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RESEARCH / ARAŞTIRMA

Effects of Different Tensions of Kinesio Taping on Lumbar Skin Temperature: A Randomized Controlled Trial

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ABSTRACT

Objective: The objective of this study was to investigate the effect of Kinesio Tape (KT) applied at different tension levels on local skin temperature using thermographic analysis and to reveal the potential role of band tension on circulatory response.
Materials and Methods: This randomized controlled study included 36 healthy subjects. Participants were randomly divided into three groups (20%, 40%, 60%) based on KT tension levels. KT was applied to the lumbar region using the specified tension, while the opposite side served as a control with 0% tension. Local skin temperature was measured at baseline, 15 and 45-min after application, and again at 24 hours. All measurements were performed in the lumbar region using an infrared camera under constant environmental conditions and at a fixed distance. Statistical analyses were performed using Kruskal-Wallis and Dunn-Bonferroni tests, with significance set at $p<0.05$.
Results: Temperature measurements revealed no statistically significant differences in local circulatory responses among the KT tension groups (20%, 40%, and 60%) at any time point ($p>0.05$). Despite a trend toward significance at the 45-min mark in the 60% tension group ($p=0.051$), no statistically significant changes were observed.
Conclusion: KT applications at different tensions did not induce a significant thermographic response in lumbar skin temperature in healthy adults. This is probably a consequence of the optimal functioning of the nervous system and circulation. It's plausible that different results may be observed when KT is applied to other body regions or clinical populations.
Keywords: Kinesio tape, skin temperature, thermography.

Farklı Gerimlerde Kinezyo Bant Uygulamasının Lumbal Bölge Cilt Sıcaklığı Üzerindeki Etkisi: Randomize Kontrollü Bir Çalışma

ÖZET

Amaç: Bu çalışmanın amacı, farklı gerim seviyelerindeki kinezyo bant (KT) uygulamasının lokal cilt sıcaklığı üzerindeki etkisini termografik analiz yöntemiyle araştırmak ve farklı bant gerimlerinin dolaşım yanıtı üzerindeki potansiyel rolünü ortaya koymaktır.
Gereç ve Yöntem: Bu randomize kontrollü çalışmaya 36 sağlıklı birey dahil edildi. Katılımcılar, uygulanan KT gerim seviyelerine göre rastgele olarak üç gruba (%20, %40, %60) ayrıldı. Belirlenen gerim seviyesinde lumbal bölgeye KT uygulaması yapılırken, diğer taraf kontrol olarak bırakılarak %0 gerimle bant uygulandı. Lokal cilt sıcaklığı ölçümleri; başlangıçta, uygulamadan sonra 15. ve 45. dakikada ve uygulamadan 24 saat sonra gerçekleştirildi. Tüm ölçümler, sabit ortam koşullarında ve standart mesafeden, kızılötesi kamera kullanılarak lumbal bölgede yapıldı. İstatistiksel analizler Kruskal-Wallis ve Dunn-Bonferroni testleri ile yapıldı ve anlamlılık düzeyi $p < 0.05$ olarak kabul edildi.
Bulgular: Sıcaklık ölçümleri, KT gerilim grupları (%20, %40 ve %60) arasında herhangi bir zaman noktasında lokal dolaşım yanıtları açısından istatistiksel olarak anlamlı bir fark bulunmadı ($p>0.05$). %60 gerilim grubunda 45. dakikada anlamlılığa yakın bir eğilim gözlemlenmiş olsa da ($p=0.051$), istatistiksel olarak anlamlı bir değişiklik saptanmadı.
Sonuç: KT'nin farklı gerim seviyelerinde uygulanmasının sağlıklı bireylerde lumbal bölgedeki lokal cilt sıcaklığı üzerinde anlamlı bir termografik yanıt oluşturmadığı gözlemlendi. Bu durumun, sağlıklı bireylerde sinir sistemi ve dolaşımın fizyolojik olarak dengeli işleyişine bağlı olabileceği düşünülmektedir. Bununla birlikte, KT'nin farklı anatomik bölgelerde veya spesifik klinik popülasyonlarda uygulanmasının farklı dolaşımsal yanıtlar ortaya çıkarabileceği göz ardı edilmemelidir.
Anahtar Kelimeler: Kinesio bant, cilt sıcaklığı, termografi.

