JBACHS
Journal of Basic and Clinical Health Sciences

J Basic Clin Health Sci 2023; 7: 756-764
https://doi.org/10.30621/jbachs.1203557
RESEARCH ARTICLE

THE EFFECT OF KINESIO TAPING TENSION ON THE PRESSURE-PAIN THRESHOLD AND PAIN TOLERANCE: A RANDOMIZED, CONTROLLED, DOUBLED-BLINDED TRIAL

Oyku Avci[1], Nazan Tugay[2], Fatih Ozden[3], Baki Umut Tugay[4]

[1] Physiodatça Wellness Center, Muğla, Turkey
[2] SANKO University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Gaziantep, Turkey
[3] Muğla Sıtkı Koçman University, Köyceğiz Vocational School of Health Services, Department of Health Care Services, Muğla, Turkey
[4] Muğla Sıtkı Koçman University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Muğla, Turkey

ORCID: O.A. 0000-0003-3385-9156; N.G. 0000-0002-5666-2578; F.O. 0000-0001-6593-3758; B.U.T. 0000-0001-7301-0785

Corresponding author: Nazan Tugay **E-mail:** nazantugay@yahoo.com
Received: 13.11.2022; **Accepted:** 24.01.2023; **Available Online Date:** 31.05.2023

Cite this article as: Avcı O, Tugay N, Ozden F, Tugay B.U, The Effect of Kinesio Taping Tension on the Pressure-pain Threshold and Pain Tolerance: A Randomized, Controlled, Doubled-blinded Trial. J Basic Clin Health Sci 2023; 7: 756-764.

ABSTRACT

Purpose: To our knowledge, no study has demonstrated the effects of Kinesio Taping (KT) tension on pressure-pain threshold and tolerance. The aim of the study was to investigate the effect of KT tension tensions on pressure pain threshold and tolerance.
Material and Methods: A double-blind, randomized controlled study was conducted with 90 healthy male subjects with an average age of 21.04 ± 2.0 years. The subjects were randomized into four groups: 0% tension (n=23), 50% tension (n= 24), 75% tension (n=22) and 100% tension groups (n=21). The KT was applied from distal to proximal, exposing the lateral epicondyle region on the dominant side. Pressure pain threshold and pain tolerance were measured using digital algometer over the lateral epicondyle. Measurements were carried out, before, immediate after and 30 minutes after KT.
Results: There was no statistically significant difference between the groups in terms of PP threshold, pain tolerance and intensity ($p>0.05$). There was a significant in-group difference only in the 100% Tension Group in terms of PP threshold ($p<0.05$). On the other hand, a significant difference was observed in the 0% tension and 50% tension groups on the pain severity measurements ($p<0.05$).
Conclusion: The results demonstrated that the KT at different tensions did not affect the pressure pain threshold or tolerance. The outcomes also considered the efficacy of low- and high-tension KT on pain tolerance and severity, respectively. A further study should investigate the pain threshold and tolerance in clinical cases with a long-term follow-up.

Keywords: Algometer; kinesio taping, pressure pain threshold, pain tolerance

INTRODUCTION

Kinesio Taping (KT) is a unique taping approach based on the natural healing physiology of the human body, providing support and stability to muscles and joints without affecting joint motion (1). In recent years, KT has become increasingly popular in treating musculoskeletal injuries and neuromuscular rehabilitation (2). KT has been reported to provide

recovery of the elastic fibres. Pain and spasm have been notified to decrease with KT application (3, 4).

KT provides traction to elevate the epidermis. This mechanical effect reduces the pressure on the receptors under the dermis, reducing nociceptive stimuli (5). Different mechanisms explain the role of KT on pain (e.g., reducing oedema and inflammation, gate control theory, stimulation of descending inhibitory pathways, and regulation of superficial and deep fascia functions) (6, 7).

KT can stretch up to 30-40% of its resting size in the longitudinal direction and has approximately the same weight/thickness as the skin. KT also can be applied with two different techniques as basic and correction. Furthermore, different tension techniques are used in clinical conditions. The amount of tension generally applied in the clinic as follows; 100% (full tension), 75% (high tension), 50% (medium tension), 15-25% (light tension), 0-15% (very light tension) and no tension (3).

