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The effectiveness of kinesiotaping in treating chronic lateral epicondylitis: a randomized, sham-controlled, single-blind study

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Abstract

Objectives Kinesiotaping (KT), with its non-restrictive nature, is a preferred treatment option, yet there remains insufficient evidence regarding its effectiveness in managing lateral epicondylitis (LE). This study aims to investigate the efficacy of KT on pain intensity, functional status, and quality of life in patients with chronic LE.

Methods Between February and August 2024, 42 patients (17 females, 25 males; mean age: 44.5 ± 9.1 years; range: 27–61) with chronic LE were included in this single-blind, parallel-group randomized controlled trial (RCT). Patients were randomized into either the KT or sham-controlled group. Kinesiotaping and sham-taping were applied six times over three weeks. Both groups received recommendations for activity modification and a home-based stretching and strengthening exercise program. Outcome measures were the visual analog scale (VAS) pain score; the Patient-Rated Forearm Evaluation Questionnaire (PRFEQ); grip strength; Disabilities of Arm, Shoulder, and Hand (DASH); quality of life in Short Form-36 (SF-36), and the Roles and Maudsley patient satisfaction score. The participants were assessed before treatment, at the end of treatment (week three), and four weeks after the end of treatment (week seven).

Results Both groups showed improvements from the baseline in all outcome parameters. At the third and seventh week follow-up, KT was superior to sham-taping in all outcome measures, except for two SF-36 subscales, with effect sizes further supporting the clinical relevance of these findings by indicating meaningful differences in favor of KT.

Conclusions The results of the present study suggest that KT using the epidermis, dermis, fascia (EDF), and muscle inhibition technique effectively reduces pain, improves disability and quality of life, and achieves high patient satisfaction levels without any adverse effects in LE. Clinicaltrials.gov identifer: NCT06611709.

Keywords Athletic tape, Kinesio tape, Lateral epicondylitis, Exercise therapy, Pain, Tennis elbow

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Introduction

Lateral epicondylitis (LE), also known as tennis elbow, is a common enthesopathy characterized by pain and tenderness over the lateral elbow, primarily due to repetitive stress, microtrauma, and degenerative changes in the extensor carpi radialis brevis (ECRB) tendon [1]. It is most commonly observed in individuals between 45 and 54 years of age, with an estimated prevalence ranging from 1 to 3% in the general population [2]. Lateral epicondylitis significantly impacts daily activities and productivity at work making it a condition of substantial clinical and socioeconomic importance [3]. Despite its high prevalence, clinical significance, and impact on daily life, LE's optimal management remains a topic of ongoing debate.

Treatment options for LE are numerous and range from conservative methods to surgical interventions. Conservative treatments typically include patient education, activity modification, physiotherapy, nonsteroidal anti-inflammatory drugs (NSAIDs), injections (corticosteroids, platelet-rich plasma (PRP), autologous blood, dry needling), and orthotic devices [4, 5]. More invasive options such as surgical debridement are reserved for cases that do not respond to conservative measures [6]. While these treatments aim to alleviate pain and restore function, their efficacy varies, and some may lead to adverse effects or complications. Given these limitations, there is a growing interest in complementary therapeutic strategies, such as kinesiotaping (KT), which offer potential benefits with minimal risks, low cost, and ease of application, and are often perceived as engaging, well-received, and readily accepted by patients with musculoskeletal disorders [7].

Kinesiotaping has become a widely used rehabilitation modality in the management of various musculoskeletal conditions, including tendinitis, plantar fasciitis, hemiplegic shoulder, joint issues, and many sports injuries [7–9]. Kinesiotaping involves applying an elastic therapeutic tape to the affected area using techniques such as muscle inhibition or facilitation, functional or mechanical correction, fascia/space correction, and lymphatic facilitation [7–9]. Practitioners select the specific technique based on the treatment's goal. The theoretical basis of KT suggests that it enhances proprioception, reduces muscle tension, and supports lymphatic circulation by expanding the subcutaneous space and alleviating tissue edema, all while promoting natural healing without restricting joint movement [7–10]. Although KT has been frequently used in practice in recent years, there is limited research on its effectiveness for managing LE, and data on the impact of different KT techniques on LE are also scarce. Some studies have shown that KT reduces pain and improves functional outcomes [11–13]. However, other studies have found it ineffective, leading to uncertainty about KT's effectiveness due to conflicting results [14–16].

Previous studies have focused on different techniques or methodologies, and available evidence is insufficient to draw definitive conclusions. The epidermis, dermis, fascia (EDF), a relatively new KT technique, is applied with the aim of creating more elevation and space within the epidermal layers [17]. Although there are studies on the combination of different techniques, to the best of our knowledge, the effectiveness of this technique in the treatment of LE has not yet been investigated. The present study hypothesized that the application of KT with EDF plus the muscle inhibition technique can reduce the clinical symptoms of LE. The most rigorous methodology to assess this intervention's efficacy is sham-controlled randomized controlled trials (RCTs). Therefore, this study aims to fill this gap by comparing the therapeutic efficacy of these two groups in managing LE as a first-line treatment.

