] The purpose of this study was to examine correlations between measurement time and different expansibility of the elastic tape on the rectus femoris and body sway index with plyometric exercise. [Subjects and Methods] The subjects of this study were 24 healthy men. C90 area, C90 angle, trace length, sway average velocity for body sway index were measured using a force plate by BT4. The collected data were analyzed using Kendall's coefficient of concordance. [Results] All of body sway index on measuring follow up 24 hours after removing tape were significantly decreased than before and right after plyometric exercise. No significant correlations were found between body sway index and different expansibility of the elastic tape. [Conclusion] It appears that different expansibility of the elastic tape does not affect the ability to body sway index. Carry over effect of taping was verified on measuring follow up 24 hours after removing tape through the decreasing body sway index.

Key words: Tape expansibility, Body sway index, Plyometric exercise

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INTRODUCTION

Elastic kinesio taping (ET) consists of a technique which uses the application of an elastic adhesive tape. It has become a widely used rehabilitation modality for the prevention and treatment of musculoskeletal disorders[1)]. It is claimed that ET supports injured muscles and joints and helps to relieve pain by lifting the skin, thus improving blood and lymph flow and either inhibit or facilitate a muscle[2)].

When applied to musculoskeletal knee pain such as patellofemoral pain syndrome, ET was found to be effective in reducing pain as well as improving range of motion, strength and functional performance[3, 4)]. The afferent cutaneous stimulation provided by ET is believed to reduce pain as well as stimulate mechanoreceptors, which in turn is believed to enhance proprioception and improve muscle excitability through modulation of the central nervous[3, 4)]. ET brings not only a small immediate increase in muscle strength[5)] but also improves muscle alignment[6)]. Contrary to these findings, The effect of ET on isokinetic knee performance has conflicting results in literature with few studies showing no effect of the tape on quadriceps torque[7, 8)].

Balance is controlled by complex interactions of sensory and motor systems. Correct perception of stimuli from visual, somatosensory and vestibular systems in the central nervous system and correct regulation of these stimuli are necessary for good standing balance[9)]. Insufficient sensory information was responsible for poor balance[10)]. Yazici et al.[10)] reported that ET application are promising in improving balance due to its flexible property and also provides proper posture and improves kinesthetic senses in stroke patients.

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Table 1. Correlations between measurement time, tape expansibility and body sway index with plyometric exercise

		Trace length	C90 area	Sway velocity	C90 angle
Measurement time	tau_b	−0.313**	−0.210*	−0.313**	−0.018
Tape expansibility	tau_b	−0.130	0.041	−0.130	−0.029

tau_b: correlation coefficient, *p<0.05, **p<0.01.

ET has been designed to allow for a longitudinal stretch of 55−60% of its resting length. ET can be applied in two conceptually different ways as regards to the direction of the application and the amount of the expansibility of the tape during application. This way, ET is thought to facilitate or inhibit muscle function via cutaneous stimulation. To inhibit muscle function the tape should be applied with very light (15 to 25% of the available) tension in the direction from insertion to origin and to facilitate muscle function the tape is applied in the opposite direction with moderate (25−50% of the available) tension[2]. It has been suggested that ET has more influence on skin and muscle mechanoreceptors and less on joint receptors[11].

While ET has been studied in a number of studies[1−11], there is a paucity of study on the different expansibility of the ET to improve body sway. Therefore, the purpose of the current study was to examine correlations between measurement time and different expansibility of the elastic tape on the rectus femoris and body sway index with plyometric exercise.

SUBJECTS AND METHODS

The subjects of this study were 24 healthy men. They were randomly selected and assigned in each 4 groups which were no taping, 130%, 100% (same length with original tape), 70% tension of original tape length. None of the subjects had problems with their musculoskeletal, nervous, cardiovascular systems or any skin allergy, and they were able to complete plyometric exercise according to the instructions given by the researcher. The experimental procedure was sufficiently explained beforehand to the subjects who voluntarily participated by signing the informed consent form. This study was approved by the Institutional Ethics Committee of Namseoul University.

