Short-Term Effectiveness of Ultrasound Treatment in Patients with Lateral Epicondylitis: Randomized, Single-Blind, Placebo-Controlled, Prospective Study

Lateral Epikondilitli Hastalarda Ultrason Tedavisinin Kısa Dönem Etkinliği: Randomize, Tek Kör Plasebo Kontrollü, Prospektif Çalışma

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Abstract

Objective: We aimed to assess the effectiveness of ultrasound treatment in patients with lateral epicondylitis and to compare with placebo ultrasound treatment.

Materials and Methods: Sixty patients (40 female, 20 male, mean age±SD 46.7±8.1, range 25-62) with lateral epicondylitis were included. All of the patients were randomized to two groups as: ultrasound (US) group (n=30) and placebo US group (n=30). Continuous US was applied to the patients in the US group whereas placebo US was applied to those in the placebo group for 5 minutes over three weeks (totally 15 sessions). All patients used a static splint at night for the three weeks. Patients were assessed before the treatment (baseline), at the end of the treatment (3rd week) and after 15 days follow-up (5th week). The following parameters were evaluated: pain with the visual analog scale (VAS), hand grip strength using a hand dynamometer, activities of daily living using the Turkish version of Disabilities of the Arm, Shoulder and Hand (DASH-T) questionnaire, and quality of life using the Short-Form (SF)-36 questionnaires. In addition, patient satisfaction was examined.

Results: VAS at rest and during motion had significantly improved in both groups at the end of treatment (3rd week) and in the follow-up (5th week), while improvement in the VAS was observed only in the 3rd week in placebo group ($p<0.01$). Pain with motion was significantly decreased in the 3rd and 5th weeks in the US group while it was increased in the 5th week in the placebo group ($p<0.01$). Hand grip strength were improved in the 3rd and 5th weeks in both groups ($p<0.008$). There was no significant difference between the two groups ($p>0.05$). No difference between the two groups was found in terms of general DASH-T scores at the end of the treatment and follow-up. However, improvement in DASH scores in the US group at the 3rd and 5th weeks was significantly higher than in the placebo group ($p<0.017$). Patient satisfaction scores increased in both groups, but satisfaction of patients in the US group was significantly higher than of those in the placebo group ($p<0.001$).

Conclusion: In this study, it was found that US treatment for lateral epicondylitis improved pain and activities of daily living and resulted in high patient satisfaction. *(Turk J Rheumatol 2010; 25: 50-5)*

Key words: Lateral epicondylitis, ultrasound, treatment

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Özet

Amaç: Lateral epikondilit tanısı almış hastalarda ultrason tedavisinin etkinliğini araştırmak ve plasebo ultrason tedavisi ile karşılaştırmaktı.

Yöntem ve Gereçler: Çalışmaya, lateral epikondilit tanısı konan 25-62 yaş (ort. yaş 46.7±8.1) arasında 60 hasta (40 kadın ve 20 erkek) dahil edildi. Hastalar randomize olarak 2 gruba ayrıldı: ultrason (US) grubu ve plasebo grubu. Ultrason grubundaki hastalara (n=30) sürekli ultrason; plasebo grubuna (n=30) ise çalışmayan başlığın kullanıldığı ultrason 5 dakika süreyle 3 hafta boyunca toplam 15 seans uygulandı. Tüm hastalara tedavi süresince (3 hafta) gece splinti verildi. Hastalar tedavi başlangıcı, sonu (3. hafta) ve 15 gün sonra (5. hafta) değerlendirildi. İstirahat ve hareket ağrısı vizüel ağrı skalası (VAS) ile, el sıkma gücü el dinamometresi ile, günlük yaşam aktivite değerlendirmesi Disabilities of the Arm, Shoulder, and Hand (DASH-T) anketi Türkçe versiyonu ile, yaşam kalitesi Short-Form (SF)-36 ölçeği ile değerlendirildi Ayrıca hasta memnuniyeti de sorgulandı.