Methods

Study design and participants

The research was structured as a randomized, sham-controlled, single-blind trial conducted among outpatient clinic patients within a tertiary hospital setting. The ethics committee approved the study (date: January 26, 2024, number: 2024/010). This study adhered to the principles of the Declaration of Helsinki, and written informed consent was secured from all participants. The study was registered on ClinicalTrials.gov (NCT06611709).

Patients who presented to the Physical Medicine and Rehabilitation clinics at Konya Beyhekim Training and Research Hospital, University of Health Sciences, and were clinically diagnosed with unilateral LE between February 2024 and August 2024 were evaluated for inclusion in the study. The diagnosis of LE was based on typical symptoms and physical examination findings, including pain at the origin of the forearm extensors, discomfort during clinical pain provocation tests such as Cozen's, Mill's, and the third finger extension test, and localized tenderness in the lateral epicondyle region [11, 12, 14]. The inclusion criteria were adults aged 18 years or older with a pain severity of 4 or higher on the visual analog scale (VAS) during daily activities, and a history of LE symptoms lasting at least three months. Patients were excluded from the study if they had communication difficulties, significant psychiatric disorders, as determined by the evaluating physician based on medical history and records, a history of trauma within the past six months, neuromuscular conditions, abnormalities of the upper limb, prior upper limb surgery, a history of rheumatic diseases, cervical disc pathology, polyneuropathy, or hand disorders (such as carpal or cubital tunnel syndrome, de Quervain's tenosynovitis, osteoarthritis), or if they had

received any treatment for LE (e.g., local injections, physical therapy, splints) within the last six months.

Interventions

Fifty patients were randomly included in the study and assigned to either the real KT or the sham-taping group through simple randomization via a coin flip. Out of these, 42 patients (17 females, 25 males; a median age of 45 years; ranging from 27 to 61 years) completed the study. Figure 1 presents a flowchart of the enrollment process.

Both the KT and sham groups were taped by the same experienced physiatrist, trained in KT. A standard 5-cm wide Kinesio® Tex Gold (Kinesio Tex Tape, Kinesio Holding Corp., NM, USA) was used in the KT group. At the same time, a similar-sized robust adhesive, non-allergic, non-elastic medical cloth tape (Asbez®), was applied to the sham group. The taping in the sham group was applied exactly as in the KT group, with the only difference being that no tension was applied in the sham group. Both groups were unaware of the treatment they were receiving and were only aware that they would undergo taping therapy; they had no detailed information

