ACTA ORTHOPAEDICA et TRAUMATOLOGICA TURCICA
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Research Article

Comparison of low level laser therapy and extracorporeal shock wave in treatment of chronic lateral epicondylitis

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ARTICLE INFO

Article history:
Submitted August 20, 2019
Received in revised form
January 27, 2020
Accepted April 16, 2020

Keywords:
Extracorporeal shock wave therapy
Lateral epicondylitis
Low-level laser therapy

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ABSTRACT

Objective: The aim of this study was to compare the efficacy of extracorporeal shock wave therapy (ESWT) ver-sus low-level laser therapy (LLLT) in treating chronic lateral epicondylitis (CLE).

Methods: In this prospective study, 52 patients (24 males, 28 females; mean age=48 years; age range=30-70 years) with a diagnosis of CLE were included and randomized into two groups (26 in each group): ESWT group (14 males, 12 females; mean age=48±10 years) or LLLT group (10 males, 16 females; mean age=48±11 years). ESWT was applied for 5 weeks with one session per week, while LLLT was applied with 15 sessions on consecutive days. All patients were evaluated using Disability of the Arm, Shoulder and Hand Questionnaire (DASH), Patient-Related Lateral Epicondy-litis Evaluation (PRTEE), and the 36-Item Short-Form Health Survey (SF-36) before and after the treatments.

Results: In the comparison of baseline data between treatment groups, significant differences were observed only in SF-Physical functioning and SF-Energy/fatigue scores (p=0.035 and p=0.038, re-spectively), which were 77.1±17.2 and 56.3±17.2 in ESWT group and 66.5±18.0 and 44.8±21.5 in LLLT group, respectively. In the comparison of post-treatment data between groups, there were sig-nificant differences in all scores (p<0.05) except two subscales of SF-36, which were SF-role limita-tions due to emotional problems (p=0.092) and physical health (p=0.147), respectively. The other subscales of SF-36, PRTEE and DASH scores obtained after the treatments were better in ESWT group than in LLLT group. The comparison of pre-and post-treatment scores in each group revealed significant improvements in all scores (p<0.05), except SF-36 subscales, including energy/fatigue, emotional well-being, social functioning, and general health scores (p>0.05).

Conclusion: Evidence from this study revealed that although both treatment modalities were effective in the treatment of CLE, ESWT seemed to more effective in pain relief and functional recovery than LLLT.

Level of Evidence: Level II, Therapeutic study

Introduction

Lateral epicondylitis (LE), or tennis elbow, is the most frequent cause of lateral elbow pain, occurring to people between 40-60 years of age. The dominant arm is mostly involved. LE is a tendinopathy of the extensor carpi radialis brevis and extensor digitorum communis muscles, due to repeated overuse, where they adhere to the lateral epicondyle (1). The prevalence of disease is between 1-3% in the general population (2).

LE is largely self-limiting in most patients and symptoms improve within 6 to 24 months (3). However, it may continue to cause persistent symptoms in other patients. Repetitive strain injury of the wrist extensors along with anatomic factors (4) and ageing (5), poor blood circulation (6), and autophagic cell death (7) may play a role in the etiology of LE. Histopathologically, increased fibroblasts and disorganized collagen deposition and vascular hyperplasia known as angiofibroblastic hyperplasia secondary to recurrent microtrauma to the tendon have been observed in LE (8).

Several treatment options are recommended for LE, such as anti-inflammatory drugs (9), splinting (10), corticosteroid injections (11), exercises (12), laser (13), electrotherapy (14), extracorporeal shock wave therapy (ESWT) (15), ultrasound (16), autologous blood and platelet-rich plasma injections (17), and surgery (18). The main purpose of all these management practices is to reduce pain and inflammation, speed up recovery, and improve the functional disability of the affected arm. However, so far, no standard protocol has been established for treating tennis elbow, and no sufficient evidence is available for the effectiveness of the proposed conservative treatments.

Although extracorporeal shock wave treatment (ESWT) and laser treatment are commonly used in the treatment of LE, the superiority of these treatments against each other has not been elucidated. There are few studies on comparing the effectiveness of these treatment methods. Therefore, in this report, we purposed to compare the effectiveness of ESWT and low-level laser therapy (LLLT) and to provide recommendations, based on the generated evidence, for patients with chronic LE who reject surgical treatment and do not benefit from conservative treatments.

