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Effectiveness of Ultrasound In Tennis Elbow Patients: Literature Review

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Abstract
Lateral Epicondylitis, commonly known as Tennis Elbow, is caused by tension in the common extensor tendon, particularly at the origin of the extensor carpi radialis brevis tendon. This condition leads to pain and reduced hand grip strength, as well as impaired elbow function. This study aims to evaluate the effectiveness of Ultrasound therapy in managing pain, improving grip strength, and enhancing elbow functionality in patients diagnosed with Tennis Elbow. The method employed is a systematic literature review, analyzing relevant studies from various scientific databases. The results show that ultrasound therapy, applied consistently over several weeks, significantly reduces pain levels, improves hand grip strength, and enhances the functional movement of the elbow. The effectiveness of ultrasound treatment is supported by the statistical significance of $p<0.01$, indicating a strong reduction in pain and improvements in physical function. The findings suggest that Ultrasound therapy is an effective, non-invasive modality for treating Tennis Elbow, offering substantial improvements in patient recovery.

Keywords: tennis elbow, ultrasound, lateral epicondylitis

INTRODUCTION

Physiotherapy is a type of health service that aims to help individuals and/or groups improve, maintain, and restore movement and function of the body throughout life through manual handling, motion improvement, equipment (mechanical, physical, and electrotherapy), functional training, and communication (PMK No. 65 of 2015).

As one of the implementers of health services, physiotherapists participate and are responsible for improving the health status of patients, especially those related to their research subjects, namely movement and function (Rudianto & Sinuhaji, 2018). In the case of Tennis Elbow, physiotherapy also helps with movement and function problems.

Lateral Epiconylitis injury, also known as Tennis Elbow, is the result of a general tendon tension of the extensor tendon in the origo extensor tendon carpi radialis brevis (ECRB).

There is activity limitation, such as picking up glasses, holding books, and grasping objects (Dimitrios, 2017). Some of the causes of tennis elbow are still unknown. Although this is related to tennis, elbow tennis can also occur during repeated play, which involves a lot of carpi extensor muscles (Dilek et al., 2016).

The incidence rate of Tennis Elbow ranges from 1 percent to 3 percent of the general population and reaches 50 percent in tennis players. About 5 percent of all Tennis Elbow sufferers are tennis players. The incidence rate ranges between 1.3 percent and 2.8 percent in the general population and 15 percent in occupations at high risk of Tennis Elbow, such as butchers, IRTs, laboratory workers, and fish processing plant employees (Saraswati et al., 2021).

Tennis Elbow sufferers in Indonesia occur at the age of 26 to 40 years as much as 80%, with a prevalence of 60% for women and 40% for men (Adjam, 2017).

An additional piece of equipment used by a physiotherapist to implement an exercise treatment program is a modality or tool of exercise therapy. A wide variety of exercise medicine supplies are made with various purposes and advantages. Exercise medicine equipment is designed to help or facilitate people suffering from diseases in performing physical exercise (Kisner, 2016).

Physiotherapy modalities that can be used for intervention in Tennis Elbow cases include Ultrasound, TENS, Infra Red and Exercise Therapy. The modality of choice for intervention in this Tennis Elbow case is Ultrasound (Luo et al., 2022).

Physiotherapists have used ultrasound as a treatment tool to help injured tissue recover and reduce pain. By reducing tissue adhesion , ultrasound can improve ROM.

Ultrasound modalities use the mechanical vibrations of sound waves at frequencies of more than 20 000 Hz. The frequencies used in physiotherapy are 0.5 MHz to 5 MHz, and are intended to improve blood circulation, relax muscles, lower pain, and accelerate tissue growth. Ultrasound is also a form of thermotherapy, also referred to as heat therapy, which serves to reduce body pain, whether mild or severe (Setyorini, 2021).

The effectiveness of ultrasound in several studies in the case of Tennis Elbow has mixed results. So the purpose of this paper is to determine the effectiveness of the use of ultrasound in relieving pain in the case of tennis elbow, which is based on several journals from previous studies.