The effect of KT applications involved at different tensions on pain has been demonstrated. However, there is insufficient data on pain threshold and tolerance. Pain threshold is defined as the intensity of the slightest stimulus that causes pain in the person. The pressure-pain (PP) threshold is the minimal pressure (force) that causes pain (8). PP threshold measurement reflects nociceptive sensitivity in superficial and deep tissues (9). Pain threshold assessment is more complex than assessing other sensory thresholds due to the concept of pain and human physiology. For the pain threshold, the individual should distinguish between painful and painless sensations instead of two types of sensation (10).

Pain tolerance is often more particular and inter-individual than pain threshold. Pain tolerance is commonly influenced by prejudice and experience. Evaluation of pain-related comprehensive parameters (pain threshold and tolerance) with objective methods is critical in clinical situations requiring physiotherapy and rehabilitation, both in determining the effectiveness of the treatments applied and in giving personalized pain treatment (11, 12).

Although the positive effect of KT on reducing pain is widely comprehended in clinical practice, the correct tension of KT on pain threshold and tolerance are not well-studied (13-15). To our knowledge, no study has demonstrated the effects of KT tension on pressure-pain threshold and tolerance. The aim of the study was to investigate the effect of KT tension tensions on pressure pain threshold and tolerance.

MATERIAL AND METHODS

Study Characteristics and Sample

A double-blind, randomized controlled study included 147 healthy male volunteers. The study was carried out in accordance with the ethical principles and the Helsinki Declaration. The study protocol was approved by the ethics committee of Muğla Sıtkı Koçman University Human Research Ethics Committee (Date: 06.10.2018, Decision no: 152). The study protocol was submitted to clinicaltrials.gov ((NCT04263077). The research was supported by Muğla Sıtkı Koçman University Scientific Research Projects Coordination Unit (Project No: 19/079/01/3/4).

Exclusion criteria of the study were; (1) having a diagnosis and treatment of lateral epicondylitis, (2) any neurological or systemic disease that impairs sensation/pain perception, (3) having a disease (e.g., diabetes, rheumatoid arthritis, peripheral vascular disease), (4) elastic taping skin sensitivity, (5) open wound, ulcer, fungal infection in the area to be taped, (6) exposure to the upper extremity and/or cervical region injury in the last six months

Sample Size

The sample size was calculated using the effect size (ES) and standard deviation (SD) values of a similar study (16). The following formula was used;

(1) Alpha (Bidirectional)=0.05, Beta=1-0.80 = 0.20
(2) Standardized ES = ES / SD = (10.7-8.9) / 2=0.9
(3) Sample Size = 16 / (Standardized ES) * 2= 20

Consequently, 20 cases were required in each group. A minimum of 22 cases were included in the groups considering the possibility of loss (10% drop-out rate) in the number of cases.

Recruitment, Randomization and Blinding

The study was carried out with healthy volunteer male students studying at Muğla Sıtkı Koçman University Faculty of Health Sciences. Participants were informed before the study, and their consent was obtained. First, 147 healthy volunteer individuals were informed about the study. Forty-seven individuals (33 did not meet the eligibility criteria, 14 did not want to participate in the study) were excluded due to various reasons (Figure 1). One hundred male