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Cite this article as: *Turgay T, Günel Karadeniz P, Sever GB. Comparison of low level laser therapy and extracorporeal shock wave in treatment of chronic lateral epicondylitis. Acta Orthop Traumatol Turc 2020; 54(6): 591-5.*

DOI: 10.5152/j.aott.2020.19102

Material and Methods

A total number of 52 patients (28 female, 24 male; mean age 48±10 years; range 30-70 years), who were admitted to outpatient clinic between August 2018 and April 2019 due to the LE, were included in this prospective analysis. The study protocol was approved by the Ethics Committee of SANKO University (Decision No: 2018/08-06; Date: 24 July 2018). The study was conducted in accordance with the principles of the Declaration of Helsinki. A written informed consent was obtained from each participant.

The demographic properties (age and gender), hand dominance, other treatments (medications and bracing), and clinic characteristics (duration of symptoms) were recorded before starting the treatment. Inclusion criteria were as follows: age >30 years, and diagnosis of LE, which had persisted for at least six months. The diagnoses of LE included physical examination of tenderness to palpation over lateral epicondyle and pain during resistive wrist dorsiflexion.

Full-time housewives (n=17), computer users (n=18), machine operators (n=6), bus drivers (n=5), hair dressers (n=3), tennis players (n=2), and self-employed workers (n=4) performing a repetitive task participated in this study. Subjects who underwent a surgery for LE, physical therapy and steroid injection within the previous three months or had cervical radiculopathy, elbow deformity, carpal tunnel syndrome, radial tunnel syndrome, neurologic deficits in the upper extremity, chronic inflammatory disease, hemophilia, pregnancy, and had a previous history of malignancy were excluded from the study. Electrodiagnostic evaluations were normal in diagnosing nerve compression syndromes, including radial nerve entrapment.

Patients were included in the treatment of LE with shock wave and laser therapy, which are used in routine. Non-steroidal anti-inflammatory drug treatments were given to both groups for 10 days.

The treatment regime supported by an exercise program consisted of a range of motions, and stretching and strengthening exercises, including hand grip strength (HGS). Each exercise was performed 3 sets a day for 10 repeats with a 1-min break between the sets under supervision of a physiotherapist.

Patients were randomized with a minimization method to assign patients to treatment groups to maintain good balance in patient variance considering age (<40 and >40), gender, and systemic disease (+, −). The first group received ESWT (Group 1, n=26) and the second group received LLLT (Group 2, n=26). Group 1 was treated by 5-week ESWT as one session per week while Group 2 was treated by LLLT for 15 sessions on consecutive days. All patients completed their sessions for each therapy. All initial tests were repeated one week after the last session.

HIGHLIGHTS

- Treatment of lateral epicondylitis is known to show contradictory results.
- While ESWT is known to act through acoustic waves, LLLT acts stimulating serotonin metabolism and increasing fibrous tissue regeneration, thus contributing to healing through the bio-stimulatory effect.
- The conclusions of the authors in this study agreed, that ESWT has a significant effect in the treatment of lateral epicondylitis compared to LLLT.

ESWT was performed with the Masterpuls MP 100 (Storz, Tägerwilen, Switzerland) device at 2000 pulse in each session on the common extensor origin of the affected elbow. Therapy was performed with 15 mm diameter treatment head. During procedure, ultrasound gel was applied to elbow for maximal transmission of the acoustic energy (19).

Laser therapy was performed via The MLS (®) device at 905 nm wavelength pulse current laser for 5 min over the six trigger points of the lateral extensor group of the forearm with doses of 0.25-1,2 joules per point/area (20).