1. Introduction

Kinesio Tape (KT) is a thin, breathable and flexible tape that stretches with the muscles but does not restrict joint movements. First developed by Dr. Kenzo Kase in Japan, this technique has since been widely used by physiotherapists, orthopaedic surgeons, and physical medicine and rehabilitation specialists to facilitate healing after musculoskeletal injury (1,2).

The therapeutic effects of KT include increasing proprioception, regulating muscle excitability (facilitation or inhibition), improving muscle function, promoting blood and lymph circulation, relieving pain and realigning subluxated joints (3-6). The tension capacity of KT may alter sensory feedback through mechanoreceptors on the muscle to which it is applied, which may have an effect on circulatory dynamics (7). There are studies indicating that when applied at different tension levels, the tape has the potential to change the pressure on tissues and superficial blood flow, but it is still unclear how KT affects circulation through mechanical interactions with fascia and skin (8,9).

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To better understand these potential circulatory effects, objective and non-invasive imaging methods are essential (10-12). Today, modern thermographic scanning methods offer the opportunity to objectively evaluate changes in tissue temperature (10). Thermography is a painless, safe and non-invasive imaging method that analyzes skin temperature distribution by detecting infrared radiation emitted from the body (10-12). Previous studies have investigated the thermal effects of KT on the lumbar region and the impact of different taping techniques on regional body temperature (8,9,13); however, findings in the literature vary, resulting in inconsistent conclusions regarding its effects on circulation (9,13).

The objective of this study was to investigate the effect of KT applied at different tension levels on local circulation by thermographic analysis method and to reveal the potential role of band tension on circulatory response in this context. It was hypothesized that varying tension levels of KT would differentially influence local circulation, reflecting a tension-dependent circulatory response.

2. Material and Method

2.1. Study Design

This study is a randomized controlled experimental study investigating the effects of Kinesio Tape applied at different tension levels on local circulation in healthy individuals.

2.2. Sample Size Determination

A total of 36 healthy participants were included in the study. The sample size was determined based on the study data of Liu et al. (8) and a power analysis performed using the G*Power 3.0 program. The primary outcome measure used for this calculation was the mean difference in skin temperature. With an assumed power of 80% (1-β = 0.80), an alpha level of 0.05, and an effect size of 0.6 derived from Liu et al., the minimum required sample size was calculated as 12 participants per group.

2.3. Participants

Participants were selected based on specific inclusion and exclusion criteria. Inclusion criteria were volunteering to participate, being between 18 and 35 years of age, and having the ability to read and understand Turkish. Individuals with known chronic systemic or psychological disorders or those who were pregnant were excluded from the study. All measurements were conducted at the Izmir Kâtip Celebi University Physiotherapy and Rehabilitation Training and Research Center. Demographic data, including gender, age, height, weight, body mass index (BMI), medical history, and family history, were recorded.

2.4. Randomization and Group Allocation

Participants were randomly assigned into three groups using block randomization (AABBCC-ABCABC-BBCCAA-BCABCA-CCAABB-CABCAB). The groups were categorized based on the level of KT tension applied, with one group receiving 20% tension, another receiving 40% tension, and the third receiving 60% tension. One side of each participant's bilateral paravertebral muscles was designated as the control side with 0% tension, while the other side received KT application at the assigned tension level according to the randomization group.

2.5. Kinesio Tape Application Protocol

All KT applications were performed using the I-strip technique. The anchor part of the tape was applied while participants stood in a neutral standing position. Tension levels (20%, 40%, and 60%) were determined based on the percentage of elongation relative to the tape's no-tension length. To ensure consistency, all applications were performed by the same trained practitioner. Participants were then asked to bend forward as much as possible, and the remaining part of the tape was applied in this position. After the application, the tape was manually rubbed to activate its adhesion to the skin. In the first group, the I-strip technique was applied with anchor parts of 5 cm bilaterally at 0% tension. One side remained at 0% tension, while the other side was applied with 20% tension along the L1-L5 vertebrae, and the final 5 cm endpoints were applied at 0% tension. In the second group, the procedure was performed similarly, but one side received 40% tension while the other side remained at 0% tension. In the third group, the same technique was followed, but 60% tension was applied on one side, while the other remained at 0% tension. In all groups, the final 5 cm endpoints of the tape were applied with 0% tension (8).