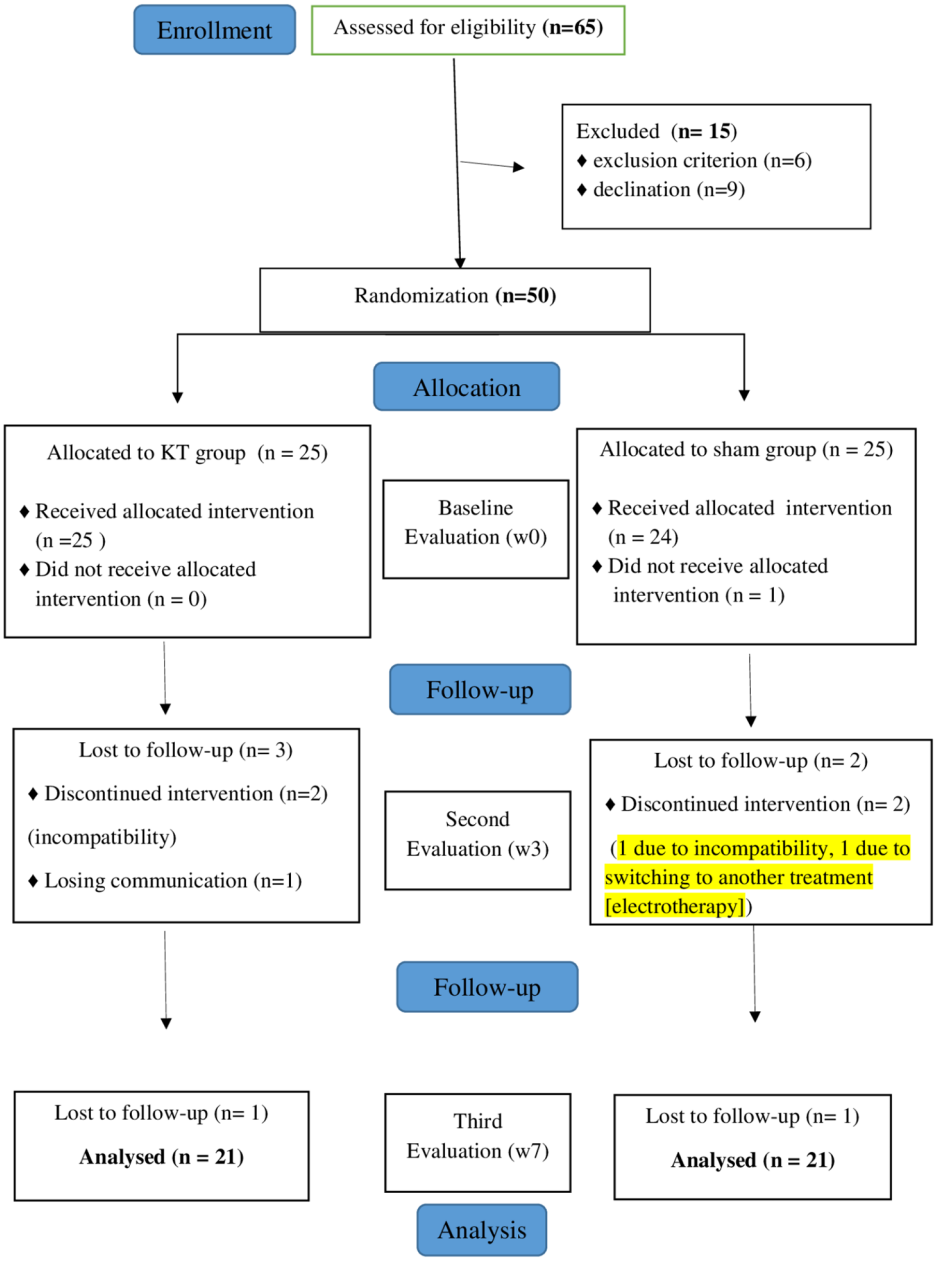

Fig. 1 Flowchart of the enrollment process of the study

or expectations regarding KT. The tape was applied a total of six times over three weeks, remained on the skin for three days, and was removed one day before the next application.

For the muscle inhibition technique, a Y-strip of approximately 30 cm in length was prepared according to the length of the patient's forearm. Kinesio tape application was initiated distally from the insertion point (EBD) of the muscles towards their origin (common extensors). The distal end of the Y-strip was attached without tension, starting at the dorsolateral side of the hand, with the separation point of the Y-strip positioned at the base of the first three metacarpals. With the elbow in extension, the wrist in flexion, and slight ulnar deviation, the medial and lateral tails of the Y-strip were applied with slight tension (15–25%) up to 4–5 cm proximal to the lateral epicondyle of the humerus [15–17]. Thus, the lateral epicondyle was positioned between the two tails of the Y-strip (Fig. 2). Following the general KT procedure, the proximal anchor, like the distal one, was applied without tension. Subsequently, the EDF technique was applied to utilize its pain-relieving, anti-edema, and superficial and lymphatic circulation-promoting properties. For this purpose, two I-strips, each approximately 6–8 cm in length, were prepared. This I-strip was cut into 6–7 pieces to create a web-cut tape. The two web-cut tapes were applied radially with a very light stretch of less than 10%, ensuring that the therapeutic target area remained centered and that the tapes intersected each other [17–19]. In the sham taping group, a single web-cut I-strip was used (Fig. 2).

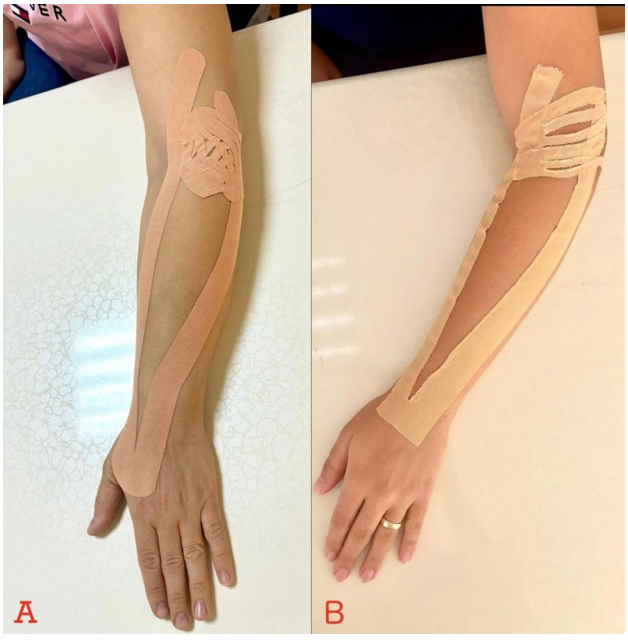

Fig. 2 Application of Kinesiotaping (**A**) and Sham taping (**B**)

Both groups were provided with education on activity modification and a home-based exercise regimen that included stretching and eccentric strengthening exercises. The program was developed as a synthesis of literature knowledge and our own expert opinions, with considerations made to ensure patient adherence [12, 14, 20]. Patients were provided with a personalized exercise program based on clinical symptoms, with exercises recommended at the threshold of pain tolerance. In the first three weeks, stretching exercises involving three sets of 5–7 repetitions were prescribed for the elbow extensors and flexors. Stretching was performed using the healthy hand, consisting of 20 s of static stretching followed by 20–30 s of relaxation. Once stretching could be done with minimal or no pain, progressive eccentric strengthening exercises were introduced for the wrist extensors, as well as the wrist and elbow flexors. Strengthening exercises were performed with free weights (0.5–2.0 kg) in three sets of 10 repetitions daily [see Additional File 1] [20].

The exercises were described to the patient by the physiatrist, and an illustrated brochure was provided. Patients' exercise adherence was assessed based on their self-reports. The study excluded individuals whose compliance rate fell below the acceptable minimum threshold of 70% for their home exercise program [21].

