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## Comparative Efficacy of Phonophoresis with Naproxen and Ultrasound Therapy on Pain and Grip Strength in Lateral Epicondylitis

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### Abstract

**Purpose:** Lateral epicondylitis, also referred to as "tennis elbow," is a painful condition resulting from the inflammation of tendons situated along the exterior of the elbow, which serve to connect the muscles of the forearm. The primary aim of this study was to assess and compare the therapeutic effects of phonophoresis with naproxen versus ultrasound therapy in managing pain levels and enhancing grip strength in individuals suffering from lateral epicondylitis

**Methodology:** This quasi-experimental study comprised a sample size of 42 participants, selected through convenient sampling methods over duration of 8 months. The inclusion criteria stipulated that individuals of both genders, aged between 31 and 50 years, experiencing chronic pain in the elbow and forearm for a period exceeding 3 months, and exhibiting a positive response to the Mill's test, were eligible for participation. The participants were divided into two groups, each consisting of 21 subjects. Out of the 42 patients, 21 were assigned to Group 1, which received baseline therapy along with Phonophoresis utilizing naproxen, while the remaining 21 were allocated to Group 2, which received baseline therapy in conjunction with therapeutic ultrasound. Both groups had received baseline treatment of stretching and strengthening exercises. Four sessions of interventions were given per week, for four weeks. Intensity of pain was assessed by Visual analogue scale (VAS) before and after the treatment of 4 week and grip strength was measured by handheld dynamometer. There were two drop outs in group 1 and three in group 2. The collected data was analyzed and interpreted by using SPSS software of version 24.0

**Findings:** Among the 42 participants (with 21 in each group), 67% of patients in Group 1 were male, while 33% were female. In Group 2, 42.9% were male, and 57.1% were female. For Group 1, the median grip strength value before treatment was 60.00, which significantly decreased to 20.00 after treatment. Similarly, in Group 2, the median grip strength value before treatment was 70.00, and it also decreased significantly to 20.00 after treatment. The pre-treatment mean grip strength in Group 1 was  $36.46 \pm 8.82$ , which increased to  $50.59 \pm 11.33$  after 4 weeks of treatment. In Group 2, the pre-treatment mean grip strength was  $31.12 \pm 4.87$ , and it increased to  $52.02 \pm 9.70$  after treatment. A statistically significant difference was observed in both groups when comparing pre- and post-treatment grip strength values ( $p < 0.001$ ). However, the between-group analysis comparing Group 1 and Group 2 showed no statistically significant difference ( $p > 0.05$ ).

**Recommendations:** Based on the study's findings, both phonophoresis with naproxen and therapeutic ultrasound are effective in managing pain and improving grip strength for lateral epicondylitis patients. Clinicians should consider incorporating these treatments into their therapeutic regimens for such patients. Future research should consider larger sample sizes and explore other therapeutic modalities to ascertain the most effective treatment option. Additionally, understanding the long-term effects and sustainability of the noted improvements would benefit clinical practice and enhance patient care outcomes.

**Keywords:** Grip Strength; Lateral Epicondylitis; Naproxen; Phonophoresis; Tennis Elbow; Ultrasound Therapy

## 1.0 INTRODUCTION

Lateral epicondylitis, commonly known as "tennis elbow" is a condition characterised by inflammation that causes pain at the origin of the wrist extensors on the lateral epicondyle of the humerus bone (1). The aetiology of lateral epicondylitis is an overloaded force and repeated stress exerted on the aponeurosis of the common extensor's origin (2). A frequent tendinopathy, lateral epicondylitis affects 0.3% to 12.2% of adult population (3). Lateral epicondylitis is more commonly associated with occupational activity. This syndrome will impact between 40% and 50% of all tennis players. The onset of lateral epicondylitis occurs between the ages of 40 and 50 (4).