The following measurements were used to assess LE patients. Level of pain was measured using a 10 cm visual analogue scale (VAS). Disability of the Arm Shoulder and Hand Questionnaire (DASH) with 30 questions was used to assess the limitations of the daily activities of the patients in this survey. DASH score provides value between 0 (no disability) and 100 (most severe disability) (21). The Patient-Related Lateral Epicondylitis Evaluation (PRTEE), which consisted of two subtopics, was used to assess the pain level and specific and daily activities about elbow-related functions of the patients, during the last week. First parameter evaluates the pain level while the second evaluates the specific and daily activities; the total score ranges from 0 to 100. Higher scores represent greater severity (22). Pain and functional disability were also assessed using a 36-item short-form health survey instrument (SF-36) (23). The SF-36 health survey form was used to evaluate the quality of life of patients. The SF-36 health survey comprises of 36 items and the scale contains following eight subscales: physical functioning, physical role functioning, bodily pain, general health, vitality, social functioning and emotional role functioning, and mental health. The scores in each subscale ranged from 0 to 100. Higher scores indicated better quality of life. Patients were evaluated before and after the treatment by an attending physiotherapist who was unaware of the clinical management procedure.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences version 23 (IBM SPSS Corp.; Armonk, NY, USA). Descriptive statistics were expressed as mean±standard deviation, median (min-max values) or frequency, and percentage. Normality of the data was evaluated with Shapiro-Wilk test. For comparisons of two independent groups when data were non-normally distributed, Mann-Whitney U test was used, and when data were normally distributed, the independent samples *t* test was used. For pre- and post-treatment comparisons, paired *t* test or Wilcoxon signed-rank test was used according to distribution of the data. For categorical variables, Chi-square test with continuity correction was used. Results with p values of <0.05 were regarded as statistically significant.

Results

There were no differences between ESWT and LLLT groups in terms of gender, age, and systemic disease. At the baseline, there was a statistically significant difference between ESWT and LLLT groups only regarding SF-physical functioning and SF-energy/fatigue scores (p=0.035 and p=0.038, respectively). After the treatments, there was a statistically significant difference in all scores between ESWT and LLLT groups, except SF-role limitations due to emotional problems and SF-role limitations due to physical health scores (Table 1). Based on the results of pre- and post-treatment comparisons for ESWT, statistically significant differences were noted in all scores, except SF-emotional well-being (Table 2). The results of pre- and post-treatment comparisons showed statistically significant differences in SF-physical functioning, SF-role limitations due to physical health,

Table 1. Comparison of groups regard to patient characteristics and health-related quality of life questionnaire scores.

	Group 1 (ESWT; n=26)	Group 2 (LLLT; n=26)	p
Gender, n (%)			
Male	14 (53.8)	10 (38.5)	
Female	12 (46.2)	16 (61.5)	0.404
Systemic disease			
No	23 (88.5)	20 (76.9)	
Yes	3 (11.5)	6 (23.1)	0.465
Age, M±SD	47.9±9.5	48.1±10.7	0.945[a]
PRE-SF-physical functioning, M±SD	77.1±17.2	66.5±18.0	0.035[a]
PRE-SF-role limitations due to physical health, Median (Min-Max)	0 (0-100)	25 (0-100)	0.411[b]
PRE-SF-role limitations due to emotional problems, Median (Min-Max)	33.3 (0-100)	16.5 (0-100)	0.389[b]
PRE-SF-energy/fatigue, M±SD	56.3±17.2	44.8±21.5	0.038[a]
PRE-SF-emotional well-being, M±SD	64.0±14.4	56.0±18.1	0.084[a]
PRE-SF-social functioning, Median (Min-Max)	75 (12.5-100)	56.3 (25-100)	0.310[b]
PRE-SF-pain, M±SD	49.3±23.8	38.3±20.3	0.077[a]
PRE-SF-general health, M±SD	55.2±18.0	49.1±14.7	0.184[a]
PRE-PRTEE, M±SD	69.1±15.8	64.0±15.7	0.244[a]
PRE-PRTEE-pain, M±SD	37.6±8.2	36.6±7.2	0.629[a]
PRE-PRTEE-functioning, M±SD	62.9±17.7	54.7±20.1	0.125[a]
PRE-DASH, M±SD	46.6±15.9	50.8±16.6	0.347[a]
POST-SF-physical functioning, Median (Min-Max)	92.5 (20-100)	82.5 (20-95)	0.007[b]
POST-SF-role limitations due to physical health, Median (Min-Max)	75 (0-100)	50 (0-100)	0.147[b]
POST-SF-role limitations due to emotional problems, Median (Min-Max)	66.7 (0-100)	33.4 (0-100)	0.092[b]
POST-SF-energy/fatigue, M±SD	59.4±18.8	46.4±15.5	0.009[a]
POST-SF-emotional well-being, M±SD	64.6±14.3	56.3±9.9	0.018[a]
POST-SF-social functioning, Medi-an (Min-Max)	81.3 (50-100)	56.3 (37.5-87.5)	0.002[b]
POST-SF-pain, Median (Min-Max)	77.5 (22.5-100)	45 (22.5-77.5)	<0.001[b]
POST-SF-general health, M±SD	59.4±16.5	47.5±9.0	0.002[a]
POST-PRTEE, M±SD	32.3±17.6	46.3±16.6	0.005[a]
POST-PRTEE-pain, M±SD	18.8±9.6	27.1±8.8	0.002[a]
POST-PRTEE-functioning, Median (Min-Max)	20.5 (10-77)	36.5 (14-80)	0.004[b]
POST-DASH, M±SD	16.6±11.8	31.6±13.8	<0.001[a]

