Kinesio Taping Reduces Cold-Induced Pain in Young Healthy Individuals Independent of the Applied Tension on the Tape

ORIGINAL

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Abstract

Introduction: *Kinesio Taping* (KT) is a relatively new method, which has been gaining importance over the past 10 years because of the significant exposure in international sporting events, such as the Olympic games. Although it is widely used by health professionals during treatment, there are few studies that provide information to justify the use of this technique and the ways in which it is applied for the treatment or prevention of any musculoskeletal affliction that causes pain.

Objective: Evaluate the effect of *Kinesio Taping* on cold-induced pain in young healthy individuals.

Methodology: 85 subjects aged 18 to 38 were selected, divided into a control group (CG: 41) and experimental group (EG: 44). The protocol for induction of pain by cold was done with cold water (0°C – 2°C), with immersion of the non-dominant hand. The variables analyzed were the pain threshold (PT), total time of immersion (TTI) and the pain intensity according to the visual analogue scale (VAS). *Kinesio Taping* was then applied in an "I" shape, starting from the distal third of the forearm until the end of the third metacarpal bone; in the CG, KT was applied without putting tension on the tape; in the EG, KT was tensioned at 25% for the application. The volunteers were instructed to keep the KT applied for 24 hours. After this period, the subjects returned to the place of evaluation, where the KT was removed and the pain induction by cold protocol was once again performed.

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Results: In the CG, 17 individuals were male and 24 female, with a mean age of 20.07 ± 3.11 . In the EG, 21 individuals were male and 23 female, with a mean age of 20.06 ± 1.88 . There was a significant increase in the variables PT and TTI, in addition to a decrease in the pain intensity according to VAS for both the CG and the EG, without a significant difference between the groups.

Conclusion: KT was able to reduce pain perception induced by the cold, but there was no difference between the experimental and control groups.

Keywords

Physical Therapy;
Kinesio Taping; Pain.

Introduction

The main creator and developer of *Kinesio Taping* (KT), or functional elastic bandaging, was the Japanese chiropractor Kenzo Kase in 1973 [1]. The technique seeks to modify the mechanics of segments, normalizing muscular function by correcting posture, facilitating lymphatic and vascular flow, providing a cutaneous stimulus that facilitates or limits movement, assisting in the reduction of edemas and reducing pain by neural pathways. Although there is little evidence about its effects and mechanisms of action, it is widely used to treat several afflictions in various segments of health care, especially in sports medicine [2-6].

KT can have a distension of 130-140% and doesn't limit range of motion since it has similar mechanical properties as skin [7, 8]. It's been used in the field of sports, in particular, to protect joints and reduce edema and pain after acute lesions [9]. According to the application technique, the tension applied on the tape and the shape of the strips vary as a function of the purpose of the treatment, with its main effects being the normalization of muscular function, the increase of lymphatic and vascular flow and assisting in the correction of any bad joint alignments and the reduction of pain. The degree of tension of the tape should therefore be linked

directly to its effects, being a basic foundation of the technique [10-12].

According to the treatment objective, the shape of the strips and the tension that must be applied on the tape by the therapist, varies. The cuts, for example, can have an "Y" or "I" shape, and the tension applied to the tape, graded in percentages, is described as one of the key factors for the success of the application. This tension ranges from: total (100%), intense (75%), moderate (50%), nothing but the removal of the protective paper or light (15-25%), to very light (0-15%) and no tension 0% [1, 11]. To inhibit muscle pain in acute situations, caused by overuse or stretching, the KT is applied from the distal insertion in the direction of the proximal insertion of the affected muscle (15-25%) [1, 13].

Although it is widely used, there are few studies that provide information to justify the use of this technique in the treatment or prevention of any musculoskeletal affliction that causes pain. There is controversy in the literature about the nature of the effect being potentially associated with the tape tension and the convolutions of the skin it produces [14]. Bearing in mind that the application of KT is currently popular as a therapeutic resource in different fields of physiotherapy practice, it becomes relevant to seek scientific support to sustain its use

with respect to its analgesic function and its mode of application [1, 15, 16, 17].

Several studies have described the effects of KT in painful situations. Most of them, however, focused on the treatment of pre-existing injuries, such as lower back pain, often associated with other therapeutic resources [3, 4]. There is a shortage of studies in the literature about pain effects induced experimentally in healthy individuals, as has been done with other therapeutic resources. The objective of this study was therefore to evaluate the relevance of tension in KT application for the perception of pain by cold experimentally induced in young healthy individuals.

