

Evaluation of the efficiency of laser acupuncture in management of chronic lateral epicondylitis in adolescents

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Received: 15 February 2024

Revised: 20 March 2024

Accepted: 25 March 2024

Published: 10 June 2024

Journal of The Arab Society for Medical Research 2024, 19:31–36

Background/aim

Lateral epicondylitis known frequently as tennis elbow, is a common disease affecting the elbow joint. It affects 1 to 3% of the population yearly especially individuals in their forties, although the pain has usually a gradual onset, it may occur abruptly. Laser acupuncture is a complementary modality that is used to stimulate the acupoints by low-power laser beam instead of the traditional needles. The present study aims to evaluate the efficiency of laser acupuncture in the management of chronic lateral epicondylitis in adolescents.

Patient and methods

This study is a randomized controlled trial study on sixty adolescent patients with lateral epicondylitis visiting the acupuncture and laser clinic in excellence Medical Centre, National Research Centre, Cairo, Egypt, during the first of November 2023 till the end of January 2024. The patients were divided into two groups (30 each). The first group was subjected to low-power laser and brufen 400 mg twice daily for 4 weeks, while the patients in the second group were given just the same dose of brufen and used as a control. Pain score, patient rated elbow score, and interleukin-6 (IL-6) were measured before and after the end of treatment. IL-6 was measured by Elisa techniques.

Results

The present study exhibited insignificant differences ($P>0.05$) between the studied groups of adolescents with chronic lateral epicondylitis regarding pain score and Patient elbow score before intervention and then it became significantly lower ($P<0.05$) in both groups group at the end of treatment with Laser and brufen or without Laser. However, adolescent patients subjected to laser and brufen exhibited more reduction ($P<0.01$) than in the control group treated with brufen only. In addition, the levels of IL-6 exhibited more reduction in the Laser group ($P<0.01$) than in the control group.

Conclusion

Low-power laser is efficient in pain reduction and improvement of elbow joint function when 200 mw power, continuous wave, and 12 Joules energy is applied on each acupoint in chronic lateral epicondylitis adolescent patients.

Keywords:

adolescent, interleukin-6, laser acupuncture, lateral epicondylitis

J Arab Soc Med Res 19:31–36

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1687-4293

Introduction

Lateral epicondylitis, known frequently as tennis elbow, is a common disease affecting the elbow joint. It affects 1 to 3% of the population yearly especially individuals in their forties [1]. The patients complain of pain and tenderness in the lateral humeral epicondyle where the tendon of the wrist extensor muscle originates. Although the pain has usually a gradual onset, it may occur abruptly [2,3]. If the condition deteriorates, the pain may be propagated to the posterior side of the forearm, It is increased with wrist extension against resistance or its flexion passively, Functional disability may occur such as a decrease in grip strength [4–6].

Lateral epicondylitis is usually caused by extensive use of the muscles located in the back of the forearm such

as extensor carpi radialis brevis [7]. It is frequently associated with tennis, racquet, paddle sports and in professions where there is repetitive wrist extension and supination of the forearm. However, it may be idiopathic as many patients have not been exposed to such activities [8,9].

Although the disease is mostly diagnosed clinically, many investigations may be performed such as plain radiography to check for arthritis of the elbow joint or

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electromyography to exclude nerve compression, Magnetic resonance imaging is the most accurate tool to diagnose muscles and tendon injury [10,11]. Oral nonsteroidal anti-inflammatory drugs or cortisosteroid injected locally are used to alleviate the pain but they may have serious side effects [12,13].

On the other hand, Laser acupuncture proved to be effective in treating pain associated with musculoskeletal diseases. Several trials showed that lateral epicondylitis cases were satisfied by the pain-relieving effect of acupuncture and the improvement of the mobility of the forearm [14,15]. Laser acupuncture is a complementary modality that is used to stimulate the acupoints by a light beam instead of the traditional needles. Some studies showed good results [6,16], while others did not prove statistical efficiency in management of pain in lateral epicondylitis [17]. The present study aimed to evaluate the efficiency of Laser acupuncture in management of chronic lateral epicondylitis in adolescents.

Patients and methods

Patients

This study is a randomized controlled trial that was conducted in an acupuncture and laser clinic in excellence medical Centre, National Research Centre, Cairo, Egypt, during the start of November 2023 till end of January 2024. Sixty patients with lateral epicondylitis, were diagnosed clinically and collected from tennis academy in public service center in the faculty of physical education at Helwan University.

Study design

Patients were classified into two groups, each group included 30 patients. The cases of the first group were subjected to low power laser and brufen 400 mg twice daily (Laser group), while the patients in the second group were given just the same dose of brufen and used as control (Control group).