Bulgular: İstirahat ağrısı (VAS); US grubunda hem tedavi sonunda (3. hafta) hem de 15 gün sonraki takipte (5. hafta) tedavi öncesine göre anlamlı düzelmişti, ancak plasebo grubundaki düzelme sadece 3. haftada gözlendi ($p<0.01$). Hareket ağrısı (VAS) ise US grubunda hem 3. haftada hem de 5. haftada tedavi öncesine göre anlamlı düzelmişti, ancak plasebo grubunda 3. haftadaki anlamlı azalmaya rağmen 5.haftada anlamlı artış gözlendi ($p<0.01$). El sıkma gücü; her iki grupta da tedavi sonunda ve 5. haftadaki takipte tedavi öncesine göre düzelmişti ($p<0.008$), ancak tedavi sonu ile 5. hafta arasında fark yoktu . Her iki grup karşılaştırıldığında ise gruplar arasında farklılık saptanmadı ($p>0.05$). DASH-T skorları açısından iki grup arasında tedavi sonunda ve 15 gün sonraki takipte fark yoktu. Tedavi öncesine göre 3. ve 5. haftalardaki DASH-T'taki değişim, US grubunda plasebo grubuna kıyasla anlamlı yüksekti ($p<0.017$). Hasta memnuniyeti her iki grupta da tedavi ile artmıştı, ancak US grubunda plasebo grubuna göre anlamlı oranda daha yüksekti ($p<0.001$).

Sonuç: Bu çalışmada, ultrason tedavisinin, lateral epikondilitli hastalarda ağrı, günlük yaşam aktiviteleri ve hasta memnuniyetinde anlamlı düzelme sağladığı gösterilmiştir. *(Turk J Rheumatol 2010; 25: 50-5)*

Anahtar sözcükler: Lateral epikondilit, ultrason, tedavi

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Introduction

Tennis elbow or lateral epicondylitis is damage of overuse, which is seen both in working adults and in the nonworking population, causing serious long-term disability. It is a tenoperiostitis originating from the elbow extensor tendons on the lateral epicondylitis of the humerus occurring with sensitivity and pain. It is one of the most frequent causes of elbow pain in adults (1).

To date, many treatment methods have been applied in lateral epicondylitis treatment, including non-steroidal anti-inflammatory drugs, splinting, exercise, massage, manual therapy, physical therapy applications, local injection treatment, and surgery. Within physical therapy applications, surface and deep heaters and electrotherapy were used individually or in combination (2). Ultrasound (US), which is a deep heater agent, is effective with vibration (micro-massage) but primarily through heat in the lateral epicondylitis (3). With its thermal and mechanical effects, it increases local metabolism, blood flow, soft tissue flexibility and regeneration, and membrane permeability, and changes nerve conduction. It reduces pain and increases joint movement opening (4).

The aim of this study was to investigate the effectiveness of US treatment in patients diagnosed with lateral epicondylitis and to compare results with placebo US treatment.

Materials and Methods

Sixty patients aged 25-62 years (average age 46.7±8.1; 40 female, 20 male) who applied to the outpatient clinic between January 2005 and January 2008 and were diagnosed with lateral epicondylitis were recruited into this study.

The study protocol was approved by the hospital ethics committee.

Southampton diagnostic criteria were used for diagnosis of lateral epicondylitis (5). These criteria are defined as: 1) pain in the lateral epicondyle zone for 24 hours or more in the last 7 days, 2) sensitivity on the lateral epicondyle zone, and 3) pain in the lateral epicondyle zone in resistant active extension of the wrist. The patients included in the study underwent routine biochemistry and complete blood investigations. To determine if there were any findings other than the criteria, other pathologies of the wrist zone and cervical discopathies were excluded after US imaging of the wrist and direct radiographs of the wrist and cervical vertebrae.

Pregnant patients, those with bilateral epicondylitis, pacemakers, systemic metabolic diseases (diabetes mellitus, thyroid diseases, etc.), history of chronic inflammatory or neoplastic disease, and cervical or shoulder lesion (those treated by corticosteroid or local anesthetic injection in the last 6 months) were not included in the study.

