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Comparison of Clinical Outcomes on Different Treatment Methods for Patients with Lateral Epicondylitis

Lateral Epikondilitli Hastalarda Farklı Tedavi Yöntemlerinin Klinik Sonuçlarının Karşılaştırılması

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ABSTRACT

Aim: In our study, the effectiveness of steroid injection therapy, extracorporeal shock wave therapy (ESWT) and splint use in the treatment of lateral epicondylitis, were compared.
Methods: A total of 97 patients (28 males, 57 females, mean age: 47 years) with a clinical diagnosis of lateral epicondylitis were included in the study. The patients were divided into three treatment groups. Steroid injection was applied to 30 patients, ESWT treatment to 28 patients, and bandage treatment to 29 patients. Patients were evaluated with Visual analog scale (VAS) and Disabilities of the Arm, Shoulder and Hand (DASH) scores before and after treatment.
Results: A decrease in VAS and DASH scores and clinical improvement compared to pre-treatment were observed in all three groups. Although positive results were obtained with all three treatment methods, we found that the most statistically significant treatment method was steroid injection. Better results were obtained in the group that received steroid injection with the peppering technique. ($p<0.05$).
Conclusion: The results of this study showed that local steroid injection, ESWT application and bandage treatment may be beneficial in the short term in the treatment of patients with lateral epicondylitis. However, it was evaluated that the best improvement in scores was obtained with local steroid injection with the peppering technique, whereas the least improvement was obtained with bandage treatment.

Keywords: Lateral epicondylitis, Elbow, Tendinitis, Tennis elbow

ÖZ

Amaç: Çalışmamızda lateral epikondilit tedavisinde steroid enjeksiyon tedavisi, ekstrakorporeal şok dalga tedavisi (ESWT) ve splint kullanımının etkinliği karşılaştırıldı.
Yöntemler: Klinik olarak lateral epikondilit tanısı alan toplam 97 hasta (28 erkek, 57 kadın, ortalama yaş: 47) çalışmaya dahil edildi. Hastalar üç tedavi grubuna ayrıldı. 30 hastaya steroid enjeksiyonu, 28 hastaya ESWT tedavisi, 29 hastaya bandaj tedavisi uygulandı. Hastalar tedavi öncesi ve sonrası Visual analog scale (VAS) ve Disabilities of the Arm, Shoulder and Hand (DASH) skorları ile değerlendirildi.
Bulgular: Her üç grupta da tedavi öncesine göre VAS ve DASH skorlarında azalma ve klinik düzelme gözlendi. Her üç tedavi yönteminde de olumlu sonuçlar elde edilmesine rağmen istatistiksel olarak en anlamlı tedavi yönteminin steroid enjeksiyonu olduğunu saptadık. Biberleme (peppering) tekniği ile steroid enjeksiyonu yapılan grupta daha iyi sonuçlar alındı. ($p<0.05$).
Sonuç: Bu çalışmanın sonuçları lateral epikondilitli hastaların tedavisinde lokal steroid enjeksiyonu, ESWT uygulaması ve bandaj tedavisinin kısa dönemde faydalı olabileceğini göstermiştir. Ancak skorlarda en iyi iyileşmenin biberleme tekniği ile lokal steroid enjeksiyonu, en az iyileşmenin ise bandaj tedavisi ile elde edildiği değerlendirildi.

Anahtar kelimeler: Lateral epikondilit, Dirsek, Tendinit, Tenisçi dirseği

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INTRODUCTION

Lateral epicondylitis (LE) is known as tennis elbow. It is characterized by pain and tenderness around the lateral epicondyle at the elbow and it usually occurs as a result of repetitive use of the wrist extensor group muscles [1]. The diagnosis of LE is often made by anamnesis and physical examination. These patients often describe pain when lifting objects and using the forearm. The incidence of LE is 1 to 3% and it is more common among women. Although etiological factors, such as microtear of the musculotendinous part of the extensor carpi radialis brevis or non-inflammatory tendinosis of the lateral epicondylitis are blamed, microscopically, it is evaluated as tendinosis with widespread fibrosis in the lateral epicondyle region, vascular hyperplasia and irregular collagen alignment [2,3]. Non-operative treatment is recommended as initial therapy for LE and is considered successful in the majority of patients [2].