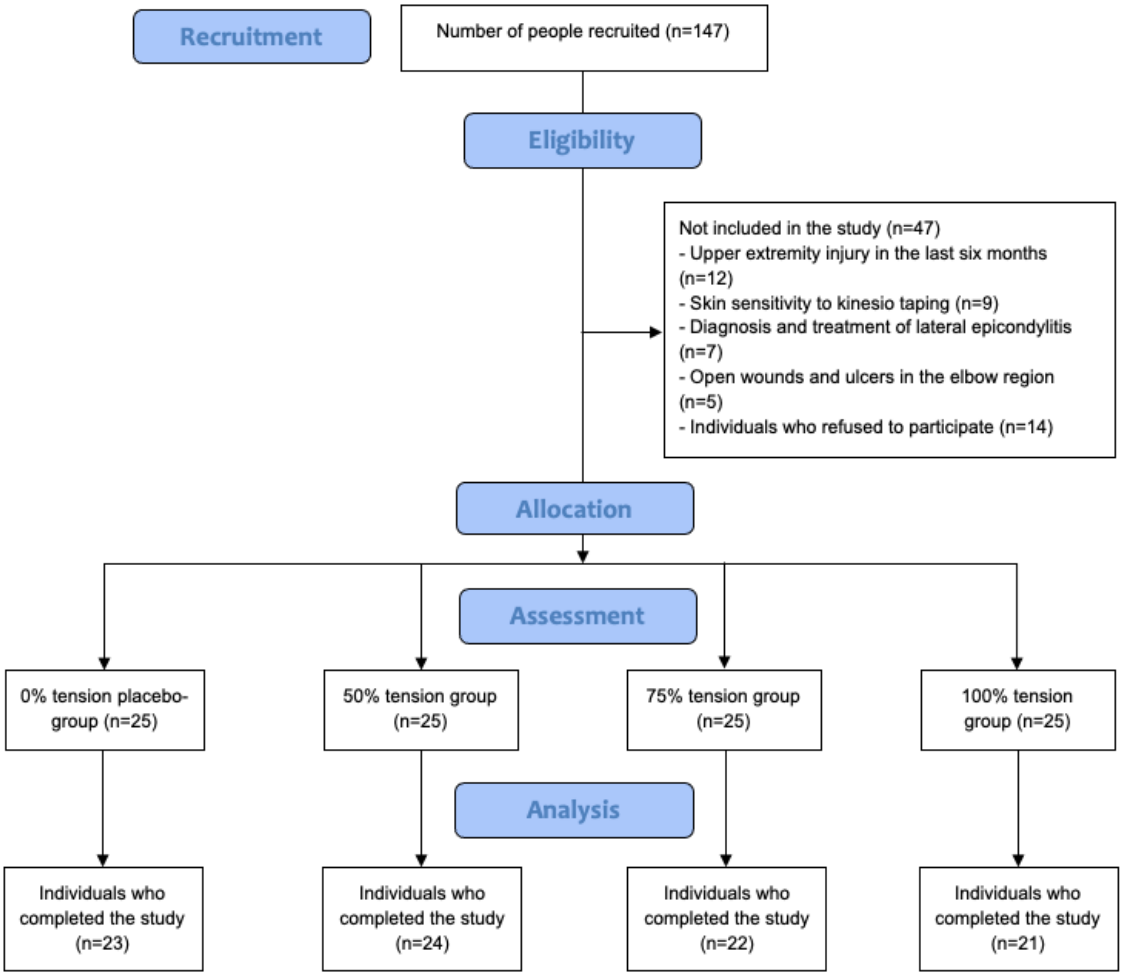

Figure 1. CONSORT flow diagram of the study

individuals were randomized using the Microsoft Excel Office (v16, Microsoft Corporation, Washington) program with a simple randomization method. Twenty-five people in each group were assigned to the intervention arms: (1) 0% tension group, (2) 50% tension group, (3) 75% tension group, (4) 100% tension group. Due to the pandemic, 2 cases in the 0% tension group, 1 case in the 50% tension group, 3 cases in the 75% tension group and 4 cases in the 100% tension group could not continue in the study. The cases and evaluator of the study were blind.

Data Collection

The individual characteristics of the participants were recorded. In order to test the presence of allergic reaction/sensitivity, KT adhered to the inner surface of the forearm without tension. Cases showing sensitivity or allergic reactions resulting from the initial test were excluded. PP threshold, pain tolerance and intensity assessments were conducted before, immediately after, and 30 minutes after KT. All measurements were applied to the lateral epicondyle region three times and averaged. A 60-second rest period was set between each measurement to avoid temporal sensitization (17). Measurements were performed by a physiotherapist who was blind to KT tensions and had no previous clinical experience in the taping technique.

Pressure-Pain Threshold Assessment

The "J Tech Commander Digital Algometer" (J Tech Medical Industries, Utah, USA) was used for PP threshold measurement. Before using the algometer, the patients were informed about the device and measurements. Pressure and pain sensations were tested on individuals' other body areas. The subjects were placed in a sitting position with their elbows

slightly flexed and their backs supported. The tip of the rubber-coated 1 cm2 probe of the algometer was placed perpendicular to the lateral epicondyle region, and pressure was applied. For the PP threshold value, the subjects were asked to say "stop" at the first moment when the pressure sensation turned into pain, and the probe was immediately withdrawn. At this point, the value read from the algometer was recorded as the pressure pain threshold value (18). It was ensured that the subjects did not see the screen of the algometer device while measuring (Figure 2).

Pain Tolerance Assessment

The same device was used for pain tolerance assessment. The tip of the rubber-covered 1 cm2 probe of the algometer was placed perpendicular to the lateral epicondyle region. The pressure was applied to assess maximum pain tolerance. The probe was withdrawn when the patients could not tolerate pressure. The highest value was recorded as pain tolerance (19) (Figure 2).