2.6. Thermal Imaging and Data Collection

Body temperature assessment was conducted using a FLIR E5 infrared camera positioned 30-40 cm from the bare skin surface. The local temperature of the lumbar region was recorded before taping as a initial measurement and then reassessed at multiple time points after application (14-16). Measurements were taken at the 15th and 45th minutes following the application, as well as 24 hours after the application before the tape was removed. An additional measurement was performed at the 15th minute after tape removal. Temperature analysis was conducted using FLIR E5 infrared camera software, and the minimum, mean, and maximum temperature values obtained from the thermal images were recorded for statistical analysis.

2.7. Analysis of Research Data

The statistical analysis was performed using IBM SPSS Statistics 26.0 (IBM Corp., Armonk, New York, USA). To assess the success of group randomization, initial characteristics of the groups were compared using the Kruskal-Wallis test. The same test was used to determine whether the local body temperature of the paravertebral muscles differed among the groups (20% tension, 40% tension, 60% tension) at different time points (pre-application, 15th minute, 45th minute, 24 hours after application, and 15 minutes after tape removal). If a significant difference was found, pairwise comparisons were conducted using the Dunn-Bonferroni post hoc test. Changes in temperature were reported with a 95% confidence interval and effect size. Descriptive statistics were used to summarize participants' characteristics (age, sex, body mass index). Continuous variables were presented as median (interquartile range), while categorical variables were presented as frequencies and percentages. The significance level was set at $p<0.05$.

2.8. Ethical Aspects of the Research

Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee of Izmir Katip Celebi University (Data: 26.01.2023, number:0648). Written Informed Voluntary Consent Forms were obtained from all participants, ensuring voluntary participation in accordance with ethical principles.

3. Results

The demographic characteristics of the participants are presented in Table 1.

Table 1. Demographic data of participants (n=36).

	Mean ± SD
Age (years)	21.6±1.9
Weight (kg)	67.3±15.6
Height (cm)	171.3±8.8
BMI (kg/m²)	22.8±4.2

kg: kilogram, cm: centimeter, BMI: Body Mass Index, m: meter, n: number of people

4. Discussion

Based on the results of this study, kinesio taping at varying tension levels did not lead to significant thermographic alterations in the lumbar region of healthy adults. Infrared imaging conducted at multiple time points demonstrated no measurable change in local skin temperature.

These findings are consistent with previous studies, which have similarly demonstrated that kinesio taping does not induce thermographic alterations in healthy individuals (17–20). Kase et al. (20), proposed that KT application enhanced peripheral blood flow in subjects afflicted with chronic conditions and poor circulation; however, no such increase was observed in healthy subjects. These observations are corroborated by Stedge et al. (17), who found no effect of KT on cutaneous red blood cell flow in a heterogeneous population. Furthermore, Miller et al. (18) expressed cutaneous blood flow as a percentage change from initial values and reported no increase in healthy participants. In a study conducted by Yang et al. (21), the effects of kinesio taping applied with and without inducing convulsions on skin temperature were examined in pain-free individuals. It was reported that both methods caused a small but significant temperature decrease only in the first 5 minutes, but this effect disappeared after 15 minutes (21). The findings of this study are in agreement with those of the present study, in that they show that kinesio taping does not cause a permanent thermographic change in healthy individuals. In a similar study, Banerjee et al. (22) demonstrated that kinesio taping did not induce a substantial change in skin temperature or deep pressure nociception (heat and pressure pain) in healthy subjects when compared with standard taping and placebo taping. These findings can be explained by the fact that the application of kinesio tape does not cause a significant change due to the optimal functioning of the nervous system and circulation in healthy individuals.

Contrary to the findings of this study, some research has indicated that KT may have an effect on local circulation. In a study by Slomka et al. (23), a decrease in temperature values was observed immediately after the removal of the tape in individuals who underwent KT, followed by an increase in temperature within one hour. It was hypothesised that this may be related to flow changes in superficial blood vessels (20,23).

