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RANDOMIZED CROSS-OVER TRIAL

Can inhibitory and facilitatory kinesiotaping techniques affect motor neuron excitability? A randomized cross-over trial

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Summary *Objectives:* The aim of this study was to investigate the immediate effects of facilitatory and inhibitory kinesiotaping on motor neuron excitability.
Design: Randomized cross-over trial.
Method: Twenty healthy people received inhibitory and facilitatory kinesiotaping on two testing days. The H- and M-waves of the lateral gasterocnemius were recorded before and immediately after applying the two modes of taping. The Hmax/Mmax ratio (a measure of motor neuron excitability) was determined and analyzed.
Results: The mean Hmax/Mmax ratios were −0.013 (95% CI: −0.033 to 0.007) for inhibitory taping and 0.007 (95% CI: −0.013 to 0.027) for facilitatory taping. The mean difference between groups was −0.020 (95% CI: −0.048 to 0.008). The statistical model revealed no significant differences between the two interventions (P = 0.160). Furthermore, there were no within-group differences in Hmax/Mmax ratio for either group.
Conclusions: Our findings did not disclose signs of immediate change in motor neuron excitability in the lateral gasterocnemius.

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Introduction

Kinesiotaping (KT), first introduced by Kase and colleagues in 1996 (Kase et al., 2003), has become a popular adjunct technique to prevent or reduce musculoskeletal injuries. KT is designed to mimic natural human skin characteristics such as stretchability, elasticity and thickness (Kase et al., 2003). Several therapeutic benefits have been reported for the use of KT. Some studies found positive effects on pain and disability (GonzáLez-Iglesias et al., 2009; Paoloni et al., 2011; Thelen et al., 2008), range of motion (Thelen et al., 2008; Yoshida and Kahanov, 2007), proprioception (Lin et al., 2011), muscle strength, and performance (Huang et al., 2011; Vithoulka et al., 2010). In contrast, other researchers found no beneficial effects of KT on clinical outcomes. In two studies of patients with patellofemoral pain syndrome and low back pain, the reduction in pain scores after KT was not significant (Aytar et al., 2011), or was too small to be clinically meaningful (Castro-Sánchez et al., 2012). Another study found that adding KT to conventional physical therapy did not improve quality of life in patients with neck pain (Llopis and Aranda, 2012). Based on the available evidence, a recent systematic review concluded that the use of KT offers no benefits over sham taping or placebo in a wide range of musculoskeletal conditions (Parreira et al., 2014).

It has been suggested that KT affects muscle activity (Hsu et al., 2009; Huang et al., 2011). KT is expected to have a facilitatory effect if applied from the origin to the insertion of the muscle, while reversing the direction of application is believed to have an inhibitory effect (Kase et al., 2003; Wong et al., 2012). Kuo et al. demonstrated that the effects of KT may be direction-dependent (Kuo and Huang, 2013). They applied both facilitatory and inhibitory KT in a group of 19 healthy junior college students and observed significant differences between the two techniques in maximum voluntary isometric contraction of the wrist and middle finger extensors (Kuo and Huang, 2013). Two recent biomechanical studies, however, found no difference between the two KT techniques in total work and peak torques of the quadriceps muscle (Poon et al., 2015), or in maximum grip strength and electromyographic activity of the wrist extensor muscles in healthy people (Cai et al., 2016). These contradictory findings raise questions about the probable underlying neurophysiological mechanisms of different KT techniques. In particular, it is not clear whether facilitatory or inhibitory techniques affect motor neuron excitability at all. To our knowledge, very few studies have investigated this effect.

Firth et al. examined the H-reflex responses of the calf muscles in athletes with Achilles tendinopathy. After KT was applied, the H-reflex amplitude remained unchanged (Firth et al., 2010). However, the KT method used in their study was a tendon correction technique. The present study aimed to shed light on the immediate effects of facilitatory and inhibitory KT techniques on motor neuron excitability in the lateral gastrocnemius muscle in healthy people. We hypothesized that the facilitatory KT technique would increase motor neuron excitability while inhibitory technique would decrease it.

Materials and methods

Participants

Twenty healthy individuals (11 male, 9 female) were recruited among students at Shiraz University of Medical Sciences with a convenience sampling method. The demographic characteristics of our sample (mean $\pm$ standard deviation) were age 22.9 $\pm$ 1.2 years, height 170 $\pm$ 9.1 cm, and weight 68.4 $\pm$ 12.8 kg. Volunteers were excluded if they had any history of serious injury to the back or lower limb, any rheumatological or neurological disorders, neurogenic low back pain, addiction to alcohol or any drug that might affect H-reflex parameters, leg length discrepancy, or myofascial trigger points in the lateral gastrocnemius muscle. In addition, individuals who had previous experience of using KT for regular or sports activity were excluded. All participants provided their informed consent in writing to take part in the study. The protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences (ir.sums.rec.1394.85).

Study design

This was a cross-over trial consisting of two sessions of taping (facilitatory and inhibitory) one day apart to reduce the impact of possible carryover effects. The order of receiving the taping technique was counterbalanced by dividing the participants into two groups (facilitatory/inhibitory & inhibitory/facilitatory) randomly. The randomization was carried out using a Random Sequence Generator program (available at http://www.random.org). On the first day, half of the participants received facilitatory taping and the other half received inhibitory taping. The order was reversed on the second day.

Outcome measure

The amplitude of H-Reflex (recorded via sub-maximal stimulation of tibial nerve) is one of the measures to evaluate motor neuron excitability. This reflex measures the efficacy of synaptic transmission through corresponding motor neuron pool of a muscle. Increasing the intensity of electrical stimulation produces a muscle response called M-wave due to direct stimulation of peripheral nerves. Because of the stability of the M-wave magnitude, it is recommended to normalize that H-reflex by dividing the maximum H-reflex amplitude to the maximum M-wave amplitude (Hmax/Mmax ratio) (Hoch and Krause, 2009; Palmieri et al., 2004). The Hmax/Mmax ratio has been shown to have excellent intersession reliability (ICC 2,1 = 0.979) (Hoch and Krause, 2009) and extensively used in various fields such as sports science and rehabilitation (Klykken et al., 2011; Lepley et al., 2014; Lo et al., 2012). Due to its advantages over H-reflex, we decided to choose the Hmax/Mmax ratio as the primary outcome of this study.

A lower ratio indicates motoneuron inhibition, whereas a higher ratio indicates motoneuron facilitation.