



# Effectiveness of laser acupuncture combined with physiotherapy in tennis elbow syndrome: a pre-post pilot study

Hung Le Viet Nguyen<sup>1</sup>, Duy Thi Thuy Duong<sup>1</sup>, Huy Chung Ly<sup>1,2</sup>, Sang Thanh Do<sup>1,2,\*</sup>

<sup>1</sup>Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam

<sup>2</sup>Department of Physiotherapy, Le Van Thinh Hospital, Ho Chi Minh City, Vietnam

## Abstract

**Introduction:** Lateral epicondylitis (LE) syndrome affects 1–3% of adults, and the effectiveness of non-invasive treatments remains unclear. Laser acupuncture (LA) may relieve pain as a less invasive alternative to other treatments, while physical therapy can help reduce stress on the tendons. Therefore, this study aimed to determine the potential effect of combining LA with physical therapy in patients with LE syndrome.

**Methods:** The pilot study used a single group with 30 LE patients, who were treated by LA combined with physiotherapy exercise for four weeks. Pain levels were measured using the Visual Analog Scale (VAS), and elbow motion was assessed using a goniometer to measure the range of motion (ROM) from February to September 2024. The VAS and ROM have been compared before treatment and after treatment.

**Results:** After 4 weeks of treatment, VAS pain scores significantly decreased from 70 mm (60–70) to 30 mm (30–40) ( $p < 0.001$ ). Elbow ROM extension decreased from 8 (5.7–10) to 0 (0–1) ( $p < 0.001$ ), and Elbow ROM flexion improved from 138.5 (134.2–140) to 142 (140–144) ( $p = 0.002$ ). No side effects were observed during the study.

**Conclusions:** After four weeks, the combination of LA and physiotherapy exercises significantly reduced pain and improved ROM (extension and flexion) with no adverse events reported. This combined treatment offers potential analgesic effects for LE with no side effects.

**Keywords:** acupuncture therapy; adult; humans; lateral epicondylitis

## 1. INTRODUCTION

Lateral epicondylitis (LE) syndrome, also known as row-er's elbow, involves inflammation at the attachment site of the extensor carpi radialis brevis tendon, characterized by pain at the LE of the humerus [1]. Previous studies estimated

that it affects 1–3% of adults annually. Additional research reported an overall incidence of LE syndrome by age and gender to be 3.4 per 1,000, with higher incidence rates among men and women aged 40–49 and 50–59, respectively [2,3]. The burden of LE syndrome continues to increase annually due to repeated microtrauma to the forearm's extensor

Received: Sep 12, 2024 / Revised: Nov 20, 2024 / Accepted: Nov 27, 2024

\*Corresponding author: Sang Thanh Do. Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam.  
E-mail: dtsang@ump.edu.vn

Copyright © 2025 MedPharmRes. This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

tendon [3]. It is a painful condition affecting the soft tissue on the lateral side of the elbow. The pain originates from or near the common extensor tendon attachment at the LE and can radiate into the forearm and the back of the wrist [4]. The primary cause is usually the overuse of the wrist and finger extensor muscles, particularly the extensor carpi radialis brevis, or strain resulting from opposing movements in the wrist's supinated position [5]. According to Traditional Chinese Medicine (TCM), LE syndrome is described under syndromes like Bi and Tong. The cause is often attributed to external factors or a combination of internal and external factors causing qi and blood stasis in the elbow meridians, manifesting as pain, swelling, and limited movement. It is categorized into deficiency or excess syndromes. Common TCM patterns include wind-cold-damp, qi stagnation with blood stasis, or qi and blood deficiency with stasis. Treatment primarily involves Chinese herbal medicine and non-pharmacological methods such as acupressure, electroacupuncture, hydroacupuncture, catgut embedding, and laser acupuncture (LA) [6,7].

LA is a modern acupuncture technique that uses laser beams to stimulate acupuncture points, offering a less invasive alternative to traditional needles and demonstrating therapeutic effectiveness [8–11]. LA is non-invasive and may be a more feasible treatment option for both younger and older patients, as well as for those who have a fear of needles. One primary ethical consideration is the principle of non-maleficence, which emphasizes the importance of not causing harm to the patient. Non-invasive treatments like LA typically carry fewer risks of adverse effects such as infection, bleeding, or nerve damage which can be associated with invasive procedures such as manual acupuncture, corticosteroid injection, or surgery [12]. While some studies suggest that LA may benefit patients with tennis elbow, the evidence is still evolving. Ensuring that patients receive effective care is also an ethical obligation under the principle of beneficence—acting in the patient's best interest [13].

Recent studies have shown that LA significantly improved pain in patients with LE [10]. Additionally, combining physical therapy for functional rehabilitation in treating LE syndrome treatment is essential for alleviating pain and

restoring elbow joint function, as well as preventing long-term stiffness [11,14]. Elbow joint exercises, which are easy to perform, cost-effective, and applicable in the community, have shown high efficiency. In practice, many hospitals use LA and physical therapy to treat LE; however, its effectiveness has not been thoroughly evidence based.

Given the limitations in evaluating treatment effectiveness for pain relief and elbow range of motion (ROM) improvement, the combination of LA and physical therapy has not been thoroughly assessed for LE syndrome. Additionally, to enhance the effectiveness of combining TCM and modern medicine, we conducted the study: “Pain reduction and range of motion improvement of LA combined with physical therapy in patients with LE syndrome”.

## 2. MATERIALS AND METHOD

### 2.1. Study design

This pre-post pilot study aimed to evaluate the effectiveness of LA combined with physiotherapy in reducing pain and assessing potential side effects in patients with LE. This initial assessment served as a foundational step toward the development of future randomized controlled trials (RCTs) to provide more robust evidence on the efficacy and safety of this intervention. The research protocol was approved by the Institutional Review Board of the University of Medicine and Pharmacy in Ho Chi Minh City, ensuring compliance with ethical standards and following the TREND Statement Checklist (Transparent Reporting of Evaluations with Non-randomized Designs) (Supplementary 1).