Lateral epicondylitis occurs when the tendons in the forearm experience excessive strain, especially when dealing with activities involving stretching and pulling forces. This strain is often due to the pressure exerted by the radial head (a bone in the forearm) during these actions. It leads to inflammation and pain in the area, involving a specific muscle called the extensor carpi radialis brevis (ECRB). The tendon is stretched over the prominence of the radial head at this location (2). Several factors are believed to contribute to the development of lateral epicondylitis. These include the natural aging process, overuse or misuse of the affected arm, and repetitive movements that strain the tendons. Additionally, other factors have also been linked to the onset of lateral epicondylitis, such as issues with the rotator cuff (shoulder muscles), De Quervain disease (affecting the wrist tendons), carpal tunnel syndrome (a condition affecting the wrist and hand), the use of oral corticosteroid medications, smoking, obesity, rheumatoid arthritis (an autoimmune disease), engaging in physically demanding manual work, and occupational exposure to vibrating machinery. These various factors can contribute to the development of tennis elbow in individuals(3).

There are many different methods used to help people recover from various health issues. These methods include things like using casts or splints, using ultrasound machines, a technique called phonophoresis, and others like laser therapy, electrical stimulation, acupuncture, physical therapy, and massage. We also have exercises that help with stretching and strengthening muscles and joints (2). One specific method, ultrasound treatment, uses sound waves or vibrations to help with medical problems. The equipment sends these vibrations through the skin to reach the deeper parts of the body. The goal is to provide warmth and energy to those areas under the skin, which can reduce pain and speed up the healing process (5).

Phonophoresis is a method that uses ultrasound to help medicines get absorbed into the skin and reach the tissues beneath it (6). This happens because the ultrasound disrupts the tissues, making the medication move more and get absorbed better (7). In a study led by S. Okan and colleagues, they looked at how different treatments work for people with lateral epicondylitis. They tested treatments like ketoprofen phonophoresis, ultrasound, mucopolysaccharide polysulfate phonophoresis, and exercise. They wanted to see if these treatments could reduce pain, improve how well people could move their arms, lessen any problems they had, and make their muscles stronger. The results of the study showed that when people with lateral epicondylitis have trouble doing exercises and using splints but receive a physical therapy plan, adding ketoprofen and mucopolysaccharide polysulfate phonophoresis to their treatment can provide extra benefits. This can make their daily activities easier, improve their performance, and enhance their ability to do their job (8).

Naproxen is a non-steroid medication having anti-inflammatory, analgesic, and anti-pyretic effects that is used to treat inflammatory diseases (9). F Baskurt et al. reported that naproxen iontophoresis and phonophoresis are efficient in lowering pain and boosting grip strength in lateral epicondylitis patients (4).

### **Statement of Problem**

Despite the widespread use of ultrasound therapy and phonophoresis in the treatment of many musculoskeletal diseases, there is a gap in the data addressing their comparative efficacy, particularly when naproxen is used as the agent in phonophoresis. This identified gap impedes evidence-based clinical decision-making. The goal of this research is to fill this gap in the literature by directly evaluating the efficacy of these two interventions in lowering pain and enhancing grip strength. A comparison like this has the potential to not only improve treatment techniques, but also to reinforce the foundation of patient-centered care in musculoskeletal rehabilitation.

While many research endeavors were anchored in established theoretical frameworks, this study primarily relied on its empirical foundation, focusing on direct comparisons between two therapeutic modalities for lateral epicondylitis. However, an underlying assumption was that targeted treatments could influence specific physiological responses related to pain and grip strength. It was this theoretical perspective that guided the investigation, seeking validation through a methodical research design and thorough statistical analysis

### **2.0 METHODOLOGY**

This study had a quasi-experimental design, involving a sample size of 42 participants recruited through a convenient sampling method. The determination of the sample size was accomplished using the Epitool software. The study spanned duration of 8 months. The inclusion criteria for participation in the study encompassed both male and female individuals aged between 31 and 50 years, with a history of chronic pain in the elbow and forearm lasting for a minimum of 3 months, and a positive response to the Mill's test. Exclusion criteria of the study were patients with any congenital deformity of upper limb, patient with history of trauma, fractures and surgery in upper limb, patients with neurological symptoms, patients with history of any metabolic disease, patients with any diagnosed psychological problem and participants not willing to sign the consent form for study.