There are many various options available in the treatment of lateral epicondylitis. Among these, rest, orthosis use, physical therapy modalities, nonsteroidal anti-inflammatory drugs (NSAID) and injections (corticosteroid, autologous blood, platelet-rich plasma, prolotherapy), are the commonly used treatments [4]. Extracorporeal shock wave therapy (ESWT) is a method that is also frequently used in treatment, despite varying results in the current literature [5]. Corticosteroid injection is currently among the most widely used treatments and provides significant short-term relief of symptoms [6,7]. There are also studies on the effectiveness of various splints in the treatment of lateral epicondylitis [4,8].

There are many studies on the efficacy and/or comparative results of treatment modalities [2-8]. However, there is insufficient objective evidence and little consensus on which treatment is more effective [4,7]. Moreover, to the best of our knowledge, there are no studies which have evaluated and compared cortisone, ESWT and splint treatments together.

In this study, we aimed to compare the efficacy of treatment in patients who received ESWT, corticosteroid or a forearm band retrospectively.

PATIENTS AND METHODS

Patients who applied to our clinic with the complaint of lateral elbow pain and diagnosed with lateral epicondylitis by anamnesis and physical examination, were evaluated. Patients with complaints of increased pain with palpation of the lateral epicondyle, grip or resistant extension of the wrist for at least six weeks were included in the study. After providing information about the risks of the treatment methods based on the study, their effect on the quality of life and the average treatment process, the choice of treatment was left to the patient. Patients who did not receive any treatment despite having pain in the previous six weeks were included in the study, but the following exclusion criteria were applied: patients with cervical radiculopathy, traumatic elbow joint pathology, arthritis, peripheral nerve compression neuropathy, previous elbow surgery and systemic or neurological disorders in the affected side upper extremity. In addition, patients who had been treated for an elbow pain or had a corticosteroid injection for elbow pain in the previous three months were also excluded from the study. Ethics committee approval required for this study was obtained from the Local Ethical Committee. (Number: 10354421-2022/04-02).

All patients were informed about the procedures to be applied and their consent was obtained. Our study was carried out in accordance with the Declaration of Helsinki.

The patients included in the study were divided into three groups as steroid injection, physical therapy (ESWT) and splint group. All patients were evaluated with VAS and DASH scores before and after the application. No additional treatment method was applied to the patients in all three groups except the treatment applied in their own group.

Treatment protocol

For patients in the corticosteroid group (group 1), a single dose of 0.5 mL of corticosteroid (betamethasone dipropianate 6.43 mg, betamethasone sodium phosphate 2.63 mg) and 0.5 mL of local anesthetic (2% lidocaine, epinephrine) was applied in the painful epicondyle area under sterile conditions; the most painful

point was determined and the tissue with multiple stretches (peppering technique) was applied (Figure 1).

Figure 1: İnjection with peppering technique

The same protocol was applied to the patients in the ESWT group (group 2) as 1.6 bar, 15.0 Hz, 2000 beats, one day/week, for a total of three weeks (Figure 2). ESWT procedure was performed with Vibrolith Ortho brand device.

Figure 2: ESWT therapy in physiotherapy laboratory

Lateral epicondylitis bandage was applied to the patients in the splint group (group 3). The epicondylitis bandage was applied to the forearm 4-5 cm distal to the epicondyle. Bandages were used for 6 weeks. They were told to put on the bandage when they woke up and only remove it at night in the process (Figure 3). Scoring was done by providing controls to the patients once before the treatment and once every two weeks after the treatment.

Figure 3: Patient with lateral epicondylitis bandage

Statistical method

Data was evaluated with the SPSS 25.0 (IBM SPSS Statistics 25 software (Armonk, NY: IBM Corp.)). Continuous variables were given as mean ± standard deviation, median (25th to 75th percentiles (IQR), mimum and maximum values, and categorical variables were given as numbers and percentages. The Shapiro Wilk test was used to examine the conformity of the data to the normal distribution. When the parametric test assumptions were not met, the Kruskal-Wallis's analysis of variance was used to compare independent group differences. The Dunn Test was used for pairwise analyses in studies with statistically significant differences. Calculation of delta values was made using the difference values obtained between measurements. Examination of the normal distribution in dependent group examinations was done by using delta values. In dependent group comparisons, when parametric test assumptions were provided, paired samples t test was used; when parametric test assumptions were not met, the Wilcoxon signed rank test was used. In addition, delta values and Cohen d effect size values were used in the comparison of the changes between the three groups. Differences between categorical variables were analyzed with the Chi-square test. In all studies, $p<0.05$ was considered statistically significant.