To enhance transparency and minimize bias, the study registered its pre-post pilot trial protocol before to data collection. ClinicalTrials.gov ID: NCT06535594 (<https://clinicaltrials.gov/study/NCT06535594>).

### 2.2. Sample size calculation

Because this was a pre-post pilot study, the sample size was set at 30 patients [15]. According to Julius (2005) [16], a sample size of approximately 12 participants per group is a common guideline for pilot studies, as it provides enough data to estimate variability and inform the design of larger

studies. In addition, the effect size of LA in LE syndrome was 1.6, indicating a large effect [17,18]. Therefore, our choice of 30 participants fell within the recommended range for pilot studies and allowed for initial observations of treatment effects on pain (Visual Analog Scale [VAS]) and ROM.

### 2.3. Participants

A total of 30 patients diagnosed with LE were recruited from the outpatient department of the Physiotherapy and Rehabilitation Department at Le Van Thinh Hospital between February and September 2024. The diagnosis was based on a clinical examination (main symptoms: pain and tenderness at the LE or radial head lasting for more than a week, not caused by direct trauma, with at least one positive Cozen, Mill, or Maudsley test) and imaging tests.

#### 2.3.1. Inclusion criteria

1. Individuals between the ages of 19–65 years with LE in one arm and pain persisting for at least four weeks.
2. Individuals with tenderness limited to the elbow joint and surrounding area.
3. Individuals reporting pain during resisted extension of the middle finger and wrist.
4. Individuals with an average pain score of 40 mm or higher (0–100) mm on the VAS score in the week before the screening visit.
5. Individuals who volunteered to participate in the study and signed a consent form.

#### 2.3.2. Exclusion criteria

1. Patients who have undergone previous elbow surgery, have systemic diseases affecting joint mobility, or have received non-steroidal anti-inflammatory drugs, acupuncture, or physiotherapy for lateral epicondylitis within the last two weeks [15].
2. Patients requiring elbow joint replacement surgery.
3. Patients with psychiatric disorders.
4. Patients with other-related conditions besides LE, including elbow trauma, tuberculosis, or cancer.
5. Patients with unexplained skin abnormalities around the elbow joint, those currently using immunosuppressive drugs, or those undergoing prolonged corticosteroid treatment.
6. Patients with an acute illness requiring prior intervention.
7. Patients with a history of trauma, ligament damage, fracture, tumor, or previous elbow joint surgery.

### 2.4. Study interventions

#### 2.4.1. Thread laser acupuncture produces

Patients were treated by LA for 15 minutes per day, five times a week, continuously for four weeks [15,19]. The research used ACULASER Plus+ M320 devices (manufactured in Vietnam) to deliver pulsed mode waves at the wavelength of 780 nm, frequency of 60 Hz, wattage of 6 mW, and dose of 2–3 J for each acupuncture point (maximum 10 points and minimum 5 points) [15] (Table 1). Previous research and the

**Table 1. Acupoint locations in the study**

Acupoint	Location	Effect	Biological mechanisms	Intensity
Ashi points	Painful areas around the elbow	Pain relief	Improving blood circulation, releasing endorphins, anti-inflammatory actions through the reduction of pro-inflammatory cytokine [21–23]	2 J/cm <sup>2</sup>
Quchi (LI11)	On the lateral aspect of the elbow, at the midpoint of the line connecting LU5 with the lateral epicondyle of the humerus.	Relief painful inflammation and weakness of the arm		3 J/cm <sup>2</sup>
Shousanli (LI10)	On the posterolateral aspect of the forearm, on the line connecting LI5 with LI11, 2 B-cun inferior to the cubital crease.	Pain relief, removes obstructions from the channel		
Zhouliiao (LI12)	On the posterolateral aspect of the elbow, superior to the lateral epicondyle of the humerus, anterior to the lateral supraepi-condylar ridge.	Pain relief, removes obstructions from the channel		
Chize (LU5)	On the anterior aspect of the elbow, at the cubital crease, in the depression lateral to the biceps brachii tendon.	Relaxes the sinews and eases pain		

Illustrations are modified from the WHO Standard 112 acupuncture point locations in the Western Pacific Region, 2009 (ISBN 978 92 9061 2487).

World Association for Laser Therapy have recommended that LA at low frequency LA (such as 60 Hz in our research) has a therapeutic effect on musculoskeletal disease [20]. Before conducting the study, a traditional medicine specialist with more than 10 years of experience calibrated and checked the laser [9].

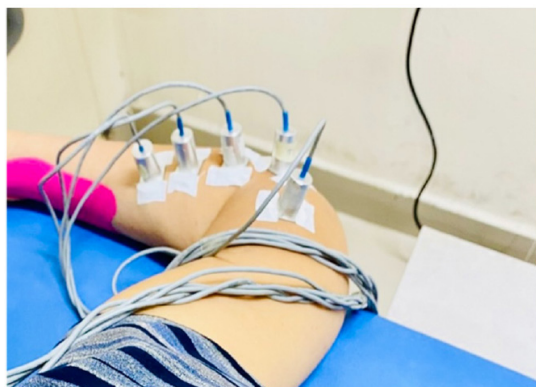


Fig. 1. Laser acupuncture process.

The procedure was conducted in the treatment room and involved exposing the treatment area, thoroughly washing hands, identifying the acupuncture points (Table 1), disinfecting the skin at the acupuncture area, and securing the LASER channel at the acupuncture points, ensuring that the LASER beam was perpendicular to and close to the skin surface (Fig. 1).