Pain Severity Assessment

The pain intensity felt at the PP threshold level was evaluated with the Visual Analogue Scale (VAS) (20). the participants marked the severity of their pain on a 100 mm line. VAS assessment was conducted immediately after PP threshold measurement. The average of three repetitive measurements was recorded.

Intervention

Kinesio Taping

5cm x 5m beige-coloured KinesioTex Gold (NM – GKT15024, Kinesio Holding Corporation, Albuquerque) was used for KT. The diamond shape taping technique on the lateral epicondyle of the subject (18, 21) regarding the groups as follows: (1) 0% tension group, (2) 50% tension group, (3) 75% tension group, (4) 100% tension group. The physiotherapist who conducted the interventions had a KT performer certificate from The Kinesio Taping Association International (KTAI).

The diamond shape technique used four "I tape" (2.5 cm x 12 cm). The middle points of the bands were stretched according to the tension groups' amount of tension. The ends of the tapes overlapped without tension. KT was applied from distal to proximal, exposing the lateral epicondyle area. In 50% Tension Application Group, 12 cm. One centimeter holding margin was measured from the ends of the long "I band". The 10 cm section in the middle was extended by 20% of its length and brought to 12 cm. The ten cm section in the middle was extended 30% of its length and brought to 13 cm in the 75% tension group. In the 100% tension group, the remaining 10 cm was extended to 40% of its length and brought to 14 cm, and then it was taped according to the diamond shape technique. The 0% tension group received the

Figure 2. Pressure-pain threshold and pain tolerance assessment

Figure 3. Taping techniques (a: 0% tension, b: intervention group)

Table 1. The comparative baseline characteristics of the groups

	0% tension (n=23)	50% tension (n=24)	75% tension (n=24)	100% tension (n=24)	p
Age (years, mean±SD)	20.78±1.76	20.79±1.79	21.45±2.20	21.19±2.29	0.62
Boy (meter, mean±SD)	1.78±0.07	1.76±0.07	1.78±0.06	1.77±0.06	0.66
Kilo (kg, mean±SD)	72.70±10.60	72.70±10.60	67.68±7.88	73.57±10.48	0.16
BMI (kg/m^2, mean±SD)	23.01±2.75	23.93±3.52	21.24±2.08	23.35±2.74	0.01

SD: standard deviation, n: number of patients, BMI: Body Mass Index

same KT application without tension (3, 18) (Figure 3).

All KT applications in study groups were performed in the sitting position with the elbow slightly flexed and the accessories that could prevent the taping removed. In the required case, the elbow area was cleaned of hair, and KT was applied to the skin. The KT was applied for 30 minutes (3, 5). The subjects remained at rest during this time.

Statistical Analysis

Statistical analysis was performed using the SPSS (v22, IBM, USA) program. Continuous variables were presented as mean and standard deviation. Categorical variables were given as numbers and percentages. Kolmogorov Smirnov and Shapiro Wilk tests determined the conformity of the data to the normal distribution (by checking the "Skewness and Kurtosis"). In order to apply the analysis of variance in repeated measurements, whether the sphericity assumption could be met was examined with the Mauchly Sphericity test. The same analysis was evaluated with the Friedman test was preferred on the contrary condition. A one-way analysis of variance evaluated the differences in the tension between the groups. Statistical significance level was used as $p<0.05$. Statistical analyzes were performed by a statistician blinded to the groups.

RESULTS

A total of 90 individuals were enrolled in the study. The mean age of the participants was 21.04±2.0 years (ranged 18 to 28 years). A comparative baseline characteristic of the groups is presented in Table 1. There was a statistically significant difference only in BMI ($p<0.05$) (Table 1).

There was no statistically significant difference between the groups in terms of PP threshold, pain tolerance and intensity ($p>0.05$) (Table 2) (Figure 4). There was a significant in-group difference only in the 100% Tension Group in terms of PP threshold ($p<0.05$) (Table 2) (Figure 4). Pain threshold of the 100% tension group was gradually decreased in three measurements before, immediately after and 30 minutes after the KT application. In-group pain tolerance measurements showed no statistically significant difference ($p>0.05$) (Table 2). There was a significant difference in the 0% tension and 50% tension groups on the pain severity measurements ($p<0.05$). Both groups' pain tolerance was decreased. On the other hand, no significant difference was observed in the other tension groups ($p>0.05$) (Table 2).

