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Original research

Effect of Kinesio Taping on gastrocnemius activity and ankle range of movement during gait in healthy adults: A randomized controlled trial

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ABSTRACT

Objective: To examine the effect of KT on gastrocnemius surface electromyography (SEMG) activity and ankle range of motion during walking in healthy subjects.
Design: Randomized controlled trial, with concealed allocation and assessor blinding.
Setting: University Biomechanics Laboratory.
Participants: Thirty six healthy physiotherapy students were randomized to KT or control group.
Outcome Measures: At baseline and immediately after 72 h with the tape in situ: amplitude of LG SEMG activity during the stance phase, duration of the LG activity, onset and offset times of LG activity, ankle plantar- and dorsiflexion peaks, and the cadence of gait.
Results: ANOVA revealed a significant time × intervention interaction effect across two variables: duration of LG activation, $F(1, 33) = 4.71$, $p = .037$, $\eta = .015$; and onset $F(1, 33) = 7.92$, $p = .008$, $\eta = .037$. KT group showed significantly shorter duration of the LG activity as compared with control, and similar results were observed when comparing the onset of LG activation. No statistically significant differences between both groups were noted in the rest of the outcomes.
Conclusion: KT does significantly shorten the duration of the LG activity during gait when applied 72 h in healthy adults. However, this result was not accompanied by a significant reduction in the amplitude of LG SEMG activity.

1. Introduction

Kinesio Taping (KT) is a technique utilizing an elastic tape originally created by Kenzo Kase in the 1970s. Having increased in popularity since the Beijing 2008 Olympics (Williams, Whatman, Hume, & Sheerin, 2011), KT is a relatively new method that is being widely used as a therapeutic (rehabilitation protocols and prevention of sports injuries) and performance (athletic field) enhancement tool.

KT is a cotton, latex-free, adhesive, elastic tape that can be applied theoretically to any muscle or joint of the body. It is unique compared with other standard rigid types of tape because its elasticity allows for elongation 130%–140% of its original length producing less mechanical restriction to movement, and mimic the thickness and flexibility of the skin. It can be worn up to 3–5 days without interfering with daily hygiene and without compromising its adhesive properties (Kase & Wallis, 2002).

According to the manufactures, the controllable variables in KT application include the degree of prestretch applied to the tape, the position of the area to be taped, and the treatment goals. Kase, Hashimoto, and Tomoki (1996) proposed several taping mechanisms with various intended outcomes depending on the application technique.

Two of the proposed potential benefits of KT include: (1) correcting misaligned joints by relieving muscle spasm (inhibiting the recruitment of muscle's motor units), and (2) improving range of motion through increasing blood circulation or through stimulation of cutaneous mechanoreceptors (Kase et al., 1996; Kase, Wallis, & Kase, 2003). According to Kase, the KT application from origin to insertion facilitates muscle activity, while its application from

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insertion to origin inhibits muscle activity. However, all these hypotheses have not been demonstrated so far. Indeed, there is limited scientific evidence evaluating KT effectiveness and the results are inconsistent and mixed (Williams et al., 2011). Specifically, surface electromyography (SEMG) studies to either support or oppose the use of KT are scarce and the results are controversial, with some authors reporting significant increases in SEMG muscle activity both in healthy subjects (Huang, Hsieh, Lu, & Su, 2011; Slupik, Dwornik, Bialoszewski, & Zych, 2007) and patients with anterior cruciate ligament (ACL) repair and shoulder impingement (Hsu, Chen, Lin, Wang, & Shih, 2009; Murray, 2004), and others showing no significant changes in healthy adults (Briem, Eythorsdottir, Magnusdottir, Palmarsson, Runarsdottir, & Sveinsson, 2011; Lins, Neto, Amorim, Macedo, & Brasileiro, 2013). However, since KT produces cutaneous mechanoreceptor stimulation, an inhibitory effect might be also expected. In this sense, a recent study by Sugawara, Shimose, Tadano, Ushigome, and Muro (2013) suggested that the modulation of muscle activation in superficial and deeper regions may be induced by tactile stimulation. Specifically, these authors showed that skin friction over the short head of biceps brachii results in an inhibitory response in its superficial regions, most likely due to the increase in firing rate of low-threshold cutaneous mechanoreceptors. The authors concluded that the actions of inhibitory interneurons may be influenced by cutaneous afferent input with skin stimulation.