#### 2.4.2. The exercise therapy method

The exercise therapy method involved six elbow joint exercises, conducted at the Department of physiotherapy and rehabilitation, Le Van Thinh Hospital. There were a total of six exercises (Fig. 2) for patients with tennis elbow [23–25]. Each exercise was performed three times a day, with each session involving five repetitions of the movement, over four weeks, gradually increasing weight until the movement was effective but below the pain threshold. Painful movements were avoided, and exercises causing pain or discomfort were

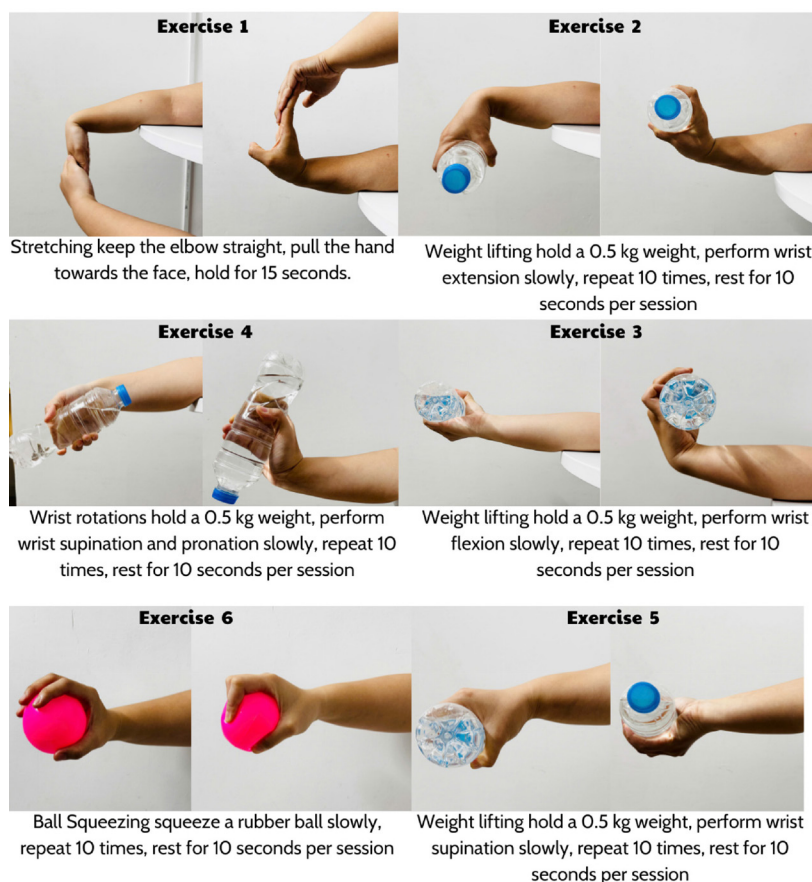


Fig. 2. The exercise for LE patient.

discontinued following consultation from a physician.

## 2.5. The outcome definition

### 2.5.1. Visual Analog Scale score

The VAS is commonly used in clinical research to measure symptom intensity and has demonstrated reliability and validity for assessing acute and chronic pain assessment. The score is recorded by placing a handwritten mark on a 100 mm line with “no pain” on the left end and “worst possible pain” on the right. Patients mark a point on the line that corresponds to their pain level [26]. The VAS is also divided into three different levels of pain [27]:

From 0–39 indicates mild pain;

From 40–69 indicates moderate pain;

From 70–100 indicates severe pain.

### 2.5.2. Range of motion (ROM) score

#### 2.5.2.1. Elbow flexion range of motion (ROM)

To measure elbow flexion ROM, move the hand toward the shoulder with the forearm in supination. Flexion ends when resistance is felt, and further attempts result in shoulder flexion.

#### 2.5.2.2. Elbow extension range of motion (ROM)

To measure elbow extension ROM, use a goniometer by positioning the fulcrum at the LE, aligning the stationary arm with the humerus, and aligning the moving arm with the forearm. Elbow extension typically ranges from 0° to 10° (or more in cases of hyperextension) and is not measured separately, as it serves as the starting point for flexion measurement.

#### 2.5.2.3. Forearm pronation range of motion (ROM)

With the individual seated and the elbow flexed at 90 degrees, pronate the forearm by rotating the distal radius until the palm faces the floor. Pronation ends when resistance causes to shoulder rotation and abduction.

#### 2.5.2.4. Forearm supination range of motion (ROM)

Supinate the forearm by rotating the distal radius so the palm faces upward. Supination ends when resistance leads to shoulder rotation and adduction.

The active ROM of the elbow joint was measured using a goniometer. The study measured VAS pain scores and ROM scores at five time points: before treatment (T0/Tpre), at weekly intervals during treatment (T1, T2, T3), and after 4 weeks of treatment (T4/Tpost).

In the study, the patients were not informed about the aim of the study, and the VAS score and ROM were measured by different physiologists before and after the intervention to reduce bias. Additionally, we limited excessive interaction between researchers and participants throughout the study to minimize potential psychological influence during the intervention [28].

### 2.5.3. Adverse effects

Adverse events were assessed at each visit based on vital signs and medical history. Common transient side effects such as hypotension [29], dizziness, headaches [30], and fatigue [31], skin redness, decreased vision, burna, hemorrhagea were recorded. All adverse events were documented in the case report form without referencing their association with interventions. In cases of severe adverse events, participants were required to temporarily stop the clinical trial [26].

## 2.6. Data analysis

Data were entered using Microsoft Office 365 Excel and Epidata, and analyzed using R-4.4.2. To maintain statistical test efficiency, the multiple imputation method was used to handle missing values. The the Shapiro-Wilk test was to assess the distribution of quantitative data. Data were expressed as mean±SD when normally distributed (analyzed using paired t-tests), or as median and interquartile range when not normally distributed (analyzed using Wilcoxon rank-sum test). Qualitative variables were described using frequency and percentage. Differences were considered statistically significant if  $p \leq 0.05$ . To measure effect size, Cohen's d was applied for normally distributed, and Cliff's Delta was used for ordinal or non-normally distributed data. The results were presented with 95% confidence intervals (CIs).



### 3. RESULTS

#### 3.1. Characteristics of participants

All 30 LE patients were screened for eligibility, and no patients met the exclusion criteria or were discontinued during the study (Fig. 3). The patients had a median age of 64 years (53.5–68), ranging from 39 to 77 years. The ratio of female to male patients was approximately equal and consistent across age groups. Intellectual occupations predominated (80%) with no statistically significant difference across age groups ( $p>0.05$ ). Regarding pain characteristics, the median VAS score was 70 (60–70), with patients primarily in the moderate and severe pain categories at approximately equal rates. ROM was generally limited in flexion extension; however, forearm pronation-supination remained within the normal range (Table 2).