DISCUSSION

The present study aimed to investigate the effect of KT tension tensions on pressure pain threshold and tolerance. The study's results demonstrated that the KT technique applied at different tensions did not affect the pressure pain threshold or tolerance. The 100% tension was found to be effective on the PP threshold. On the other hand, 0% tension and 50% tension groups' pain severity were decreased. The outcomes considered the efficacy of low- and high-tension KT on pain tolerance and severity, respectively.

There are two unique aspects of the present study. To our knowledge, this is the first randomized

controlled study investigating the effects of KT at different tensions on pressure pain threshold and pain tolerance. Existing studies primarily aim to evaluate the pain intensity of the KT technique (22, 23). Another notable characteristic of the study is to ensure the pain assessment with a sensitive device, "algometer". Healthy female individuals were observed to have a lower PP threshold than male subjects (24). Based on the presumption that hormonal differences may affect the results of the study, only male subjects were included in the study. There are many studies investigating the effect of KT on pain. A current randomized controlled trial focused on the perception threshold of KT, pressure pain threshold, and soft tissue stiffness in thirty healthy female subjects. The study's results indicated that fan strips of KT intervention applied to the waist provided higher pressure pain threshold values, lower soft tissue stiffness and higher perception threshold results compared to placebo and Y-type KT. In addition, the authors stated that different taping techniques did not demonstrate significant differences in terms of perceived pain during the acute period. It should be noted that Liu et al. enrolled female individuals in their study (25). Contrarily, our study only included male individuals. This methodological difference in sample choice constructed our results more generalizable. In addition, similar results were obtained with fan strip KT, unlike the diamond shape technique in our study, which showed the KTs' particulate results from pain perception in more specific application techniques. Koçak et al. evaluated the effect of KT on pain in lateral epicondylitis patients. The ring technique on the forearm extensor muscle group was positively affected for 3 and 12 weeks for both rest and activity VAS (26). Shakeri et al. used a diamond shape technique on pain intensity in 30 women diagnosed with lateral epicondylitis. The results proved the favorable effect of 75% tension KT application on pain (18). Ay et al. evaluated the pain intensity of 61 patients diagnosed with cervical myofascial pain

Table 2. Between and in group comparison of the measurements

		0% tension (n=23)	50% tension (n=24)	75% tension (n=24)	100% tension (n=24)	p
PP threshold	Baseline	12.7±13.06	12.83±2.58	11.82±2.48	13.72±3.12	0.19
	Immediate	12.70±2.84	12.92± 3.44	12.41±2.62)	13.78±2.75	0.47
	30 min	11.76±2.68	12.86±3.59	11.71±2.45	11.75±2.78	0.46
	p (in-group)	0.07	0.58	0.29	**0.00**	
Pain tolerance	Baseline	22.28±3.13	22.57±3.11	20.90±3.98	22.19±3.23	0.36
	Immediate	22.67±2.28	22.75±3.57	21.93±4.34	21.91±3.39	0.76
	30 min	21.59±4.24	22.52±3.62	21.57±3.70	21.37±4.20	0.76
	p (in-group)	0.70	0.83	0.36	0.81	
Pain severity	Baseline	3.93±1.66	3.79±1.63	3.73±1.63	4.36±1.32	0.56
	Immediate	3.64±1.97	3.04±1.37	3.16±1.78	3.89±1.69	0.31
	30 min	3.33±1.61	3.40±1.46	3.37±1.64	4.05±1.96	0.44
	p (in-group)	**0.03**	**0.03**	0.17	0.24	

SD: standard deviation, n: number of patients, PP: pain-pressure

syndrome after KT application. "I tape" was found to be effective on pain intensity (27). In our study, statistically significant results were obtained in the 0% tension and 50% tension groups in the change of pain severity assessment over the acute period. Namely, pain intensity decreased more in the lowest stretch (50%) and non-stretch KT groups. This outcome suggested that choosing low tensions to improve pain-related symptoms in subsequent studies may provide more clinically effective results.

As stated above, no study has investigated the effects of KT on PP threshold and pain tolerance in healthy individuals. A few studies investigated this hypothesis on rigid taping. Chen et al. applied intermittent, non-tension and 100% rigid tension tape in one session to healthy cases. The PP threshold values in the 100% tension group were higher. However, no significant difference was found between the groups (28). Similar to this study, we evaluated the effectiveness of KT in healthy subjects in terms of pressure pain threshold. Our results also supported these outcomes in terms of statistical significance. Therefore, the PP threshold is presumed not to be affected by the tension of KT. However, a subjective aspect of the pain assessment should also be evaluated by patient-reported outcome measures to reveal the psychological aspects of pain evaluation in terms of pressure sensation (29, 30).