Outcome measures

All assessments were conducted by the same investigator at baseline, at the end of the third week when the taping was completed, and four weeks after the end of treatment (7th week).

The study's primary outcome measures were the VAS-pain and the Patient-Rated Tennis Elbow Evaluation Questionnaire (PRTEE). The secondary outcomes included the Disabilities of the Arm, Shoulder, and Hand (DASH) score, maximal grip strength, the Short Form-36 (SF-36) quality of life index, and patient satisfaction level (Roles and Maudsley score).

A VAS-rest (0–10) and VAS-force (0–10) were used to measure pain at rest and the level of pain experienced during the most challenging daily activities, based on the discomfort experienced over the past week.

The PRTEE is a 15-item questionnaire designed to measure forearm pain and functional disability in patients with LE. It consists of two subscales: pain and function. Each subscale score ranges from 0 to 50, and the total score ranges from 0 (best) to 100 (worst). The Turkish version of the PRTEE has been validated and found to be reliable [22].

The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire is a 30-item tool designed to assess functional status and symptoms in musculoskeletal disorders of the upper extremity. Each question is

answered using a 5-point Likert scale. The final score ranges from 0 (best condition) to 100 (worst condition). The questionnaire has been validated and found reliable in its Turkish version [23].

The grip strength of the affected side considered an objective criterion for the functional integrity of the upper extremity, was measured using a Jamar® dynamometer. The measurement was performed according to the standardized procedure described in the literature, with an average of three measurements recorded in kilograms [12, 16].

The Short Form-36 (SF-36) quality of life index was utilized to assess the general health status and well-being of the patients. This widely used instrument consists of 8 subgroups, covering various domains such as physical functioning, social functioning, and mental health. Scores range from 0, indicating the worst health status, to 100, representing the best possible health. The Turkish version of the SF-36 has been validated and found reliable [24].

The Roles and Maudsley score was utilized to evaluate pain and activity limitations in the assessment of LE treatment efficacy, categorized into four levels: 1 point indicating excellent, 2 points indicating good, 3 points indicating fair, and 4 points indicating poor [25].

To evaluate treatment effectiveness, changes in VAS, DASH, and PRTEE values, which are patient-reported outcome measures (PROMs), were assessed. The necessity for these changes to exceed the Minimal Clinically Important Difference (MCID) values, as defined in the literature, was taken into account to ensure a meaningful interpretation of the results. The MCID has been reported as 1.5 points for VAS, 15.8 points for DASH, and 11 points for PRTEE [26–29]. By comparing the observed changes to these thresholds, the clinical relevance of the findings is better contextualized, providing insight into whether the improvements are likely to be perceived as beneficial by patients [26].

Sample size

A power analysis for sample size estimation was conducted using the G Power 3.1.9.7 software (Heinrich-Heine-Universitat Dusseldorf, Dusseldorf, Germany). A literature review was performed by taking into account the primary outcomes of our study, VAS-pain, and PRTEE scores. The effect size (d) was found to range between 0.94 and 1.21. Based on this, with an alpha value of 0.05 and a power of 0.8 (two-tailed test and allocation ratio N1/N2 = 1), it was calculated that a minimum total of 38 patients, with at least 19 in each group, would be required [11, 12].

Statistical analysis

The collected data were analyzed using the SPSS (Statistical Package for Social Sciences) version 22.0 software. Descriptive analyses were presented as frequencies (n) and percentages (%) for categorical variables, and as mean ± standard deviation (SD) or median (1st quartile–3rd quartile) based on the distribution characteristics for numerical variables. Pearson's chi-square test or Fisher's exact test was used to compare categorical variables. The normality of the quantitative variables was assessed using histogram graphics, coefficient of variation, skewness and kurtosis values, normal Q-Q plot and detrended normal Q-Q plot graphics and the Shapiro-Wilk Test. The Independent Samples t-test was used to compare parametric data with a homogeneous distribution between two groups, while the Mann-Whitney U test was used for non-parametric data. For within-group repeated measures, the Friedman test and Wilcoxon signed-rank test were performed. Bonferroni correction was applied for multiple comparisons between the two groups. Cohen's effect size was utilized to assess treatment effectiveness. Results were evaluated within a 95% confidence interval, with p-values < 0.05 (two-tailed) considered statistically significant.

Results

Table 1 presents the sociodemographic and clinical characteristics of the study's patients. No significant differences were observed between the groups in terms of sociodemographic and baseline clinical characteristics. During the follow-up period, none of the patients reported any side effects. In the KT group, the tape detached early on three occasions in different patients, whereas in the sham taping group, this occurred on eight occasions, leading patients to seek reapplication between sessions.

In both groups, there were significant reductions in VAS-rest and VAS-force, and a significant increase in grip strength at the end of treatment (W3) and at the 1-month follow-up (W7) after treatment ($p < 0.001$). Both groups had similar baseline levels; however, a statistically significant greater improvement was observed in the KT group during the follow-up periods ($p < 0.05$) (Table 2). In the follow-up evaluations of PRTEE and DASH scores, both groups showed significant reductions compared to baseline. However, when comparing these reductions between the groups, the results favored the KT group, indicating superior effectiveness ($p < 0.05$) (Table 3). In the sham-taping group, the change in VAS-rest did not exceed the MCID during follow-up. However, for VAS-force, DASH, and PRTEE-total, the MCID was exceeded in both groups.

