



A Comparison of Laser and Extracorporeal Shock Wave Therapies in Treatment of Lateral Epicondylitis

Lateral Epikondilitte Lazer ve Ekstrakorporeal Şok Dalga Tedavisi Etkinliklerinin Karşılaştırılması

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Abstract

Objective: Lateral epicondylitis (LE) is a common painful problem of the elbow. This study was conducted to evaluate and compare the effectiveness of extracorporeal shock wave therapy (ESWT) and low-intensity laser therapy in LE treatment.

Material and Methods: The study included 60 LE patients. Subjects were divided into two groups randomly. Group 1 received ESWT, while group 2 received laser therapy. Presence of lateral epicondyle tenderness, elbow pain, and hand grip strength (HGS) were evaluated at the beginning and at 4 and 12 weeks. Elbow pain was evaluated with the Short-Form McGill pain questionnaire (SF-MPQ).

Results: The patients with tender lateral epicondyle were not significantly different between groups at each time point. Both groups had improvement on HGS evaluated at the 4th and 12th weeks, but in the ESWT group, the improvement was significantly higher. All SF-MPQ parameters improved significantly after each therapy evaluated at the 4th and 12th weeks. However, mean visual analog scale, present pain intensity, affective pain subscale, and total pain scale scores were significantly lower in the ESWT group at the 4th and 12th weeks.

Conclusion: Both ESWT and laser therapy are effective and safe treatment options for LE; however, ESWT seems to be more efficient in pain reduction and improvement of functions.

Key Words: Lateral epicondylitis, laser, ESWT, elbow

Özet

Amaç: Lateral epikondilit (LE), kolun yaygın ağrılı bir problemidir. Bu çalışmadaki amacımız, ekstrakorporeal şok dalga tedavisi (ESWT) ve düşük doz lazer tedavisinin etkinliğini araştırmak ve tedavi etkinliklerini karşılaştırmaktır.

Gereç ve Yöntemler: Çalışmaya alınan 60 hasta randomize olarak 30 kişilik iki gruba ayrıldı. Birinci gruba ESWT, diğerine lazer tedavisi uygulandı. Hastalar başlangıçta, 4 ve 12. haftalarda lateral epikondilde hassasiyet varlığı, dirsekte ağrı ve el kavrama gücü (EKG) parametreleri ile değerlendirildi. Dirsekteki ağrı Kısa form-McGill ağrı anketi (KF-MAA) ile değerlendirildi.

Bulgular: Tedavi sonrasındaki kontrollerde lateral epikondil hassasiyetinde, gruplar arasında anlamlı farklılık saptanmadı. Dördüncü ve 12. haftalarda yapılan değerlendirmelerde her iki grupta gelişmeler görüldü, fakat bu düzelmeler ESWT grubunda daha belirgindi. Kısa form-McGill ağrı anketinin tüm parametrelerinde 4 ve 12. haftalarda her iki tedavide anlamlı iyileşmeler elde edildi. Bununla birlikte KF-MAA'nın görsel ağrı skalası, total ağrı yoğunluğu, toplam ağrı oranı ve affektivite alt skala skorları 4 ve 12. haftalarda ESWT grubunda anlamlı oranda daha düşük idi.

Sonuç: Ekstrakorporeal şok dalga tedavisi ve lazer tedavileri, LE'de etkili ve güvenli yöntemlerdir. Ancak ağrının azalması ve fonksiyonel iyileşmede ESWT daha etkili görünmektedir.

Anahtar Kelimeler: Lateral epikondilit, lazer, ESWT, dirsek

Introduction

Lateral epicondylitis (LE) is a common painful problem of the elbow. The pain is derived from the origin of the wrist and finger extensors and is more pronounced during repetitive, forceful wrist extension or pronation and supination, during exercise or occupational use (1). LE is defined as pain on the lateral epicondyle generated by palpation of the lateral epicondyle, resistive wrist, and middle finger extension and hand grip (2). Angiofibroblastic hyperplasia and microtears mostly of extensor carpi radialis tendon origin were shown to have a role in the pathogenesis (3). Hand grip strength measurement and Thomson and Mill's tests are commonly used diagnostic procedures together with lateral epicondyle tenderness (4). The treatment of LE includes corticosteroid injections, splinting, physical therapy modalities, and surgery (5,6).

Extracorporeal shock wave therapy (ESWT) seems to be an efficient treatment modality in various conditions, including rotator cuff tendinopathies, lateral epicondylitis, and plantar fasciitis (3). ESWT serves as an alternative treatment modality in patients who reject surgical treatment (7).