[a]Independent samples t test; [b]Mann-Whitney U test; M: Mean; SD: Standard Deviation

Table 2. Pre- and post-treatment comparison for group 1 (ESWT)

	Pre-Treatment	Post-Treatment	p
SF-Physical functioning, M±SD	77.1±17.2	84.2±20.2	0.004[a]
SF-Role limitations due to physi-cal health, Median (Min-Max)	0 (0-100)	75 (0-100)	0.001[b]
SF-Role limitations due to emo-tional problems, Median (Min-Max)	33.3 (0-100)	66.7 (0-100)	0.002[b]
SF-Energy/fatigue, M±SD	56.3±17.2	59.4±18.8	0.020[a]
SF-Emotional well-being, M±SD	64.0±14.4	64.6±14.3	0.381[a]
SF-Social functioning, Median (Min-Max)	75 (12.5-100)	81.3 (50-100)	0.001[b]
SF-Pain, M±SD	49.3±23.8	71.5±16.8	<0.001[a]
SF-General health, M±SD	55.2±18.0	59.4±16.5	0.004[a]
PRTEE, M±SD	69.1±15.8	32.3±17.6	<0.001[a]
PRTEE-Pain, M±SD	37.6±8.2	18.8±9.6	<0.001[a]
PRTEE-Functioning, M±SD	62.9±17.7	27.0±17.7	<0.001[a]
DASH, M±SD	46.6±15.9	16.6±11.8	<0.001[a]

[a]Paired t test; [b]Wilcoxon signed-rank test; M: Mean; SD: Standard Deviation

Table 3. Pre- and post-treatment comparison for group 2 (LLLT)

	Pre-treatment	Post-treatment	p
SF-Physical functioning, M±SD	66.5±18.0	73.7±19.5	0.011[a]
SF-Role limitations due to physical health, Median (Min-Max)	25 (0-100)	50 (0-100)	<0.001[b]
SF-Role limitations due to emo-tional problems, Median (Min-Max)	16.5 (0-100)	33.4 (0-100)	0.037[b]
SF-Energy/fatigue, M±SD	44.8±21.5	46.4±15.5	0.664[a]
SF-Emotional well-being, M±SD	56.0±18.1	56.3±9.9	0.910[a]
SF-Social functioning, Median (Min-Max)	56.3 (25-100)	56.3 (37.5-87.5)	0.417[b]
SF-Pain, M±SD	38.3±20.3	50.6±14.8	0.002[a]
SF-General health, M±SD	49.1±14.7	47.5±9.0	0.572[a]
PRTEE, M±SD	64.0±15.7	46.3±16.6	<0.001[a]
PRTEE-Pain, M±SD	36.6±7.2	27.1±8.8	<0.001[a]
PRTEE-Functioning, M±SD	54.7±20.1	38.5±17.7	<0.001[a]
DASH, M±SD	50.8±16.6	31.6±13.8	<0.001[a]

[a]Paired t test; [b]Wilcoxon signed-rank test; M: Mean; SD: Standard Deviation

SF-role limitations due to emotional problems, SF-pain, PRTEE, PRTEE-pain, PRTEE- functioning, and DASH scores in the LLLT group. However, there were no statistically significant differences in SF-energy/fatigue, SF-emotional well-being, SF-social functioning, and SF-general health scores (Table 3).

