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High Intensity Laser Therapy Versus Extracorporeal Shock Wave Therapy In Treating Lateral Epicondylitis

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Abstract

Background - Objective. Lateral epicondylitis (LE) is the primary etiology of lateral elbow pain, predominantly affecting the dominant arm. The objective of this investigation was to assess and contrast the efficacy of extracorporeal shock wave therapy (ESWT) and high-intensity laser therapy (HILT) in treating lateral epicondylitis.
Methods. Fifty-one patients diagnosed with lateral epicondylitis were separated into two groups: group one underwent ESWT, while group two received HILT. Visual analogue scale (VAS), Quick Disabilities of the Arm Shoulder and Hand Questionnaire (QDASH), LE tenderness, handgrip strength and ultrasonographically assessed common extensor tendon thickness (CET) were assessed, before treatment, immediately post-treatment completion at the 3rd week and at the 9th week. Comparisons were done within each group and between groups.
Results. Prior to treatment, both groups demonstrated comparable characteristics ($p > 0.05$). Immediately following the completion of treatment, significant improvements were observed within each group across all parameters ($p < 0.001$), as well as in comparisons between the two groups, the HILT group demonstrated superior outcomes in all parameters ($p < 0.05$), except for CET thickness ($p > 0.05$). By the ninth week, significant improvements were observed within each group across all parameters ($p < 0.05$), with the exception of CET thickness ($p > 0.05$). The HILT group also demonstrated superior outcomes across all parameters ($p < 0.05$), with the exception of CET thickness ($p > 0.05$).

Conclusion. Both ESWT and HILT demonstrate efficacy in the management of lateral epicondylitis, However, HILT demonstrated greater superiority over ESWT.

Keywords- Lateral epicondylitis; Laser therapy; Extracorporeal shock wave therapy; Physical medicine.

Introduction

Lateral epicondylitis (LE) is the primary etiology of lateral elbow pain, predominantly affecting individuals between the ages of 40 and 60 years. The dominant arm is predominantly affected. Overuse injury can cause tendinopathy of the muscles that attach to the lateral epicondyle, specifically the extensor carpi radialis brevis and extensor digitorum communis. This condition is known as lateral epicondylitis (LE). (1) Histopathologically, LE is associated with vascular hyperplasia, elevated fibroblast activity, and aberrant collagen deposition due to recurrent microtrauma to the tendon (2). Thomson and Mill's tests along with lateral epicondyle tenderness and hand grip strength measurements are commonly used diagnostic methods (3). A notable relationship was identified between the findings of diagnostic ultrasound (USG) and the clinical manifestations of LE. Ultrasound observations may reveal changes such as localized hypoechogenicity, intratendinous calcification, increased thickness of the common extensor tendon, and bone anomalies.(4)
The management of lateral epicondylitis (LE) includes a variety of treatment modalities such as local injections, nonsteroidal anti-inflammatory medications, banding, splinting, acupuncture, physical therapy interventions, and surgical procedures (5,6).
ESWT is a non-invasive, safe treatment option with few known adverse effects, such as mild bruising and discomfort during the procedure. Numerous musculoskeletal disorders, including tennis elbow, calcifying tendonitis, bone marrow edema, early-stage osteonecrosis, delayed fracture healing, pseudoarthrosis, insertional tendinopathies, and wound healing problems, have been shown to respond well to ESWT(7). ESWT has been shown to alleviate pain, promote vascularization, and enhance the production of collagen in soft tissues, tendons, and bones, according to the evidence that has been gathered (8).
Musculoskeletal pain, sports injuries (such as tendonitis, contusions, and muscle spasms), and traumatic injuries can all find relief with high-intensity laser therapy (HILT). Through the photomechanical, thermal, electrical, and biostimulating effects that it has on deep tissues, high-intensity laser (HILT) therapy improves blood flow and enhance regeneration of tissues while simultaneously reducing pain, inflammation, and oedema. Laser treatment is characterized by its noninvasive nature, lack of pain, and compatibility with other therapeutic approaches. (9-11)
The current study sought to examine the impacts of HILT and ESWT on levels of pain, disability, grip strength, and

ultrasonographically assessed CET thickness in patients with LE. Additionally, the study aimed to determine whether one of these therapeutic modalities demonstrated superior efficacy relative to the other.

