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Original

Effect of kinesio taping on calf pain after a half marathon: A pilot study



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ABSTRACT

Objective: The purpose of the present study was to examine the effect of kinesio taping on calf pain in healthy runners immediately after a half marathon.
Method: A sample of 13 runner volunteers was recruited in a half marathon. Calf pain measurements were taken at baseline and 10-15 minutes after competition. Kinesio tape was applied to the calf of runners the evening before the competition, only on one leg, with the contralateral leg acting as a control.

Results: The results of the repeated measures ANOVA in the leg differences on pain values did not show statistically significant differences ($p = 0.515$). However, the effect size after the race could be an indication that kinesio tape might be useful ($g = -0.37$) and that studies with the sample calculated would be necessary ($n = 61$).

Conclusions: When kinesio tape was applied to healthy half marathon runners, the data did not disclose whether the tape could lead to control calf pain produced by the competition.

Keywords: Kinesio tape; Myalgia; Muscle disorder; Analog pain scale; Running.

Efecto del vendaje neuromuscular sobre el dolor en las pantorrillas después de una media maratón: Un estudio piloto

RESUMEN

Objetivo: El propósito del presente estudio fue examinar el efecto del vendaje neuromuscular sobre el dolor de la pantorrilla en corredores sanos inmediatamente después de una media maratón.

Método: Una muestra de 13 corredores voluntarios fue reclutada en una media maratón. Las mediciones de dolor de las pantorrillas se tomaron al inicio y 10-15 minutos después de la competición. El vendaje neuromuscular se aplicó en la pantorrilla de los corredores la noche anterior a la competencia, sólo en una pierna, con la pierna contralateral actuando como control.

Resultados: Los resultados del ANOVA de medidas repetidas sobre las diferencias en los valores de dolor en las piernas no mostraron diferencias estadísticamente significativas ($p = 0.515$). Sin embargo, el tamaño del efecto después de la carrera podría ser un indicio de la utilidad del vendaje ($g = -0.37$) y de que estudios con la muestra calculada son necesarios ($n = 61$).

Conclusiones: Cuando el vendaje neuromuscular se aplicó a los corredores de medio maratón sanos, los datos no revelaron si podría controlar el dolor de las pantorrillas producido por la competición.

Palabras clave: Kinesio tape; Mialgia; Trastorno muscular; Escala analógica del dolor; Carrera.

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Efeito da bandagem neuromuscular na dor na panturrilha após meia maratona: um estudo piloto

RESUMO

Objetivo: O objetivo do presente estudo foi examinar o efeito da bandagem neuromuscular na dor na panturrilha em corredores saudáveis imediatamente após uma meia maratona.

Método: Uma amostra de 13 corredores voluntários foi recrutada para uma meia maratona. As medições da dor na panturrilha foram feitas no início e 10-15 minutos após a competição. A bandagem neuromuscular foi aplicada na panturrilha dos corredores na noite anterior à competição, apenas em uma perna, com a perna contralateral atuando como controle.

Resultados: Os resultados da ANOVA de medidas repetidas sobre as diferenças nos valores de dor nas pernas não mostraram diferenças estatisticamente significativas ($p = 0,515$). Porém, o tamanho do efeito após a corrida pode ser um indicativo da utilidade da bandagem ($g = -0,37$) e que estudos com a amostra calculada são necessários ($n = 61$).

Conclusões: Quando a bandagem neuromuscular foi aplicada em corredores saudáveis de meia maratona, os dados não revelaram se ela poderia controlar a dor na panturrilha produzida pela competição.

Palavras-chave: Kinesio tape; Mialgia; Desordem muscular; Escala analógica de dor; Carreira.