Tennis Elbow, or Lateral Epicondylitis, is a common musculoskeletal condition that significantly affects the functionality and quality of life of individuals, especially those involved in repetitive wrist and forearm movements. The prevalence of Tennis Elbow is high, particularly in both professional athletes and individuals in occupations requiring repetitive hand motions, such as laboratory workers, butchers, and housewives. Despite its high prevalence, effective treatment methods, particularly those using physiotherapy, remain a topic of debate, with inconsistent findings on the effectiveness of common modalities such as Ultrasound. This research is urgently needed to provide clarity on the use of Ultrasound as a treatment option for Tennis Elbow, particularly in terms of pain reduction and functional recovery.

The main objective of this research is to evaluate the effectiveness of Ultrasound as a physiotherapy modality in reducing pain and improving functional outcomes for patients suffering from Tennis Elbow. By conducting a thorough review of previous studies, the research aims to provide evidence-based recommendations for clinicians on the optimal use of Ultrasound for this condition.

While Ultrasound is widely used in physiotherapy for treating Tennis Elbow, the effectiveness of this modality remains inconclusive due to varying study results. This research aims to fill the gap by systematically reviewing and synthesizing existing evidence on Ultrasound therapy, focusing specifically on its impact on pain relief, hand grip strength, and range of motion (ROM) improvement in Tennis Elbow patients. The novelty of this study lies in its comprehensive analysis

of different treatment parameters (such as duration, frequency, and intensity) to determine the most effective application of Ultrasound in managing Tennis Elbow.

This research contributes to the field of physiotherapy by offering a clear understanding of the role of Ultrasound in managing Tennis Elbow. The findings will help physiotherapists make informed decisions regarding the use of Ultrasound as a treatment modality, potentially leading to better clinical outcomes. Additionally, the study provides insights into the optimization of treatment protocols, which could enhance patient care and reduce the economic burden associated with prolonged Tennis Elbow treatment. The study's results may also serve as a foundation for future research aimed at refining physiotherapy techniques for musculoskeletal injuries.

METHODS

This study uses a literature review approach. A Literature Review is an academic piece of writing that demonstrates the knowledge and understanding of the academic literature on a particular topic placed in context. Literature Review also includes a critical evaluation of the material; this is why it is called a literature review and not a literature report. It is the process of reviewing literature, as well as a form of writing.

Literature Reviews serve as a foundation for different types of research because their results provide an understanding of technological advancements, encourage policymaking, encourage new ideas, and change the way we view the world (Snyder 2019: 333).

The research question followed the PICO format: (P=Population) of patients with tennis elbow, (I=Intervention) ultrasound, (C=Comparison) no comparison, (O=Outcome) the effectiveness of ultrasound can reduce pain in patients with tennis elbow. The research journal articles reviewed are limited by inclusion and exclusion criteria, with journal collection having a span of time for the last 10 years, namely 2013-2023.

The article will be reviewed if it has met the following inclusion criteria: (i) the study subject is a patient with tennis elbow who has pain in the outer elbow with an age range of 18 – >50 years

The research article will be rejected if the author meets the following exclusion criteria: (i) the research uses a systematic review method, (ii) the research journal is under 2013, (iii) the subject refuses to participate (Shamsi et al., 2015).

The author obtained information based on the journal database, namely Google Scholar. To overcome bias in the study will be accepted by the authors of any effect of the intervention of each article on the impact or not on the research sample. The authors summarized the articles based on the research subjects, age and gender of the participants, the type of intervention given (both from frequency, duration and tools to measure the effectiveness of the intervention), and conclusions.

The research instrument used: Visual Analogue Scale (VAS): a psychometric response scale that can be used in questionnaires and serves as a tool to measure individual subjective characteristics. The VAS contains only one question that can be answered by the respondent, which is only a statement submitted by the researcher to the respondent. The Likert scale is a VAS scale that has a straight line from zero to ten (Ediz & Alpayci, 2012).

Elbow Functional Assessment (EFA): is a questionnaire that contains 25 questions about a person's ability to perform daily tasks. These assessments can be used to measure a patient's

initial function, ongoing progress, and outcomes, as well as to establish functional goals. This assessment can also be used to monitor patients and evaluate the effectiveness of an intervention.