Patients and methods

The study included 51 patients admitted to the physical medicine outpatient clinics at Al-Azhar University Hospitals and Alagouza Hospital from February 2019 to January 2020, all diagnosed with lateral epicondylitis. The participants were aged between 18 and 60 years, with a mean age of 40.80±7.4 years.
The diagnosis of LE was made using the Southampton diagnostic criteria, which include pain and tenderness on the lateral epicondyle as well as pain felt during resistive wrist dorsiflexion (12).
Individuals with a history of fibromyalgia, cervical radiculopathy, chronic inflammatory diseases, diabetes mellitus, thyroid dysfunction, hypo- or hyperthyroidism, malignancy, entrapment neuropathy, brachial plexopathy, elbow deformity, bleeding disorders, or those currently using anticoagulants were excluded from the study. Patients who underwent surgical treatment for the elbow, received physical therapy, or corticosteroid injections within three months prior to the study were excluded. All patients and controls gave their informed consent in compliance with the local ethics committee's guidelines. The study protocol was approved by the same committee and completed in line with the Helsinki declaration codes and WHO guidelines for research conduction and reporting.
The patients' demographic data were documented, and they were divided into two groups at random. Group 1 had 26 patients who received ESWT, while group 2 had 25 patients who received HILT. Before treatment and immediately post-treatment completion at the 3rd week and at the 9th week as follow up, hand grip strength (HGS) was evaluated using a dynamometer, alongside the assessment of lateral epicondyle tenderness and elbow pain. By using the thumb to palpate the distal lateral epicondyle, the tenderness of the lateral epicondyle was evaluated, and the results were noted either as "present" or "absent". (13)
A 10-cm visual analogue scale (VAS), with a score of 0 denoting no pain and a score of 10 denoting maximum pain, was used to measure the degree of pain during both activity and rest. [14].
The Quick Disabilities of the Arm Shoulder and Hand Questionnaire (QDASH) was used to assess the patients' limitations in their daily activities. Patients with upper limb issues can self-report their physical functions and symptoms using the QDASH questionnaire. The QDASH questionnaire consists of eleven questions meant to assess a patient's capacity to execute upper extremity tasks during the previous seven days. Elevated QDASH questionnaire scores signify increased levels of disability [15].
We used a Jamar hand dynamometer to evaluate handgrip strength (HGS), in accordance with the guidelines that were established by the American Society of Hand Therapists. At one-minute intervals, three measurements were taken, and the mean was calculated (16, 17).
Ultrasonographic evaluation (USG) was used to determine the CET's thickness. The wrist was in pronation and the elbow was at 90° flexion during the USG for LE. On the elbow's radial surface, the USG probe is positioned longitudinally (18).
A range of motions exercises, as well as Stretching and strengthening exercises, such as handgrip strength (HGS), were part of the treatment regimen backed by an exercise program. Under the guidance of a physiotherapist, each exercise was done three sets per day for ten repetitions, with a one-minute break inbetween. The first group received ESWT (Shock Master 300, Gymna Uniphy, Germany) once a week for three sessions. Every session involves, a 10 Hz, 2.5 bar, 2000 pulse was applied to the affected elbow's common extensor origin. To maximize the transmission of acoustic energy, ultrasonic gel was applied to the elbow during the procedure.
In our study, we used a high-intensity laser therapy device (Electronica Pagani HPL Laser, Italy). Using constant circular motions, we applied the device to the lateral epicondyle's most painful region. The initial three sessions focused on delivering analgesic effects at an intermittent phase, with 75 seconds at 8 watts and 6 joules per square centimeter, culminating in a total energy delivery of 150 joules. (2, 19) The following six sessions were designed to apply a 30 second, 6 W, 120 to 150 J/cm in order to produce a biostimulatory effect at a continuous phase. (2, 19) In total, nine sessions were conducted over three weeks, with treatments going on three times per week.
Data analysis: The SPSS 21.0 software was used for all of the analyses. For continuous variables, the results are shown as the mean and standard deviation [SD]. On the other side, categorical variables were displayed as frequencies and percentages. The "t" test and the Mann-Whitney test were used to compare data for continuous variables in order to assess how the study group and control group differed from one another. The Chi-square test or Fisher's exact test were used to evaluate differences for categorical variables. The Wilcoxon signed-rank test was used to compare continuous variables within groups. A significance criterion of 5% [$p<0.05$] was set as the margin of significance.

Results

This study enrolled 51 patients with a history of lateral epicondylitis, ranging in age from 18 to 60 years. The participants were randomized into two groups: the HILT group and the ESWT group. No statistical difference was observed between the groups regarding demographic and physical characteristics. Data are presented in Table 1.