#### 3.2. Visual Analog Scale (VAS) scores

After four weeks of treatment, the VAS score showed a statistically significant reduction from T0, 70 (60–70) to T4, 30 (30–40) ( $p<0.001$ ; Cohen's  $d$  effect size for change in VAS score for LE=3.84; 95% [CI] 2.66–5.01; Cliff's Delta effect size=1; 95% [CI] –1–0.99). Throughout the treat-

ment period, a statistically significant reduction in the VAS score was also observed starting from the first week (T1) ( $p<0.05$ ) (Fig. 4A). Additionally, patients with severe pain tended to experience a greater reduction in pain compared to those with moderate pain, and there was no significant difference in VAS scores at T3 ( $p>0.05$ ) (Fig. 4C). There was also no difference in VAS scores throughout the treatment period based on age (Fig. 4B) and occupational group (Fig. 4D).

#### 3.3. Elbow range of motion (ROM) scores

##### 3.3.1. The elbow extension range of motion (ROM)

After 4 weeks, the extension ROM decreased from 8 (5.7–10) at T0 to 0 (0–1) at T4, with a statistically significant difference ( $p=0.002$ , Cohen's  $d$  effect size for change in ROM of extension for LE=2.1; 95% [CI] 1.3–2.8; Cliff's Delta effect size=–0.77; 95% [CI] –0.93–0.31). Throughout the study, the extension ROM improved each week starting from the T2 (Fig. 5).

##### 3.3.2. The elbow flexion range of motion (ROM)

After 4 weeks, the flexion ROM improved from 138.5 (134.2–140) to 142 (140–144), with a statistically signifi-

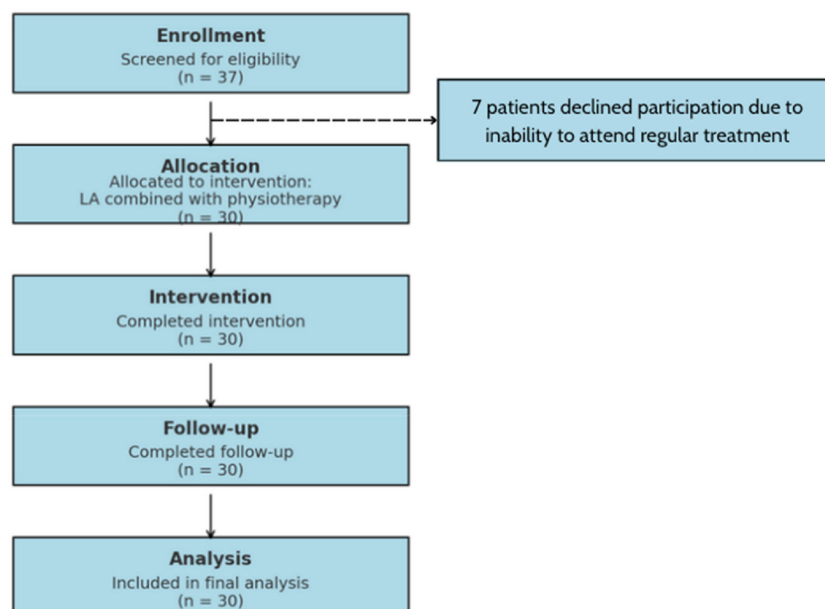


Fig. 3. Flow diagram of the study.

**Table 2. Baseline clinical characteristics of LE patient (n=30)**

Clinical characteristic	Total (n=30, %)	Age group (n, %)		p-values
		≤60 years (12, 40)	>60 years (18, 60)	
Age (median, IQR)	64 (53.5–68)*			
Gender				
Female, n (%)	14 (46.7)	5 (16.7)	9 (30)	0.94 <sup>1)</sup>
Male, n (%)	16 (53.3)	7 (23.3)	9 (30)	
Career				
Manual labor, n (%)	6 (20.0)	2 (6.7)	4 (13.3)	1 <sup>1)</sup>
Intellectual work, n (%)	24 (80.0)	10 (33.3)	14 (46.7)	
Pain arm				
Right, n (%)	23 (76.67)	8 (26.7)	15 (50)	0.3 <sup>2)</sup>
Left, n (%)	7 (23.33)	4 (13.3)	3 (10.0)	
Levels of pain				
Mild pain, n (%)	0 (0)	0 (0)	0 (0)	0.2 <sup>2)</sup>
Moderate pain, n (%)	14 (46.6)	4 (13.3)	10 (33.3)	
Severe pain, n (%)	16 (53.4)	8 (26.7)	8 (26.7)	0.2 <sup>3)</sup>
VAS score, median (IQR)	70 (60–70)*	65 (60–72.5)	70 (60–70)	
ROM elbow				
Flexion, median (IQR)	138.5 (134.2–140)*	136 (134–140)	140 (134–142)	0.4 <sup>3)</sup>
Extension, median (IQR)	8 (5.7–10)*	8 (6–10)	9 (5.5–10)	0.9 <sup>3)</sup>
Supination, median (IQR)	79 (78.3–81)*	80.5 (79–81.3)	79 (78–79.8)	0.1 <sup>3)</sup>
Pronation, median (IQR)	79.5 (78–81)*	80.5 (79–81.3)	79 (78–79.8)	0.1 <sup>3)</sup>

<sup>1)</sup> Chi – squared test; <sup>2)</sup> Fisher's exact test; <sup>3)</sup> Wilcoxon rank-sum test.

\* p<0.05 Shapiro-Wilk test (Non-normal distribution).

LE, lateral epicondylitis; VAS, Visual Analog Scale; IQR, interquartile range; ROM, range of motion.

cant difference ( $p=0.002$ , Cohen's  $d$  effect size for change in ROM of flexion for LE=−0.83; 95% [CI] −1.20–−0.46; Cliff's Delta effect size=0.46; 95% [CI] 0.16–0.67). The extension range gradually increased over time; however, this change was not statistically significant ( $p>0.05$ ) (Fig. 6).