Low-intensity laser therapy for the management of lateral epicondylitis has conflicting results (8,9); however, in the meta-analysis by Tumilty et al. (10), the authors determined that low-intensity laser therapy with an appropriate dose regimen may be an efficient treatment modality in treatment of tendinopathies. No study has compared the effectiveness of these novel treatment modalities so far. Therefore, this study was conducted to evaluate and compare the effectiveness of ESWT and low-intensity laser therapy in lateral epicondylitis treatment.

Material and Methods

The study included 60 patients diagnosed with LE, aged between 18-60 (mean 39.0±9.3) years. The Southampton diagnostic criteria were used for LE diagnosis (lateral epicondyle pain and tenderness and pain during resistive wrist dorsiflexion) (11). Patients with cervical radiculopathy, elbow deformity, history of diabetes mellitus, hypo- or hyperthyroidism, history of malignancy, chronic inflammatory diseases, and pregnancy were excluded. Patients who received corticosteroid injections to the lateral epicondyle within 6 weeks were also excluded. All patients filled an informed consent form. The local ethics committee of our university approved the present study, and written consent was obtained from all participants (09/03/2012, No: 2012/27). The demographic data of the patients were recorded, and patients were randomized into two groups consisting of 30 patients. Patients in group 1 received ESWT, while the second group of patients received low-intensity laser therapy. Presence of lateral epicondyle tenderness, elbow pain, and hand grip strength (HGS) measured with a dynamometer were evaluated before the treatment and the 4th and 12th weeks. Elbow pain was evaluated with the short-form McGill pain questionnaire (SF-MPQ) (12,13). The patients were also asked to score their elbow pain on a 10-cm visual analog scale (VAS) (14).

Lateral epicondyle tenderness was evaluated by palpation of the distal lateral epicondyle with thumb and noted as 'present'

Table 1. The demographic data of the patients in each group and the significance of the difference between groups.

	ESWT group	Laser group	p
Gender	22 F/8 M	20 F/10 M	0.576
Age	37.76±8.52	40.30±10.00	0.296
Weight	76.46±10.13	73.30±9.89	0.170
Length (cm)	166.50±8.89	164.77±9.41	0.313
BMI (kg/m ²)	27.46±1.80	26.88±1.31	0.158
Right/left elbow	24/6	22/8	0.54

Values are represented as mean±standard deviation.
BMI: body-mass index; ESWT: extracorporeal shock wave therapy

or 'absent' (15). HGS was measured according to recommendations of the American Society of Hand Therapists with a Jamar hand dynamometer. The mean of three measurements held with one moment interval was used (16,17).

Treatment Protocol

For the shock wave therapy group, 2000 shock waves with 1.6 bar intensity and 16 Hz frequency were applied three times in 3 weeks with a 1-week interval by using a Masterpuls MP2004 radial shock wave therapy system (Storz Medical, Swiss) (18).

The second group of patients received 10 sessions of low-dose-regimen laser therapy with 3.6 joule intensity, 500 Hz frequency, and 850 nm wavelength, which was applied for 40 seconds in each session by using a Chattanooga (USA) (19).

All patients used 10-cm lateral epicondyle bandages in the treatment period, while none of them received analgesic or anti-inflammatory drugs and received exercise programs.

Statistical Analysis

Statistical Package for the Social Sciences 12.0 for Windows (SPSS, IL, USA) was used for the statistical analysis. The normality of the distribution for all variables was determined with the Kolmogorov-Smirnov test. Gender of the study groups was compared by using the chi-square test. Student t-test was used for normally distributed variables, and Mann-Whitney U test was used for nonparametric variables. Pre- and post-treatment variables within groups were compared with paired t-test and Wilcoxon test. Proportions of LE tenderness between groups were compared with McNemar test. The statistically significant point was set at <0.05.

Results

Sixty patients aged between 18-60 years with the diagnosis of lateral epicondylitis were recruited into this study. The demographic data are outlined in Table 1. No treatment-associated complication was observed in either group. Mean disease duration of the patients in group 1 (ESWT) was 14.16±7.06 months (range 5-31) and 13.43±7.46 months (range 4-33) in group 2 (laser) (p=0.697).