Table1. Characteristics of both groups

	HILT N=25	ESWT N=26	P
Sex-F/M	13/12	13/13	0.684
Age	40.06±1.88	41.86±8.43	0.189
BMI	26.74±5.41	27.30±6.65	0.284
Right/left elbow	18/7	17/9	0.661

Values are represented as mean±standard deviation. . BMI: body-mass index

At baseline, prior to the initiation of treatment, the groups exhibited comparable characteristics concerning lateral epicondyle tenderness, Visual Analog Scale (VAS) for rest, VAS for activity, Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH) score, grip strength, and common extensor tendon (CET) thickness. The data are presented in Table 2.

In comparison to the baseline, both groups exhibited a significant improvement in LE tenderness, VAS rest, VAS activity, grip strength, and Q-DASH scores post-treatment completion at 3rd. week and follow-up, at 9th week. Furthermore, all parameters improved between 3rd week and at follow-up at 9th week, with the exception of CET thickness. Data are presented in Table 2.

A statistically significant difference favoring the HILT group was observed in comparisons between the two groups at 3rd. week and at follow-up at 9th week concerning LE tenderness, VAS rest, VAS activity, Q-DASH, and grip strength. The CET thickness showed no significant difference between the groups. The data are presented in Table 2.

Table 2.clinical parameters comparisons within each group and between groups before treatment, at 3rd week and at 9th week

	HILT N=25	**ESWT N=26**	***P***
Before treatment LE tenderness (*n*, %)	**25 (%100)**	**26 (%100)**	
After 3 weeks LE tenderness (*n*, %)	**7(%28)**	**14 (%53.84)**	**< 0.001**
After 9 weeks LE tenderness (*n*, %)	**2 (%8)**	**6 (%23.07)**	**0.004**
P[a]	**< 0.001**	**<0.001**	
P[b]	**< 0.001**	**< 0.001**	
P[c]	**0.022**	**0.003**	
Before treatment VAS-rest	**3,57±1.1**	**4.21±2,10**	**0.164**
After 3 weeks VAS-rest	**1,19±31.5**	**2.2 ± 65.43**	**0,009**
After 9 weeks VAS-rest	**0.69 ±63**	**1.6± 87.73**	**0,005**
P[a]	**< 0.001**	**< 0.001**	
P[b]	**< 0.001**	**< 0.001**	
P[c]	**< 0.001**	**< 0.001**	
Before treatment VAS-Activity	**6.88±4.59**	**7.46±2.34**	**0.216**
After 3 weeks VAS-Activity	**2.31±5.9**	**3.98±7.63**	**0.008**
After 9 weeks VAS-Activity	**0.97±0.84**	**1.87±5.69**	**0,006**
P[a]	**<0.001**	**< 0.001**	
P[b]	**< 0.001**	**< 0.001**	
P[c]	**< 0.001**	**< 0.001**	
Before treatment Q-DASH	**58.27 ± 44.36**	**60.39 ± 19.56**	**0.518**
After 3 weeks Q-DASH	**34.68± 48.74**	**43.56 ± 64.75**	**0.006**
After 9 weeks Q-DASH	**26.18 ± 83.45**	**35.32± 71.29**	**0.002**
P[a]	**< 0.001**	**< 0.001**	
P[b]	**< 0.001**	**< 0.001**	
P[c]	**< 0.001**	**< 0.001**	
Before treatment HGS	**18.13±36.52**	**17.35±69.44**	**0.327**
After 3 weeks HGS	**23.56± 4.16**	**21.92 ± 1.64**	**0.008**
After 9 weeks HGS	**27.33±5.21**	**24. ±85±6.37**	**< 0.001**
P[a]	**< 0.001**	**0.003**	
P[b]	**< 0.001**	**< 0.001**	
P[c]	**< 0.001**	**< 0.001**	
Before treatment CET thickness	**5.68±0.33**	**5.49±0.52**	**0.621**
After 3 weeks CET thickness	**4.74±0.46**	**4.53±0.41**	**0.432**
After 9 weeks CET thickness	**4.69±0.58**	**.4.51±0.64**	**0.774**
P[a]	**< 0.05**	**< 0.05**	
P[b]	**< 0.05**	**< 0.05**	
P[c]	**0.883**	**0.620**	

Values are represented as mean ± standard deviation. P[a] = before treatment Vs 3rd week; pb = before treatment Vs 9th week; p[c]= 3rd week Vs 9th week