### 3.3.3. The forearm supination – pronation range of motion (ROM)

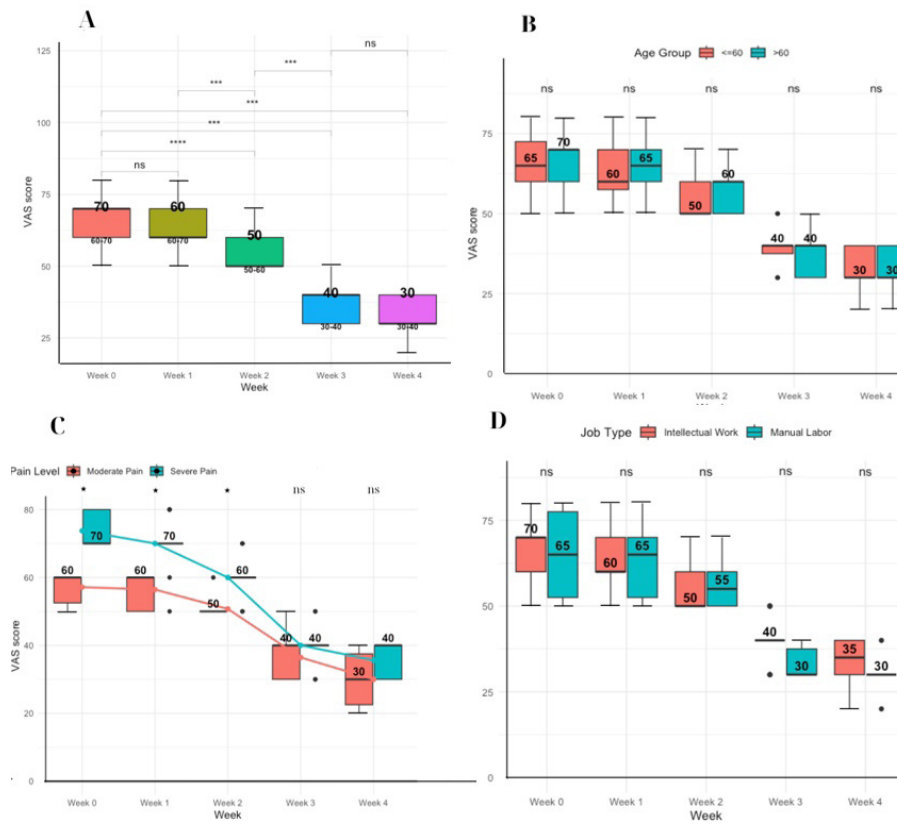
After 4 weeks, almost no statistically significant changes in supination and pronation angles were observed ( $p>0.05$ ) (Table 3).

### 3.4. Safety assessment

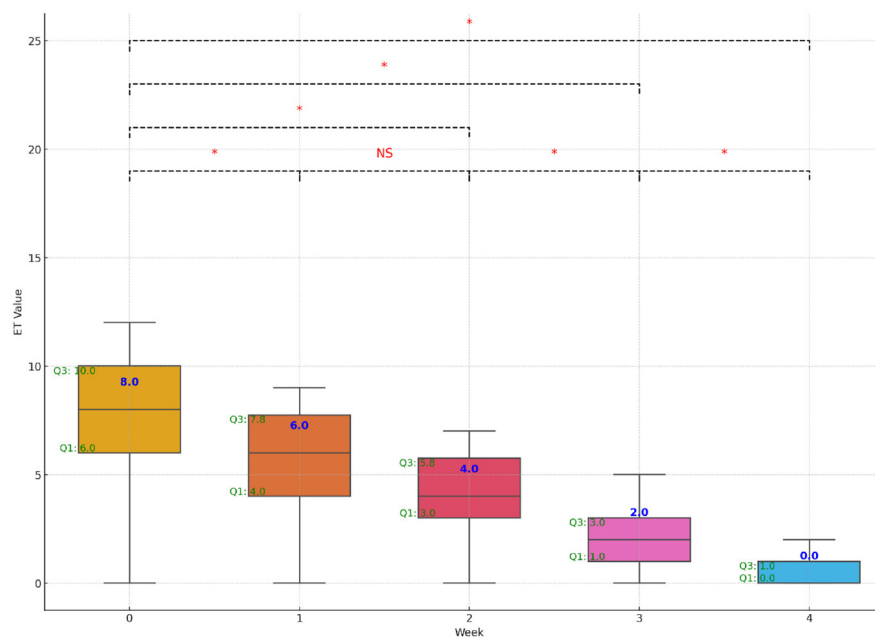
No side effects were observed when LA was administered during the study (Table 1–Supplementary 1).

## 4. DISCUSSION

This is the first study in Vietnam to preliminarily assess the potential effectiveness of combining physical therapy and LA in reducing pain and improving the ROM in LE patients. In a pre-post study conducted over four weeks of intervention, no patients withdrew during the study period. The results suggested that low-level laser therapy (LLLT) at acupuncture points around the elbow (Ashi, LI11, LI10, LI12, LU5) combined with physical therapy has the potential for pain relief and ROM improvement for patients with LE syndrome. Our findings are consistent with other studies on the effectiveness of pain reduction and ROM improvement [18,19,32,33]. However, there are a few differences from previous research. First, unlike the study by Kamel IEMA (2024) [32] on adolescent subjects, participants in our study had an average of 64 years (53.5–68) and included individu-

