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Kinesio taping effect on quadriceps strength and lower limb function of healthy individuals: A blinded, controlled, randomized, clinical trial

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ABSTRACT

Objectives: To analyze kinesio taping (KT) effect on quadriceps strength and lower limb function over a 7-day period.
Design: Blind randomized clinical trial.
Setting: Hospital's Physical Therapy Department.
Participants: Sixty healthy individuals (30 men and 30 women) were randomly distributed into three groups: Control – without KT application; Placebo – placebo KT application and Experimental - A KT application designed to stimulate quadriceps femoris activity.
Main outcome measures: The quadriceps strength was measured using a manual dynamometer whereas lower limb function was assessed using the Single Hop Test for Distance. Evaluations occurred at five time-points: baseline; immediately, 3 and 5 days after KT application; and 72 h post KT withdrawal.
Results: There was no significant interaction between time-points and groups for muscle strength: dominant ($P = 0.13$) and non-dominant ($P = 0.41$) and lower limb function: dominant ($P = 0.09$) and non-dominant ($P = 0.53$); but lower limb function within-group comparisons showed improvements in all groups at the evolution of all time-points analyzed for both limbs ($P = 0.001$). This is possibly due to a learning effect as the participants became more familiar with executing the assessment tests.
Conclusion: KT did not improve quadriceps strength and lower limb function of healthy individuals and its application with these objectives should be reconsidered.

1. Introduction

The search for resources to promote performance enhancement has been the focus of several studies. Kinesio taping (KT), an adhesive taping with characteristics claimed to be similar to the elasticity and movement of human skin falls within this context (Lins, Neto, Amorim, Macedo, & Brasileiro, 2013).

KT exhibits several positive effects when applied, including: pain and edema reductions; lymphatic flow improvement by increased interstitial space; muscle and joints support; muscle spasms reduction and articular misalignment correction (Kalron & Bar-Sela, 2013; Kase, Walls, & Kase, 2003). In addition, KT can be used for five days without reapplication because it is latex free taping and has cotton fibers that allow fast drying. These characteristics mean the claimed effects of this technique may last longer than other bandage or tape methods (Akbas, Atay, & Yuksel, 2011; Briem, Eythordottir, Magnúsdóttir, Pálmarsson, Rúnarsdóttir, & Sveinsson, 2011; Chen, Hong, Lin, & Chen, 2008; Fu, Wong, Pei, Wu, Chou, & Lin, 2008; Kalron & Bar-Sela, 2013; Thelen, Dauber, & Stoneman, 2008).

There are some studies reporting modulations on muscle strength and motor function after KT application (Fu et al., 2008; Lins et al., 2013; Słupik, Dwornik, Białoszewski, & Zych, 2007; Vercelli et al., 2012). The continuous stretch applied on the skin under the adhesive taping might activate the mechanoreceptors, which in turn could stimulate modulatory mechanisms within the

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central nervous system and therefore increase muscular excitability (Gómez-Soriano et al., 2014).

However, these KT positive results are related to short-term effects at very specific evaluation methods; studies with small number of participants and results influenced by proposed tests familiarization. Therefore these results do not provide clinical and therapeutic implications, and moreover produce no consensus about the best KT application techniques and lack of information about long-lasting effects to attain these benefits (Aktas & Baltaci, 2011; Gómez-Soriano et al., 2014; Yeung et al., 2014).

Thus, the aim of the present study was to analyze KT effects on quadriceps femoris strength and lower limb function of healthy individuals over a 7-day period, in order to provide results that examine these KT muscular applications in clinical practice.

2. Methods

This blinded, controlled, randomized, clinical trial was approved by the Ethics Committee of *Universidade Nove de Julho* (UNINOVE) – protocol number 456.617.

2.1. Participants

Initially, one hundred and fourteen healthy individuals were pre-selected at the institutions whose authors have ties.

Healthy men and women, who did not practice regular physical activity; with availability to participate in all assessments proposals; without history of allergy to bandages and derivatives; and who read, understood and signed the statement of informed consent, were included in the present study. The exclusion criteria were previous surgery and/or history of lumbar spine fracture; neurological abnormalities; history of anterior pain in the knee and muscle injuries in the lower limbs in the previous 12 months (Huang, Hsieh, Lu, & Su, 2011).

Finally, a convenience sample of sixty individuals (30 men and 30 women), aged between 20 and 40 years old (mean ± SD age, 24.2 ± 2.4 years old; height, 169 ± 5.0 cm; weight, 68.6 ± 11 kg) met the eligibility criteria and were recruited.