Koçak et al. and Ay et al. conducted a PP threshold assessment with an algometer. The results proved an increment in pressure threshold after KT in medium to long term (26, 27). Our study proved an increase in PP threshold in 0 to 30 min (immediate and acute effect). However, long-term studies proved the contrary effect of KT. Therefore, the following studies might focus on both acute and long-term effects of KT to provide a comparative effect in various periods of monitorization.

Regarding the pain tolerance results in our study, there were no significant differences between and in group assessment. According to these results, the tension-type and the also KT application have no acute positive effect on pain tolerance. However, considering the relationship between pain tolerance and subjective pain experiences, it has ascertained the essence of including subjective measurement parameters such as kinesiophobia and pain catastrophizing in a comprehensive evaluation (29, 30).

Evaluating pain is critical for clinicians. PP threshold measurements are still based on a subjective evaluation, even if measured with an objective measurement method, an algometer device (31). Pain threshold can be affected by the gender, past experiences and sociocultural level of the person (32). Increased mechanical pain sensitivity is a consequence of various pain conditions that challenge medical diagnosis and may be essential for developing chronic pain. Accurate evaluation of the pain level is vital to determine the effectiveness of the treatments applied and to give personalized pain treatment (33). Therefore, controversial results are obtained from several studies, as noticed above. Further studies should yield similar methodologies to provide research integrity on this topic.

Clinicians need to provide maximum benefit in treatment. Kinesio taping has recently become a frequently used method in treating painful conditions in different areas of physiotherapy and rehabilitation (14, 15). We believe that our results would provide an

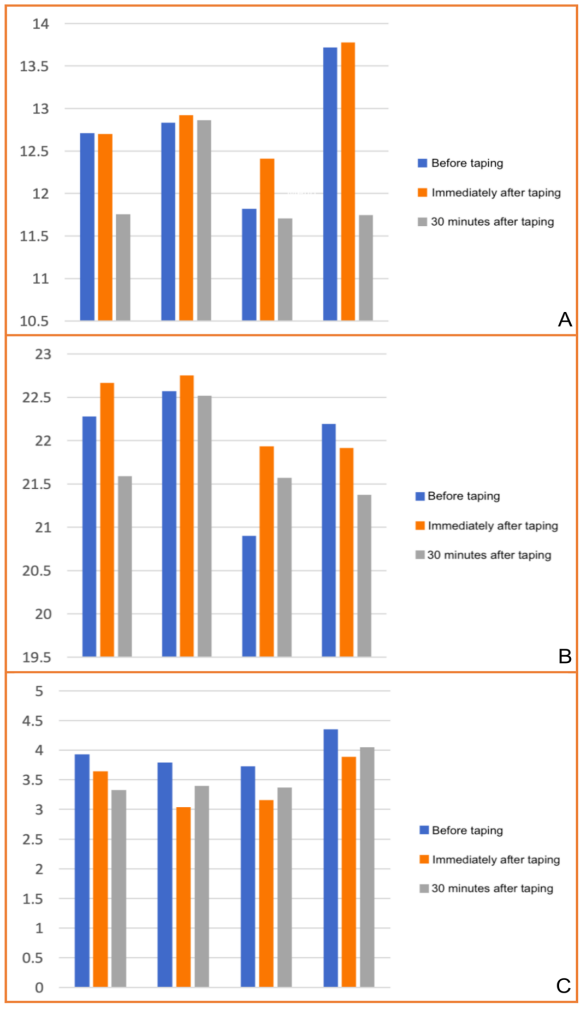

Figure 4. Score changes (a: pressure-pain threshold, b: pain tolerance, c: pain severity)

essential contribution in terms of the effectiveness of KT-tension on pressure pain threshold and tolerance.

Limitations

The limitations of the present study should be acknowledged. First, the cases were healthy volunteers. Therefore, the pain sensation might not clearly represent the clinical cases, including severe chronic pain conditions. Second, enrolled cases are monitored for the acute effect of pain. However, long-term pain evaluation results are more valuable in terms of clinical practice. Third, post-hoc analysis was not given for the Friedman test. Lastly, subjective pain assessment tools with a psychosocial dimension might add holistic insights and perspectives (30).