Study design: In this study, planned as a randomized, single-blind placebo-controlled prospective study, 60 patients included in the study were divided into two groups of 30 patients in a randomized manner as Group I (US group) and Group II (placebo US group). Randomization was made by drawing. Four patients were disqualified from the study for discontinuing the treatment.

Treatment protocol: Patients in Group I (US group) (n=30) underwent a total of 15 US sessions (Petas Petson 250 Ultrasound 2200) for 1 MHz and 1.5 W/cm^2, 5 minutes over three weeks. Patients in Group II (placebo group) (n=30) underwent a total of 15 US sessions with a nonworking head for 5 minutes. To avoid leaving the patients in the placebo group without treatment, an epicondylitis bandage was applied to all patients during treatment (3 weeks). The patients were analyzed clinically before treatment (baseline), at the end of the treatment (3rd week) and 2 weeks after the end of treatment (5th week). The patients did not receive any treatment with any other anti-inflammatory or analgesic drug or any additional physical therapy agent during the treatment.

The US head was changed by a researcher who was blind to the analyses. US application and analyses were also made by another researcher who was blind to the treatment.

Result Scales

Wrist pain complaints of the patients within 24 hours were analyzed by a 10 cm visual analog scale (VAS). The patients were asked to rank the pain sensation on a 10 cm ruler, with 0 indicating no pain and 10 the most severe pain. VAS values of the patients were recorded in entry and exit as relaxation and movement pain (6, 7).

Hand grip strength was measured by Jamar hand dynamometer (with JAMAR, JA Preston Co, Michigan, USA) with the shoulder in the position of adduction and the wrist in 90° flexion. Three measurements were made and their mean was determined (8).

Quality of life was evaluated by Short-Form (SF)-36 scale. SF-36 evaluates eight areas including physical role, physical function, emotional role, social function, general health, pain, vitality, and mental health. Turkish reliability and validity of the SF-36 have been reported, and its Turkish version was used in our study (9).

Activities of daily living were evaluated by the Turkish version of Disabilities of the Arm, Shoulder and Hand (DASH-T). The DASH-T is a measure developed for analysis of disability based on upper limbs and is used for monitoring disability level and treatment utilization. The questionnaire consists of 30 questions related to physical activities and connected symptoms. 1 point was given for no complaint or performance of the specific activity without difficulty and 5 points for disability or performance with complaints. Total score ranged between 30 (best) and 150 (worst) (10, 11).

All assessments were made prior to treatment, at the end of treatment (3rd week) and 2 weeks after the end of treatment (5th week).

Patient satisfaction and response of the patient to treatment were evaluated by asking the patient to select one of the following options: 1, very good; 2, good; 3, moderate; 4, bad; or 5, very bad. In the evaluation regarding satisfaction in the 3rd and 5th weeks, those responding with moderate, bad and very bad levels of satisfaction were determined and results are given as number of subjects and their percentage values.

Statistical Analysis

Analysis of data was made using SPSS for Windows 11.5 package program. Whether distribution of continuous variables was consistent with normal was investigated using Shapiro Wilks test. Definitive statistics were given as mean ± standard deviation or number of observations (%). Whether there was a significant difference between the patient and control groups statistically in terms of continuous variables was assessed by Student's t or Mann-Whitney U test. Fifth week measurements were considered as reference and effects on the change occurring in the 5th week were compared to the 3rd week. Bonferroni correction multiple comparison test was used in the comparisons in the group and significance of change in patient satisfaction ratio was evaluated by McNemar test. Results of $p<0.05$ were considered significant.

Results

Demographic data and pre-treatment evaluation parameters of the patients in both groups are shown in Table 1.

Treatment was started in 18 (60%) female and 12 (40%) male patients in the US group and in 20 (66.7%) female and 10 (33.3%) male patients in the placebo group. In total, 63% of the patients were female and 37% were male.

When ages of the cases were examined, age average was calculated as 46.7±8.1 (min-max 25-62) in the patient group and as 45.4±8.1 (min-max 28-65) in the placebo group.