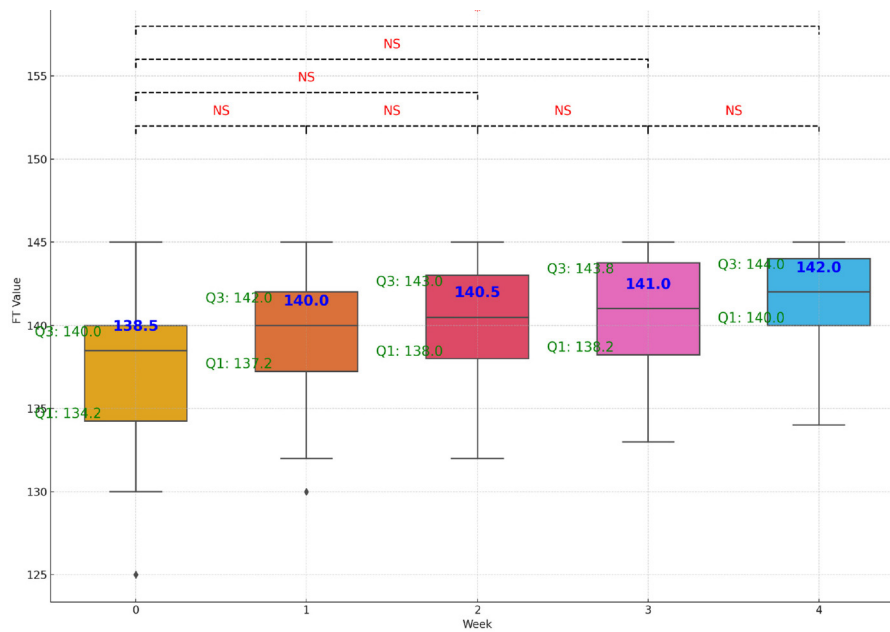


**Fig. 4.** Patient's VAS pain score in total, by age groups, occupational groups and severity level during the intervention. (A) Changes in total VAS score throughout the intervention. (B) Changes in VAS score by age group. (C) Changes in VAS score by pain level. (D) Changes in VAS score by occupation. Wilcoxon rank-sum test: \*  $p \leq 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; NS, Not Significant.  $p > 0.05$ . VAS, Visual Analog Scale.



**Fig. 5.** The comparison of the range of motion (ROM) in extension before and after treatment. Wilcoxon rank-sum test: \*  $p \leq 0.05$ ; NS  $p > 0.05$ .





**Fig. 6.** The comparison of the range of motion (ROM) in flexion before and after treatment. Wilcoxon rank-sum test: \*  $p \leq 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ; NS  $p > 0.05$ .

**Table 3.** Assessment of Forearm supination - pronation range of motion in patients

Time point	Supination		Pronation	
	Median (IQR)	p-value	Median (IQR)	p-value
Tpre	79 (78.3–81)		79.5 (78–81)	
Tpost	79 (78–81)	>0.05	79.5 (78–81)	>0.05

p-value: Wilcoxon rank-sum test compares the Tpre with Tpost.  
IQR, interquartile range.

als still engaged in the workforce or sports, as well as elderly patients who are retired but continue to perform household chores. At Le Van Thinh Hospital, our patients were generally older but remained active in daily activities [34]. This approach may offer an advantage over traditional acupuncture or other invasive treatments for elderly patients who fear needles and have multiple comorbidities, as it involves only LA and physical therapy rather than NSAIDs, which were used in previous studies [32].

Secondly, although the study showed pain reduction and increased ROM after 4 weeks within a single group, this may be subject to placebo effects, making it challenging to assess the individual effectiveness of each method. However, we mitigated this by designing the study to limit excessive interaction between researchers and participants throughout

the study period [35,36]. Additionally, the effectiveness in reducing the VAS score in our study was higher than the results of the placebo group in Acosta-Olivo CA's study, which used normal saline injections. These findings suggest that the observed effects are due to the laser combined with physiotherapy [37]. Thus, we will include a control group to eliminate the placebo effect and assess the impact on patient function to confirm its effectiveness.

The laser dosage used was 2–3 J/cm<sup>2</sup> for acupoints, based on previous studies suggested by Stergioulas A [38,39]. Meta-analysis research indicated that a power output of 2J is suitable for acute pain points (ashi points), facilitating rapid recovery during inflammation and wound healing in the affected area [38]. Additionally, research by Longo L suggested that a power output of 3J is effective for nerve regeneration and improving blood circulation in painful joint areas [40]. Regarding the mechanism, the therapeutic effectiveness of LA through LLLT is supported by evidence demonstrating its impact on cellular and molecular mechanisms. These include activation of mitochondrial respiration, which leads to increased ATP production [41], release of nitric oxide, promoting vasodilation [42], a decrease in pro-inflammatory cytokines (e.g., TNF- $\alpha$ , IL-1 $\beta$ ); and an increase in anti-in-

flammatory cytokines (e.g., IL-10), resulting in reduced inflammation and pain [43].

According to Traditional Medicine, tennis elbow is described within the frameworks of Bi Syndrome and Painful Obstruction Syndrome. Common causes often involve external pathogens or a combination of internal and external factors, leading to Qi and blood obstruction within the meridians around the elbow area. The connection between TCM meridians and musculoskeletal pain is notable, as studies show that exercises targeting meridians can effectively reduce pain and improve function. TCM holds that meridians are channels through which vital energy (Qi) flows, and exercises aimed at these pathways can enhance both physical and emotional well-being [44]. This represents a new approach to managing tennis elbow in the future, aiming to limit invasive procedures.

This study has some limitations. First, while our research focused solely on Vietnamese subjects, factors such as lifestyle, occupation, healthcare systems, and cultural attitudes may differ from those in other countries. However, studies on the effectiveness of low-power laser therapy have been conducted across various continents, including Europe [39], and Asia [17,18] with different lifestyle, cultural, and physical activity contexts, suggesting potential broader applicability in other regions in future research.

Second, due to ethical considerations and resource limitations, our study followed patients for only four weeks and did not include inflammatory markers. However, prior studies have assessed the biological effects of laser therapy on tendon repair and collagen formation [45], and have shown improvement with extended treatment durations of over eight weeks [17,43]. Moving forward, we plan to conduct longer-term studies with larger sample sizes, pending approval from the ethics committee.

