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

Fatmanur Aybala Koçak, MD, Emine Eda Kurt, MD, Senem Şaş, MD, Figen Tuncay, MD, and Hatice Rana Erdem, MD

Objective: The aim of the study was to compare the efficacy of steroid injection and kinesio taping (KT) in the treatment of lateral epicondylitis.

Design: A total number of 84 patients were randomized into three groups. Group 1 was given steroid injection, group 2 received KT, and group 3 received both. Pain was measured using a visual analog scale, functional status was measured using a quick form of the Disabilities of Arm, Shoulder and Hand questionnaire, pain-free grip strength was measured using a dynamometer, and the pressure pain threshold was measured using an algometer. All evaluations were performed before treatment and at the third and twelfth weeks after the treatment.

Results: Twenty-eight patients were included in each group. A statistically significant difference was found between the pretreatment and posttreatment evaluations of all groups in the third and twelfth weeks after treatment. When group 1 and group 2 were compared, there was a significant difference only in pain-free grip strength measured in the twelfth week. The results of treatment in group 3 patients were significantly better in almost all evaluation parameters compared with the other groups.

Conclusion: In the treatment of lateral epicondylitis, KT alone was found to be as effective as steroid injection alone. However, co-administration of steroid injection and KT is more effective compared with each treatment alone.

Key Words: Pain, Taping, Kinesio-Tex, Corticosteroid, Rehabilitation, Tennis Elbow

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Lateral elbow pain is one of the most common reasons for referral to a physiatrist for nontraumatic elbow disorders. The most frequent diagnosis is the tendinous disorder known as lateral epicondylitis (LE).[1] In the literature, there are many names used to describe the condition, including LE, lateral epicondylalgia, lateral epicondylosis, tennis elbow, and directly lateral elbow pain.[2] There is still no consensus about the nomenclature among authors. Lateral epicondylalgia may be an umbrella term indicating pain at the region, whereas epicondylitis is indicative of an inflammatory process and epicondylosis is more indicative of a tendinopathic process.

A study found evidence of reduced hyperemia measured with spectral and color Doppler in LE treated with corticosteroids, suggesting the evidence of an inflammatory component.[3] Other studies, in which little evidence of inflammation was found, proposed the term "lateral epicondylalgia" for the condition[4] because some histologic studies did not show many inflammatory cells; some authors consider LE as a tendinosis, a symptomatic degenerative process of the tendon.[1] Tendons can stretch easily in response to gradually increasing forces. If this stress exceeds the tendon's tolerance to stretch, a microtear may occur. Multiple microtears lead to degenerative changes within the tendon, which are known as tendinosis.[1]

Tendinopathy is a general term used to describe chronic overuse tendon disorders encompassing a wide spectrum of histopathologic changes. Tendinosis relates to some specific histologic changes.[5] The pathologic changes in the tendon consist of angiofibroblastic hyperplasia with an increase in cell number and ground substance, vascular hyperplasia or neovascularization, increased concentrations of neurochemicals, as well as disorganized and immature collagen formation. Ultrasonography has demonstrated different tendon pathologies, including tendon thickening or thinning, focal areas of hypoechogenicity, tendon tears, calcification, and even bony irregularity.[2] Ultrasonography examinations are supportive of a degenerative pathologic origin, but the role of inflammation is still subject to debate.[6]

Clinically, LE is characterized by tenderness over the lateral epicondyle of the humerus, normal range of motion of the affected elbow, and pain on resisted extension of the wrist or middle finger.[7] It is a common condition that affects 1%–3%

From the Department of Physical Medicine and Rehabilitation, Ahi Evran University Faculty of Medicine, Kırşehir, Turkey (FAK, EEK, FT, HRE); and Department of Physical Medicine and Rehabilitation, Ahi Evran University Training and Research Hospital, Kırşehir, Turkey (SŞ).

All correspondence should be addressed to: Fatmanur Aybala Koçak, MD, Department of Physical Medicine and Rehabilitation, Ahi Evran University Faculty of Medicine, Bağbaşı Mah, Şehit Sahir Kurutluoğlu Cad. No: 100 40100 Merkez, Kırşehir, Turkey.