CONCLUSION

The study's results demonstrated that the KT technique applied at different tensions did not affect the pressure pain threshold or tolerance. The 100% tension was found to be effective on the PP threshold. On the other hand, 0% tension and 50% tension groups' pain severity were decreased. The outcomes considered the efficacy of low- and high-tension KT on pain tolerance and severity, respectively. A further study should investigate the pain threshold and tolerance in clinical cases with a long-term follow-up.

Acknowledgement: None.

Author contributions: Conceptualization: Öykü Avcı, Nazan Tuğay; Methodology: Öykü Avcı, Nazan Tuğay; Formal analysis and investigation: Öykü Avcı, Nazan Tuğay, Fatih Özden, Baki Umut Tuğay; Writing - original draft preparation: Öykü Avcı, Nazan Tuğay, Fatih Özden, Baki Umut Tuğay; Writing - review and editing: Öykü Avcı, Nazan Tuğay, Fatih Özden, Baki Umut Tuğay

Conflict of interests: The authors report no conflicts of interest and certify that no funding has been received for this study and/or preparation of this manuscript.

Ethical approval: The study was carried out in accordance with the ethical principles and the Helsinki Declaration. Informed consent of the patients was obtained. The study protocol was approved by the ethics committee of Muğla Sıtkı Koçman University Human Research Ethics Committee (Date: 06.10.2018, Decision No: 152). The study protocol was submitted to the clinicaltrials.gov (NCT04263077).

Funding The research was funded by Muğla Sıtkı Koçman University Scientific Research Projects Coordination Unit (Project No: 19/079/01/3/4)

Peer-review: Externally peer-reviewed.

REFERENCES

1. Yoshida A, Kahanov L. The effect of kinesio taping on lower trunk range of motions. Research in Sports Medicine 2007;15(2):103-12.
2. Ozmen T, Aydogmus M, Dogan H, Acar D, Zoroglu T, Willems M. The effect of kinesio taping on muscle pain, sprint performance, and flexibility in recovery from squat exercise in young adult women. Journal of Sport Rehabilitation. 2016;25(1):7-12.
3. Kase K, Wallis J, Kase T. Clinical Therapeutic Applications of the Kinesio Taping Method. Ken Ikai Co. s14, 2003.
4. Tunay VB, Baltacı G. Kinezyo bantlama yumuşak doku yaralanmalarında etkili midir? TOTBİD Dergisi 2017;16:238-46.
5. Kase, K., Hashimoto, T., Okane, T. Kinesio taping perfect manual: Development of Kinesio Tape. Kinesio Taping Association 1996
6. Çeliker R, Güven Z, Aydoğ T, Bağiş S, Atalay A, Çağlar Yağci H, et al. Kinezyolojik Bantlama Tekniği ve Uygulama Alanları. Journal of Physical Medicine & Rehabilitation Sciences/Fiziksel Tup ve Rehabilitasyon Bilimleri Dergisi 2011;14.
7. Kalichman L, Vered E, Volchek L. Relieving symptoms of meralgia paresthetica using Kinesio taping: a pilot study. Archives of Physical Medicine and Rehabilitation. 2010;91(7):1137-9.
8. Fischer AA. Pressure algometry over normal muscles. Standard values, validity and reproducibility of pressure threshold. Pain 1987;30(1):115-26.
9. Rollman GB, Lautenbacher S. Sex differences in musculoskeletal pain. The Clinical Journal of Pain 2001;17(1):20-4.
10. ÖK G. Değişik Muskuloskeletal SistemHastalıklarının Basınç Ağrı Eşiği Üzerine Etkisi (Uzmanlık Tezi). İstanbul: Haydarpaşa Numune Eğitim ve Araştırma Hastanesi Fiziksel Tıp ve Rehabilitasyon Kliniği 2009.
11. Robinson ME, Wise EA. Prior pain experience: influence on the observation of experimental pain in men and women. The Journal of Pain 2004;5(5):264-9.
12. Robinson ME, Gagnon CM, Riley III JL, Price DD. Altering gender role expectations: effects on pain tolerance, pain threshold, and pain ratings. The Journal of Pain 2003;4(5):284-8.
13. Trobec K, Peršolja M. Efficacy of Kinesio Taping in reducing low back pain: A comprehensive review. Journal of Health Sciences 2017;7(1):1-8.
14. Kalron A, Bar-Sela S. A systematic review of the effectiveness of Kinesio Taping--fact or fashion. Eur J Phys Rehabil Med 2013;49(5):699-709.