Finally, the cost of LA devices is higher than that of traditional acupuncture and requires specialized training for practitioners. However, since these devices are manufactured in Vietnam, a developing country, and LA training is included in the Traditional Medicine Doctor program, in addition to being less expensive than methods such as corticosteroid injections or surgery, LA has the potential for widespread use

in clinics in the future.

## 5. CONCLUSION

Low-intensity LA combined with physical exercise is a safe, non-invasive approach with the potential to improve acute pain and ROM in elderly patients in Vietnam with high pain levels. However, to establish it as a first-line option, further studies are needed to strengthen clinical evidence. Additionally, the group with higher pain intensity showed greater pain reduction compared to the moderate-pain group.

## SUPPLEMENTARY MATERIALS

Supplementary materials are only available online from:  
<https://doi.org/10.32895/UMP.MPR.9.2.16>

### Acknowledgements

Not applicable.

### Funding sources

This study was provided in parts by research grants from Le Van Thinh hospital and University of Medicine and Pharmacy at Ho Chi Minh City.

### Conflict of interest

No potential conflict of interest relevant to this article was reported.

### ORCID

Hung Le Viet Nguyen

<https://orcid.org/0009-0004-6878-5569>

Duy Thi Thuy Duong

<https://orcid.org/0009-0003-2154-1674>

Huy Ly Chung

<https://orcid.org/0000-0002-4950-1493>

Sang Thanh Do

<https://orcid.org/0009-0009-8176-2501>

### Authors' contributions

Conceptualization: DTT Duong.

Data curation: ST Do, HC Ly.

Formal analysis: HLV Nguyen.

Methodology: HLV Nguyen, HC Ly.

Validation: HLV Nguyen, DTT Duong, HC Ly, ST Do.

Writing - original draft: HLV Nguyen, DTT Duong, ST Do.

Writing - review & editing: HLV Nguyen, DTT Duong, HC Ly, ST Do.

### Availability of data and material

Upon reasonable request, the datasets of this study can be available from the corresponding author.

### Ethics approval

The Council of Ethics in Biomedical Research at the University of Medicine and Pharmacy at Ho Chi Minh City approved this study on February 1st, 2024, No. 271/HĐĐ- ĐHYD (Supplementary 2).

Participants were thoroughly informed about the potential adverse events, benefits, and research procedures before voluntarily providing written Informed Consent Form to participate (Supplementary 3). Personal information will be kept anonymous. Each participant will be assigned a unique study number. This number will help distinguish their data from the rest of the study population. Only research team staff authorized by the lead investigator could access this personal information.

## REFERENCES

1. Nguyen TX. Guidelines for diagnosis and treatment of musculoskeletal diseases. Hanoi: Hanoi Medical Publishing House; 2016.
2. Duncan J, Duncan R, Bansal S, Davenport D, Hacker A. Lateral epicondylitis: the condition and current management strategies. *Br J Hosp Med*. 2019;80(11):647-51.
3. Degen RM, Conti MS, Camp CL, Altchek DW, Dines JS, Werner BC. Epidemiology and disease burden of lateral epicondylitis in the USA: analysis of 85,318 patients. *HSS J*. 2018;14(1):9-14.
4. Jameson. Harrison's principles of internal medicine. McGraw Hill; 2018.
5. Ciccotti MC, Schwartz MA, Ciccotti MG. Diagnosis and treatment of medial epicondylitis of the elbow. *Clin Sports Med*. 2004;23(4):693-705.
6. Nguyen Thi B, Le Thi Lan H. Pathology and internal medicine treatment combining eastern and western medicine. Hanoi: Medical Publishing House; 2022.
7. Trinh Thi Dieu T. Acupuncture studies 2. Hanoi: Medical Publishing House; 2019.
8. Adly AS, Adly AS, Adly MS. Effects of laser acupuncture tele-therapy for rheumatoid arthritis elderly patients. *Lasers Med Sci*. 2022;37(1):499-504.
9. Zhou Y, Guo Y, Zhou R, Wu P, Liang F, Yang Z. Effectiveness of acupuncture for lateral epicondylitis: a systematic review and meta-analysis of randomized controlled trials. *Pain Res Manag*. 2020;2020(1):8506591.
10. Chang WD, Lai PT, Tsou YA. Analgesic effect of manual acupuncture and laser acupuncture for lateral epicondylalgia: a systematic review and meta-analysis. *Am J Chin Med*. 2014;42(6):1301-14.
11. Dingemans R, Randsdorp M, Koes BW, Huisstede BMA. Evidence for the effectiveness of electrophysical modalities for treatment of medial and lateral epicondylitis: a systematic review. *Br J Sports Med*. 2014;48(12):957-65.
12. Taylor SA, Hannafin JA. Evaluation and management of elbow tendinopathy. *Sports Health*. 2012;4(5):384-93.
13. Trinh KV, Phillips SD, Ho E, Damsma K. Acupuncture for the alleviation of lateral epicondyle pain: a systematic review. *Rheumatology*. 2004;43(9):1085-90.
14. Yoon SY, Kim YW, Shin IS, Kang S, Moon HI, Lee SC. The beneficial effects of eccentric exercise in the management of lateral elbow tendinopathy: a systematic review and meta-analysis. *J Clin Med*. 2021;10(17):3968.
15. Shin KM, Kim JH, Lee S, Shin MS, Kim TH, Park HJ, et al. Acupuncture for lateral epicondylitis (tennis elbow): study protocol for a randomized, practitioner-assessor blinded, controlled pilot clinical trial. *Trials*. 2013;14:174.
16. Julious SA. Sample size of 12 per group rule of thumb for a pilot study. *Pharm Stat*. 2005;4(4):287-91.
17. Bjordal JM, Lopes-Martins RAB, Joensen J, Couppe C, Ljunggren AE, Stergioulas A, et al. A systematic review with procedural assessments and meta-analysis of low level laser therapy in lateral elbow tendinopathy (tennis