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of the population, generally affecting the middle-aged without a sex predisposition.[1,2,5] In most cases, nonobvious underlying causes can be identified. The extensor carpi radialis brevis is the most commonly affected muscle, but supinator and other wrist extensors can also be involved as well. Any activity involving excessive and repetitive use of these muscles (eg, tennis, playing an instrument, typing, manual work, hammering, gardening) may cause tendinosis.[1]

For the treatment of LE, patient education, rest, braces, exercise therapies, nonsteroidal anti-inflammatory drugs, injection therapies (eg, corticosteroid, autologous blood, platelet-rich plasma, botulinum toxin A, hyaluronan gel), physical therapy modalities (eg, low-level laser, ultrasound, extracorporeal shock wave), taping, manual therapy, acupuncture, and surgery in refractory cases are recommended in the literature.[1,2,8] However, there is a lack of consensus regarding the optimal treatment method. Among these treatments, one of the most frequently discussed and investigated treatments is steroid injection (SI) therapy. Some authors have shown that steroids are useful in the treatment of LE.[9–11] However, others claim that steroids are ineffective and may even be harmful in the long term.[12–15] Despite all these opposing views in the literature, in a survey conducted among medical specialists, SI therapy was shown to be the most frequently preferred treatment.[16]

Kinesio taping (KT) has gained popularity in the past decades among professional sportspeople and medical specialists who work on neuromusculoskeletal diseases. The KT has physiologic effects such as reducing pain or abnormal sensations, promoting drainage of the blood and lymphatic fluid under the skin, and correcting joint arrangement.[17] The KT has been shown to be useful in the treatment of LE in some studies.[18–20] No studies have reported any long-term adverse effects of KT.

Until now, many studies have been conducted to compare the efficacy of SI therapy and other nonsurgical treatments for LE.[6,21–23] However, to the best of our knowledge, no studies have examined the effectiveness of KT and SI for the treatment of LE. Therefore, this study aimed to compare the efficacy of SI and KT in the treatment of LE.

METHODS

Patients

In this study, 153 patients aged between 18 and 70 yrs who were admitted to the physical medicine and rehabilitation outpatient clinics of Kırşehir Ahi Evran University Education and Research hospital with LE were evaluated. Sixty-nine patients were excluded for various reasons; therefore, 84 patients were included in the final analysis (Fig. 1). Ethical approval for this study was obtained from the local ethics committee, and the study was conducted in accordance with the Declaration of Helsinki. This study conforms to all CONSORT guidelines and reports the required information accordingly (see Supplemental Checklist, Supplemental Digital Content 1, http://links.lww.com/PHM/A770). Patients were informed about the study, and their oral and written informed consents were obtained. This study was registered in the Iranian Registry of Clinical Trials, which is a primary registry in the World Health Organization Registry Network set. Trial ID of this study is 28782 and Iranian Registry of Clinical Trials ID of this study is IRCT20180108038268N2.

Inclusion Criteria

Patients with pain at the lateral side of the elbow, whose pain increased with pressure on the lateral epicondyle and opposed wrist extension, opposed middle-finger extension, or passive stretch of the wrist extensors, with a pain duration between 2 and 12 wks, whose pain severity was equal to 5 and higher on a numeric scale where 0 indicated no pain and 10 indicated the most severe pain, who were aged 18–70 yrs, and those with sufficient cognitive ability to complete questionnaires and sign the informed consent form were included.

Exclusion Criteria

Patients who received treatment for LE; with problems in both elbows; with a history of inflammatory arthritis, elbow surgery, trauma to the elbow, tendon rupture of the muscles located around the elbow, humerus, radius or ulna fracture or joint dislocation, oral or systemic steroid use, malignancy; limb joint motion limitation; congenital or acquired elbow joint deformity; cervical vertebrae or other upper limb problem; root pathology of cervical origin; systemic musculoskeletal or neurologic disease; cooperative difficulty due to cognitive dysfunction; and conditions for which local steroids were contraindicated (septic arthritis, sepsis, tuberculosis, unknown caused fever, history of allergy against local anesthetics or steroids, monoarthritis with unknown cause, neutropenia, thrombocytopenia, anticoagulant use, coagulation disorders) were excluded from the study.

Treatment Procedure

An administrative assistant performed casual randomization using the sealed numbered envelope technique. After evaluation by a physiatrist, the patients were randomized into the following three groups: the SI group (group 1, $n = 28$), the KT group (group 2, $n = 28$), and the SI + KT group (group 3, $n = 28$) (Fig. 1).