Inclusion criteria

The inclusion criteria included patients with increased C-reactive protein, ages ranging between 14 and 17 years, chronic cases (lasting more than 3 months), and unilateral elbow affection.

Exclusion criteria

The inclusion criteria included patients with rheumatoid arthritis, physiotherapy, or nonsteroidal anti-inflammatory medications within the previous 3 months.

Ethical consideration

The present study was conducted with the Code of Ethics of the World Medical Association, according to the principles expressed in the Declaration of Helsinki. This study has been approved by the local Ethics Committee of National Research Centre, Cairo, Egypt with approval number 01470123, written informed consent was provided by the parents of each participant before their inclusion in the study.

Methods

All the cases were evaluated concerning pain VAS during Cozen's test and tennis elbow evaluation before laser intervention.

P (VAS) assessment (pain score)

P (VAS) is a validated tool for the assessment of the degree of pain in acute or chronic conditions. Scores are identified by making a mark on zero to 10 lines, where 0 means pain-free and 10 indicates the most severe pain [18].

Cozen's test

Every case was asked to extend the wrist (in a neutral position) against resistance while sitting in a chair with no armrest, shoulder with slight adduction, and elbow flexed at 90°, with the forearm in pronation. Patients were told to do this maneuver, with as much effort they could, twice with an interval period of two minutes between each attempt. The test is considered positive if the patient experienced pain in the lateral epicondyle [19].

Patient rated elbow evaluation

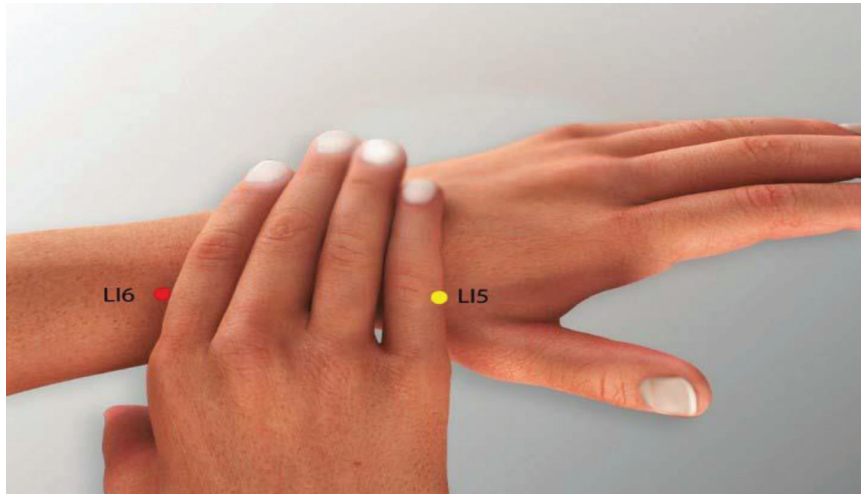
It is a questionnaire assessing pain sensation and level of disability in the affected elbow joint. The marks are given range from 0 (painless and full function of the joint) to 100 (intolerable pain with marked deterioration of joint function).

Laser used and acupoints

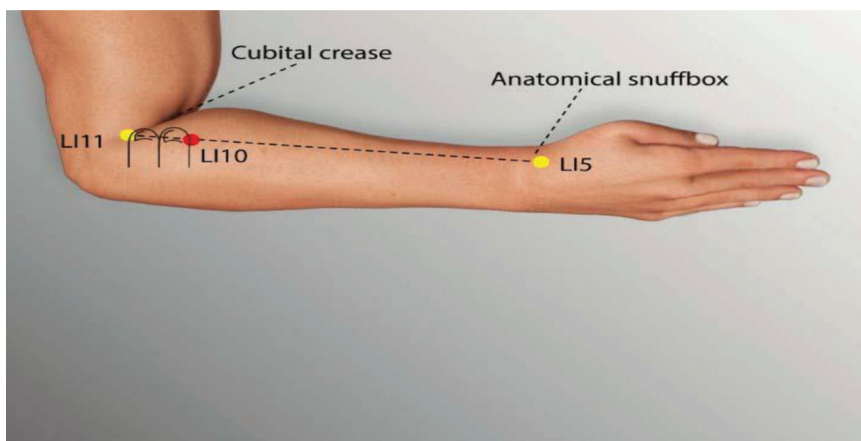
The present study applied low power laser (200 mws) with continuous wave (830 nm) on the following acupoints (large intestine 10 (LI 10), LI 11, LI 5, LI 6, Gall bladder 34 (GB 34) and Spleen 9 (Sp 9) (Figs. 1–3). Every point is subjected to laser for 1 min giving energy of 12 Joules per point. The sessions were held 3 times a week for 4 weeks. Pain (VAS) and PREE were performed just after the end of the therapy.