With regard to range of motion, Nakajima and Baldridge (2013) reported inconsistent results among KT studies.

SEMG analysis of gait is considered a paradigmatic application in the study of dynamic exercise (Felici, 2004). Although an inhibition in calf muscles could be a protective mechanism to prevent cramps due to fatigue, it is surprising that no studies have investigated the effects of KT on calf muscles SEMG activity during gait. Therefore, the purpose of this study was to examine the effect of KT on Lateral Gastrocnemius (LG) SEMG activity and ankle range of motion during treadmill walking in a sample of healthy subjects. We hypothesized that the application of KT from insertion to origin following Kase recommendations (Kase et al., 2003) would (1) inhibit LG muscle motor activity, and (2) improve ankle dorsiflexion.

2. Method

2.1. Participants

Forty healthy physiotherapy students at the University Cardenal Herrera were screened for eligibility criteria. To be included, participants had to be aged 18 years or older. Those who reported history of hip, knee or foot pathology, any neurological impairment or a history of lower limb fractures were excluded.

All subjects were informed of the aims of the study and gave written informed consent before participating. The study complies with the Declaration of Helsinki and was approved by the Ethics Committee of the University.

2.2. Design

Subjects were assigned to KT or control group using a random-number generator and allocation was concealed. Both KT and control groups were tested prior to tape application and following 72 h of use (with the taping remaining in situ in KT group subjects). All measurements were conducted in the University Biomechanics laboratory. Body weight was recorded to the nearest 0.1 kg with the use of a standard beam balance scale with the subjects wearing light indoor clothing and no shoes. Height was recorded to the nearest 0.5 cm by a standardized wall mounted height board. Kinesio Tex Gold elastic sports tape (Kinesio USA, LLC, Albuquerque, NM) was used for the intervention group. The first author of this study is a certified Kinesio Taping therapist (levels KT 1 and KT 2) and applied all the taping procedures after the participants' skin had been cleaned and hair removed. To avoid bias, the second author, who was blinded to the group assignment, analyzed SEMG and kinematic data. A first strip was applied, from insertion to origin, using the I-shaped taping technique for calf muscle according to the recommendations of Kase et al. (2003). The base of the tape was applied on the surface of calcaneus bone on the sole of the foot with the subject in a relaxed prone position. Then, the anchorage was applied at a subjectively approximated tension of 50% and 75% over the Achilles tendon up to the musculotendinous junction. Afterward, a second strip was applied using a Y shaped KT technique. The distal head was applied on the base of the first strip, and the two proximal heads were attached (15%–25% of tension) following the soleus muscle and ended on the origin of medial and lateral gastrocnemius (LG) muscles below the knee joint, respectively (Fig. 1). This method of tape application was chosen because it is believed to inhibit the recruitment of muscle's motor units (Kase et al., 2003). Prior to testing, all subjects underwent a 5 min warm up consisting of walking on the treadmill (BH Fitness Columbia Pro) at the same tests speed (1.1 m/s) to become familiar with the equipment. After the familiarization stage and before data collection participants performed three plantar-flexion maximal voluntary isometric contractions (MVICs) in order to normalize muscle electromyography assessment. Participants stood unilaterally on the tested leg underneath a weightlifting stand. With the knee at 0° and the ankle in the neutral position, the height of the stand was adjusted so that the horizontal bar rested on the cervicothoracic region of each participant. The bar was subsequently secured to the base of the weightlifting stand, thus preventing movement of the unit upon the application of an external force. A pad was placed around the horizontal bar to minimize discomfort to the participant's cervicothoracic region during unilateral plantar-flexion MVIC trials. The participant was permitted to grasp the horizontal bar for upper body stabilization (Hébert-Losier & Holmberg, 2013).

2.3. Instrumentation

SEMG data acquisition was accomplished by using a 16 analog input channel MP150 acquisition unit (Biopac Systems Inc.). A twin-

Fig. 1. KT applied on gastrocnemius.