Patients in group 1 were given SIs. The SI was performed while the patient's forearm was resting in pronation and 45-degree flexion on a firm surface. After ensuring standard aseptic conditions, the mixture of 20 mg of methylprednisolone acetate (0.5 mL) and 0.5 mL of prilocaine at 2% was injected into the subcutaneous tissues and muscles 1 cm distal to the lateral epicondyle in a fan-shaped manner using a 22-G 30-mm needle.[10] The needle was withdrawn cleanly, and firm pressure was applied. All patients were injected by the same researcher who has approximately 15 yrs of experience in the field of musculoskeletal injections. The injections were performed only once.

Patients in group 2 were treated with KT using Kinesio Tex Gold. The researcher who applied the KT has an advanced level certificate from Kinesio Taping Association International. The researcher has 8 yrs of experience in this field and is the same physiatrist who performed the SIs to patients in groups 1 and 3. The application of elastic therapeutic tape was based on the recommended application techniques by Kase et al.[24] Before the implementation of the tape, the skin was cleaned to ensure that the surface was free of oils and creams to improve tape adherence. Then, the "space correction technique"[25] was used to reduce the pressure on the target tissue. An X-band, which was

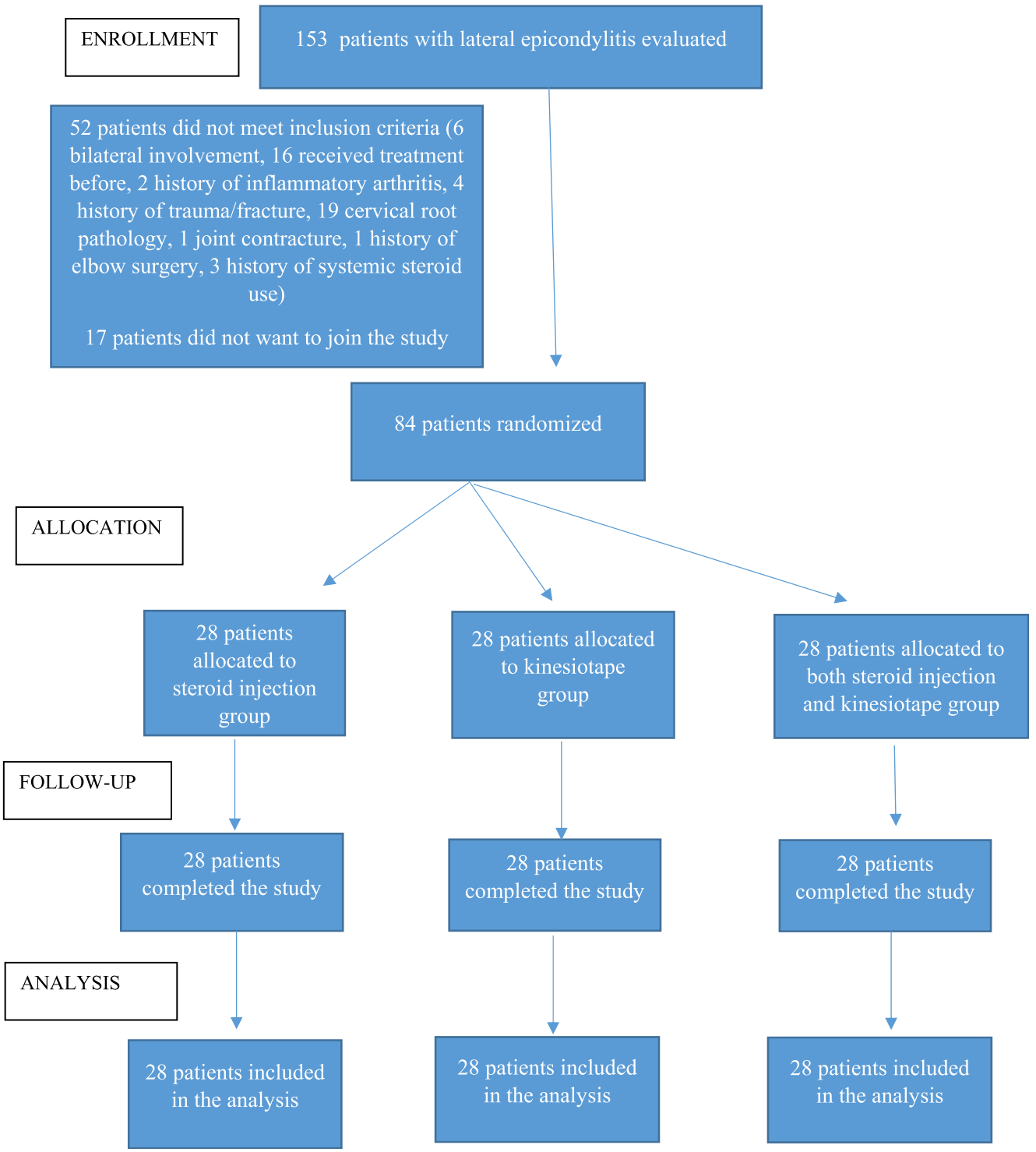

FIGURE 1. Participant flow through the study.

cut as a donut hole, was used. The space in the middle was placed on the lateral epicondyle with a stretch of 15%–25%. The endings were taped without stretching (Fig. 2A).