IL-6 measurement

Blood samples were collected from all patients before and after the end of treatment. The blood samples remained in the test tubes for about 30 min and were

Figure 1

The sites of LI 5 and LI 6 acupuncture points. Red dot LI 6, large intestine 6; yellow dot LI 5, large intestine 5.

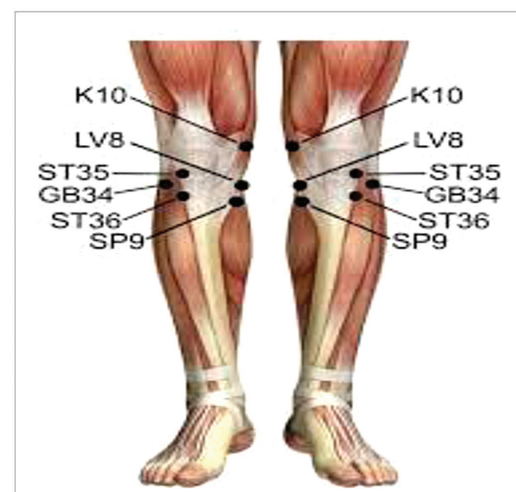
Figure 2

Sites of LI 11, LI 10 and LI 15. Yellow dot LI 11, large intestine 11; red dot LI 10, large intestine 10; yellow dot LI 5, large intestine 5.

then centrifuged at 6,000 rpm for 10 min and the serum was separated and let at -80°C until measurement of interleukin-6 (IL-6) levels. Determination of serum IL-6 was performed by the enzymatic immunoassay method using the kits supplied by DRG International, Inc. (Springfield, NJ 07081, USA), according to the manufacturer's instructions.

Statistical analysis

The collected was managed and analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 22.0, IBM Corp., Chicago, USA, 2013. Quantitative data was tested for normality using the Shapiro–Wilk test, then described as mean $\pm$ SE, and then compared using an independent t -test. Qualitative data is described as numbers and percentage and then compared using χ^2 test. The level of significance was taken at P value less than or

Figure 3

Acupoints complementary for pain.

Table 1 Comparison regarding age and sex of the two groups of adolescent patients with chronic lateral epicondylitis

Variables	Laser group (group 1)	Control group (group 2)	P value
Age (years)			
Mean±SD	15.8±1.2	15.5±1.1	[^] 0.302
Sex Number (%)			
Male	15 (50.0)	18 (60.0)	[#] 0.436
Female	15 (50.0)	12 (40.0)	

[^]Independent *t*-test. [#] Chi square test.

Table 2 Comparison regarding pain score (VAS-10)

Variables	Laser group (Group 1)	Control group (Group 2)	P value
Before	8.7±0.9	8.5±0.8	0.376
After	3.2±2.4	5.3±1.4	<0.001*
Change (%)	-63.2	-37.6	
P value	<0.001**	<0.001**	

All data are represented as Mean±SE. *Significant difference between the two group, using *t*-test at *P* less than 0.05. **Significant difference before and after treatment in each group, using *t*-test at *P* less than 0.05.

equal to 0.050. The percent of change between two values has been done using the following formula: (Treated – control/control) × 100.

Results

The data presented in (Table 1) showed insignificant differences in age (*P*=0.302) and number of males and females (*P*=0.436) between the two groups of adolescents patients with chronic lateral epicondylitis subjected to low-power laser and brufen 400 mg twice daily (group 1), or given just same dose of brufen and used as control (group 2).

The data presented in (Table 2) showed insignificant differences between the studied groups regarding pain score before intervention (*P*=0.376), then it became significantly lower (*P*<0.05) in the Laser group comparing to the control group after 4 weeks of treatment. However, Pain score exhibited significantly decreased (*P* <0.001) in both groups after 4 weeks of treatment. Moreover, pain was significantly more reduced in the Laser group with a percentage of change of -63.2 than control group (-37.6%) that was treated with brufen only.

Regarding the results of patient-rated elbow evaluation score, as shown in (Table 3). It showed insignificant differences between the studied groups regarding

elbow evaluation score before intervention (*P*=0.497), while after 4 weeks of intervention, it became significantly lower (*P*<0.05) in Laser group than control group. However, the inflammation score exhibited significantly decreased in both groups (*P* <0.001). In addition, it was reduced in Laser group (-60.5%) than in the control group (-37.1%).

Regarding the results of serum IL-6, it was found that insignificant differences between the levels of serum IL-6 in the two studied groups before intervention (*P*=0.224), while after 4 week of intervention, it became significantly lower (*P*<0.05) in Laser group than the control group. However, serum IL-6 exhibited a significant decrease (*P*<0.001) in both groups after 4 weeks of intervention. Moreover, IL-6 was significantly more reduced in the Laser group (-62.1%) than in the control group (-43.4%), as shown in (Table 4).