Discussion

The main goals of LE treatment include relieving pain, improving physical function, and decreasing inflammation. The pathology of lateral epicondylitis (LE) is characterized by chronic micro-trauma resulting from injury to the bone attachment point or partial tears in the common extensor tendon due to repetitive overuse.(20-23) The extensor carpi radialis tendon is the most commonly affected, with the dominant arm being the most impacted. (1, 2)
Upon reviewing the studies that address the application of lasers in the treatment of patients with lateral epicondylitis, it was observed that low- intensity laser therapy (LILT) is commonly utilized. Nevertheless, research on HILT has increased significantly in the last several years. (11, 19,24,25).
Previous studies have found that ESWT is effective in treating LE at rates ranging from 68-91%. (26-29) The efficacy of ESWT is attributed to its ability to act as acoustic waves that enhance energy in the pathological area, thereby promoting regeneration of bone, tendon, and soft tissue in that region (30, 31). Furthermore, enhancing the development of novel blood vessels in the affected area elevates the release of growth factors in that area, thus facilitating regeneration. (32)
According to previous studies, people suffering from lateral epicondylitis noted improvements in their pain levels, functional capacity, and grip strength after exclusive use of ESWT (33–35). Moreover, Yang et al. demonstrated that the integration of physiotherapy with ESWT yielded more favorable outcomes compared to physiotherapy in isolation, particularly concerning pain relief, functional improvement, and grip strength enhancement. (35).
HILT, on the other hand, documented to enhances tendon repair, to improve blood circulation and vascular permeability, promote collagen synthesis, and reduce pain and inflammation of tendons via photochemical and photothermal stimulation (24, 19). The long-term effects of HILT treatment were studied by Akkurt et al., who found that participants started to see significant improvements in the VAS (activity and rest), DASH, and hand grip strength as early as the second week of treatment and persisted through the sixth month (11). A further investigation into the efficacy of HILT treatment with epicondylitis bandages was carried out by Salli et al. (24). The researchers discovered that the HILT treatment resulted in a significant pain reduction, disability alleviation, improvement in hand grip strength and overall quality of life parameter.
Our findings align with the aforementioned studies. Both the ESWT and HILT groups exhibited substantial improvement across all variables, such as pain level, disability index, and handgrip strength (HGS), assessed post-treatment completion at 3rd week and 9th week. While both therapies demonstrated effectiveness in the treatment of lateral epicondylitis, a comparative analysis reveals that high-intensity laser therapy exhibited superior efficacy in enhancing pain relief, functional capacity, and grip strength. A singular prior study conducted by Karaca et al. was identified, which compared the effectiveness of HILT and ESWT. Thee reported that both therapeutic modalities were effective in alleviating pain, enhancing grip strength, and improving functional outcomes in patients. When comparing both groups to the baseline, each outcome demonstrated a significant improvement. The HILT group demonstrated outstanding performance across all measured outcomes, including pain reduction, enhancement of grip strength, and functional improvement, as evidenced by a comparative analysis of mean differences between baseline and final values across the groups [36]. However, two earlier studies comparing the efficacy of LLLT and ESWT in treating LE were identified, and both concluded that LLLT and ESWT are safe and efficacious treatments for lateral epicondylitis, but that ESWT treatment appears to be more effective than LLLT in terms of functional recovery and pain relief.(38,39)
Ultrasonographic measurement is a crucial diagnostic technique that validates the results of clinical examinations in LE diagnosis.(40) The current study demonstrated, a notable decrease in CET thickness in both groups, following completion of treatment. Our findings align with the prior research conducted by Ozmen et al., who examined forty individuals with lateral epicondylitis, categorized into three groups: kinesio taping, extracorporeal shock wave therapy (ESWT), and ultrasound therapy. Clinical and sonographic comparisons between the groups showed a notable decrease in CET thickness exclusively in the ESWT group. (41) Gunduz et al., on the other hand, found no significant difference in CET thicknesses in patients with LE treated with ESWT between baseline and 6-month follow-up. (42) Upon a review of the studies that have investigated the therapeutic effects of HILT on lateral epicondylitis using ultrasonography, we were unable to locate any prior research.
In conclusion, both ESWT and HILT demonstrate efficacy in the management of lateral epicondylitis, particularly in terms of alleviating pain, enhancing grip strength, reducing disability, and improving ultrasonographically measured CET thickness. However, HILT demonstrated greater superiority over ESWT.

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