Patients were grouped in terms of occupation in the categories of housewife, inactive (retired and sedentary patients) and active (those working by using their hands actively). Accordingly, there were 12 housewives, 8 inactive and 10 active patients in the US group and 16 housewives, 4 inactive and 10 active patients in the placebo group. Most of the patients included in the study were housewives.

The right wrist was affected in 23 patients and the left wrist in 7 patients in US and placebo group. The right wrist became stiff more frequently than the left in both groups. Affected dominant hand/non-dominant hand ratio was found as 23/7 (76%) in the placebo group and as 21/9 (70%) in the US group.

The disease period was calculated as an average 8.7±11.5 months (min-max 2-60 months) in the US group and as 6.8±5.3 months (min-max 1-24 months) in the placebo group.

There was no difference between the two groups in terms of gender, age, occupation, affected dominant hand/non-dominant hand ratio, disease period, hand grip strength, or frequency of analgesic use for wrist pain ($p>0.05$). However, DASH-T scores were higher in the US group than placebo group before treatment, and the difference was statistically meaningful ($p<0.05$). Among SF-36 subgroups, only the emotional role difficulty subgroup was meaningfully higher in the US group than placebo group ($p<0.016$). In terms of other subgroups of SF-36, there was no difference between the US and placebo group at the beginning of treatment ($p>0.016$).

A comparison of pre-treatment and post-treatment values of the patients in both groups is shown in Tables 2 and 3.

Rest pain (VAS) had improved meaningfully compared to baseline in the follow-up at the end of treatment (3rd week) and in the 5th week in the US group, but improve-

Table 1. Characteristic features and comparison of the patients in the two groups

	Ultrasound group (n=30)	Placebo group (n=30)	p
Age (year)	46.7 ± 8.1 (25-62)	45.4 ± 8.1 (28-65)	0.537
Gender (Female/Male) (%)	18/12 (60/40)	20/10 (66.7/33.3)	0.592
Profession (housewife/inactive/active) (%)	12/8/10 (40/26.7/33.3)	16/4/10 (53.3/13.3/33.3)	0.386
Disease duration (month)	8.7 ± 11.5 (2-60)	6.8 ± 5.4 (1-24)	0.732
Affected dominant/non-dominant hand (%)	23/7 (76.7/23.3)	23/7 (76.7/23.3)	
VAS- Rest pain	3.5 ± 2.7 (0-10)	2.4 ± 2.1 (0-10)	0.114
VAS- Movement pain	7.3 ± 1.6 (0-10)	6.5 ± 1.7 (0-10)	0.055
Hand grip strength (kg)	21.6 ± 11.5 (5-45)	20.5 ± 9.6 (5-45)	0.958
DASH-T scores	58.6 ± 22.5 (14-91)	46.1 ± 12.7 (24-75)	0.016
SF- 36 Life Quality Scale[a]			
Physical function	21.7 ± 3.3 (13-27)	19.8 ± 5.4 (8-27)	0.376
Physical role	7.0 ± 11.5 (4-8)	4.8 ± 1.0 (3-8)	0.535
Pain	5.7 ± 1.3 (4.2-8.2)	5.1 ± 1.2 (3.2-8.2)	0.023
General health	15.2 ± 3.3 (9-22)	14.5 ± 4.1 (9-22)	0.357
Vitality	14.1 ± 3.8 (6-20)	12.7 ±4.5 (6-20)	0.185
Social function	7.8 ± 1.4 (4-10)	7.4 ± 2.1 (4-10)	0.758
Emotional role	4.7 ±1.0 (3-6)	3.6 ± 0.8 (3-6)	0.001
Mental health	21.6 ± 4.1 (10-28)	19.5 ± 4.4 (11-28)	0.048

Average of values ± standard deviation is given as (min-max).

a $p<0.016$ has been accepted as significant.

VAS: Visual Analog Scale, DASH-T: Disability of Arm, Shoulder and Hand-Turkish

ment in the placebo group was observed only in the 3rd week (p<0.008). General (mean VAS-relaxation obtained during monitoring range) VAS-relaxation averages were similar between the groups (p=0.654). In addition, changes in VAS-relaxation levels that occurred in the 5th week compared to baseline and the 5th week compared to the 3rd week were similar between the groups (p=0.360 and p=0.667).