Then, a Y band was prepared by measuring the distance between the hand dorsum and the lateral epicondyle to perform the "muscle inhibition technique."[26] The process was initiated while the elbow was in extension, the forearm in pronation, and the wrist in the neutral position. The tip of the Y tape was placed onto the radial side of the wrist without stretching. Then the wrist was put into palmar flexion position and the forearm was put into the pronation position and the band was applied to the wrist with a 15%–25% stretch, and the tips were put together around the target tissue. The taping was terminated without stretching (Fig. 2B).

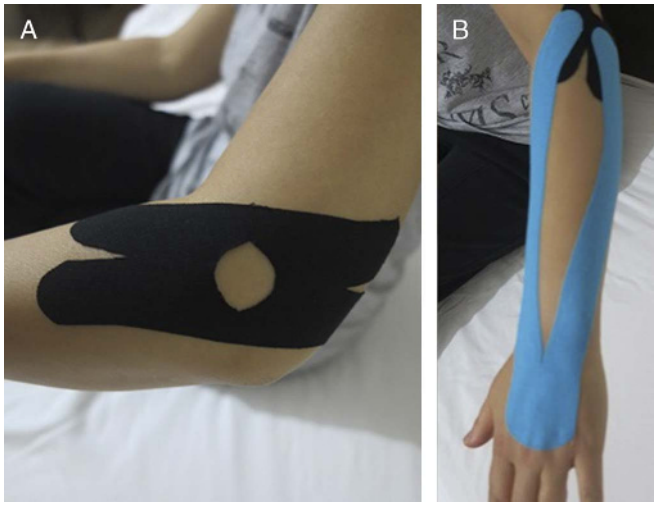

FIGURE 2. Space correction KT using donut hole tape (A, black tape) and muscle inhibition KT applied from the origin to insertion of the extensor muscle group (B, blue tape).

A shorter Y band was then prepared to perform the "fascia correction technique."[27] When the elbow was in extension, and the forearm was in pronation, the tip of the Y tape was put onto the underside and the posterior of the target tissue. Oscillation movement was formed from the lateral end to the medial on the tips of the Y band to create a 10%–50% stretch. The taping was terminated without applying any stretching to the endings (Fig. 3).

The KT was applied twice a week for a total of five times. The previous tape was removed before applying a new one each time. Patients were trained on how to remove the tape. On the evening before the new tape was applied, the patients removed the tape from their arm. The next morning, the new tape was readministered to the patient by the researcher. Evaluations of the patients were performed after the completion of KT therapy. No measurements were made while the tape was on the patients' arms.

Group 3 patients received both SI therapy and KT therapy. First, SI therapy was applied as described in group 1. One day after the injection, KT therapy was started and completed as described in group 2. The same researcher applied both the SI and KT therapies to all patients in all groups.

During the study, all subjects were instructed to use their arm but to avoid activities that could irritate the elbow such as lifting heavy objects, crafts such as knitting, grasping, handwriting, gardening or using a screwdriver. In addition, every subject received advice on activity modification techniques to reduce symptoms, which included information regarding suggested changes about working and work equipment (eg, fitting larger handles on tools/equipment), alternating use of hands so that both elbows shared the work, and keeping elbows close to the body in flexion when applicable. No specific exercise was recommended for any patient in any of the groups. During the study, patients were not allowed to use oral/topical nonsteroidal anti-inflammatory drugs. All patients completed the study.

A single physiatrist who was blinded to the randomization process and group selection evaluated each patient before treatment and 3 and 12 wks after the treatments.

Measurement Parameters

Pain Assessment

A 10-cm visual analog scale (VAS)[28] was used to evaluate the pain severity. A horizontal 10-cm-long ruler was used (0 = no pain and 10 = most severe pain). The patients were asked to mark their pain at rest and during movement, separately.