Both groups showed significant improvements in their SF-36 quality of life scores. However, in six of the eight

Table 1 Demographic and clinical characteristics of study participants

	KT Group (*n* = 21)	Sham Group (*n* = 21)	*p*
Age (y ± SD)	43.0 ± 8.1	46.14 ± 10.0	0.261[a]
Sex (n %)			
Male	12 (%57)	13 (%62)	1.0[b]
Female	9 (%43)	8 (%38)	
BMI (Mean ± SD)	27.81 ± 4.2	28.33 ± 5.4	0.850[c]
Education (n %)			0.213[b]
Primary school (8 y)	6 (%29)	10 (%48)	
High school (12 y)	7 (%33)	8 (%38)	
College (≥ 14 y)	8 (%38)	3 (%14)	
Employment (n %)			0.843[d]
Employed	11 (%52)	10 (%48)	
Housewife	6 (%29)	8 (%38)	
Retired	4 (%19)	3 (%14)	
Disease time (months)	7 (6–15)	12 (7–12)	0.267[c]
Hand dominance (R); n (%)	20 (%95)	18 (%86)	0.606[d]
Affected elbow (R); n (%)	13 (%62)	13 (%62)	1.0[b]
Baseline grip strength (kg)			
Painful arm	26.7 (19.0-34.5)	23.0 (19.7–26.5)	0.247[c]
Healthy arm	35.0 (29.2–47.5)	33.0 (31.2–39.0)	0.678[c]
VAS-pain (rest)	6 (3–8)	5 (3.5-8)	0.741[c]
VAS-pain (force)	9 (7–10)	9 (7–10)	0.785[c]

KT, kinesiotaping; BMI, body mass index; SD, standard deviation; y, years; R, right; [a] Independent Samples t-test

[b] Pearson Chi-square test; [c] Mann–Whitney U test; [d] Fisher's Exact test

Median (1st quartile–3rd quartile) for non-normal distribution values were used

subscales, except for physical and social functioning, the KT group showed a greater increase, indicating superior improvement in quality of life ($p < 0.05$) (Table 4). In terms of treatment satisfaction, 86% of patients in the KT group reported excellent or good levels of satisfaction, while in the sham group, these rates were 33% at the end of treatment and 29% at the 4-week follow-up ($p = 0.001$ and < 0.001, respectively) (Table 5).

Discussion

The efficacy of KT, which involves muscle inhibition, and the EDF technique for treating LE with sham taping was compared in the study. The study demonstrated the superiority of KT. Significant improvements observed in pain, functional status, and quality of life in both groups highlights that exercise and activity modification are effective components of the management strategy for LE.

Lateral epicondylitis is commonly observed in active individuals in daily life. Naturally, restriction of hand function is an undesirable situation in these patients. Altough static wrist splints are frequently used and effectively used and effective in the teratment of LE, they often cause difficulties in terms of patient complience [27]. Unlike rigid splints, KT offers the an extra benefit of not restricting movement, which may contribute to better patient outcomes by allowing for more natural, pain-free motion during daily activities. This movement-friendly aspect of KT may be particularly advantageous in maintaining functional mobility and enhancing the overall rehabilitation process. Another treatment option, such as physical therapy, often faces challenges due to its time-consuming nature and associated costs, and this may lead many patients to prefer more easily implemented alternatives. Although local steroid injections can be quite effective, they are not considered a first-line treatment option. They also carry risks of side effects and are unlikely to provide a full recovery unless accompanied by rest/splinting activity modification and exercise [31].

In the context described above, KT has emerged as a popular treatment option for LE in recent years due to its non-invasive nature, ease of application, affordable cost, safety, and non-restrictive structure. However, there are only a few studies on the effectiveness of KT in treating LE, and these studies have produced conflicting results [11–16, 31]. In some studies, KT has been found to have a positive effect on symptoms, while in others, it has been found to be ineffective. Cho YT et al. and Giray E et al. investigated the effectiveness of KT in LE in their RCTs, with sample sizes of 15 and 30 patients, respectively [11, 12]. Both studies reported improvements in subjective symptoms and grip strength immediately after the intervention and at the four-week follow-up. In contrast to these studies, two RCTs with short-term follow-ups found that KT was not superior to placebo [14, 16]. Factors such as methodological differences, potential bias in the research, the variable nature of KT depending on the practitioner, and the lack of a standard protocol make it difficult and complicated to obtain robust evidence.