Hand Grip Measurement (HGM): Grip strength is usually measured using a handheld dynamometer. The patient presses the dynamometer with all his strength, usually three times with each hand. The average score is then calculated using measurements from both hands. A handheld dynamometer is used to assess the strength of wrist extensions.

Ultrasound (US): Ultrasound is a pro-inflammatory technique. This means that this invites inflammation in the tendons so that they can heal effectively. During fenestration, sound waves are repeatedly directed directly through the damaged tendon tissue. This process promotes local bleeding, initiates the initial phase of the healing process, stimulating the development of healthy tendon tissue by initiating a healing response. Ultrasound is generally given to reduce pain, improve blood circulation and improve the elasticity of connective tissue, which includes joint capsules.

RESULTS AND DISCUSSION

Of the 5 journals that have been researched through *screening, eligibility* and *Inclusion*. *Ultrasound* is one of the physiotherapy therapy modalities that uses sound waves with mechanical vibrations so as to produce longitudinal waves that propagate through a certain medium with varying or different frequencies. From this understanding *Ultrasound* is a treatment using vibrations from sound waves that have a frequency of more than 20,000 Hz (Purnomo, 2017). *Ultrasound* is a conservative treatment, which shows improvements in pain relief and functional activity.

Table 1. Comparison *of Experimental Group* and *Control Group*

	Participant		**Intervention**		**Measurement**	**Results**	**Design Study**
Reviewer	**Intervention group**	**Control group**	**Experimental group**	**Control group**			
(Koesoemadhipura & Wijayanti, 2021)	n= 1 46 years	-	Ultrasound	No intervention	VASE	P<0.01	Quasi Experimental Design
Pawel Lizis, PhD (2015)	n= 25 >18 years old	-	Ultrasound	No intervention	VASE	P<0.05	Experimental Studies
Hamza., et al (2019)	n= 10 20 -50 years old	n= 10 20 - 50 years old	Ultrasound	Kinesiotaping + Exercises	HGM	P<0,001	RCT
G. Mohan Kumar., et al (2016)	n= 15 25-50 years old	-	Ultrasound	No intervention	EFA	P<0.01	Experimental study
Felicia., et al (2021)	n= 1 >46 years	-	Ultrasound	No intervention	VASE	P<0.05	Quasi Experimental Design

Based on a literature review study, the authors found that of the 62 sample results, the average sample was dominated by men with an age of >/= 50 years. Of the many literatures found, most of the literature uses the research design *of Experimental study* and measurement of VAS, HGM and EFA with p<0.001. Experimental group using *Ultrasound intervention*.

Table 2. Ultrasound Intervention Therapy Dosage

Reviewer	Type of Intervention	Therapeutic Dosage				Duration Therapy
		F	I	T	T	
Dhema., et al (2021)	Mode: Continuous	1 MHz	1.5 W/cm2	Ultrasound	5 min	4 times/week
(Lizis, 2015)	Mode: Continuous	1 MHz	0.8 W/cm2	Ultrasound	10 min	3 times/week
(Hamza et al., 2021)	Mode: Continuous	1 Mz	1.5 W/cm	Ultrasound	5 min	3 times/week, for 4 weeks
(Mohan & Sivakumar, 2023)	Mode: pulsed with 1: 4 ratios,	1 MHz	0.8 W/cm	Ultrasound	5 min	5 times/week, for 4 weeks
Felicia., et al (2021)	Mode: Continuousu	1 MHz	2 W/cm2	Ultrasound	5 min	3 times/week, for 2 weeks

Based on the research that has been conducted, researchers have found that *the Ultrasound* modality can be applied to Tennis *Elbow sufferers* with a frequency of 5 times/week, Intensity 1.5 W/cm, with a duration of 5 minutes for 4 weeks.

