

# Comparison of the effectiveness of local corticosteroid injection and extracorporeal shock wave therapy in patients with lateral epicondylitis

MÜNEVVER SERDAROĞLU BEYAZAL<sup>1)\*</sup>, GÜL DEVRİMSEL<sup>1)</sup>

<sup>1)</sup> Department of Physical Medicine and Rehabilitation, School of Medicine, Recep Tayyip Erdoğan University: 53100 Rize, Turkey

**Abstract** [Purpose] This study aimed to determine and compare the effectiveness of extracorporeal shock wave therapy and local corticosteroid injection in patients with lateral epicondylitis. [Subjects and Methods] Sixty-four patients with lateral epicondylitis were randomly divided into extracorporeal shock wave therapy and steroid injection groups. Patients were evaluated using hand grip strength, visual analog scale, and short-form McGill pain questionnaire at baseline and at 4 and 12 weeks post-treatment. [Results] Both groups showed statistically significant increase in hand grip strength and decreases on the visual analog scale and short form McGill pain questionnaire overtime. There was no statistically significant difference in the percentage of improvement in hand grip strength and on the short-form McGill pain questionnaire between groups at 4 weeks post-treatment, whereas the extracorporeal shock wave therapy group showed better results on the visual analog scale. The percentages of improvements in all 3 parameters were higher in the extracorporeal shock wave therapy group than in the injection group at 12 weeks post-treatment. [Conclusion] Both the extracorporeal shock wave therapy and steroid injection were safe and effective in the treatment of lateral epicondylitis. However, extracorporeal shock wave therapy demonstrated better outcomes than steroid injection at the long-term follow-up.

**Key words:** Lateral epicondylitis, Corticosteroid injection, Extracorporeal shock wave therapy

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## INTRODUCTION

Lateral epicondylitis (LE) is a common musculoskeletal condition that affects 1–3% of the adult population and 2% and 23% of the working population<sup>1)</sup>. Males and females are affected equally, and it commonly presents between the ages of 35 and 50 years<sup>2)</sup>. The tendinous origin of the extensor carpi radialis brevis is the area of the most pathologic change. Overuse or repetitive trauma in this area causes fibrosis and microtears in the involved tissues<sup>3)</sup>. Elbow pain is the presenting complaint in patients with epicondylitis. Tenderness on palpation of the lateral epicondyle and origin of the wrist extensor muscles is suggestive of LE<sup>4)</sup>.

The primary goals of LE treatment are reduction in pain, preservation of motion, flexibility, and strength, and improved endurance<sup>5)</sup>. Nonoperative management is the keystone of LE treatment, with improvement reported in up to 95% of the cases. Physical therapy, activity modification, nonsteroidal anti-inflammatory drugs, and injections are the primary nonoperative modalities<sup>6)</sup>. A recent systematic

review and meta-analysis revealed that beyond 8 weeks, the glucocorticoid injection was no more effective than placebo<sup>7)</sup>.

Extracorporeal shock wave therapy (ESWT) has been used in the treatment of LE that is refractory to conservative treatment<sup>4)</sup>. In ESWT, extracorporeal shockwaves are applied to lesions to help revascularization and stimulate or reactivate the process of connective tissue and bone healing, thereby relieving pain and improving function<sup>8)</sup>. There are conflicting reports in the literature regarding the effectiveness of ESWT in LE. Although some studies have reported significant improvement in hand grip strength (HGS), pain score, and functional score after ESWT<sup>9–11)</sup>, a recent systematic review of ESWT revealed platinum level evidence for little to no benefit from this procedure in the treatment of lateral elbow pain<sup>12)</sup>.

This study aimed to determine and compare the effectiveness of ESWT and steroid injection treatment in patients with LE.

## SUBJECTS AND METHODS

This study was approved by the local ethics committee of our institution and performed in accordance with the principles stated in the 1975 Declaration of Helsinki. All patients provided written informed consent prior to participation. Sixty-four consecutive patients (54 females and 10 males, age range 26–57 years) diagnosed with LE, who were

\*Corresponding author. Münevver Serdaroglu Beyazal (E-mail: drmunser@yahoo.com)

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**Table 1.** Demographic characteristics of the participants according to groups

	ESWT group (n=32)	Injection group (n=32)
Age (mean±SD) (years)	38.7±9.1	42.6±6.6
Gender (F/M) (%)	26/6 (81.3/18.8)	28/4 (87.5/12.5)
Weight (kg)	75.9±10.1	76.5±10.6
Height (m)	1.61±0.05	1.60±0.05
BMI (kg/m <sup>2</sup> )	29±3.5	30±4.6
Disease duration (mean±SD) (months)	8.5±3.5	7.9±3.0
Side of involvement (R/L) n (%)	26/6 (81.3/18.8)	28/4 (87.5/12.5)

admitted to our outpatient physical medicine and rehabilitation clinic, were included in this study. The diagnosis of LE, which was defined as elbow pain that is maximal over the lateral epicondyle, increases with pressure on the lateral epicondyle, and resists dorsiflexion of the wrist and/or middle finger, was based on a detailed physical examination<sup>13</sup>. Patients were excluded if they had a history of cervical radiculopathy, corticosteroid treatment, or physical therapy in the past 6 months, hand or elbow deformity, or metabolic, inflammatory, or neuromuscular diseases.

