



# Investigation on the analgesic effects of ultrasound therapy and extracorporeal shock wave therapy for chronic tennis elbow

Imran akhlaq, Karishma Das

## Abstract

Tennis elbow is a widespread upper extremity disease for which a variety of therapeutic approaches have been suggested. In patients with chronic tennis elbow, this study compared the analgesic effects of extracorporeal shock wave therapy (ESWT) and ultrasound therapy (UST). Analgesics are of the utmost significance in the management of pain, as they provide relief without jeopardizing a patient's health with tennis elbow. A random allocation of total forty patients diagnosed with tennis elbow was allocated to either the UST or the ESWT group. The patients' mean ages for extracorporeal shock wave therapy is  $50 \pm 0.9$  years and for ultrasound therapy they are  $48 \pm 0.75$  years. The functional limb that is dominant in both categories is the right arm. The pain levels were measured utilising a visual analogue scale. Pain at rest was also documented. A comparison was made between and within groups regarding pain scores prior to, immediately following, and 12 weeks after treatment. Following treatment, the VAS (reduced pain) of all participants in both groups decreased. 45% patients experienced no pain after 12 weeks of the ESWT treatment and zero patients with no pain with UST group. No patients observed worst pain experience after the ESWT treatment, whereas 15% patients still observed poor pain in UST group. However, the findings indicated that ESWT exhibited a more substantial reduction in pain compared to ultrasound therapy. ESWT is, in conclusion, with a successful analgesic effect, for the treatment for persistent tennis elbow discomfort.

**Keywords:** Pain intensity, Extracorporeal shock wave therapy (ESWT), ultrasound (UST), Tennis Elbow.

## 1. Introduction

The term "Tennis Elbow," or lateral epicondylitis (LE), refers to a kind of tendinopathy characterised by persistent traumatic inflammation and degenerative illnesses originating from the common extensor of the forearm (Gong et al., 2024). It primarily results in discomfort in the elbow, affecting approximately 1% to 3% of the global population. This condition typically affects individuals between the ages of 30 and 64, with no significant difference between genders (Sen et al., 2024). Typically, the dominant upper limb is most affected, as it is frequently engaged in repetitive and forceful activity. Additionally, pain in the lateral elbow is observed,

resulting from a condition of minor instability in the lateral elbow. Various treatments can be employed for patients experiencing different levels of pain (Aldajah et al., 2022).

Tennis elbow is characterized by discomfort in the extensor muscles of the forearm and lateral epicondyle (Ibrahim et al., 2021). It may result in “chronic pain syndrome, sensitivity, and discomfort in the lateral epicondyle, especially when wrist and middle finger extension is resistant”. The diagnosis of Tennis Elbow is readily attainable via clinical examination (Razavipour et al., 2018).

Analgesics, also known as pain relievers or painkillers, for pain management, are a class of drugs. Without causing mental perplexity, paralysis, or other disruptions to the nervous system, these medications alleviate pain (Ibrahim et al., 2021). These medications have no effect on the condition's long-term results (Razavipour et al., 2018). Orthotics, ice therapy, physiotherapy, rest, and painkilling medication are common forms of therapy. When all other options have been exhausted, ESWT and UST is frequently taken into consideration. While the precise mechanism by which ESWT exerts its effects remains uncertain, speculation suggests that it operates through hyperstimulation analgesia. ESWT and UST are analgesics as it alleviates pain by delivering intensive to moderate sensory input to the location of utmost torment.

The primary objectives in analgesic effects of chronic tennis elbow are pain relief, accelerated recovery, reduction of arm overload and facilitating patients' return to activities of daily living (ADLs). Conservative therapeutic options encompass a range of interventions, including “orthotics, cryotherapy, extracorporeal shock wave therapy (ESWT), ultrasound (UST), laser, acupuncture, massage, manipulation-mobilization, therapeutic exercises, and pharmacological treatments” (Yalvac et al., 2018).

However, existing studies on ESWT and UST for analgesic activity of Tennis Elbow yield conflicting results, partly due to methodological variations across studies. Most studies have evaluated ESWT and UST as a standalone treatment for analgesic effects, with limited comparisons to other therapeutic modalities (Testa et al., 2020; Gong et al., 2024). An analgesic effect describes the capacity of a substance or treatment to diminish pain. Analgesics encompass medications or therapies that relieve pain without inducing without causing loss of consciousness (Aldajah et al., 2022). In light of this, this study aims to directly study the effectiveness of two distinct therapeutic methods, ESWT and UST and also identify the superior approach for managing analgesic effect of chronic Tennis Elbow.

## 2. Material and method

Forty participants having a clinical diagnosis of tennis elbow syndrome were enrolled in the trial. Twenty patients each, treated with extracorporeal shock wave therapy or ultrasound therapy, were randomly assigned to one of two groups.

### Inclusion Criteria:

- Patients between the ages of 40 and 60 who have been clinically diagnosed with lateral epicondylitis associated with tennis elbow.
- Symptomatic duration exceeding three months.
- When conservative interventions (rest, physical therapy, NSAIDs) failed to be effective.

### Exclusion criteria

- Prior ESWT and UST treatment for tennis elbow.
- Obstetrical conditions haemorrhage disorders, malignancy are all contraindications to ESWT and UST.
- Severe comorbidities that impair the function of upper extremities.

All participants in the study gave their informed consent and refrained from undergoing any further physical regimens between the commencement of treatment and 12 weeks following the final session. Patients should not return to work until the therapy concluded. The patients who were administered extracorporeal shock wave therapy comprised the initial cohort.