A meta-analysis encompassing 168 patients across five studies conducted by Zhong et al. KT found that it was effective in reducing pain, improving grip strength, and enhancing functional outcomes in patients with LE [13]. Similarly, a recent meta-analysis of 11 RCTs published this year also identified KT as effective in achieving similar outcomes [32]. In both meta-analyses, half of the studies (8 out of 16) were sham-controlled, and half of these studies demonstrated the superiority of KT over sham. The methodology of all these studies differed significantly from each other. In our study, we applied two KT techniques (muscle inhibition and EDF) together for the first time to treat LE, and used an inelastic medical tape (adhesive medical plaster) for the sham-control group instead of an authentic kinesiology tape to ensure visual similarity with the real KT. Unlike previous studies, our approach included longer KT sessions and distinct exercise plans with activity modifications for both groups.

Table 2 Comparison of evaluation parameters between groups and within-groups

Variable	KT Group ($n=21$)			Sham Group ($n=21$)			Between-group analysis (p*)
VAS-pain (rest)							
W0	6.0 (3–8)			5.0 (3.5-8)			0.741
W3	0 (0–2)			4.0 (3–4)			< 0.001
W7	0 (0.2)			4.0 (3–5)			< 0.001
P^a	< 0.001			0.001			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	3.73	3.74	0.82	2.99	2.77	1.0	
p^b	< 0.001	< 0.001	0.414	0.003	0.006	0.317	
r	0.57	0.58	0.13	0.46	0.43	0.15	
VAS-pain (force)							
W0	9.0 (7–10)			9.0 (7–10)			0.785
W3	4.0 (2–5)			5.0 (5-7.5)			0.002
W7	4.0 (0–5)			6.0 (4–7)			0.001
P^a	<0.001			< 0.001			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	4.00	4.03	1.19	3.68	3.65	0.34	
p^b	< 0.001	< 0.001	0.234	< 0.001	< 0.001	0.973	
r	0.62	0.62	0.19	0.57	0.56	0.05	
Grip strength (kg)							
W0	26.7 (19.0-34.5)			23.0 (19.7–26.5)			0.247
W3	35.0 (28.1–41.9)			27.0 (21.7–28.5)			0.001
W7	36.0 (31.0-42.9)			25.6 (21.4–28.7)			< 0.001
P^a	< 0.001			0.016			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	3.77	4.02	2.70	1.88	2.02	0.23	
p^b	< 0.001	< 0.001	0.007	0.060	0.440	0.816	
r	0.58	0.62	0.42	0.29	0.31	0.04	

r: Effect size * Mann-Whitney U test; P^a Friedman test; ^{b} Wilcoxon Signed-Ranks test; W0-3, W0-7, W3-7: Pre-post treatment differences; Median (1st quartile–3rd quartile) for non-normal distribution values were used. Adjusted p-values were considered significant based on Bonferroni correction

W0: Baseline assessment (pre-treatment)

W3: Assessment immediately after treatment completion (week three)

W7: Assessment 4 weeks after treatment completion (week seven)

Almost all studies aiming to demonstrate the effectiveness of KT use the same kinesiology tape without tension for a sham taping group, whether the same or a different technique is used. This practice may trigger a placebo effect due to the positive expectations, visual input, and the sense of security provided by the mechanical sensation created by the unique characteristics of kinesiology tape on the skin [33]. Indeed, in a single RCT assessing the efficacy of KT for upper trapezius myofascial pain syndrome, Dilek et al. performed KT with a trained physiatrist for the active treatment group and applied sham KT with an untrained physiatrist for the sham control group [34]. Both groups received a home exercise program in addition to two sessions of KT per week for a total of six sessions. After a six-week follow-up, both groups showed similar levels of improvement with no significant superiority between them. In our study, unlike the study mentioned above, we used a tape that did not have the properties of kinesiology tape in the sham group in order to more closely resemble a true placebo. Therefore, the significant findings obtained may more accurately reflect the absolute effectiveness of real KT. It elevates the skin at the application site, creating more space between the muscles and skin, and alleviates pressure in the affected area. By reducing this pressure and enhancing blood flow, stimulation of subcutaneous pain receptors is diminished, leading to painless mobility [35].

In the first-line management of LE, activity modification and exercise are crucial and necessary. Several studies have demonstrated the effectiveness of stretching and eccentric strengthening exercises [36, 37]. Oya-Casero et al. showed [37] that self-performed eccentric exercises in LE treatment have a similar positive effect as those supervised by a physiotherapist. In our study, we provided exercise therapy to both groups to avoid neglecting first-line treatments and address ethical concerns. Therefore, we were unable to establish a true head-to-head placebo-controlled study design. Nevertheless, the study aims to assess the effectiveness of KT by implementing a low-cost, risk-free initial treatment protocol that does