Introduction

In the past 30 years the number of people who participate in competitive running events has increased dramatically. Half marathon running has emerged as one of the most popular recreational sports among physically active individuals in the last quarter century, with millions of runners participating annually worldwide. After finishing long running events, runners usually present soreness and injuries focused on the most demanded lower limb muscles, specifically in the calf muscles.¹

The kinesio tape (KT) is an elastic therapeutic tape used for treating sports injuries and a variety of other disorders.² KT has several properties: biomechanic, exteroceptive, circulatory, neuro-reflex and analgesic.³ It is increasingly used by physical therapists and trainers to improve athletic performance and prevent injuries.² KT is a popular treatment among athletes due to its capacity to decrease muscle pain and inflammation after sport.⁴ It is applied over muscles to prevent muscle over-contraction.^{5,6}

Regarding the effect of KT on pain, contradictory data exists. For instance, in some studies KT reduces pain in patients with shoulder impingement syndrome,⁷ leads to pain relief in chronic low back patients,⁸ and also controls calf pain after strenuous exercise.⁶ On the other hand, for example, KT application does not seem to reduce muscle pain after squatting until exhaustion,⁹ does not reduce pain in Achilles Tendinopathy,¹⁰ nor in patients with chronic low back pain¹¹ or healthy individuals with delayed onset muscle soreness.¹² Consequently, the purpose of the present study was to examine the effect of KT on calf pain in healthy runners immediately after a half marathon.

Method

Sample

The sample consisted of 14 Caucasian athletes (3 females and 11 males) recruited from the competitors in a half marathon. The participants were recreational healthy runners involved in regular training and competition. The following inclusion criteria were used: (a) athletes aged 18 years old or older, (b) do not report any form of musculoskeletal disorder, and (c) enroll in and finish the half marathon. Participants were fully informed, before their participation, about all the features of the study and signed informed consent was obtained. Data from a male participant was deleted as did not meet inclusion criteria. The study protocol met the ethical standards of the World Medical Association and the Declaration of Helsinki and it was approved by the Ethics and Research Committee of the University of Granada.

Experimental design

The organizer of the 'V Half Marathon Rincon de la Victoria' (Malaga, Spain) contacted the participants via a newsletter in the

race web page one month before the race in which they were asked to participate in the study. A total of 678 athletes started the 'V Half Marathon Rincon de la Victoria', from which 14 starters volunteered to participate in the research study. The competition held on November 2, 2014, started at 10:00 am and took place on a hilly route, on a sunny day with temperatures ranging from 17 to 19°C and humidity from 60% to 65%. The path was most of the time flat at the sea level (except a pronounced slope for about 0.5 km going up and then 0.5 km going down) and over a hard surface (about 18 km on asphalt and promenade, and 3 km on compacted sand). The participants were allowed to drink and eat normally before and during the event.

The outcome measurement for this study consisted in a Numerical Pain Rating Scale (NPRS).¹³ The measurement was obtained at baseline (preKT) and 10 to 15 minutes after finishing the competition (postRace). The KT was applied on the calf of runners the day before the competition (from 19:00 to 21:00h). The KT was applied only on the right leg of every participant (experimental leg, EL) while the left leg acted as a control (control leg, CL). All runners received the KT application by the same certified physiotherapist trained in this specific tape application. Prior to KT application, hair was removed from the calf and the area was cleaned with an alcohol swab. Tape adherent was applied to the area to improve KT adhesiveness (Figure 1).

Pain was evaluated on the calf muscle, due to its solicitation during the running event. The NPRS (0 = no pain; 10 = maximum pain) was used to record the runners' current level of calf muscle pain. Each participant was asked to rate their current level of pain. Participants were asked to mark the intensity of pain on a 10 cm long line marked with numbers 0 on one end and 10 on other, where 0 indicated no pain and 10 was for maximum pain. The scale was explained to each runner prior to evaluating calf pain, to avoid ambiguities in its interpretation. The NPRS was administrated to each runner before the competition, without KT (preKT), and with the KT applied, at the finish line (postRace). The NPRS is a valid, reliable tool and is sensitive to pain.¹⁴

For the KT scenario, a white KT (Kinesiology Tape, South Korea) was used. A 5 cm wide KT was applied to the calves using the I-shaped taping technique¹⁵ from insertion to origin of muscle to obtain a relaxing effect. Runners were positioned prone on a table in a neutral body position. The ends of the tape were placed without stretching. Finally, a functional strip (between both proximal and distal extremes of the tape) was applied on the stretched muscle belly with 10% tension (Figure 2).