RESULTS

Results of 97 patients, 29 (29.89%) male and 58 (59.79%) female, were evaluated. The mean age of the patients was 47 years. The right side was affected in 55 (56.70%) of the patients, and the left side was affected in 42 (43.29). There was no statistically significant difference between the groups in terms of age and gender. However, in the examination made according to the parties, it was seen that there was a statistically significant difference between the three groups. The rate of occurrence on the right side in the steroid group was statistically significantly higher than in the Splint group (Table 1).

Table 1.

group		1(steroid)	2(ESWT)	3(Bandage)	p
side	Right	23 (%76,7)	19 (%67,9)	13 (%44,8)	0.033* (cs=6.811)b
	Left	7 (%23,3)	9 (%32,1)	16 (%55,2)	
gender	Woman	19 (%63,3)	17 (%60,7)	22 (%75,9)	0.427 (cs=1.7)
	Male	11 (%36,7)	11 (%39,3)	7 (%24,1)	
age	A.M ± S.D	48,2 ± 7,64	46,21 ± 7,34	46,76 ± 8,28	0.758 (kw=0.555)
	Med (IQR)	46 (43 - 54)	47 (40,25 - 50)	49 (40 - 53,5)	
	min - max	37 - 75	34 - 64	30 - 61	

*p<0.05 statistically significant difference; A.M: Arithmetic mean; S.D: standard deviation; Med (IQR): Median (25th-75th percentiles); min – max: Minimum – maximum; b: Significant difference between 1st and 3rd groups, cs: Chi-Square test; kw: Kruskal Wallis Variance Analysis;

In the DASH1 examination, there was a statistically significant difference between the three groups. The values of the Splint Group were found to be significantly lower than the values of the Steroid and ESWT groups. No statistically significant difference was found between the three groups in the DASH2 examination (Table 2). It was observed that the difference (delta) values obtained from DASH1 and DASH2 measurements showed statistically significant differences between the three groups. The values of the Splint Group were found to be significantly lower than the values of the Steroid and ESWT groups. The change in the splint group was significantly less than in the other groups (Table 2).

When the within-group changes of DASH examinations were examined, it was seen that the changes before and after the three groups were statistically significant. It is seen that the 2nd measurement values in all three groups showed a significant decrease compared to the 1st measurement. When the changes in each group were examined with the Cohen effect size, it was seen that Cohen d=7.18 in the steroid group, Cohen d=0.87 in the ESWT group and Cohen d=4.36 in the Splint group. It was seen that the most effective change was in the Steroid group and the lowest change was in the ESWT group (Table 2).

In the DASHD examination, there was a statistically significant difference between the 3 groups. The values of the Splint Group were found to be significantly lower than the values of the Steroid and ESWT groups (Table 2).

In the VAS1 examination, there was a statistically significant difference between the three groups. The values of the Splint Group were found to be significantly lower than the values of the Steroid and ESWT groups. No statistically significant difference was found between the three groups in the VAS2 examination (Table 2).

It was observed that the difference (delta) values obtained from VAS1 and VAS2 measurements showed statistically significant differences between the three groups. The values of the Splint Group were found to be significantly lower than the values of the Steroid and ESWT groups. The change in the splint group was significantly less than in the other groups (Table 2).

When the intra-group changes of VAS examinations were examined, it was seen that the changes before and after were statistically significant in all three groups. It is seen that the 2nd measurement values in all three groups showed a significant decrease compared to the 1st measurement. When the changes in each group were analyzed with the Cohen effect size, it was seen that it was Cohen d=0.880 in the steroid group, Cohen d=0.879 in the ESWT group and Cohen d=0.887 in the Splint group. It was seen that the most effective change was in the Splint group and the lowest change was in the ESWT group. Considering the effect sizes, it can be said that the changes in the groups do not show a significant clinical difference (Table 2).

In the VASD examination, it was observed that

Table 2.