Discussion

This prospective study aimed to compare the effectiveness of ESWT and LLLT in the treatment of LE using PRTEE, DASH, VAS, and SF36 scores. Our overall results show that ESWT treatment provided statistically significant improvement in all scores, except SF-emotional well-being. On the contrary, we observed that all scores improved following LLLT, except SF-energy/fatigue, SF-emotional well-being, SF-social functioning, and SF-general health. When comparing both treatment methods in terms of efficiency, ESWT was found to be more effective than all LLLT, except SF-role limitations due to emotional problems, and SF-role limitations due to physical functioning scores. Our results, therefore, suggest that ESWT is more effective than LLLT.

The incidence of LE has been reported to be 1-3% in previously published studies (2). This disease rarely seen under the age of 30 and mostly afflicts the dominant arm. Similarly, the average age of the subjects was 48 years old and LE was seen in the dominant arms of all the cases in our study.

Pathology of LE is defined as chronic micro-trauma due to repeated overuse and partial tears in the common extensor tendon (24) or damage to the bone adhesion site (25-27) (enthesopathy), while the most commonly affected tendon is the extensor carpi radialis tendon.

In the past, the success rates of ESWT in the treatment of LE have been reported between 68-91% (28-31). The mechanism underlying the effectiveness of ESWT is that it acts as acoustic waves and increases energy in the pathological area, and increases bone, tendon, and soft tissue regeneration in this region (32, 33). In addition, increasing the formation of new blood vessels in the pathological region increases the production of growth factors in this region, thereby contributing to the regeneration (34). On the contrary, several studies have reported the efficacy of LLLT in the successful treatment of LE following the LLLT in the treatment of LE (35-37). To suppress pain, LLLT is known to act through modulating serotonin metabolism and increasing fibrous tissue regeneration, thereby contributing to healing through bio-stimulatory effect (38-42).

In literature, only one study has compared ESWT and LLLT in the treatment of LE. In this study, Devrimsel et al. investigated the effectiveness of both treatments in a total number of 60 patients (43). These 60 patients were divided into two groups of 30 patients each, while there was no distinction between chronic or acute LE in the selection of the cases. The pain evaluation of the cases was carried out through short-form McGill pain questionnaire and VAS pain score at the 4th and 12th weeks following the treatment, and the cases were also evaluated functionally by HGS test. The outcomes of the study showed that both treatments were effective in the treatment of LE overall; however, ESWT was more effective, especially in reducing pain and improving function. There are a couple of differences between this study and the above-mentioned study. First, we compared the effectiveness of both treatments on chronic LE cases, while the previous study used both chronic and acute LE cases. Second, in the present study, we used PRTEE test, which is a specific test for LE. In accordance with the previous study, our results also suggested that ESWT may be more effective in the treatment of LE, especially based on the outcomes of the PRTEE test.

After both the treatments, a statistical difference was observed in all scores, except SF-role limitations due to emotional problems and SF-role limitations due to physical health scores. It has been interpreted that environmental factors related to anxiety, social activity, and emotional problems affect responses in these sub-parameters.

There are some limitations of this study. First, the long-term follow up findings were not available. Another limitation was that monitoring was not used to investigate the effect of treatments. Therefore, this study suggests further long-term follow-up and large-scale studies based on ultrasonography techniques.

In conclusion, ESWT and LLLT are effective and safe modalities for the treatment of LE; however, based on our cumulative findings, ESWT treatment seems to be more effective than LLLT with regard to pain relief and functional recovery. We believe that further randomize controlled studies with a larger sample size are necessary to validate the treatment protocol of LE.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics committee of SANKO University (Decision No: 2018/08-06; Date: 24 July 2018).

Informed Consent: Written informed consent was obtained from each participant.

Author Contributions: Concept - T.T.; Design - T.T., P.G.K.; Supervision - T.T.; Materials- T.T., G.B.S.; Data Collection and/or Processing -T.T., G.B.S.; Analysis and/or Interpretation - T.T, P.G.K; Literature Search - T.T., G.B.S.; Writing Manuscript - T.T., G.B.S, P.G.K.; Critical Review - T.T.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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