Pain-Free Grip Strength

Lateral epicondylitis is characterized by pain and tenderness at the common extensor origin, which can be aggravated by a forceful grip. Therefore, the pain-free grip strength (PFGS) test is one of the standard clinical assessments to evaluate this condition. The PFGS was defined as the amount of grip force generated with an isometric contraction before the onset of pain.[29] In this study, the PFGS of the upper limbs of all patients with LE was evaluated using a Jamar hand dynamometer (Sammons Preston, Inc, Bolingbrook, IL). For the test position, patients were instructed to sit in a chair with their feet flat on the floor, and measurements were performed while the shoulder was in adduction, elbow in 90-degree flexion, and the forearm in the neutral position between the supination and pronation position. Patients were first shown how to use the dynamometer. The researcher then helped support the weight of the dynamometer without restricting its movement. In the PFGS test, patients were required to increase their grip force smoothly and to maintain the same strength for approximately 3 secs at the onset of pain. The third range of the dynamometer was used as the standard when measuring and the grip strength was measured in kilogram-force. The PFGS was evaluated three times with 1-min rest intervals, and their averages were calculated.

Pressure Pain Threshold

The pressure pain threshold (PPT) is defined as the pressure at which participants first feel pain.[29] The PPT was measured on the lateral epicondyle using a Baseline 10-kg to 22-lb Algometer (Push-Pull Force Gauge; Fabrication Enterprises,

FIGURE 3. Fascia correction KT applied from lateral to medial (pink tape).

Inc, NY). At first, all patients familiarized themselves with the procedure using their unaffected arms. Then, metal rod of the algometer was put upright on the most palpable tender site over the lateral epicondyle. That area was then compressed slowly enough until subjects felt an increase in pain intensity and discomfort. The researcher gradually applied pressure, with a maximum of 6 kg/cm^2 perpendicular to the tender site. The compression was stopped when the subject reported pain. The measurements were repeated three times with an interval of 30–60 secs. The average value of three repeat measurements (kilogram per square centimeter) was taken for data analysis of the PPT.

Functional Assessment

The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire is commonly used as an applicable method to examine the efficacy of different treatment modalities in the management and improvement of disability in patients with upper limb disorders. The QuickDASH (qDASH) is a shortened version of the DASH questionnaire. Instead of 30 items, the qDASH uses 11 items to measure physical function and symptoms in people with musculoskeletal disorders of the upper limb.[30] To calculate the qDASH score, at least 10 of the 11 headings must be answered. Each question is scored on a five-point scale, and the final score ranging from 0 (no disability) to 100 (severe impairment) is calculated.

Patient's Global Assessment

One of the secondary outcome measures was the patient's comprehensive assessment of their impression of improvement. The question asked was "What were the effects of treatment on your symptoms?" The patient's global assessment was made using the Patient's Global Assessment of Response to Therapy (PGART) scale.[31] Patients indicated their answers on a five-point Likert scale (3 = almost complete relief, 2 = marked improvement, 1 = slight improvement, 0 = no change, and −1 = worsening of symptoms).

Statistical Analysis

In the calculation of sample size, to test the statistical significance of a difference of at least 1.4 units at 80% power and 5% error level in terms of change in VAS pain scores before and after treatment between at least two groups, at least 27 subjects were required for each group; 1.4-unit difference information was obtained from the literature.[32] Sample size calculations were performed using the PASS 13 (Power Analysis and Sample Size Software; NCSS, LLC, Kaysville, UT) package program.

IBM SPSS Version 20.0 (IBM Corporation, Armonk, NY) software was used for statistical analyses. Measured data are described as arithmetic mean ± standard deviation, whereas categorical data are described as percentages. Qualitative data comparisons of groups were performed using the χ^2 test. The Shapiro-Wilk test was used to examine the normal distribution of measured data. One-way analysis of variance was used for intergroup comparisons of normally distributed variables. A statistical level of significance was accepted as $P < 0.05$. The Kruskal-Wallis test was used if data were not normally distributed, and the Mann-Whitney U test was used for post hoc analysis with Bonferroni correction (P value was divided by the number of groups, which was 0.05/3 = 0.016). Thus, statistical significance was accepted as $P < 0.016$.

To compare the repeated measurements for each group, repeated measurements variance analysis was used when data were normally distributed, and the level of statistical significance was accepted as $P < 0.05$. The Friedman test was used if data were not normally distributed, and the Wilcoxon-test was used for post hoc analysis with Bonferroni correction. Statistical significance was accepted as $P < 0.016$.