15. Mostafavifar M, Wertz J, Borchers J. A systematic review of the effectiveness of kinesio taping for musculoskeletal injury. The Physician and Sports Medicine 2012;40(4):33-40.
16. Hazar Z, Çitaker S, Demirtaş Cy, Bukan Nç, Kafa N, Çelik B. Effects of kinesiology taping on delayed onset muscle soreness: a randomized controlled pilot study. Journal of Exercise Therapy and Rehabilitation 2014;1(2):49-54.
17. Nie H, Graven-Nielsen T, Arendt-Nielsen L. Spatial and temporal summation of pain evoked by mechanical pressure stimulation. European Journal of Pain 2009;13(6):592-9.
18. Shakeri H, Soleimanifar M, Arab A, Behbahani SH. The effects of KinesioTape on the treatment of lateral epicondylitis. Journal of Hand Therapy. 2018;31(1):35-41.
19. Keser I, Esmer M. Does manual lymphatic drainage have any effect on pain threshold and tolerance of different body parts? Lymphatic Research and Biology 2019;17(6):651-4.
20. Haefeli M, Elfering A. Pain assessment. European Spine Journal. 2006;15(1):S17-S24.
21. Goel R, Balthilaya G, Reddy RS. Effect of Kinesio taping versus athletic taping on pain and muscle performance in lateral epicondylalgia. Int J Physiother Res 2015;3(1):839-44.
22. Castro-Sánchez AM, Lara-Palomo IC, Matarán-Peñarrocha GA, Fernández-Sánchez M, Sánchez-Labraca N, Arroyo-Morales M. Kinesio Taping reduces disability and pain slightly in chronic non-specific low back pain: a randomised trial. Journal of Physiotherapy 2012;58(2):89-95.
23. Cho H-y, Kim E-H, Kim J, Yoon YW. Kinesio taping improves pain, range of motion, and proprioception in older patients with knee osteoarthritis: A randomized controlled trial. American Journal of Physical Medicine & Rehabilitation 2015;94(3):192-200.
24. Gökoğlu F, NA Eİ, Yorgancioğlu Z. Analysis of the pressure pain threshold in geriatric population. Turk J Geriatr 2001;4(3):113-5.
25. Liu K, Yin L, Ma Z, Yu B, Ma Y, Huang L. Effect of different kinesio taping interventions on the local thresholds of current perception and pressure pain in healthy adults. Frontiers in Physiology 2020:1476.
26. Koçak FA, Kurt EE, Sas S, Tuncay F, Erdem HR. Short-term effects of steroid injection, kinesio taping, or both on pain, grip strength, and functionality of patients with lateral epicondylitis: A single-blinded randomized controlled trial. American Journal of Physical Medicine & Rehabilitation 2019;98(9):751-8.
27. Ay S, Konak HE, Evcik D, Kibar S. The effectiveness of Kinesio Taping on pain and disability in cervical myofascial pain syndrome. Revista Brasileira de Reumatologia 2017;57:93-9.
28. Chen S-M, Lo SK, Cook J. The effect of rigid taping with tension on mechanical displacement of the skin and change in pain perception. Journal of Science and Medicine in Sport 2018;21(4):342-6.
29. Picavet HSJ, Vlaeyen JW, Schouten JS. Pain catastrophizing and kinesiophobia: predictors of chronic low back pain. American Journal of Epidemiology 2002;156(11):1028-34.
30. Mee S, Bunney BG, Reist C, Potkin SG, Bunney WE. Psychological pain: a review of evidence. Journal of Psychiatric Research 2006;40(8):680-90.
31. Lorusso L, Salerno M, Sessa F, Nicolosi D, Longhitano L, Loreto C, et al. Autoalgometry: an important tool for pressure pain threshold evaluation. Journal of Clinical Medicine 2018;7(9):273.
32. Güldoğuş F, Kelsaka E, Öztürk B. Sağlıklı gönüllülerde cinsiyet ve çalışma şartlarının ağrı eşik değeri üzerine etkisi. Ağrı. 2013;25(2):64-8.
33. Zhang Y, Zhang S, Gao Y, Tan A, Yang X, Zhang H, et al. Factors associated with the pressure pain threshold in healthy Chinese men. Pain Medicine 2013;14(9):1291-300.