Before participation, each patient was required to sign an informed consent form. Participants were assigned conveniently in 2 groups, each group with 21 subjects. Out of the total of 42 patients, 21 were allocated to Group 1, where they underwent baseline therapy in conjunction with Phonophoresis featuring naproxen. The remaining 21 patients were designated to Group 2, where they received baseline therapy alongside therapeutic ultrasound. Both groups underwent a standard baseline treatment regimen that included stretching and strengthening exercises. The treatment schedule involved four sessions per week, conducted over a period of four weeks. To gauge the intensity of pain, the Visual Analogue Scale (VAS) was used to assess pain levels before and after the four-week treatment. Grip strength was measured using a handheld dynamometer. It's worth noting that two participants dropped out from Group 1, and three participants dropped out from Group 2 during the course of the study.

### Statistical Analysis

Data analysis and interpretation were carried out using SPSS software, specifically version 24.0. To check whether the data followed a normal distribution, the Shapiro-Wilk test was employed. For evaluating changes within each group based on the Visual Analog Scale (VAS), the Wilcoxon signed-rank test was utilized. Meanwhile, for making comparisons between the two groups, the Mann-Whitney U test was employed. When examining changes in grip strength within each group, we applied the paired t-test. For comparing the two groups against each other, the Independent Samples t-test was used. A significance level of 0.05 was set to determine whether the study's findings were statistically significant. To present the data in an organized and comprehensible manner, tables and charts were created. This approach facilitated a clear and structured representation of the study's results.

### Ethical Consideration

All ethical considerations were taken into account. Prior to the trial, individuals signed a consent form. The safety of the research subjects was assured. Participants' dignity was emphasized. All personal information was kept private.

### 3.0 FINDINGS

Out of 42 participants (21 in each group) 67% patients in group 1 were males and 33% were females. In group 2, 42.9% were males and 57.10% were females (Fig 1). Age of the participants was divided in four categories. In group 1 38.10% were of age between 31 to 35 years, 28.6% were 36 to 40 years, 23.8% were 41 to 45 years and 9.5% were of age between 46 to 50 years. In group 2 23.80% were of age between 31 to 35 years, 23.8% were between 36 to 40 years, 28.6% were of age between 41 to 45 years and 23.8% were between the age of 46 to 50 years (Fig 2). Figures 3 show the occupations of the participants.