One hypothesis proposed by Kenzo Kase suggests that the space between the skin, fascia and muscles expands following KT application, resulting in increased and facilitated blood and lymph flow in the area (20). However, there is a paucity of publications that attempt to explain the effect of KT on decreasing tissue temperature in relation to this hypothesis. It is acknowledged that skin surface temperature is closely related to subcutaneous perfusion and tissue metabolism, and that emitted infrared radiation probably reflects an increase or decrease in local perfusion (20,23).

The absence of significant thermographic change in the treated subjects, who were healthy and free from circulatory disorders, may be attributed to the fact that different results may be obtained in subjects experiencing pain or in patient populations with circulatory disorders. The extant literature contains studies reporting significant effects of kinesio tape application on local circulation in individuals with chronic conditions and poor circulation (13,24-27). However, the mechanisms through which KT affects circulation have yet to be fully elucidated. Consequently, there is a necessity for methodologically robust studies with long-term follow-up in diverse populations to enhance comprehension of the manner in which KT impacts local circulation.

A major strength of this study is the use of a thermal imaging camera, a reliable and objective method that minimises subjective bias in the assessment of local temperature changes (15). However, the findings of the study should be interpreted with caution due to the relatively small sample size. Furthermore, the fact that the study was conducted only on healthy individuals limits the generalisability of the results obtained to patient populations with microcirculatory dysfunction or circulatory disorders. It is also important to note that different results may be observed when the method is applied to different body sites or in specific clinical situations. Future studies in larger and more heterogeneous groups will contribute to a more comprehensive evaluation of the effects of KT on circulation.

4.1. Limitation

This study has several limitations. First, the sample size was relatively small, which may limit the generalizability of the findings. Second, the participants were healthy young adults, so results may not be generalisable to clinical populations. Third, the focus on the lumbar region limits understanding of regional variations in thermographic responses. Finally, the short-term assessment design prevented the evaluation of long-term thermographic effects of KT.

5. Conclusion and Recommendations

Based on the findings of this study, kinesio taping applied at varying tension levels did not produce significant thermographic changes in the lumbar region of healthy adults. The absence of measurable skin temperature alterations suggests that the tape may not have a notable effect on local circulation, contrary to some hypotheses. Given these results, it is recommended that future research focuses on replicating this study with a larger sample size to enhance the generalizability of the findings. Additionally, studies exploring the effects of kinesio taping in clinical populations are needed to determine if the outcomes differ in individuals with circulatory or inflammatory conditions. Future work should also consider a longer-term assessment design to evaluate any potential delayed thermographic effects of the taping.

Table 2. Kruskal–wallis analysis of temperature values in kinesio taping tension groups.

Tension Group	Initial (°C) Median (IQR: 25/75)	15 min After (°C) Median (IQR: 25/75)	45 min After (°C) Median (IQR: 25/75)	24 h After (°C) Median (IQR: 25/75)	p
20% Tension	34.95 (33.95/36.20)	33.90 (33.50/35.20)	34.20 (33.12/36.45)	35.00 (33.42/36.50)	0.959
40% Tension	34.25 (33.47/35.50)	33.80 (33.42/35.30)	34.50 (33.77/36.27)	34.50 (33.42/35.50)	0.174
60% Tension	33.95 (33.27/34.75)	33.70 (32.30/34.85)	34.65 (33.45/35.20)	34.40 (33.75/35.15)	0.051
p	0.075	0.61	0.88	0.684	

6. Contribution to the Field

This study is one of the rare studies that systematically investigated the effect of tape tension on local circulation in Kinesio Taping application by thermographic analysis method.

By comparing the effect of different tape tensions on circulatory responses, it provides important contributions to the development of KT application standards and optimal adjustment of tape tension in clinical practice. In addition, the use of thermography, an objective and non-invasive method, provides methodological diversity and innovation in the field.

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Conflict of Interest

There is no conflict of interest regarding any person or institution.

Authorship Contribution

Concept: İT, UZK, SMA; Design: İT, UZK, SMA; Supervision: İT, UZK, SMA; Funding: UZK, SMA; Materials: None; Data Collection/Processing: İT, UZK, SMA; Analysis/Interpretation: İT, UZK; Literature Review: İT; Manuscript Writing: İT; Critical Review: İT, UZK.

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