RESULTS

Eighty-four patients (48 F, 36 M) with a mean ± SD age of 43.06 ± 11.19 yrs were included in the study. The mean duration of the onset of the patient's symptoms was 5.44 ± 3.61 (min: 2, max: 12) wks. The etiology of injury for all patients was nonsport-related overuse. Each group consisted of 28 patients. There was no statistically significant difference between the groups regarding age, sex, disease duration, and affected limb (dominant *vs.* nondominant) (all $P > 0.05$) (Table 1). There was no statistically significant difference between the groups regarding VAS at rest, VAS during movement, PFGS, PPT, and qDASH scores before treatment ($P < 0.05$) (Table 2).

A statistically significant difference was found between the pretreatment and posttreatment evaluations of all groups in the third and twelfth weeks after treatment (all $P < 0.001$) (Table 2).

When the treatment results of the patients in group 1 and group 2 were compared, there was a statistically significant difference only in PFGS in the twelfth week after treatment, in favor of group 1 ($P = 0.014$) (Table 2).

When the treatment results of the patients of group 1 and group 3 were compared, there were statistically significant differences in VAS during movement at the third weeks after treatment and PPT, qDASH, and PGART values at the third and twelfth weeks, in favor of group 3 (all $P < 0.001$) (Table 2).

TABLE 1. Demographic characteristics of the patients

	Group 1 (n = 28)	Group 2 (n = 28)	Group 3 (n = 28)	P
Age, mean ± SD, yr	43.54 ± 12.08	40.96 ± 11.60	44.68 ± 9.83	0.65
Sex (F/M), n/n (%/%)	14/14 (50%/50%)	18/10 (64.3%/35.7%)	16/12 (57.1%/42.5%)	0.56
Disease duration, mean ± SD, wk	4.50 ± 3.09	5.07 ± 3.77	5.75 ± 3.66	0.07
Affected limb (dominant/nondominant), n/n	22/6	19/9	18/10	0.48

$P < 0.05$ was considered statistically significant.

TABLE 2. Clinical findings and *P* values of comparisons in repeated measures and between groups

	Group 1 (n = 28)		Group 2 (n = 28)		Group 3 (n = 28)		Group 1 *vs.* 2	Group 1 *vs.* 3	Group 2 *vs.* 3
	Mean ± SD	*P*	Mean ± SD	*P*	Mean ± SD	*P*	*P*	*P*	*P*
VAS at rest									
Pretreatment	2.79 ± 2.45		1.93 ± 1.56		2.25 ± 2.41		0.270	0.363	0.953
Posttreatment 3rd week	0.96 ± 1.85	**<0.001**[a]	0.28 ± 1.01	**<0.001**[a]	0.32 ± 1.09	**<0.001**[a]	0.052	0.056	0.988
Posttreatment 12th week	0.93 ± 2.14	**<0.001**[b]	0.11 ± 0.57	**<0.001**[b]	0.14 ± 0.52	**<0.001**[b]	0.025	0.069	0.585
VAS during movement									
Pretreatment	7.64 ± 1.31		7.36 ± 1.50		7.89 ± 1.31		0.532	0.524	0.221
Posttreatment 3rd week	5.82 ± 2.19	**<0.001**[a]	5.21 ± 2.43	**<0.001**[a]	3.68 ± 1.63	**<0.001**[a]	0.387	**<0.001**	**0.005**
Posttreatment 12th week	3.46 ± 3.45	**<0.001**[b]	3.03 ± 2.96	**<0.001**[b]	0.96 ± 1.17	**<0.001**[b]	0.626	0.021	0.021
Pain-free grip strength									
Pretreatment	29.96 ± 12.19		21.89 ± 7.88		25.68 ± 11.44		0.018	0.165	0.236
Posttreatment 3rd week	33.14 ± 13.72	**0.001**[a]	24.46 ± 8.43	**0.001**[a]	32.21 ± 9.40	**<0.001**[a]	0.020	0.876	**0.003**
Posttreatment 12th week	34.68 ± 13.11	**0.001**[b]	26.07 ± 8.41	**<0.001**[b]	32.75 ± 10.06	**<0.001**[b]	**0.014**	0.599	**0.011**
PPT									
Pretreatment	3.31 ± 096		3.45 ± 1.26		3.45 ± 0.89		0.921	0.400	0.576
Posttreatment 3rd week	3.93 ± 1.52	**0.011**[a]	4.64 ± 1.37	**0.001**[a]	5.28 ± 0.82	**<0.001**[a]	0.286	**0.001**	**0.010**
Posttreatment 12th week	4.08 ± 1.41	**0.004**[b]	4.61 ± 1.44	**0.001**[b]	5.49 ± 0.71	**<0.001**[b]	0.175	**<0.001**	**0.015**
qDASH									
Pretreatment	57.39 ± 17.09		55.11 ± 18.63		59.32 ± 16.17		0.652	0.539	0.363
Posttreatment 3rd week	48.82 ± 16.91	**<0.001**[a]	40.21 ± 20.61	**<0.001**[a]	25.00 ± 17.10	**<0.001**[a]	0.046	**<0.001**	**0.013**
Posttreatment 12th week	34.89 ± 22.91	**<0.001**[b]	35.53 ± 28.06	**<0.001**[b]	12.07 ± 9.50	**<0.001**[b]	0.805	**<0.001**	**<0.001**
PGART									
Posttreatment 3rd week	1.04 ± 0.99		1.17 ± 1.09		1.96 ± 0.88		0.533	**<0.001**	**0.006**
Posttreatment 12th week	1.46 ± 1.30	**0.001**[c]	1.46 ± 1.29	**0.005**[c]	2.5 ± 1.00	**0.002**[c]	0.950	**<0.001**	**<0.001**