Methodology

This is a descriptive, longitudinal and prospective study carried out at the Federal University of Piauí. A total of 85 healthy subjects, with a mean age of 20.07 ± 2.5 , of both genders, participated in the study. All participants signed a written informed consent agreeing with the objectives and methods of the study. The exclusion criteria included people under 18 or over 38 years of age, people reporting any orthopedic or neurological problem, circulatory disorder, allergy to KT, hypersensitivity to cold or skin lesions in the area that would be subjected to immersion. The inclusion criteria were healthy individuals at the time of application of the test and being an university student.

The volunteers were divided into two groups, 44 people were part of the experimental group (EG), where the KT was applied with a tension of 25-50%, and 41 of the control group (CG), considered as the placebo, in which the KT was applied without tension. The participants were randomly distributed between the groups and were not informed of which group they were participating. To determine the tension of application, a piece of tape of around 10cm was stretched to its maximum and then taken back to below half the size achieved, which resulted in a range between 25 and 50% of tension.

In the first instance, the previously reported protocol for pain induction by cold was followed [18], in which first the non-dominant hand of the volunteer was immersed in a container containing water at 37°C for five minutes to normalize the temperature and then transferred to another container with cold water (0°C – 2°C). The temperature of both containers was controlled by a thermometer for liquids and solutions. The volunteer was instructed to focus on the sensation of the submerged limb until the point at which this sensation became painful, at which time the individual should inform the evaluator, using the term "pain", while keeping the hand submerged until he could no longer support it. He was then given 10 minutes of rest before the procedure was repeated. The time between immersion, the moment in which the participant reported pain, and the total time of immersion, was recorded. The volunteer also indicated the intensity of pain through the Visual Analogue Scale (VAS) on a curve from 0 to 10 cm, where 0 means no pain and 10 means the worst pain imaginable.

In the second instance, KT (Kinesio® Tex Gold™) was applied in an "I" shape, starting from the distal third of the forearm until the end of the third metacarpal bone, in the posterior region, considering the anatomical position. For the participants of the EG, the KT was tensioned at 25%, while in the CG the KT was applied without any tension. The volunteer was instructed to keep the KT applied for 24 hours, performing all the activities of daily life as usual. After 24 hours, the KT was removed and the protocol of pain induction by was repeated, including the identical method to record the pain times and intensities as in the initial assessment.

The variables analyzed were elapsed time between the beginning of cryostimulation until the moment in which the volunteer reported pain, the so-called pain threshold (PT), the time that the individual maintained the hand submerged in cold water was called the total time of immersion (TTI) and the pain was evaluated through the VAS. The

data were organized so as to compare the results between the two instances of the study (pre and post application of the KT).

The analyses between the instances were done using Wilcoxon's test. The normality of the groups was analyzed using the Shapiro-Wilk test. The considered level of significance was $p \leq 0,05$. The tabulation of results was done in the Microsoft Office Excel 2010 software, and the data comparison was performed in the GraphPad Prism 5 software. The project was submitted to the Ethics Committee for Research with Human Beings of the Federal University of Piauí and approved under the registration number: 1,055,201.

Results

Table 1 shows the distribution of the sample by gender and age of the participants. There were no significant differences of these variables among the volunteers, pointing to the homogeneity of the sample.

With respect to the pain threshold, it was possible to observe a significant increase ($p < 0.0001$) in the time of onset of pain perception in both groups, as can be seen in **figure 1**.

The total time of submersion supported by the participants in the study was measured and it was observed that the use of the kinesio tape increased this tolerance in both groups, regardless of tape tension, as can be seen in **figure 2**.

The painful sensation was assessed with the Visual Analogue Scale (VAS), applied at the end of

Table 1. Characterization of the groups in terms of gender and age. There was no difference between the mean ages of the experimental and control groups (t-Test; $p = 0.9672$).

	Experimental	Control	P
Gender (M/F)	21/23	17/24	0.425
Age (Mean/ Standard Deviation)	20.06 ± 1.88	20.07 ± 3.11	0.9672
Total	44	41	

Figure 1: Pain threshold. Mean time (s) of the onset of pain perception. An increase can be seen in both groups. * Difference between the final and initial measurement of the experimental group and # Difference between the initial and final measurement of the control group (Wilcoxon; $p < 0.001$).

Figure 2: Total Time of Immersion (s). The use of KT provided for a greater tolerance in both groups. * Difference between the final and initial measurement of the experimental group and # Difference between the initial and final measurement of the control group (Wilcoxon; $p < 0.001$).

Table 2. Mean VAS values. There was a reduction in pain perception in both groups. (Wilcoxon; $p < 0.001^*$). Variation between the start and final instance of each group (Wilcoxon test; $p < 0.6557^\#$).