Table 3. *Mean of Study Characteristics*

Reviewer	Measurement	Group experiment		Control group		Significant
		Pre	Post	Pre	Post	
Dhema., et al (2021)	VASE	5.20 ± 0.92	1.87 ± 0.53	-	-	P<0.01
Pawel Lizis, PhD (2015)	VASE	4.2 ± 0.6	4.0 ± 0.6	-	-	P<0.05
Hamza., et al (2019)	HGM	27.35 ± 14.11	31.59 ± 14.47	11.25 p.m. ± 11.88 p.m.	33.17 ± 11.73	P<0,001
G. Mohan Kumar., et al (2016)	EFA	55.7 ± 3.71	31.3 ± 2.08	-	-	P<0.01
Felicia., et al (2021)	VASE	5.90 ± 1.96	2.50 ± 1.84	-	-	P<0.05

Based on the table above, when compared to the control group, the intervention group showed a good and significant improvement.

Discussion

One effective method to reduce pain is *ultrasound*. Micromassage with ultrasound will heat up the tissues. Since heat affects nerves directly, the effect of heat will help improve blood circulation. This is due to the fact that the waves continue to have a low level of intensity, so they can exert analgetic and sedative effects on the sensory nerve endings, thus reducing pain (Muttaqin, 2011).

Inflammation can lead to increased muscle strength in tennis elbow patients, but it can also lead to decreased muscle strength due to pain that causes the patient to be reluctant to move. Spasms can cause limited joint motion if this condition is left untreated (Kisner, 2016).

We investigated in this study the effects of *Ultrasound* treatment on pain, hand grip strength, and functional elbow movement in patients with a diagnosis of *Tennis Elbow*.

The joint capsule, tendons, and soft tissues usually lose their elasticity due to water loss after age 30 and become more fragile. Therefore, repetition of the upper extremities is more likely to cause epicondylitis in patients over 30 years of age.

From the statistical analysis of pre- and post-treatment pain assessments in patients who received *ultrasound*, there was a significant difference in pain intensity values between pre-treatment and post-treatment values. In addition, there was a significant difference in the value of hand grip strength between the pre-treatment value and the post-treatment value. To determine the effect of *ultrasound* therapy before and after treatment, pain outcomes were measured with VAS. There was a significant decrease in pain intensity after treatment. The results of this study are consistent with studies that have investigated the severity of pain using VAS (Hamza et al., 2021).

This effect on pain can be explained as pointed out by (Hamza et al., 2021) US is tissue vibration that causes the formation of microscopic bubbles, which transmit vibrations in a way that directly stimulates the cell membrane. This physical stimulation seems to enhance the cell-repairing effects of the inflammatory response and thus reduce pain.

There is a significant difference in wrist extension strength between the affected and unaffected arms. Changes in grip strength showed a statistically significant increase in the affected arm compared to the unaffected arm. In addition, in the assessment of pain in the lateral epicondyle, the mean change between the affected and unaffected arms was significant (Mohan & Sivakumar, 2023).

Increasing grip strength with the use of *Ultrasound* in tennis elbow patients may explain that *Ultrasound* therapy can speed up the recovery process in damaged tissues. This mechanism may explain our finding that *ultrasound* reduces pain thereby increasing wrist active movement and grip strength.

In recent years research on *ultrasound* for the treatment of tennis elbow has been carried out more generally. From a recent study of (Mohan & Sivakumar, 2023). showed that the combination of *Ultrasound* and *Strenghtening Exercises* can reduce pain and increase grip strength. It is also worth saying here that the same study showed more significant results on *Ultrasound* combined with *Strenghtening Exercises*.

In this study, we also found a significant improvement in pain during relaxation and movement in patients who underwent *ultrasound* application at the end of treatment compared

to before treatment. These results suggest that the long-term effects *of ultrasound* are superior in the treatment of lateral epicondylitis.

In our study, the positive results obtained in terms of pain, hand grip strength, and functional movement of the elbow on the *Ultrasound* intervention can be interpreted as supporting that *Ultrasound* treatment has a significant influence on the course of the disease.

CONCLUSION

Tennis Elbow, is the result of eccentric contractions of the common extensor tendon in the origo extensor tendon carpi radialis brevis. The conclusion of the study is that the Ultrasound intervention is quite significant in reducing pain and increasing grip strength in the hand, and also improving the functional movement of the elbow. The results of the study showed that ultrasound modality therapy provided a significant effectiveness of $p<0.01$ in reducing pain.

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