Significant *P* values are shown as bold.

[a]Comparison between pretreatment and 3-wk posttreatment.

[b]Comparison between pretreatment and 12-wk posttreatment.

[c]Comparison between 3- and 12-wk posttreatment.

When the treatment results of the patients in group 2 and group 3 were compared, there were statistically significantly differences in favor of group 3 in VAS during movement at the third week after treatment ($P = 0.005$), PFGS at the third and twelfth weeks after treatment ($P = 0.003$, $P = 0.011$), PPT at the third and twelfth weeks after treatment ($P = 0.010$, $P = 0.015$), qDASH at the third and twelfth weeks after treatment ($P = 0.013$, $P < 0.001$), and PGART at the third and twelfth weeks after treatment ($P = 0.006$, $P < 0.001$) (Table 2).

DISCUSSION

This study examined the short-term effects of SI and/or KT for the treatment of LE. The first finding of this study was that SI therapy was effective in all measured parameters (pain, PFGS, PPT, functionality, and patient satisfaction) after the third week of treatment, and this effect was continued in the twelfth week. In a study that investigated the effects of SI on pain, PPT, and handgrip strength of patients with LE, it was found that SI was effective in pain, disability and impaired hand functions, and the treatment effect, which lasted at least 12 wks, reflected the positive long-term effects of local SI.[10] The results of that study support our findings. In another randomized controlled study that aimed to compare the effects of SI versus local anesthetic injection in patients with LE, qDASH and VAS scores were evaluated.[13] It was found that patients in the SI group had dramatic response to the treatment at 3 wks after the injections (a three-fold greater effect response compared with the control group). However, at 6 and 12 wks after the injection therapies, the qDASH and VAS scores in the SI group were increased, suggesting recurrence in 34.7% of patients. In conclusion, the authors claimed that although SI had the best short-term outcome, it had the highest recurrence rate and that combining SI with other treatment options would be promising.[13] In a study comparing SI therapy with physiotherapy and wait-and-see methods, the authors found that SI was the best treatment option in the short term for patients with LE, but these beneficial effects only persisted for a short time. At long-term follow-up, the findings suggested that physiotherapy became the best option, followed by a wait-and-see policy.[15] However, in another study that compared the effects of SI and physiotherapy for a 1-yr period, among patients with LE, there was a worse clinical outcome in the SI group compared with placebo, despite its short-term benefits. In addition, physiotherapy did not result in any significant 1-yr differences.[12]

The easy accessibility of tendons and their insertions make the local injection of medical therapies an easily applicable and logical therapeutic approach. At the present time, steroids remain

the most widely used injectable therapy for a variety of tendon disorders, as well as LE in clinical practice.[16] There are contradictions regarding the role of SI therapy such as the balance of benefit versus harm. Potential mechanisms of tendinopathy include a reduction of extrinsic or intrinsic inflammation, reduction of tenocyte proliferation or cellular activity, antiangiogenic activity, inhibition of scarring/adhesion, antinociceptive action, or some combinations thereof.[14] Besides the discussion of the efficacy or lack thereof with SI therapy, the naming of the disease has also been discussed for many years.