2.2. Procedures

At *Irmandade da Santa Casa de Misericórdia de São Paulo* – Physical Therapy Department; all participants were submitted to initial anamnesis to collect personal data: name; age; weight; height; dominant lower limb; address and telephone number. Next, they carried out the baseline assessments of strength and function. The same evaluator, who knew nothing about the individual allocation, performed all assessments.

After the anamnesis and the baseline assessments for strength and function, the individuals were randomly allocated, through a draw with sealed envelopes, into three groups: control group (CG) – with no KT application; placebo group (PG) – with a placebo KT application on quadriceps femoris (bilateral); and the experimental group (EG) – with KT application on the quadriceps femoris (bilateral) in an attempt to stimulate it. Ten men and ten women were placed in each of the three groups and although they knew their condition were told not to report anything to the evaluator and the other study participants about its group allocation.

2.3. KT application

In the EG, KT was applied in a standardized manner (origin to insertion), from a point 10 cm below the anterior superior iliac spine to the superior pole of the patella, without any tension. The individual was then asked to perform maximal knee extension and the KT was divided so that it could be adjusted around the medial and lateral patella edges, finishing at the anterior tuberosity of the tibia, again without tension (Akbas et al., 2011; Briem et al., 2011; Chen et al., 2008; Fu et al., 2008; Kase et al., 2003; Thelen et al., 2008; Vercelli et al., 2012) (Fig. 1).

At the PG, two horizontal strips of 10 cm were applied 10 cm below the anterior superior iliac spine and 5 cm above the patella base, respectively, without any tension (Thelen et al., 2008) (Fig. 1). In the CG, no KT was applied.

The KT was standardized for the groups that received it and black Kinesio Tex™ was used. The same researcher, who has experience in clinical KT application, always applied the adhesive taping. Prior to the KT being applied, the skin was shaved and cleaned with an antiseptic. All KT were applied to the individuals in dorsal decubitus position, keeping the knee flexed and beyond examination table lateral limits, with the hip in a neutral position.

2.4. Assessments

Strength and function assessments were performed, always in the same order, starting with the dominant limb and followed by the non-dominant limb, at the following time-points in all groups: baseline (72 h before KT application); immediately after KT application; on the third and fifth days after KT application; and 72 h after removing the adhesive taping. Therefore, the individuals used the KT or placebo KT for five consecutive days.

All individuals were told to maintain their activities of daily living while using the adhesive taping. The individuals in the CG were assessed at the same time-points intervals as the other groups and received the same instructions.

A pilot study was conducted prior to the present one, with five healthy individuals who did not practice regular physical activity (10 lower limbs evaluated: 5 dominant and 5 non-dominant). The aim of this pilot study was to assess the reliability and validity of the manual dynamometer when assessing the quadriceps strength. The participants were tested according to the protocol described below and the results demonstrated excellent reliability and an interclass correlation coefficient (ICC) of 0.96 for the quadriceps femoris manual dynamometer.

The quadriceps femoris strength (voluntary maximal isometric contraction) was assessed by a manual dynamometer (Lafayette Instrument Company, Lafayette, IN) (Deones, Wiley, & Worrell, 1994; Dolak, Silkman, Mckeon, Hosey, Lattermann, & Uhl, 2011; Magalhães, Fukuda, Sacramento, Forgas, Cohen, & Abdalla, 2010; Piva, Goodnite, & Childs, 2005). The participant was positioned in the leg extension chair with the hip at 90° flexion and 0° rotation and the knee at 60° flexion. A three-point belt stabilized the trunk and hip. In all assessments, the individuals were told to cross their

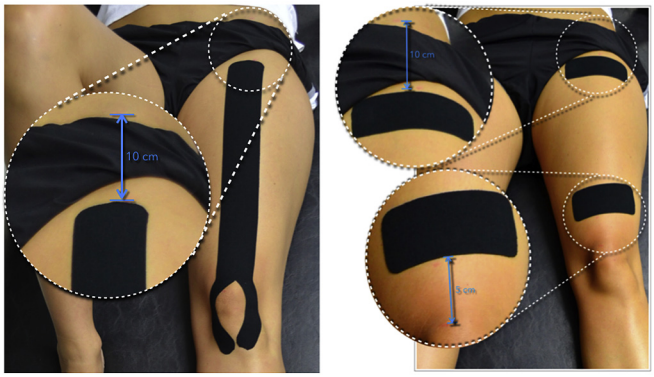

Fig. 1. KT application technique in the EG and PG.