Movement pain (VAS), however, improved significantly in the US group in both the 3rd week and 5th week compared to baseline; however, in the placebo group, while there was a significant decrease in the 3rd week, there was a significant increase in the 5th week (p<0.001). General VAS-movement averages were similar between the groups (p=0.318). In addition, changes in VAS-movement that occurred in the 5th week compared to baseline and 5th week compared to the 3rd week were similar between the groups (p=0.055 and p=0.582).

Hand grip strength had improved considerably during monitoring in the 3rd week and 5th week compared to pre-treatment in the US group (p=0.017). However, there was no difference between 3rd week and 5th week values. When the two groups were compared, general hand grip strength averages were similar (p=0.310). Again, changes in hand grip strength in the 5th week compared to baseline and in the 5th week compared to the 3rd week were similar between the groups (p=0.648 and p=0.840) (Table 2).

A significant decrease was found in DASH level in the 5th week compared to baseline according to DASH-T scores (p=0.002). Third week and 5th week DASH averages were similar (p=0.779). Although general DASH averages were similar between the groups (p=0.861), change in DASH in the 5th week compared to baseline was significantly higher in the US than placebo group (p<0.017).

When patient satisfaction was compared between groups, level of satisfaction in both the 3rd and 5th weeks was better than in the US group (3rd week p<0.001; 5th week p=0.020) (Table 2).

Among SF-36 quality of life scale subgroups, no significant change was found in physical function level in the 5th week compared to baseline and 3rd week (p=0.519 and p=0.937). However, general physical function averages in the US group were significantly higher than in the placebo group (p=0.035). In addition, changes in physical function level in the 5th week compared to baseline and in the 5th week compared to the 3rd week were similar between the groups (p=0.608 and p=0.882).

Although social function and emotional condition showed significant improvement in the US group in the 3rd week and 5th week compared to pre-treatment (p<0.017), it did not change in the placebo group. General social function averages were similar between the groups (p=0.079). In addition, changes in social function level in the 5th week compared to baseline and in the 5th week compared to the 3rd week were similar between the groups (p=0.542 and p=0.874) (Table 3).

No significant change was seen in the SF-36 pain subgroup in the 5th week compared to baseline and 3rd week in both groups (p=0.088 and p=0.805). General SF-36 pain averages were significantly higher in the US group than the placebo group (p=0.008). In addition, changes in SF-36 pain level in the 5th week compared to baseline and in the 5th week compared to the 3rd week were similar between the groups (p=0.397 and p=0.429) (Table 3).

Discussion

We investigated in this study the effect of US treatment on pain, hand grip strength, quality of life, and activities of daily living in patients with a lateral epicondylitis diagnosis and we compared results with placebo treatment.

Table 2. Comparison of the pre- and post-treatment values of the two groups

Variables	Pre-treatment	3rd week	5th week	5th week-baseline change	5th week-3rd week change
VAS-rest pain					
Ultrasound group	3.5±2.7[a,b]	2.1±1.8[a]	2.1±2.2[b]	-1.3±2.1	0.03±1.1
Placebo group	2.4±2.1[a]	1.5±1.9[a]	1.9±2.3	-0.5±1.7	0.4±0.9
VAS-movement pain					
Ultrasound group	7.3±1.6[a,b]	4.5±2.2[a]	4.8±2.3[b]	-2.5±1.9	0.4±1.1
Placebo group	6.5±1.7[a,b]	4.6 ±2.4[a,c]	5.4±2.2[b,c]	-1.0±1.6	0.8±1.2
Hand grip strength					
Ultrasound group	21.6±11.5[a,b]	25.3±11.8[a]	25.5±12.0[b]	3.8±5.7	0.2±4.3
Placebo group	20.5±9.5[a]	23.1±10.6[a]	22.5±10.5	2.0±3.9	-0.7±2.9
DASH-T					
Ultrasound group	58.6±22.5[a,b]	42.7±20.1[a]	43.9±20.4[b]	-14.7±14.6	1.2±6.7
Placebo group	46.0±12.7[a]	40.8±10.7[a]	43.2±12.2	-2.9±7.0	2.4±4.8
Satisfaction					
Ultrasound group	--	15 (50%)[d]	21 (70%)[d]	9 (30%)	-
Placebo group	--	27 (90%)[d]	28 (93.3%)[d]	11 (36.7%)	-