### 2.1 Extracorporeal shock wave therapy method

For the purpose of administering ESWT, a focussed shockwave apparatus E-SWT Roland series was used. The parameters indicated that the energy discharge density used as  $0.18 \text{ mJ/mm}^2$ . The cumulative number of disruptions amounted to 2000. Three sessions of the therapy were separated by one week. The insertion of the “extensor carpi radialis brevis tendon” at the “lateral epicondyle” were primary focus of treatment. Following the verification of participants' posture for comfort, gel coupling was executed.

During the course of treatment, pain levels were monitored and recorded using a visual analogue scale (VAS). Recovery after treatment entails a 48-hour period of rest and avoidance of vigorous activities.

### 2.2 Ultrasound therapy Method

Ultrasound therapy was administered through the utilisation of a focused ultrasound device Sonoplus 492 by Enraf Nonius System. The parameters followed are 1-megahertz is the frequency. Attenuation of ultrasound is  $1.5 \text{ W/cm}^2$  and the duration of each treatment session is ten minutes. A total of three sessions were held each week for eight weeks. The therapeutic strategy placed emphasis on the region of the lateral epicondyle. Following the verification of participants' posture for comfort, gel coupling was executed. Rest for 24 hours and avoiding of strenuous activities are recommended following treatment.

Evaluation of the patients' states 12 weeks after their last treatment session, immediately after treatment, and before treatment were conducted using VAS scores. The purpose of the VAS is to evaluate an individual's level of pain. The VAS is a straight line with two endpoints that is typically 10 cm long. "No pain (0), less frequent pain (1-4), frequent pain (5-8), poor (9-10)" is represented by the left endpoint to right endpoint.

The evaluation encompassed an assessment of pain intensity and frequency, The SPSS 24 programme was used to undertake the statistical analysis of the data, and all tests were looked at for significance at a level of  $p < 0.05$ .

## Result and Discussion

According to the study's key findings, the benefits of the therapy include pain relief, endurance and restoration of normal function. The demographic characteristics are depicted in Table 1. The mean age of the patients is  $50 \pm 0.9$  in the "extracorporeal shock wave therapy" and  $48 \pm 0.75$  "ultrasound therapy". Dominant working arm in both the groups is the right arm. Treatment side of the patients are right side. There is no significance difference between the demographic data of the patients in both the groups.

**Table 1 – Demographic characteristics of the two patient groups.**

Characteristics	ESWT group	UST group
Patients (n)	20	20
Age (year)	$50 \pm 0.9$	$48 \pm 0.75$
Duration of symptoms (months)	$10 \pm 1.9$	$12 \pm 2.3$
Dominant arm (Right/ left)	20 (Right)	20 (Right)
Treatment side (Right/ left)	20 (Right)	20 (Right)
Previous unsuccessful treatment 6 months prior	20	20

ESWT- Extracorporeal shock wave therapy, UST- Ultrasound Therapy.

Statistically significant ( $p < 0.05$ )

**Table 2- Outcome 12 weeks after treatment by VAS Scale score**

Pain intensity	ESWT Group		UST Group	
	n	%	n	%
No pain	9	45	00	00
Less frequent discomfort	7	35	10	50
Frequent Discomfort	4	20	7	35
Poor	00	00	3	15

Table 2 suggested that there is efficient reduction in the pain while using ESWT group than the UST group. Less frequent discomfort was observed 35% in ESWT group and 50% in UST group patients. Frequent discomfort was showed in 20% patients in ESWT group and 35% patients in UST group. Poor pain intensity was observed in no patients in ESWT group and 15% patients in UST group after 12 weeks of therapy. No

patients in the ESWT group were not in poor condition after the therapy, but 15% patients in the UST group were in poor condition. ESWT and UST therapy are crucial components in the management of Tennis Elbow-associated pain. They function by inducing distressing levels of stimulation in order to alleviate pain, a process known as "hyperstimulation analgesia." Meanwhile, a number of studies have examined the effects of ESWT and UST after treatment (Nambi et al., 2022).

Additionally, ESWT was shown to be a promising treatment for tennis elbow syndrome by Król et al., (2015). A favorable tissue response characterized both the initial and long-term outcomes. Radial shockwave therapy was administered to patients at random, similar to the present study where patients randomly received shockwave therapy. Similar to the present study, the experimental groups received lateral humeral epicondyle pulses (2000 pulses, 4 Hz, 0.2 mJ/mm<sup>2</sup>) and dorsal parts of the forearm pulses (2000 pulses, 8 Hz, 2.5 bar) experienced notable enhancements in wrist extensor function and significant pain relief, respectively, which is also notable in the present study.

Both therapies, restore the physiological function of afflicted structures by initiating a chain reaction (Krol et al., 2015). The patients with tennis elbow syndrome treated with ESWT method, (Kocjan et al., 2016). The present study and the research work by Kocjan et al., (2016) found that both approaches were efficacious, resulting in a decrease in pain levels, though ESWT is more efficient.

Patients diagnosed with tennis elbow who undergo extracorporeal shockwave therapy (ESWT) or ultrasound therapy experience a reduction in the frequency and intensity of their pain, in addition to a diminished requirement for analgesics.

### 3. Conclusion

ESWT decreases the mean overall discomfort of patients with lateral epicondylitis (LE), according to the findings of this study. It is value noting that a clinically significant difference can be observed in the treatment outcomes of UST and ESWT. ESWT group had maximum 9 (45%) patients with no pain whereas in UST group there were no patients with no pain. The study emphasises the necessity for further extensive randomised controlled trials that are of superior quality and meticulously planned in order to provide evidence for clinical practice. In future, novel methods that are especially intended to reduce pain and promote tissue repair can be explored.

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