Discussion

In recent years, the interest in the use of laser therapy has increased gradually, although there is still heterogeneity in research data and findings, however, Low-power lasers began in Russia in the early 60's of the twentieth century. Low-power lasers have proved to be effective in the treatment of pain and inflammation through light beams instead of the

Table 3 Comparison regarding patient rated elbow evaluation score

Variables	Laser group (Total=30)	Control group (Total=30)	P value (groups)
Before	81.7±6.4	82.8±6.5	0.497
After	32.3±17.7	52.1±11.8	<0.001*
Change (%)	-60.5	-37.1	
P value	<0.001**	<0.001**	

All data are represented as Mean±SE. *Significant difference between the two group, using *t*-test at *P* less than 0.05. **Significant difference before and after treatment in each group, using *t*-test at *P* less than 0.05.

Table 4 Comparison regarding serum interleukin-6 (pg/mL)

Variables	Laser group (Total=30)	Control group (Total=30)	P value (groups)
Before	119.9±8.0	121.9±4.6	0.224
After	45.4±25.1	69.0±17.2	<0.001*
Change (%)	-62.1	-43.4	
P value	<0.001**	<0.001**	

All data are represented as Mean±SE. *Significant difference between the two group, using *t*-test at *P* less than 0.05. **Significant difference before and after treatment in each group, using *t*-test at *P* less than 0.05.

heat produced by high-power laser devices [20]. However, the mechanism of action of low-power laser is still controversial. It may enhance the release of serotonin and trigger anti-inflammatory effects [21].

Moreover, low-power laser may increase the intracellular messengers such as adenosine triphosphate and ionized calcium. Also, it can accelerate collagen synthesis which decreases oxidative stress and improves the fibrosis of the tendon. This helps muscle healing and alleviate inflammation and pain [22].

Low-power laser can also relieve the pain through increasing the secretion of morphine like substances such as beta- endorphins and enkephalins. Additionally, it may inhibit pain signals in A-delta and C fibers. Low-power laser increases the blood flow, thus improving blood vessels permeability and boosting the metabolic response. This helps combating inflammation, repair damaged cells, and improve pain [23].

In the current study, pain on visual analog scale and patient rated elbow evaluation showed significant improvement after low-power laser treatment. To our knowledge, this is the first trial accomplished on adolescents. Many studies showed a significant reduction of pain and increased functional elbow capacity in lateral epicondylitis adults treated with low-power laser.

Ercan *et al.* [24] used low-power laser device at a wavelength of 904 nm, a power of 240 MW in a pulsed mode (5,000 Hz of frequency) over the ashi points. Each point was subjected to laser for 30 s. Laser sessions were performed three times per week for 3 weeks. A significant alleviation of pain and restoration of mobility of the joint had been detected in patients (18–64 years age) although the total energy applied to each point (7.2 joules) is less than what used in our study (12 joules). Contrary to the current study, Ercan *et al.* [24] clinical trial did not include a control group.

A meta-analysis study conducted by Bjordal, *et al.* [25] showed significant pain relief in 10 trials including lateral epicondylitis patients treated by lower power laser just after the last laser session. All these trials had control groups that showed also decrease in pain on visual analog scale but less significant than the laser groups.

Lam *et al.* [26] and Stergioulas [27] applied low-power laser (904 nm) directly to the affected tendon. They detected that the pain was significantly reduced more than placebo. Another trial using low-power laser with shorter wavelength (632 nm) than ours (830 nm) showed also significantly better results than ultrasound therapy [28]. However, Bisset and Vicenzino [29] and Basford *et al.* [30] showed no significant pain improvement after laser sessions. This may be due to inadequate laser power or energy.

In the current study, low-power laser proved significant decrease in serum pro-inflammatory IL-6 levels in both group treated with Laser and brufen or with brufen only. Moreover the reduction in cases treated with Laser exhibited more reduction than in cases treated by brufen only and used as control. In agreement with our study, many published papers concluded the anti-inflammatory effect of the low-power laser and its efficiency in lowering the serum levels of IL-6 [31–33].

Conclusion and recommendation

Low-power laser is efficient in pain reduction and improvement of elbow joint function when used with the selected parameters (continuous wave, 830 nm wavelength, and energy of 12 joules) on the acupoints specific for lateral epicondylitis.

We recommend more attention to diagnose lateral epicondylitis in the age group selected in this study which is the first trial performed on adolescents from 14 to 17 years. More number of patients should be included in further studies, follow-up of the cases for 3 to 6 months after termination of laser sessions and higher energy (more than 12 Joules per point) can be applied.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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