Sociodemographic characteristics of patients including age, gender, weight, height, body mass index (BMI), duration of elbow symptoms, and side of involvement were recorded. The patients were randomly divided into ESWT (n=32) and local corticosteroid injection (n=32) groups, and were evaluated at baseline and at 4 and 12 weeks post-treatment. Patient evaluation included measurement of HGS, assessment of pain intensity, and administration of the short-form McGill pain questionnaire (SF-MPQ)<sup>14, 15</sup>. Pain intensity was evaluated using a 10-cm horizontal visual analog scale (VAS) after resistive wrist dorsiflexion. The Jamar hand dynamometer (kg) was used for evaluation of HGS<sup>16</sup>. The percentages of improvement in the study parameters were recorded for each group, and the groups were compared in terms of these values.

For the ESWT group, 3X2000 shock waves with 1.6 bar intensity and 16 Hz frequency were applied without local anesthesia at weekly intervals using a Masterpuls MP2004 radial shock wave therapy system (Storz Medical, Swiss). In the local steroid injection therapy group, 20 mg methylprednisolone acetate with 1 mL prilocaine was administered using a peppering technique at the point with maximal tenderness in the lateral epicondyle area. All patients used lateral epicondyle bandages during the treatment period; none of them received analgesics, antiinflammatory drugs, or exercise program.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 13.0, for Windows (SPSS, Chicago, IL, USA). Continuous variables are presented as mean±standard deviation [SD]. The normality of the distribution for all variables was assessed using the Kolmogorov-Smirnov test. Patient gender and the affected side in both groups were compared using the  $\chi^2$  test. Intergroup comparisons were made using the Student's t-test for normally distributed variables and the Mann-Whitney U test for non-parametric variables. Within-group comparisons

**Table 2.** Within-group comparison of HGS, VAS score, and SF-MPQ score according to the follow-up duration

	Baseline	Post-treatment	
		4th week	12th week
ESWT group			
HGS (kg)*	19±3.0	24±3.5	28.8±1.6
VAS*	6.8±1.3	2.1±0.9	0.7±0.6
SF-MPQ*	18.4±8.4	9.2±4.7	5.1±2.5
Injection group			
HGS (kg)*	24.5±7.5	29.2± 8.5	30.7±8.4
VAS*	7.8±0.9	3.1±1.5	2.4±1.6
SF-MPQ*	18.7±4.5	9.5±3.3	7.1±3.4

Values are expressed as mean±standard deviation. \*p<0.01

ESWT: extracorporeal shock wave therapy; HGS: hand grip strength; VAS: visual analog scale; SF-MPQ: short-form McGill pain questionnaire

were performed using one-way repeated measures analysis of variance or Friedman test based on data distribution. A value of p<0.05 was considered statistically significant

## RESULTS

Demographic characteristics of each group are shown in Table 1. There were no significant differences in age, gender, weight, height, BMI, and affected side between the groups (p>0.05, for all). The mean disease duration in the ESWT group was 8.5±3.5 months and in the injection group was 7.9±3 months.

In the injection group, the baseline mean HGS value was better than that in the ESWT group, and the VAS score was significantly higher than that in the ESWT group (24.5±7.5 vs. 19±3, p<0.001; 7.8±0.9 vs. 6.8±1.3, p=0.001, respectively). There was no difference between groups in the baseline SF-MPQ score (19.4±8.4 vs. 18.7±4.5, p>0.05).

In both groups, there were statistically significant increases in the mean HGS values and decreases in the mean VAS and SF-MPQ scores over time (p<0.001, for all) (Table 2). The percentages of improvements in the study parameters for each group during the follow-up period are shown in Table 3. There was no statistically significant difference in the percentage of improvement in HGS and the SF-MPQ

**Table 3.** Comparison of groups according to the percentage of improvement in HGS, VAS score, and SF-MPQ score during the follow-up period

	ESWT group (n=32)	Injection group (n=32)
Improvement in HGS at 4th week	27.6±13.9	20.5±15.2
Improvement in HGS at 12th week*	55.1±20.6	28.5±21.9
Improvement in HGS between 4th and 12th weeks*	22.2±13.6	7.5±9.6
Improvement in VAS at 4th week*	70.1±11.0	59.8±18.3
Improvement in VAS at 12th week*	90.4±8.9	69.7±19.2
Improvement in VAS between the 4th and 12th weeks*	68.9±27.6	32.4±36.01
Improvement in SF-MPQ at 4th week	50.9±12.4	49.3±11.7
Improvement in VAS at 12th week*	70.8±10.9	62.6±13.3
Improvement in VAS between the 4th and 12th weeks*	44.6±17.9	26.4±21.2