The BT4 (HUR labs., HUR, Finland) was used to measure body sway index before and after applied ET (5 cm × 5 cm, 3NS, Korea). The body sway index for measuring balance consists of 4 factors which were trace length (mm), C90 area (mm^2), C90 angle (deg) and sway velocity (mm/s). Trace length is defined by summing the length of straight segments connecting point that follow in a succession and separated in time by 1/5 of a second. C90 area is the area of the confidence ellipse. C90 angle is the angle of the major axis of the ellipse relative the medial-lateral direction. Sway velocity is calculated by dividing the total trace length by the duration of test[12]. Generally, the bigger score of body sway index means bigger sways. The sampling frequency of the BT4 was set to 50 Hz (50 samples/second) and the performance time was 30 seconds[12].

The body sway index with one leg (dominant) standing was measured 3 times which were before plyometric exercise, right after 3 weeks plyometric exercise and follow up 24 hours after finished plyometric exercise. All measurements were performed without ET. The plyometric exercise consists of jump squat, split squat jump and double leg truck jump[13]. The duration of plyometric exercise with ET was 2 sessions a week for 3 weeks. Above 3 jump exercises were performed 3 sets (4 times a set) for a session respectively. The interval between sets was set to 1 min and between sessions set to 72 hours[13]. ET was attached to rectus femoris (dominant leg) between antero superior iliac spine (ASIS) and tibia tuberosity[1] according to expansibility of each group (no, 130%, 100%, 70% ET). If the subjects had complains to taping during plyometric exercise, ET was changed to new one.

SPSS Version 21.0 for Windows was used for the data analysis. Kolmogorov-Smirnov test was applied to check data normal distribution. One-way ANOVA was used to analyze the homogeneity for the general characteristics between the four groups. Kendall's coefficient of concordance was used to analyze the correlations between measurement time and different expansibility of the elastic tape on the rectus femoris and body sway index. Statistical significance was accepted for values of $\alpha \le 0.05$.

RESULTS

Twenty four subjects were randomly selected and assigned 6 to their respective groups randomly. They were 130% ET group (21.1 ± 2.4 years old, 176.4 ± 4.9 cm height, 74.1 ± 11.3 kg weight), 100% ET group (23.5 ± 1.8 years old, 172.9 ± 3.8 cm height, 71.2 ± 9.4 kg weight), 70% ET group (21.6 ± 1.9 years old, 174.5 ± 3.6 cm height, 70.6 ± 11.1 kg weight) and no ET group (23.5 ± 3.2 years old, 172.4 ± 9.3 cm height, 68.3 ± 10.7 kg weight). The homogeneity between the four groups can be verified by One-way ANOVA.

The trace length (tau_b=−0.313, p<0.01), C90 area (tau_b=−0.210, p<0.05) and sway velocity (tau_b=−0.313, p<0.01) were significantly correlated with measurement time. Above 3 variables on measuring follow up 24 hours after removing tape were significantly decreased than before and right after plyometric exercise. No significant correlations were found between the body sway index and the expansibility of the ET (p>0.05) (Table 1).

DISCUSSION

This study demonstrated that the trace length, C90 area and sway velocity were significantly correlated with measurement time. No significant correlations were found between the body sway index and the expansibility of the ET.

Aytar et al.[3] and Anandkumar et al.[14] reported that ET can be effective in reducing pain as well as improving range of motion, strength and functional performance. Hsu et al.[6] and Cortesi et al.[15] reported that ET can affect both increasing muscle strength and improving muscle alignment. This study showed that trace length, C90 area and sway velocity for body sway index on measuring follow up 24 hours after removing tape were significantly decreased than before and right after plyometric exercise. It showed that carry over effect occurred by ET. This study suggest that long term ET could be more effective to decreasing body sway index with increasing muscle strength and improving muscle alignment.

It appears that different expansibility of the elastic tape does not affect the ability to body sway index. Serrão et al.[1] and Ekiz et al.[16] reported that ET has no effect to the magnitude of the electromyography activity of vastus lateralis, vastus medialis, and biceps femoris during the squat exercise in healthy men. Our study also conducted using only a small number of healthy men in their 20s. It may not alter the body sway index. Future research would benefit from a large sample size and any other age group to apply ET

In conclusion, ET is efficient modality for decreasing body sway index. Appling time of ET has more effects on trace length, C90 area and sway velocity than expansibility of ET. A limitation of the present research was that this experiment was conducted using only a small number of healthy men in their 20s. Thus, we cannot safely generalize our research results to any other age group.

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