group		Steroid	ESWT	Splint	p
DASH1	A.M ± S.D	74,25 ± 7,26	77,59 ± 5,39	61,03 ± 10,77	0.0001* (kw=32.810)bc
	Med (IQR)	73,75 (68,78 - 81,7)	77,9 (74,6 - 81,48)	60 (54,59 - 67,92)	
	min - max	62,5 - 85,8	62,5 - 88,3	43,33 - 82,5	
DASH2	A.M ± S.D	9,21 ± 8,8	14,83 ± 13,4	10,42 ± 5,24	0.147 (kw=3.839)
	Med (IQR)	7,9 (0 - 15,2)	14,2 (4,4 - 22,3)	10 (6,67 - 12,5)	
	min - max	0 - 31,7	0 - 63,3	2,5 - 26,23	
In-group p		0.0001* (t=39.309)	0.0001* (z=-4.623)	0.0001* (t=23.482)	
Delta DASH	A.M ± S.D	65.03 ± 9.06	62.76 ± 15.25	50.62 ± 11.61	0.0001* (kw=23.834)bc
	Med (IQR)	65.85 (57.9 - 72.5)	64.95 (53.13 - 73.9)	50.83 (45.84 - 55.84)	
	min - max	43.3 - 85.8	5.9 - 88.3	17.1 - 73.33	
DASHD	A.M ± S.D	65,03 ± 9,06	62,76 ± 15,25	50,62 ± 11,61	0.0001* (kw=23.834)bc
	Med (IQR)	65,85 (57,9 - 72,5)	64,95 (53,13 - 73,9)	50,83 (45,84 - 55,84)	
	min - max	43,3 - 85,8	5,9 - 88,3	17,1 - 73,33	
VAS1	A.M ± S.D	9,3 ± 0,79	8,61 ± 1,13	6,07 ± 1,25	0.0001* (kw=53.086)bc
	Med (IQR)	9 (9 - 10)	9 (8 - 9,75)	6 (5 - 7)	
	min - max	7 - 10	6 - 10	3 - 8	
VAS2	A.M ± S.D	1,27 ± 1,6	0,96 ± 0,92	0,76 ± 0,91	0.358 (kw=2.057)
	Med (IQR)	1 (0 - 2)	1 (0 - 2)	1 (0 - 1)	
	min - max	0 - 8	0 - 2	0 - 4	
In-group p		0.0001* (z=-4.822)	0.0001* (z=-4.656)	0.0001* (z=-4.775)	
Delta VAS	A.M ± S.D	8.03 ± 1.52	7.64 ± 1.25	5.31 ± 0.97	0.0001* (kw=48.623)bc
	Med (IQR)	8 (7 - 9)	8 (7 - 8)	5 (5 - 6)	
		2 - 10	6 - 10	3 - 7	
VASD	A.M ± S.D	8,03 ± 1,52	7,64 ± 1,25	5,31 ± 0,97	0.0001* (kw=48.623)bc
	Med (IQR)	8 (7 - 9)	8 (7 - 8)	5 (5 - 6)	
	min - max	2 - 10	6 - 10	3 - 7	

*p<0.05 statistically significant difference; A.M: Arithmetic mean; S.D: standard deviation; Med (IQR): Median (25th-75th percentiles); min – max: Minimum – maximum; b: Significant difference between 1st and 3rd groups c: Significant difference between the 2nd and 3rd groups, kw: Kruskal Wallis Variance Analysis; t: Paired samples t test; z: Wilcoxon Signed Rank test

there was a statistically significant difference between the three groups. The values of the Splint Group were found to be significantly lower than the values of the Steroid and ESWT groups (Table 2).

DISCUSSION

The main results of this study show that LE patients benefit from all three treatments. However, considering the average recovery scores, it was found that the least effective method was the epicondylitis bandage treatment.

There are many studies on the efficacy and/or comparative results of treatment modalities [2-8]. Although there are a number of methods for the conservative treatment of lateral epicondylitis, the evidence on the effectiveness of treatment methods is insufficient due to methodological differences between studies [9]. Also, there is insufficient objective evidence and consensus on which treatment is more effective [4,7].

In the literature, there are mostly reports on the results of steroid injection, and it is reported that the results of short-term treatment are particularly successful [6,7]. Tonks JH et al. [10], based on the results of their prospective randomized controlled trial, advocate steroid injection alone as the first treatment option in patients presenting with tennis elbow and demanding a rapid return to daily activities [9]. However, the method of administration of steroid injection in the lateral epicondylitis also seems important. Many studies have reported that injection with the peppering technique (multiple injections into the sensitive area after the needle insertion, injection without leaving the skin, withdrawal, redirection and repositioning),

is more effective than a single point injection [11,12,13]. Altay at al. reported that injection with the peppering technique was a reliable method in one-year follow-up in their study in which they compared local anesthetic (lidocaine) alone with the combination of lidocaine and triamcinolone, and applied the peppering technique [11]. Okçu et al. evaluated the clinical results of single injection and peppering injection in patients who applied betamethasone and 1 ml prilocaine combination with DASH Turkish score [12]. As a result, they stated that the late treatment success in lateral epicondylitis depends on the injection technique rather than the local effect of the corticosteroid, and the peppering technique gives long-term and more effective results. Doğramacı et al. evaluated the results with VAS and satisfaction score at the 3rd week and 6th month in their prospective randomized studies in which they applied 1 mL triamcinolone and 1 mL lidocaine combination as a single injection, the same combination with the peppering technique and lidocaine alone with the peppering technique [13]. The authors reported that the peppering technique of corticosteroid injection was associated with the best results. In our study, the most significant improvement was observed in the DASH and VAS scores after the application, compared to the pre-application in the steroid group made with the peppering technique.