All patients had lateral epicondyle tenderness before treatment, and on the 4th week, 11 patients (36.6%) in the ESWT group and 15 patients (50%) in the laser therapy group had tenderness, while at the 12th week, only 2 patients (6.6%) in the

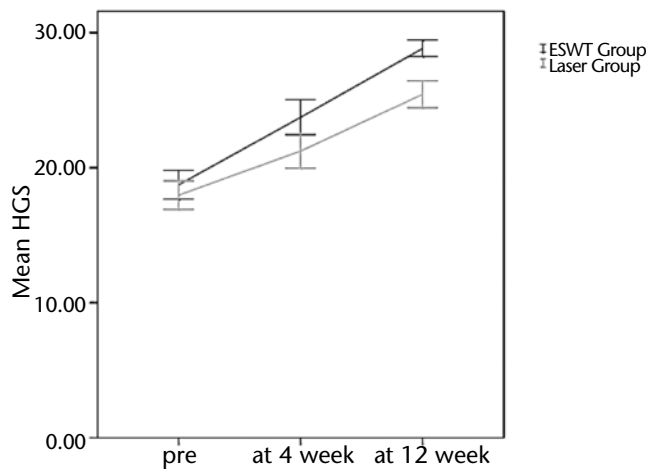


Figure 1. Line plot of the mean hand grip strength (HGS) scores in the pre-treatment phase, at 4-week follow-up, and at 12 weeks of review in both groups

first group and 4 patients (13.3%) in the second group still had tenderness. The ratio of the patients with a tender lateral epicondyle was not significantly different between groups at each time ($p=0.35$, $p=0.43$, respectively).

There was no significant difference between two groups in terms of initial mean HGS values ($p=0.303$). Both groups had improvement on HGS evaluated at the 4th and 12th weeks, but the mean HGS value in the ESWT group was significantly higher than the laser therapy group ($p=0.007$, $p<0.001$, respectively) (Figure 1).

Short-form McGill pain questionnaire (SF-MPQ) subscales scores were calculated and compared between two groups at each time point (Table 2). All SF-MPQ parameters improved significantly after each therapy evaluated at the 4th and 12th weeks ($p<0.001$). Although mean VAS, present pain intensity (PPI), affective pain subscale (SF-MPQ APS), and total pain scale scores (SF-MPQ TPS) were not differing between groups initially, at the 4th and 12th weeks, these scores were significantly lower in the ESWT group (Figure 2). Mean sensory pain subscale (SF-MPQ SPS) scores were similar in two groups initially and at the 4th week after the therapy, but it was lower in the ESWT group at the 12th week. Additionally, the differences in study parameters measured initially and 12 weeks after treatment were calculated and compared between groups. The improvements in HGS, VAS, SF-MPQ APS, and SF-MPQ PPI were significantly higher in the ESWT group ($p<0.001$, $p=0.004$, $p=0.029$, and $p=0.047$, respectively), while the differences of improvements in SF-MPQ SPS and SF-MPQ TPS did not reach a significant value ($p=0.131$ and $p=0.074$).

In both groups, significant improvements in HGS, VAS, and all subscales of the SF-MPQ evaluated at the 4th and 12th weeks, compared to the initial measurements ($p<0.001$ for all) were observed. The improvements regarding HGS, VAS, and all subscales of the SF-MPQ after the 12th week were also significant compared to the 4th week ($p<0.001$ for all).

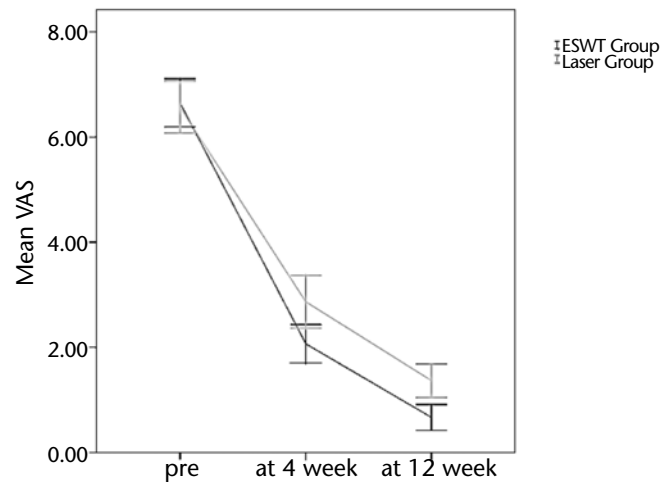


Figure 2. Line plot of the mean visual analog scale (VAS) scores in the pre-treatment phase, at 4-week follow-up, and at 12 weeks of review in both groups

Discussion

Elimination of pain and improvement in physical function with a reduction of inflammation are the main goals of LE treatment. There was overall improvement in both the ESWT and low-intensity laser treatment groups evaluated at 4 and 12 weeks after completion of the treatment, while patients in the ESWT group had less pain and higher HGS.

Lateral epicondylitis has a 1%-3% prevalence in the general population, while this percentage increases in subjects aged between 30-60 (2). The dominant hand is more frequently affected generally, which is explained by the role of physical stress in the pathogenesis of LE (2,19). In the current study, LE was more frequent in the dominant side of the patients.

Although there are a few reviews and meta-analyses regarding conservative treatment of LE, there is still inadequate evidence regarding the management of LE (20).