Values (%) are expressed as mean±standard deviation. \*p <0.01

ESWT: extracorporeal shock wave therapy; HGS: hand grip strength; VAS: visual analog scale; SF-MPQ: short-form McGill pain questionnaire

score between groups at 4 weeks post-treatment ( $p=0.077$ ,  $p=0.584$ ), whereas the ESWT group showed better results in the VAS score than the injection group ( $p=0.009$ ). The percentages of improvements in HGS, VAS score, and SF-MPQ score were higher in the ESWT group than in the steroid injection group at 12 weeks post-treatment ( $p<0.001$ ,  $p<0.001$ ,  $p=0.009$ , respectively). Additionally, the percentages of improvements in HGS, VAS score, and SF-MPQ score between 4 weeks and 12 weeks post-treatment in the ESWT group were higher than those in the steroid injection group ( $p<0.001$ ,  $p<0.001$ ,  $p=0.001$ , respectively).

## DISCUSSION

In our study, the effectiveness of ESWT and local corticosteroid injection therapy was compared between groups and within groups during the 12-week follow-up period. Both the ESWT and corticosteroid injection treatment showed statistically significant improvements in HGS, VAS score, and SF-MPQ score over time compared to baseline values. Numerous treatments used in clinical practice for management of LE have been evaluated in the literature, but there has been no consensus on the best treatment. Local glucocorticosteroid injections have been used formerly in patients with LE. A systematic review by Smidt et al. demonstrated statistically significant differences in terms of pain, global improvement, and grip strength in the corticosteroid injection group compared to placebo, local anesthetic, and conservative treatment including nonsteroidal anti-inflammatory drugs, elbow support, and physical therapy, but no beneficial effects were demonstrated at the intermediate and long-term follow-up<sup>17</sup>). Similar results also have been reported by others in the literature<sup>7, 18–20</sup>). On the other hand, 2 other studies found no significant differences in the VAS and functional scores, even in the short-term, in the steroid injection group compared to the placebo injection group<sup>21, 22</sup>). In our study, post-treatment improvements in the VAS score, HGS, and the SF-MPQ score in the steroid injection group were statistically significant at both 4 and 12 weeks post-treatment.

In the present study, the effectiveness of ESWT compared

to the steroid injection therapy was evaluated. There was no statistically significant difference in the improvement in HGS and SF-MPQ score between groups at 4 weeks, whereas the improvements in HGS, VAS score, and SF-MPQ score were higher in the ESWT group than in the injection group at 12 weeks. In addition, the ESWT group showed better improvement in HGS, VAS score, and SF-MPQ score between the 4th and 12th week post-treatment than the injection group, indicating the greater beneficial effects of ESWT than the steroid injection at the long-term follow-up. A study by Speed et al.<sup>23</sup>) found no difference in VAS score between ESWT and sham therapy at 3 months. In this study, the authors concluded that there was no evidence of added benefit of treatment compared to sham therapy other than a significant placebo effect of moderate dose ESWT. Melikyan et al.<sup>24</sup>) also reported that the differences in HGS, pain, and functional impairment between the ESWT and control groups were not statistically significant. By contrast, statistically significant decreases in pain and functional impairment, and an increase in HGS were demonstrated in a 6-month follow-up study by Spacca et al.<sup>11</sup>). Additionally, Pettrone and McCall<sup>10</sup>) reported statistically significant improvement in pain and functional activity score with ESWT compared to sham therapy. Previously, some studies have compared the effectiveness of local corticosteroid injection and ESWT. In a 6-month follow-up study by Crowther et al.<sup>25</sup>), it was found that local corticosteroid injection was more successful and 100 times less expensive than ESWT in the treatment of LE. Three sessions of ESWT with 2000 shock waves at weekly intervals were used in their study. Gündüz et al.<sup>26</sup>) also compared the therapeutic effects of physical therapy modalities, local corticosteroid injection, and ESWT in LE and found that all the therapies had favorable effects on pain and grip strength in the early period of LE treatment. Changes in the VAS score and grip strength of the patients at follow-up were not statistically significant among the treatment groups in their study. In addition, the ESWT protocol consisting of 10X500 shock waves with 1.4 bar intensity and 4.0 Hz frequency administered at a 1-day interval between sessions differed from the protocol used

in our study. Lee et al.<sup>27)</sup> demonstrated superior symptom relief and subjective satisfaction levels at the beginning of the treatment in the local steroid injection group compared to the ESWT group. However, there were no significant differences in the clinical improvement between the groups afterwards, and the subjective satisfaction level with ESWT was even higher. Since their study involved a small number of patients with LE (only 5 patients), the results regarding the effectiveness of ESWT in LE treatment are considered inconclusive.

Our study has some limitations. A placebo group was not included in this study. Additionally, the follow-up period was short, and long-term effectiveness was therefore not assessed. In addition, the use of a lateral epicondyle support may have affected the results of our study. In conclusion, our study showed that both the ESWT and local steroid injection were effective in the treatment of LE, and the improvement in HGS was greater in the ESWT group than in the injection group at the long-term follow-up. However, further follow-up studies involving large samples are required to obtain sufficient evidence regarding effective treatment of LE.

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