Table 3 Comparison of evaluation parameters between groups and within-groups

Variable	KT Group ($n=21$)			Sham Group ($n=21$)			Between-group analysis (p*)
PRTEE-pain							
W0	35.0 (30–46)			39.0 (29–41)			0.850
W3	14.0 (7–19)			24.0 (19–31)			< 0.001
W7	13.9 (5–21)			25.0 (21–32)			< 0.001
P^a	< 0.001			<0.001			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	4.02	4.02	0.12	3.54	3.21	0.91	
p^b	< 0.001	< 0.001	0.906	< 0.001	< 0.001	0.364	
r	0.62	0.62	0.02	0.55	0.50	0.02	
PRTEE-function							
W0	34.0 (24–43)			34.0 (28–41)			0.890
W3	13.0 (8–16)			23.0 (20–28)			< 0.001
W7	13.0 (5–19)			21.5 (18–34)			< 0.001
P^a	< 0.001			0,118			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	4.02	4.02	0.54	2.82	2.28	0.26	
p^b	< 0.001	< 0.001	0.589	0.005	0.023	0.793	
r	0.62	0.62	0.08	0.44	0.50	0.04	
PRTEE-total							
W0	68.5 (55–84)			73.0 (58–83)			0.890
W3	26.5 (14–35)			46.5 (38–58)			< 0.001
W7	27.5 (10–38)			46.0 (39–65)			< 0.001
P^a	< 0.001			0.047			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	4.016	4.015	0.313	3.32	2.798	0.63	
p^b	< 0.001	< 0.001	0.755	< 0.001	0.005	0.526	
r	0.62	0.62	0.05	0.51	0.43	0.09	
DASH Total							
W0	94.0 (70–106)			89.0 (74–109)			0.811
W3	40.0 (35–64)			66.0 (60–87)			0.002
W7	41.0 (31–55)			66.0 (57–86)			< 0.001
P^a	< 0.001			< 0.001			
	W0-3	W0-7	W3-7	W0-3	W0-7	W3-7	
Z	3.79	3.98	0.39	2.91	3.04	0.94	
p^b	< 0.001	< 0.001	0.700	0.004	0.002	0.345	
r	0.58	0.61	0.06	0.45	0.47	0.15	

r: Effect size * Mann-Whitney U test; P^a Friedman test; [b] Wilcoxon Signed-Ranks test; W0-3, W0-7, W3-7: Pre-post treatment differences; Median (1st quartile–3rd quartile) for non-normal distribution values were used. Adjusted p-values were considered significant based on Bonferroni correction

W0: Baseline assessment (pre-treatment)

W3: Assessment immediately after treatment completion (week three)

W7: Assessment 4 weeks after treatment completion (week seven)

not restrict hand movements and does not require excessive time. It should be noted that taping six times over three weeks could positively influence patients' compliance with activity modification and exercise.

For the first time in this study, a relatively newer technique, the EDF, was combined with the frequently used muscle inhibition technique in the treatment of LE. The EDF technique is distinguished by its ability to provide increased stimulation to the epidermal layers, creating a greater lifting effect and enhancing space that supports circulation, thereby alleviating pain and edema in cases of repetitive trauma [19, 34–35]. In this study, KT was applied to reduce excessive muscle activity through muscle inhibition and decrease edema and inflammation using the EDF technique. By applying a different type of taping (non-elastic medical cloth tape) for the sham group, methodological limitations were minimized, allowing for a clearer comparison of the specific effects of kinesiology tape [35].

The study's primary limitation is the absence of a true placebo group, i.e., a group receiving only exercise and/or a group receiving only sham KT. However, both groups received the same exercise program, ensuring that any

Table 4 Evaluation of patients' SF-36 quality of life scores

Variable		KT Group ($n=21$)	Sham Group ($n=21$)	Between-group analysis (p^a)
Physical Functioning	W0	65 (60–83)	75 (50–75)	0.723[a]
	W3	90 (80–100)	80 (50–90)	0.101[a]
	W7	100 (85–100)	85 (50–98)	0.210[a]
	P^c	< 0.001	0.071	
	W0-3 (p^b)	< 0.001	0.105	
	W0-7 (p^b)	< 0.001	0.014	
	W3-7 (p^b)	0.125	0.260	
Social Functioning	W0	88 (50–100)	100 (63–100)	0.576[a]
	W3	100 (88–100)	100 (63–100)	0.307[a]
	W7	100 (88–100)	100 (63–100)	0.314[a]
	P^c	0.001	0.076	
	W0-3 (p^b)	0.005	0.040	
	W0-7 (p^b)	0.005	0.056	
	W3-7 (p^b)	0.564	0.317	
Physical Role Limitations	W0	0 (0-100)	0 (0–0)	0.01[a]
	W3	100 (75–100)	0 (0–0)	< 0.001[a]
	W7	100 (88–100)	0 (0–0)	< 0.001[a]
	P^c	0.001	0.565	
	W0-3 (p^b)	0.001	0.106	
	W0-7 (p^b)	< 0.001	0.106	
	W3-7 (p^b)	0.890	1.0	
Emotional Role Limitations	W0	0 (0-100)	0 (0-100)	0.932[a]
	W3	100 (100–100)	100 (0-100)	0.023[a]
	W7	100 (100–100)	100 (0-100)	0.032[a]
	P^c	< 0.001	0.018	
	W0-3 (p^b)	0.099	0.001	
	W0-7 (p^b)	< 0.001	0.905	
	W3-7 (p^b)	< 0.001	< 0.001	
Pain	W0	35 (16–56)	23 (5–35)	0.232[a]
	W3	90 (56–95)	45 (28–58)	< 0.001[a]
	W7	90 (58–100)	45 (28–56)	< 0.001[a]
	P^c	< 0.001	0.009	
	W0-3 (p^b)	< 0.001	0.007	
	W0-7 (p^b)	< 0.001	0.009	
	W3-7 (p^b)	0.833	0.490	
Vitality (Energy)	W0	65 (50–78)	50 (38–78)	0.23[a]
	W3	80 (75–90)	50 (40–70)	0.001[a]
	W7	80 (75–90)	50 (40–68)	< 0.001[a]
	P^c	< 0.001	1.0	
	W0-3 (p^b)	0.001	0,779	
	W0-7 (p^b)	< 0.001	0.726	
	W3-7 (p^b)	0.674	0.655	
Mental Health	W0	68 (62–82)	64 (46–74)	0.121[a]
	W3	73 (61–75)	45 (41–57)	< 0.001[a]
	W7	88 (78–92)	60 (52–72)	< 0.001[a]
	P^c	< 0.001	< 0.001	
	W0-3 (p^b)	0.099	0.001	
	W0-7 (p^b)	< 0.001	0.905	
	W3-7 (p^b)	< 0.001	< 0.001	