Statistical analysis

Descriptive statistics (means and standard deviations) of age, body mass, body height, body mass index, training hours per week, years of competition, and NPRS scores were calculated. The repeated measures analysis of variance (ANOVA) with leg differences (experimental leg - control leg) on NPRS values

(preKT, postRace) was used. Hedges' g effect size was used to estimate the magnitude of the intervention effects. Finally, from the data of the present study, the sample size needed to detect statistically significant differences at a statistical power of 80% was estimated. All statistical analyses were performed using the SPSS version 20.0 for Windows (IBM® SPSS® Statistics 20), except for the sample size calculation that was performed using the EPIDAT version 3.1 for Windows (Conselleria de Sanidade, Xunta de Galicia). The statistical significance level was set at $p < 0.05$.

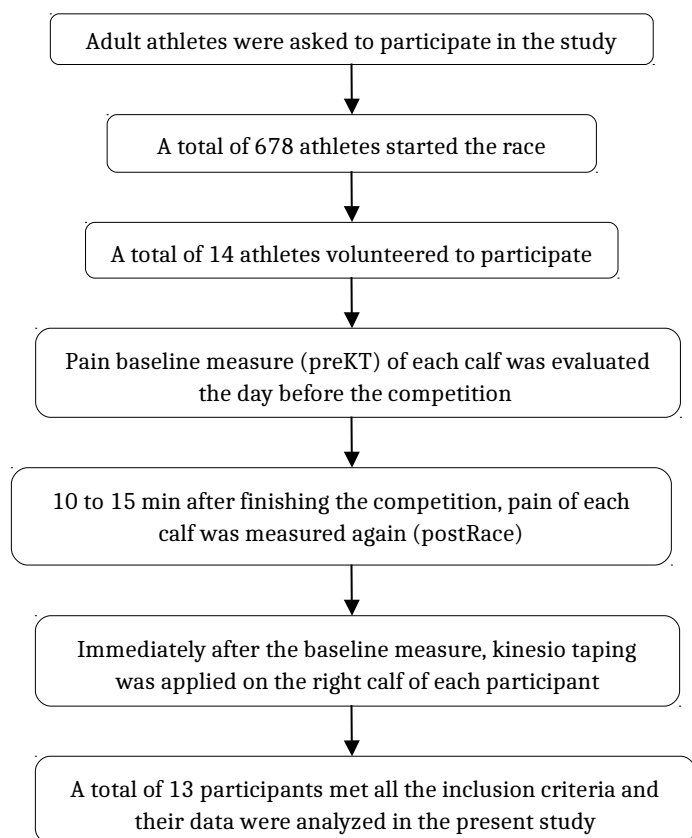


Figure 1. Flow chart corresponding to the sampling and procedure of the present study.

Results

[Table 1](#) shows general characteristics of the included participants. On average, the included athletes were aged 42.46 years old, used to train 8.27 hours per week, were competing for 13.23 years, and had a race time of 108.06 minutes. [Figure 3](#) shows the original data of all the included participants' calf pain reported at preKT and postRace. Raw data tend to seem flatter for the experimental leg than the control leg. Then, the mean values and standard deviations obtained of the calf pain, as well as the results of the repeated measures ANOVA, are shown in [Table 2](#). The results of the repeated measures ANOVA in the leg differences on NPRS values did not show statistically significant differences ($F = 0.451$; $p = 0.515$). However, although the results did not show a statistically significant effect, the effect sizes after the race could be considered an indication that it might be useful ($g = -0.37$) and that studies with the sample calculated would be necessary. Furthermore, the sample size calculation needed to detect statistically significant differences at a statistical power of 80% was 61.

Table 1. General characteristics of the studied sample ($n = 13$)

	Mean	SD	Minimum	Maximum
Age (years)	42.46	5.49	30.00	51.00
Body mass (kg)	67.92	8.40	54.00	79.00
Body height (m)	1.73	0.08	1.60	1.83
Body mass index (kg/m ²)	22.60	1.22	20.51	24.30
Training per week (hours)	8.27	3.11	4.00	15.00
Time competing (years)	13.23	11.91	2.50	35.00
Race time (minutes)	108.06	8.95	95.20	121.01

Note. SD = standard deviation.