Group	Start (Mean/deviation)	Final (Mean/deviation)	P*	Variation (Mean/deviation)
Experimental	6.83 ± 1.46	6.32 ± 1.44	<0.0001	-0.49 ± 1.27
Control	7.48 ± 1.23	6.80 ± 1.40	<0.0001	0.66 ± 1.13
P#				0.6557

each experiment. **Table 2** shows the means of the results. The application of KT significantly reduced the pain in both groups ($p < 0.001$). However, there was no difference in the comparison of the variation of initial and final values between the groups ($p = 0.6557$), with this variation being -0.49 ± 1.27 points in the experimental group and 0.66 ± 1.13 in the control.

Discussion

The combination of these results reveals that the kinesio tape acts positively, reducing the sensation of pain induced by cold. This effect, however, occurs independent of the tension on the tape, with no statistically significant difference between the experimental and control groups in all evaluated parameters. The similarity of results between the two forms of application, leads us to question the real effectiveness of varying the tension on the tape in the treatment of painful conditions.

Several authors [2, 6, 19] have carried out studies comparing the effects of the use of KT in pain situations, such as chronic lumbar pain, acute neck whiplash sprains and medial epicondylitis; all compared the application of KT in two ways, one according to the recommendations of the technique, applying a tape tension of 20-50% that can cause the skin convolutions, which would be responsible for the technique's effects [1], and another where the tape was applied without tension. The results found corroborate ours and reveal that individuals treated with KT had a sig-

nificant clinical improvement, regardless of the way it is applied, but without difference in results between the groups, supporting the idea that the effect of the tape is not related to the formation of skin convolutions.

The model of cold-induced pain was used because it is a simple method that involves a minimal risk of tissue injury and the pain ceases after the removal of the stimulus. During this test, a painful sensation is generated by temperature receptors, which send stimuli of potential tissue damage through the peripheral (C and A-delta fibers) and central (spinothalamic and spinoreticular) pathways, resulting in the sensation of pain [20]. This pain induction model has been used by other researchers, particularly to study the effects of transcutaneous electrical stimulation (TENS) [18, 20]. Its application has proven to be effective for the study of the effects of KT, since its potential mechanism of action would be similar to TENS. Although its mechanism of action is not completely understood, it has been suggested that KT applies a pressure, or stretching to the skin, which possibly stimulates mechanoreceptors that compete with and inhibit nociception through fast conduction myelinated fibers (gate control theory) [21-23].

Other researchers also point to external factors, such as the reduction of lumbar pain after treatment with KT being associated with a greater body awareness, which could lead the patient to avoid harmful movements [4], or the fact that KT provides a better patellar alignment, thus decreasing pain in patients with patellofemoral pain

syndrome [23]. One should also take into account the bioneuropsychological pathway, through the release of analgesic neurotransmitters as a function of patient expectations [24].

The participants of both groups were also able to support crioelectrostimulation longer (**Figure 2**), and the painful experience, evaluated through VAS, was reported as being less intense (**Table 3**). The reduction of pain with the use of KT has been reported by other researchers, being singled out as an important factor for the musculoskeletal rehabilitation, providing a positive psychological effect in addition to accelerating the return to routine activities [9, 21].

Our findings show a reduction of pain as assessed with the VAS in both the experimental group and the control group, with no differences occurring between the mean variation in each group, indicating there was no influence of the tape tension on the analgesic effect. While evaluating the intensity of pain in the shoulder through VAS, Thelen and collaborators (2008) observed similar results, with a reduction in pain immediately after application of the KT, but this improvement occurred both in the group that received the treatment and the placebo [15]. Corroborating these findings, a study carried out with surgeons using the VAS, revealed that KT was effective in reducing lower back and cervical pain [25].

Recent bibliographical reviews [24, 26, 27], on the other hand, indicate that the clinical application of KT had no significant result in the reduction of long-term pain or when compared to conventional techniques, such as kinesiotherapy and electrotherapy, for the treatment of musculoskeletal afflictions. These researchers discourage the use of the bandage because they conclude that it has no effect based on the difference between the groups with and without tape tension, or when compared with other resources. One can observe, however, that KT has a positive effect in the treatment of pain, regardless of the format or tension on the tape,

with its efficiency being maximized when used as an adjuvant to other, already proven techniques and resources [8].

Conclusion

Based on this study, we can conclude that KT reduced pain perception induced by the cold, but there was no difference between the experimental and control groups. This effect may therefore be caused by contact of the tape with the skin, regardless of the tension or manner of application. Its therapeutic use should only be recommended when associated with other resources for the treatment of pain. Further studies are recommended, however, to clarify the mechanism of analgesic action in a concrete manner.

Conflicts Of Interest

All authors declare there were no conflicts of interest.

Contribution Of The Authors

AMF, RSM, TSPC, YMD and RHGT participated in data acquisition. All authors participated in the review of the manuscript. MCF guided the design and organization of the study. MSC and FFQ wrote the manuscript. All authors discussed the results and worked on the discussion.

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