In addition to many treatment methods, non-operative measures such as extracorporeal shock wave therapy, have been extensively evaluated in recent years. Various studies have reported that ESWT is successful in the treatment of lateral epicondylitis. [5,9,14,15]. Guler et al. evaluated the results in ESWT and placebo patients according to VAS and clinical results. They reported that the VAS results were significantly better in the ESWT group, but the clinical results did not differ significantly [5]. Yuruk et al. divided the patients with lateral epicondylitis into two groups as exercise and ESWT, placebo and exercise, and then applied 2000 beats per week to the ESWT group for a total of three sessions. Patients were evaluated at six and twelve weeks at the end of treatment. The authors reported that although VAS scores were similar in both groups, the ESWT group was significantly better in terms of comprehension and functionality [9]. Erdem et al. reported that patients diagnosed with lateral epicondylitis had better VAS and clinical scores compared to the control group, in which they applied three sessions of ESWT treatment, once every 2000 beats a week [15].

In our study, the protocol was applied to the patients in the ESWT group for a total of three weeks, with 2000 beats, once a week. It was observed that the post-application scores of the patients improved significantly compared to the pre-application scores.

Although some studies have presented results regarding the short-term benefits of splinting, there is insufficient evidence of long-term benefit compared to other treatment modalities [16]. Moreover, it is stated that long-term splint applications may cause negative consequences such as forearm muscle weakness and atrophy [14]. They stated that corticosteroid, autologous blood and prolotherapy injections may be beneficial in the treatment of LE. However, the authors reported that the use of wrist splints did not provide an increase in grip strength and functional improvement, although it reduced pain [4]. Bisset LM et al., in their study where they compared the effectiveness of two different splints, applied a counterforce brace applied to the forearm and forearm-elbow. They stated that both bandage applications had a positive effect in the short term. However, the authors stated that the forearm bandage was sufficient [17]. Belhan and Karakurt, in their study comparing lateral epicondyle bandage and steroid injection in patients with LE, reported that steroid injection was more effective than lateral epicondyle bandage [18].

In our study, epicondylitis bandage was applied to the forearm from 4-5 cm distal to the epicondyle in patients in the splint group. Although there was an improvement in the scores after the application compared to prior, the least significant improvement was observed in the bandage group compared to the other treatment groups.

LE usually occurs between the ages of 35-50 and affects men and women equally [9]. However, it has been stated that female gender, dominant side and manual labour are important risk factors for lateral epicondylitis [19]. In our study, there was no significant difference between the genders. There was, however, a statistically significant

difference in terms of sides in our study. We did not investigate whether the affected side of the patients was dominant and the statistical difference in terms of parties may be related to this fact.

Although many treatment methods have been described in the treatment of lateral epicondylitis, the most important problem regarding the frequently used treatments such as steroid, ESWT and splint is that there does not exist a complete consensus in the literature on the dosage, namely steroid applications in different doses and active ingredients, and application method of these treatments [2-9,12-17]. Similarly, we could not find any application concensus on issues such as ESWT frequency, dose, number of strokes and duration. Similarly, when studies on the results of splint treatment are carefully examined in the literature, it is seen that different splints, bandages, etc. are used. Different corticosteroids and different doses of administration [20], betamethasone [12], triamcinolone [13] or methylprednisolone [21] have been reported in the literature. There are different splint applications [4,17] and finally ESWT applications at different durations and doses [5,9,15]. It is therefore very challenging to make comparisons due to methodological differences between studies in the literature.

Limitations: The limitations of this study are that we only researched the short-term results and did not perform a dominant-side research in the study. The fact that the study was not randomized prospective may also be a limitation.

Conclusion: The results of this study show that local steroid injection, ESWT application and bandage treatment may be beneficial in the short term, in the treatment of patients with lateral epicondylitis. However, it was evaluated that the best improvement in scores was obtained with local steroid injection with the peppering technique, whereas the least improvement was obtained with bandage treatment.

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