Table 2. Effects of kinesio taping on calf pain (0-10 scale) ($n = 13$)

	preKT (1) (M ± SD)	postRace (2) (M ± SD)	Repeated measures ANOVA		
			F	p	g ^a
Difference ^b	0.00 ± 1.00	-0.31 ± 0.86	0.451	0.515	-0.37
Experimental	0.62 ± 0.77	2.08 ± 1.61			
Control	0.62 ± 0.87	2.38 ± 1.76			

Note. preKT = baseline; postRace = after finishing the competition; M = mean; SD = standard deviation; ^a Hedges' g effect size; ^b Difference between legs (experimental leg - control leg).

Discussion

The purpose of the present study was to examine the effect of KT on calf pain in healthy runners immediately after a half marathon. Contrary to the present research study, most of the studies about the effect of KT on pain have been conducted on



Figure 2. Application of the kinesio tape to the (right) calf using the I-shaped taping technique.

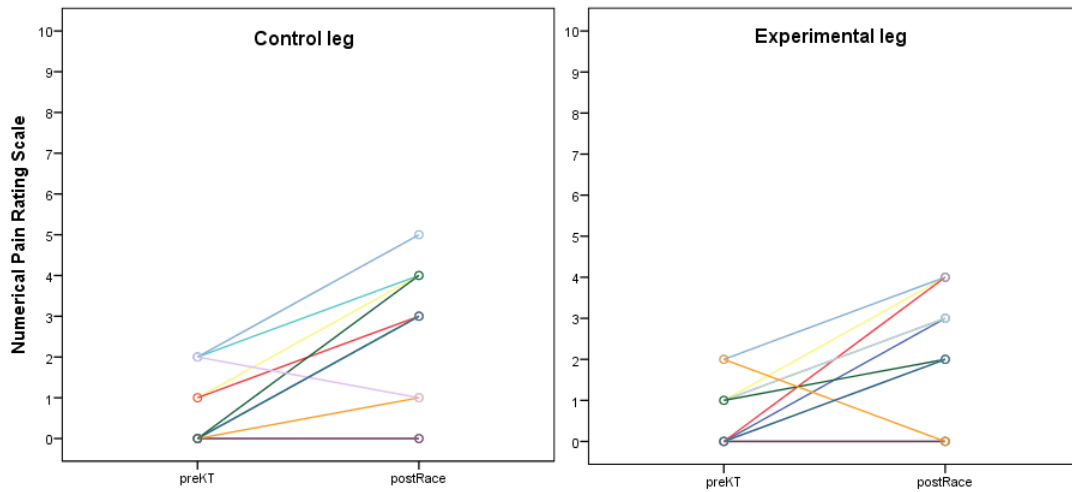


Figure 3. Original data of all the included participants' calf pain reported at baseline (preKT) and after finishing the competition (postRace). *Note.* Some participants' scores overlapped. Control leg: from 0 to 0 (3 cases) and from 0 to 3 (2 cases); Experimental leg: from 0 to 0 (3 cases), from 0 to 2 (2 cases) and from 1 to 3 (2 cases).

individuals with pain caused by a lesion. Nevertheless, the results remain contradictory.^{7,10,11} Regarding the present study, the results of the Wilcoxon test in the leg differences on pain values did not show statistically significant differences ($p = 0.515$). Perhaps the profile of the half marathon was not tough enough to cause appreciable pain in the calf muscles. However, the effect sizes after the race could be an indication that it might be useful and that studies with the sample calculated would be necessary ($g = -0.37$). According to Valentine and Cooper,¹⁶ we have to be aware that even these values of effect size could be considered of practical relevance. The Cohen's cutoffs define that a value of 0.5 is moderate and a value that is lower 0.5 is low. However, this definition is arbitrary and depends on many factors. For this reason, it must be considered in order to interpret the effect of the study.