- elbow). *BMC Musculoskelet Disord*. 2008;9:75.
18. Lam LKY, Cheing GLY. Effects of 904-nm low-level laser therapy in the management of lateral epicondylitis: a randomized controlled trial. *Photomed Laser Surg*. 2007;25(2):65-71.
19. Basford JR, Sheffield CG, Cieslak KR. Laser therapy: a randomized, controlled trial of the effects of low intensity Nd:YAG laser irradiation on lateral epicondylitis. *Arch Phys Med Rehabil*. 2000;81(11):1504-10.
20. Ly HC, Nguyen DT, Do ST, Nguyen HLV, Le NT, Nguyen TB, et al. Effect of laser acupuncture combine a knee exercise on patients with knee osteoarthritis: a pilot trial. *MedPharmRes*. 2023;7(4):120-7.
21. Liu SJ, Liu JT, Li JQ, Wang CC, Yu M, Guan ZQ, et al. Effect of acupuncture pretreatment of “Quchi”(LI11) and “Xuehai” (SP10) on mast cells and IL-33/ST2 in rats with urticaria. *Zhen ci yan jiu Acupunct Res*. 2023;48(4):311-6.
22. Shu Q, Chen L, He W, Zhou H, Liang F. A review of inflammatory signaling pathway regulated by acupuncture. *World J Acupunct Moxibustion*. 2016;26(2):63-9.
23. Johnson GW, Cadwallader K, Scheffel SB, Epperly TD. Treatment of lateral epicondylitis. *Am Fam Physician*. 2007;76(6):843-8.
24. Upadhyay S, Shukla Y, Patel KK. Effects of progressive strengthening exercises in chronic lateral epicondylitis. *Int J Health Sci Res*. 2020;7(4):244-57.
25. Bisset L, Paungmali A, Vicenzino B, Beller E. A systematic review and meta-analysis of clinical trials on physical interventions for lateral epicondylalgia. *Br J Sports Med*. 2005;39(7):411-22.
26. Pritchard M. Measuring anxiety in surgical patients using a visual analogue scale. *Nurs Stand*. 2010;25(11):40-4.
27. Collins SL, Moore AR, McQuay HJ. The visual analogue pain intensity scale: what is moderate pain in millimetres? *Pain*. 1997;72(1):95-7.
28. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. *J Clin Epidemiol*. 2014;67(3):267-77.
29. Buzinari TC, de Moraes TF, Cárnio EC, Lopes LA, Salgado HC, Rodrigues GJ. Photobiomodulation induces hypotensive effect in spontaneously hypertensive rats. *Lasers Med Sci*. 2020;35(3):567-72.
30. Quah-Smith I, Williams MA, Lundeberg T, Suo C, Sachdev P. Differential brain effects of laser and needle acupuncture at LR8 using functional MRI. *Acupunct Med*. 2013;31(3):282-9.
31. Quah-Smith JI, Tang WM, Russell J. Laser acupuncture for mild to moderate depression in a primary care setting: a randomised controlled trial. *Acupunct Med*. 2005;23(3):103-11.
32. Ahmed Kamel IEM, Ibrahim AMM, Razek WAA. Evaluation of the efficiency of laser acupuncture in management of chronic lateral epicondylitis in adolescents. *J Arab Soc Med Res*. 2024;19(1):31-6.
33. Ayşar Ö, Erdem İH. Efficiency of low-intensity laser therapy in the treatment of lateral epicondylitis. *J Health Sci Med*. 2023;6(2):481-6.
34. Cioce T, Pennella D, Brindisino F, Di Filippo L, Salomon M, Maselli F. Assessment and management of lateral elbow pain in physiotherapy clinical practice: an Italian National Survey. *Muscles Ligaments Tendons J*. 2020;10(4):698.
35. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. *J Clin Epidemiol*. 2014;67(3):267-77.
36. Goodwin MA, Stange KC, Zyzanski SJ, Crabtree BF, Borawski EA, Flocke SA. The Hawthorne effect in direct observation research with physicians and patients. *J Eval Clin Pract*. 2017;23(6):1322-8.
37. Acosta-Olivo CA, Millán-Alanís JM, Simental-Mendía LE, Álvarez-Villalobos N, Vilchez-Cavazos F, Peña-Martínez VM, et al. Effect of normal saline injections on lateral epicondylitis symptoms: a systematic review and meta-analysis of randomized clinical trials. *Am J Sports Med*. 2020;48(12):3094-102.
38. Taylor DN, Winfield T, Wynd S. Low-level laser light therapy dosage variables vs treatment efficacy of neuromusculoskeletal conditions: a scoping review. *J Chiropr Med*. 2020;19(2):119-27.
39. Stergioulas A. Effects of low-level laser and plyometric

- exercises in the treatment of lateral epicondylitis. *Photomed Laser Surg.* 2007;25(3):205-13.
40. Korolev IN, Zagorskaia NZ. The effect of infrared laser radiation of different frequencies on the healing of skin wounds. *Vopr Kurortol Fizioter Lech Fiz Kult.* 1996(3):8-10.
  41. Passarella S, Karu T. Absorption of monochromatic and narrow band radiation in the visible and near IR by both mitochondrial and non-mitochondrial photoacceptors results in photobiomodulation. *J Photochem Photobiol B.* 2014;140:344-58.
  42. Hamblin M, Demidova T. Mechanisms of low level light therapy: an introduction. In: *Proceedings of SPIE - The International Society for Optical Engineering*; 2006 Apr 2; San Diego, CA.
  43. Okita S, Sasaki R, Kondo Y, Sakamoto J, Honda Y, Okita M. Effects of low-level laser therapy on inflammatory symptoms in an arthritis rat model. *J Phys Ther Sci.* 2023;35(1):55-9.
  44. Li Z, Zhuang J, Zhang S, He Q, Zhao R, Alima T, et al. Therapeutic effects of traditional Chinese exercises on musculoskeletal pain: a systematic review and meta-analysis. *Pain Res Manag.* 2021;2021(1):5584997.
  45. Lyu K, Liu X, Jiang L, Chen Y, Lu J, Zhu B, et al. The functions and mechanisms of low-level laser therapy in tendon repair. *Front Physiol.* 2022;13:808374.