In a systematic review, it was claimed that the efficacy of SI for tendinopathies had been investigated and that most patients might experience short-term improvement in pain and/or function but experience a higher risk of relapse in the medium to long term.[14] In another systematic review that compared SI and other injection therapies, the authors claimed that despite the effectiveness of SI in the short term, non-SI might be of benefit for the long-term treatment of LE.[22] However, as a result of another systematic review comparing SI and other injection therapies, it was found that there was a paucity of evidence from unbiased trials on which to base treatment recommendations regarding injection therapies for LE.[6]

Numerous publications in the literature have reported on the efficacy of SI therapy in the short term, but there are conflicting results for its long-term effects. In this study, we wanted to compare the efficacy of SI therapy with KT, which is a noninvasive treatment method. It has been reported that the use of KT restored the normal function of muscles and joints, created normal biomechanics of tissue by decreasing pain, and restored tissue hemostasis in rehabilitation.[18] Although athletes and patients with LE use KT, the exact mechanism is still not clear. The hypothesis of the mechanism proposed for KT use is that it decreases the pressure on muscles, which also decreases the stimulus on cutaneous mechanoreceptors and eventually on soft tissue. The KT causes tensional force and mechanical pressure on the skin, and through these changes, skin tension affects the PPT. The other mechanisms of KT are as follows: normalization of muscular function (inhibition of hyperactive muscles and stimulation of weak muscles), increase in proprioception by stimulating the mechanical skin receptors, increase in vascular and lymphatic flow, correcting joint dysfunction by correction of abnormal muscle tension, and raising the skin and providing more space under KT.[18]

There are different techniques of KT. We used a combination of the following three techniques: space correction, muscle inhibition, and fascia correction. Space correction is used to provide extra space over the area of pain, inflammation, swelling, or edema. Increasing the cavity area by removing the skin above the treated area decreases the pressure in this area. A decrease in pressure helps reduce the stimulation of the chemical receptors and reduce pain. Muscle inhibition is used to inhibit and rest the extensor group of muscles, which originate from the lateral epicondyle. By reducing pressure, a kind of inhibition can be created in these tissues, and the tension can be reduced while proprioception can be increased. Fascia correction aims to reduce tension and adhesion by making a vibration movement between the fascia layers.[33]

In the current literature, KT has been shown to be effective in the treatment of LE.[18–20] However, no studies have compared the efficacy of KT and SI treatment. Accordingly, the most important finding of this study is that the effectiveness of KT alone was found to be close to that of SI alone regarding pain, functionality, and grip strength in patients with LE who had a disease duration between 2 and 12 wks. Thus, KT can be used in cases where SI therapy is not desired.

Finally, in this study, the combination of both treatments was found to be significantly more effective than the administration of SI alone or KT alone. This result is not surprising. Therefore, combination therapy may be preferred in patients with severe pain or when recovery is desired in a shorter time. However, there is a need for studies evaluating the long-term results of combination therapy.

STUDY LIMITATIONS

The first limitation of this study is that patients were not blinded to the treatment groups because of the nature of the study. Only the researcher who made the clinical evaluations before and after the treatment was blinded. The second limitation is that there was no real control group in this study. A control group receiving placebo injection[7,11,13,21] and/or sham taping[18,20] has been investigated before. The primary objective of this study was to compare the effects of SI and KT treatments, not to examine the effectiveness of SI or KT. Nonetheless, the local ethics committee would not allow patients to be left entirely untreated. The third limitation was the inability to perform long-term follow-up of the patients; therefore, the authors' next goal is to obtain long-term results to investigate whether the treatment effects are long lasting. The fourth limitation was that the SI therapy was applied via blinded injections rather than using an ultrasound-guided technique. The final limitation was that the diagnosis of LE was only clinically established, and no diagnostic imaging (eg, ultrasonography, magnetic resonance imaging) was performed on the patients. The severity of tendon damage of the patients could be different, which was not possible to be evaluated clinically. On the other hand, despite certain limitations to the present study, we believe that it may prove valuable in that it is the first study to compare SI treatment with KT for the treatment of LE.

CONCLUSIONS

In the treatment of LE, administration of SI or KT and co-administration of these two treatments are effective on pain, PFGS, PPT, functional status, and patient satisfaction in the short term. The efficacy of KT alone was found to be close to the efficacy of SI therapy alone. In cases where the use of SI therapy is not desired (such as patient's unwillingness, contraindications, and the situations, whereas the long-term results cannot be predicted), KT can be considered as a treatment option for LE. However, co-administration of the two therapies may be more effective on pain, PFGS, PPT, functional status, and the patient's global assessment compared with each treatment alone.

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