In contrast with the present study, the positive effect of wearing KT applied over calf muscles in pain reduction after an endurance competition can be observed in the following two studies. Merino-Marban et al.^{5,6} found that applying KT on calves seems to reduce muscle pain produced by the competition. It must be highlighted that KT was applied before starting the competition and maintained throughout the entire process until the final evaluation of perceived pain. As in the present study, there were no statistically significant improvements in Merino-Marban et al.,⁵ but there were statistically significant improvements found in Merino-Marban et al.⁶ And, the effect size from baseline to post-Race was ($g = -0.38$) and ($g = -0.54$) respectively. According to Valentine and Cooper,¹⁶ we have to be aware that even these values of effect size could be considered as of practical relevance. There are no universal standards for interpreting the practical relevance of a particular intervention.

It has been suggested that KT can decrease pain associated with delayed onset muscle soreness. Nevertheless, some laboratory setting studies targeting this issue arrived at contradictory results. While Nosaka¹⁷ found a trend of KT to control pain and muscle damage after eccentric resistance exercise in the upper extremity of healthy individuals, Lee, Bae, Hwang, and Kim¹⁸ found a reduction in muscle pain, thickness and a recovery in maximal voluntary isometric contraction after 72h. Oshiro and Powers¹² found negative results of KT reducing pain after eccentric resistance exercise in the upper extremity of healthy participants. But there is a significant difference between these studies: in Oshiro and Powers¹² the KT was applied after the exercise was finished, while in Nosaka¹⁷ it was applied before starting the eccentric exercise and maintained during it, as in the present study. Lee et al.¹⁸ applied KT after inducing delayed onset muscle

soreness in the biceps brachii and participants maintained the KT for 72h. It seems that maintaining the KT applied over the muscle during exercise or a few days after exercise may play a role in controlling muscle pain.

When KT is applied over the skin, a series of convulsions will appear that restore the lymphatic and blood circulation, reducing the pressure on the mechanoreceptors.¹¹ This leads to a decrease in pain in the area bandaged, and consequently restores the movement pattern, making it more physiological.¹⁹ Kataoka and Ichimaru²⁰ assessed the effect of KT on the peripheral circulation in the calf muscles of six healthy participants at rest and after doing low intensity exercises. The KT increased circulation, activating the nerve impulses from periphery of the body to the cerebral cortex. Another theory considers the property of KT to emulate a sort of artificial fascia, tensing the underlying superficial fascia in specific directions.²¹ This tensioning provides a fast, effective analgesic effect.²² Some researchers highlight that application of KT reduces the levels of pain experienced by loosening the muscular fascia,²³ and therefore reducing the mechanical load on free nerve endings within the fascia.²⁴

To date, there is no uniform protocol on the application of KT² over calf muscle. Two forms of application are often used: (1) a Y-shaped strip applied from muscle insertion to origin starting from the middle third of the foot following the direction of Achilles tendon, then the strip is divided into two parts, one over the external calf and the other over the internal calf muscle;²⁵ (2) a I-shaped strip goes from insertion to muscular origin over the Achilles tendon with an extensibility of 10%, in muscle inhibition mode. In both techniques, the ends of the bandage are applied without tension.¹⁵

KT is used to treat and prevent sport injuries in healthy individuals, but there is no firm evidence-based conclusion on the effectiveness of KT in the majority of studies on muscle pain after strenuous exercise.^{5,6,9,12,17,18}

There are some limitations in this study that warrant consideration. First, the study was conducted on a healthy population. Several authors defend applying the KT on a non-healthy population diagnosed with some kind of musculoskeletal injury. Moreover, despite the fact that all the adult athletes of the half marathon were invited to participate in the present study one month before, only a small sample could be recruited. Therefore, in future studies any kind of strategy so that it could increase the sample such as gifts for volunteers should be used. Thirdly, a quantitative method to assess pain such as algometry could be used instead. Finally, another limitation of the present study was that it would have been advisable to measure pain again 60

minutes or even 12 hours after the end of the race. However, because of feasibility issues it could not be made.

In conclusion, when KT was applied to healthy half marathon runners, the data did not disclose whether the tape could lead to control calf pain produced by an endurance competition. Since currently the related research studies are scarce and contradictory, future research studies are required.

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