[a]: Difference between pretreatment and 3rd week is statistically significant (p<0.05)
[b]: Difference between pretreatment and 5th week is statistically significant (p<0.05)
[c]: Difference between 3rd week and 5th week is statistically significant (p<0.05)
[d]: Difference between ultrasound and placebo groups is statistically significant (3rd week p<0.001 and 5th week p=0.020) (number of subjects and % values by taking the total of satisfied responses from the point of moderate, bad and very bad degrees
Abbreviations: VAS: Visual Analog Scale, DASH-T: Diseases of the Arm, Shoulder and Hand-Turkish

The joint capsule, tendon and soft tissue lose their elasticity due to water loss generally after the age of 30 and become more fragile. Therefore, upper limb repetitions cause epicondylitis more easily in patients over 30 (4). The fact that most of the patients included in our study were between 30-60 supports this opinion.

Most of the patients included in our study were women. This was also reported in similar studies carried out in our country and abroad (12, 13). Most researchers agree that according to occupation distribution, the majority of patients are housewives (14).

When cases were examined in terms of localization, pathology was localized on the right wrist in most cases. These results are consistent with the literature data indicating that lateral epicondylitis is on the dominant side in many people; therefore, the right arm, which is more frequently exposed to microtraumas due to excessive repetitive activities, is usually stiff (15, 16).

It was also shown in the literature that US is effective in placebo-controlled, double- blind studies. In the study carried out by Hong et al. (17), US treatment was applied to the patients in 1-2 W/cm^2 dose, for 10 minutes 2-3 times a week for 4-6 weeks. Sixty-three percent of all patients were treated according to this schedule. The placebo group obtained only 29% benefit. Again, in another study carried out by Binder et al. (18) including a comparison of US and placebo, positive improvements were reported in pain and functional condition in 63% of the patients treated by US, and these effects were reported to continue during monitoring for one year. In this study, we also found a significant improvement in the pain during relaxation and movement in the patients who underwent US application at the end of treatment compared to pre-treatment, but this recovery was not different from the placebo group. Although the efficiency of US continued during monitoring, the effect of the placebo disappeared. This result shows that long-term effects of US are superior to placebo in the treatment of lateral epicondylitis.

We found an increase in hand grip strength in patients in the US and placebo groups at the end of treatment, and we observed that this effect continued in the 5th week in the US group. However, there was no difference between two groups. Similar to our results, in the study carried out by Binder et al. (18), patients received either US or placebo treatment. A comparison of the groups showed no superiority of US over placebo in terms of hand grip strength. Likewise, no difference was found between the patients applied pulsed US and placebo US in terms of hand grip strength in the study conducted by Haker et al. (19).

In terms of daily living activities, recovery in the US group was found more significant at the end of treatment and in the 5th week than in the placebo group, but improvement was seen in both groups. It was also stated in the study of Binder et al. (18) that improvement was

Table 3. Comparison of SF-36 life quality scale values of the patients in the two groups before and after treatment