Extracorporeal shock wave therapy was shown to initiate angiogenesis and increase blood flow through the tendon-bone area by improvement in angiogenic growth factors on the Achilles tendons of rabbits; accordingly, inflamed tissues were regenerated and pain was alleviated (21,22). Recent studies demonstrated that ESWT was an effective treatment option in calcific tendinitis of the rotator cuff and chronic plantar fasciitis (23). In the study by Chen et al. (24), ESWT was shown to be an effective treatment modality in Achilles tendinitis. ESWT was also demonstrated to be an effective and reliable option in chronic LE (25,26).

In their placebo-controlled study conducted in patients with LE, Rompe et al. (27) reported improved upper extremity function evaluated 3 months after the therapy in the ESWT group, similar to results of this study. Furia et al. (28) assessed pain and physical function after ESWT treatment and reported improved

Table 2. Hand grip strength and short-form Mc-Gill pain questionnaire subscale scores measured at certain time points and the significance level of the differences between groups at these time points

		ESWT	LASER	p
HGS	Before treatment	18.73±2.87	17.96±2.83	0.303
	4 th week	23.73±3.52	21.23±3.44	0.007
	12 th week	28.83±1.64	25.43±2.67	<0.001
VAS	Before treatment	6.65±1.22	6.56±1.30	0.800
	4 th week	2.06±0.9	2.86±1.35	0.012
	12 th week	0.66±0.66	1.36±0.85	<0.001
SF-MPQ PPI	Before treatment	2.93±1.04	2.86±0.86	0.905
	4 th week	1.40±0.81	1.90±0.84	0.020
	12 th week	0.60±0.56	1.00±0.58	0.011
SF-MPQ SPS	Before treatment	13.76±6.33	14.13±4.72	0.800
	4 th week	7.60±4.41	9.50±4.55	0.106
	12 th week	4.23±2.20	6.16±2.42	0.002
SF-MPQ APS	Before treatment	4.36±2.41	3.93±2.06	0.398
	4 th week	1.46±0.73	2.30±0.79	<0.001
	12 th week	0.90±0.75	1.53±0.93	0.008
SF-MPQ TPS	Before treatment	18.13±8.58	18.06±6.69	0.973
	4 th week	9.13±4.86	11.83±5.02	0.039
	12 th week	5.13±2.58	7.70±3.10	<0.001

ESWT: extracorporeal shock wave therapy; HGS: hand grip strength; VAS: visual analog scale; SF-MPQ PPI: short-form McGill pain questionnaire present pain intensity subscale; SF-MPQ SPS: short-form McGill pain questionnaire sensory pain subscale; SF-MPQ APS: short-form McGill pain questionnaire affective pain subscale; SF-MPQ TPS: short-form McGill pain questionnaire total pain score. All values are represented as mean±standard deviation

function and decreased pain 12 weeks after ESWT without any treatment-associated complication.

Although ESWT was found to be an effective and reliable treatment option in LE, there is still uncertainty in the treatment intensity, number of sessions needed, length of treatment, and treatment periods (the time interval between two sessions). Likewise, in clinical trials, optimal treatment intensity was not established (2). This can explain the ineffective results in certain studies (29,30). In the study by Rompe et al. (31) in tennis elbow, patients were divided into two groups. The first group had 30 shock waves per session, while the second group had 3000 shock waves per session. They reported that functional recovery and pain reduction was better in the second group evaluated at the 3rd and 12th weeks.

Laser therapy stimulates cell metabolism, increases blood supply via capillary and arteriolar vasodilatation, and increases pain threshold in algotrophic nerve fibers and results in analgesic effects (32). As a result, it is an effective treatment in tissue regeneration and pain management (33). Previous studies reported that laser therapy was more effective in decreasing pain and increasing HGS compared to placebo in patients with LE (33,34). On the other hand, Konstantinovic et al. (35) compared laser therapy with corticosteroid injections in patients with LE.

They reported that two treatment regimens had similar analgesic effects, while with the combination treatment, they obtained superior improvements. In a recent meta-analysis, laser therapy for LE has been demonstrated to have statistically significant effects in pain relief, increasing grasp force and increasing ROM of wrist joints (36). In their placebo-controlled study, Emanet et al. (37) reported significant improvements in patients treated with laser therapy. In accordance with previous studies, the current study revealed that laser therapy decreases lateral epicondyle pain and tenderness and increases HGS.

Conclusion

Both ESWT and laser therapy are effective and safe treatment options for LE; however, ESWT is more efficient in reducing pain and improving function. To obtain more definite conclusions and establish appropriate treatment regimens, future RCTs examining different intensities with larger samples and long-term follow-up periods as well are needed.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Recep Tayyip Erdogan of University (09/03/2012, Decision No: 2012/27).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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