Table 4 (continued)

Variable		KT Group ($n=21$)	Sham Group ($n=21$)	Between-group analysis (p^a)
General Health	W0	60 (46–68)	45 (35–68)	0.270[a]
	W3	70 (60–80)	55 (43–60)	< 0.001[a]
	W7	75 (60–75)	50 (39–60)	< 0.001[a]
	P^c	< 0.001	0.343	
	W0-3 (p^b)	0.001	0.394	
	W0-7 (p^b)	0.001	0.858	
	W3-7 (p^b)	0.803	0.257	

KT, kinesiotaping; SF-36, Short form-36; [a] Mann-Whitney U test; P^c Friedman test; [b] Wilcoxon Signed-Ranks test; W0-3, W0-7, W3-7: Pre-post treatment differences; Median (1st quartile–3rd quartile) for non-normal distribution values were used. Adjusted p-values were considered significant based on Bonferroni correction

W0: Baseline assessment (pre-treatment)

W3: Assessment immediately after treatment completion (week three)

W7: Assessment 4 weeks after treatment completion (week seven)

Table 5 Comparison of patients' satisfaction scores

Roles and Maudsley Score	KT Group ($n=21$)	Sham Group ($n=21$)	Between-group analysis (p^a)
W3			0.001
Excellent & Good	18 (86)	7 (33)	
Acceptable & Poor	3 (14)	14 (67)	
W7			< 0.001
Excellent & Good	18 (86)	6 (29)	
Acceptable & Poor	3 (14)	15 (71)	

[a] Fisher's Exact Test

W3: Assessment immediately after treatment completion (week three)

W7: Assessment 4 weeks after treatment completion (week seven)

differences observed were attributable to the taping intervention. Nonetheless, the lack of a true placebo group may limit the ability to fully isolate the specific effects of KT from potential non-specific effects. Future studies could address this limitation by including a third arm consisting of an exercise-only group to better determine the true efficacy of KT in the management of LE. Although the evaluation parameters were meticulously assessed by the same physiatrist without any conflict of interest, the lack of a double-blind design is another limitation. Although LE is a clinical condition characterized by symptoms such as pain and functional impairment, the use of self-reported questionnaires as outcome measures may introduce subjectivity. In this context, the absence of diagnostic imaging techniques (e.g., ultrasonography) for assessing diagnosis and treatment efficacy remains a potential limitation. Despite the sample size was confirmed as sufficient through G*Power analysis and aligned with similar RCTs, the relatively small sample size and single-center design may limit the generalizability of the results. Additionally, while the relatively short follow-up period could be seen as a limitation, the self-limiting nature of LE and the fact that symptoms generally decrease over time mitigate this concern [29, 38–39]. Nonetheless, long-term follow-up studies are still needed to evaluate the effectiveness of KT.

Conclusion

Kinesiotaping when combined with activity modification and an individualized home-based exercise program, is highly effective and satisfactory in improving pain, functional status, and quality of life in treating chronic LE. Strengthening the evidence supporting the efficacy of KT, a preferred treatment option due to its patient comfort and non-restrictive nature on hand function, should be a key objective for future research.

Supplementary Information

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Supplementary Material 1

Author contributions

HEA, RY, SK, and FSS were involved in forming the concept and research aims and developing the methodology for the present study. RY, SK, FSS, and HAE recruited participants and conducted data collection. RY and HAE prepared and wrote the first draft of this manuscript, with reviews and revisions undertaken by all authors. According to the ICMJE authorship criteria, all authors have fulfilled the requirements of providing final approval for the version to be published and agree to be accountable for all aspects of the work, including the investigation and resolution of any questions regarding the accuracy or integrity of the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval

The present study protocol was approved by the Ethics Committee of KTO Karatay University Non-Pharmaceutical and Medical Devices (date:26.01.2024, number:2024/010). All procedures performed in studies involving human participants followed the ethical standards of the institutional research committee and the principles of the Declaration of Helsinki. The study was registered on ClinicalTrials.gov (NCT06611709).

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Consent for publication
The consent of all the authors of this article has been obtained for submitting the article to the Journal.

Competing interests
The authors declare no competing interests.

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