Variables	Pretreatment	3rd week	5th week	5th week-baseline change	5th week-3rd week change
Physical function					
Ultrasound group	21.73±3.31	22.43±3.67	22.53±3.97	0.80±2.55	0.1±1.2
Placebo group	19.83±5.48	19.90±5.67	19.73±5.91	-0.10±1.49	-0.2±1.1
Physical role					
Ultrasound group	5.03±1.16	5.23±1.22	5.33±1.27	0.30±0.60	0.1±0.3
Placebo group	4.83±1.09	4.83±1.23	4.70±1.37	-0.13±0.78	-0.1±0.9
Pain[c]					
Ultrasound group	5.79±1.31	6.33±1.64	6.43±1.67	0.64±1.39	0.1±0.8
Placebo group	5.11±1.21	5.67±1.65	5.30±1.52	0.19±1.23	-0.4±0.8
General health					
Ultrasound group	15.27±3.39	15.73±3.51	15.75±3.68	0.48±1.67	0.01±0.9
Placebo group	14.51±4.13	14.57±4.33	14.51±4.15	0.00±0.98	-0.1±0.9
Vitality					
Ultrasound group	14.13±3.82	14.50±3.71	14.40±3.83	0.27±1.82	-0.1±1.1
Placebo group	12.77±4.56	12.73±4.59	12.53±4.67	-0.23±0.57	-0.2±0.4
Social function					
Ultrasound group	7.80±1.47[a.b]	8.13±1.43[a]	8.13±1.43 [b]	0.33±0.66	0.0±0.4
Placebo group	7.40±2.16	7.23±1.98	7.33±1.99	-0.07±0.64	0.1±0.5
Emotional situation					
Ultrasound group	4.70±1.02[a.b]	5.10±0.99[a]	5.03±1.10[b]	0.33±0.55	-0.1±0.4
Placebo group	3.63±0.81	3.80±1.00	3.73±0.98	0.10±0.48	-0.1±0.4
Mental health					
Ultrasound group	21.67±4.20	21.53±4.21	21.50±4.33	-0.17±0.59	-0.03±0.8
Placebo group	19.57±4.41	19.33±4.44	19.40±4.22	-0.17±0.87	0.1±0.9

[a]: Difference between baseline and 3rd week is statistically significant (p<0.05)
[b]: Difference between baseline and 5th week is statistically significant (p<0.05)
[c]: Difference between ultrasound and placebo groups is statistically significant (p<0.05)
SF36; Short-Form 36 life quality scale

found in activities of daily living. However, unlike in our study, recovery was only seen in the US group and no change was found in the placebo group.

Furthermore, the decrease found in emotional role difficulty in SF-36 quality of life index in the US group was greater than in the placebo group at the end of treatment in our study, and this situation was found to continue during the follow-up as well. There was a decrease in pain in the follow-up in the 5th week compared to baseline in the US group in comparison with the placebo group. Likewise, a significant improvement was seen in social function in the US group at the end of treatment and during follow-up compared to baseline. This result led us to think that pain and activity restriction caused by lateral epicondylitis adversely affect the quality of life of patients and that any decrease in pain positively affects the participation of patients in the emotional and social areas. To our knowledge, there is no study in the literature regarding SF-36 in lateral epicondylitis.

Improvement in terms of patient satisfaction was greater both at the end of treatment and in the 5th week in the US group compared to the placebo group. However, there was a decrease in satisfaction in the 5th week in both groups. This may result in a conclusion that US is more effective in the short term and starts to lose its effect in the long term. Trudel et al. (20) supported this case with their report that short-term effects of US reduce pain in lateral epicondylitis. It was found in the study of D'Vaz et al. (21) that patient satisfaction is higher at the end of the treatment in patients receiving US treatment compared to the placebo group.

Epicondylitis bandages, which are often used in conservative treatment, have been designed to distribute the load imposed on the starting point of hand-wrist extensors during repetitive activity. In biomechanical studies, it was shown that this bandage is effective in reducing both vibration amplitude and acceleration (22). In our study, the aim of bandaging used in both patient groups was to reduce the load on extensor muscles, thus preventing formation of pain during extensor muscle activity.

In our study, the positive results obtained in pain, activities of daily living and patient satisfaction especially in the US group may be interpreted as supporting that US treatment has a significant effect in the course of the disease. However, this effect was not superior to the placebo group in the short term.

According to results of our study, a decrease especially in pain and accordingly improvement in functional condition and activities of daily living were observed in the patients with lateral epicondylitis receiving US treatment. Therefore, we concluded that US treatment is a safe treatment alternative in patients with lateral epicondylitis. However, the short monitoring period is the limitation of the study. Thus, studies with longer monitoring periods are needed.

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Conflict of Interest

No conflict of interest is declared by the authors.

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