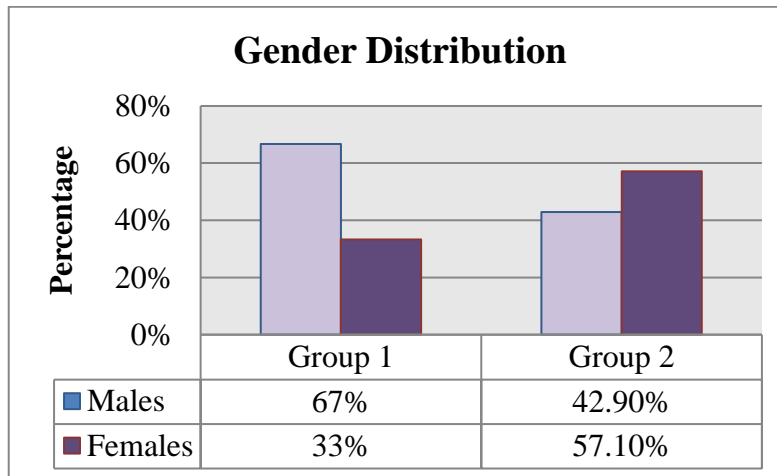


Figure 1: Gender Distribution

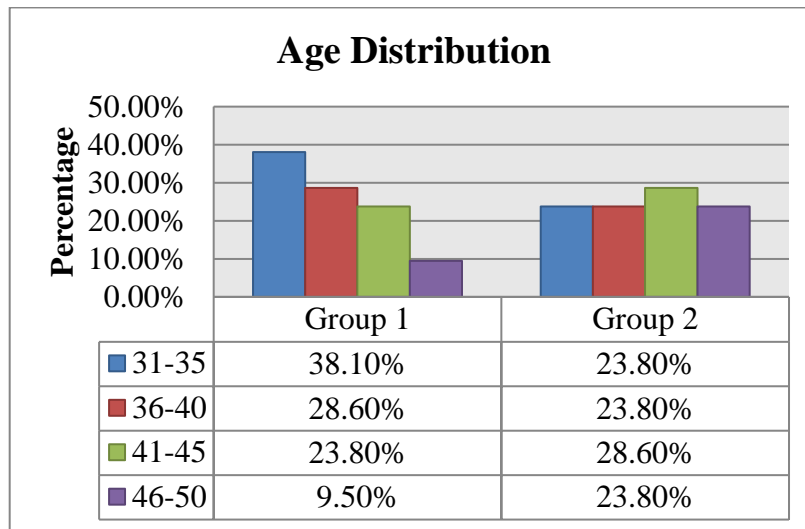


Figure 2: Age Distribution

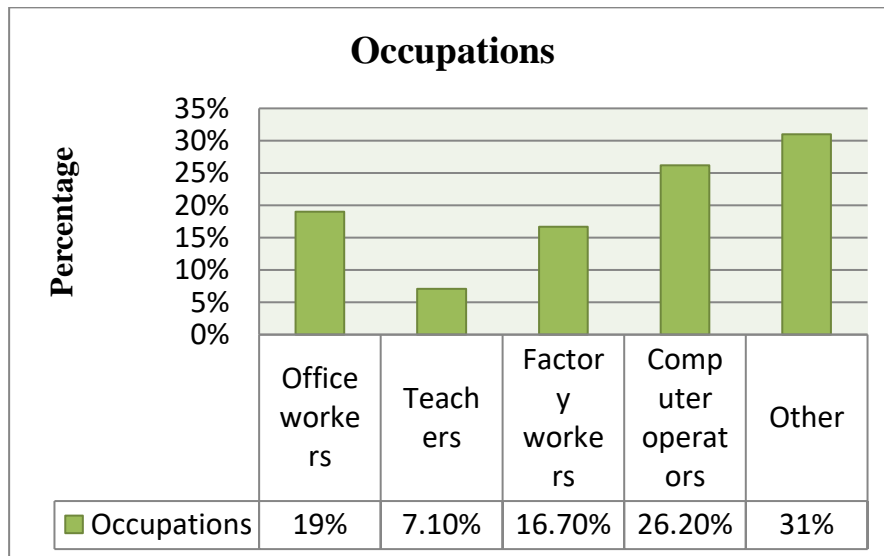


Figure 3: Occupations of the Participants

The normality of the data was evaluated by using the Shapiro wilk test (Table 2), the data is considered to be normality distributed if the significance value of the test statistics is greater than 0.05, the Shapiro wilks test gives the best value for the data having sample size below 50. By looking at the data, it can be seen that the VAS is violating the assumptions of normal distribution so, for the analysis of data of VAS, nonparametric tests i.e., for within group analysis Wilcoxon Signed-Rank Test and for between group analysis Mann-Whitney U test were used. Grip strength was found to following the normal distribution so, for the analysis of data of grip strength, parametric tests i.e., for within group paired t test and for the between group analysis Independent samples t-test was used. The 0.05 was considered as the level of significance

**Table 1: Test of Normality**

Shapiro Wilk test			
	Statistic	df	Sig.
Visual Analogue scale at baseline	.872	42	.00
Grip Strength at baseline	.953	42	.08

**Visual Analogue Scale within Group Analysis**

In Table 2, the within-group analysis of VAS (Visual Analog Scale) is presented. The Wilcoxon Signed-Rank Test results indicate that for Group 1, the median VAS score before treatment was 60.00, and after treatment, it decreased significantly to 20.00. Similarly, for Group 2, the median VAS score before treatment was 70.00, and after treatment, it also decreased significantly to 20.00. This reduction in VAS scores from pre-treatment to post-treatment was found to be statistically significant ( $p < 0.001$ ) in both groups, indicating a substantial improvement in pain levels following the treatment.

**Table 2: VAS within Group Analysis**

Wilcoxon Signed-Rank Test						
		N	Mean & SD	Median	Standardized Test Statistics	Asymp. Sig. (2-Tailed)
Group 1- Therapeutic ultrasound	VAS-pre	21	62.85±10.07	60.00	-3.90	0.00
	VAS-post	19	18.42±10.67	20.00		
Group 2- Phonophoresis with Naproxen	NPRS-pre	21	67.14±6.43	70.00	-3.75	0.00
	VAS-post	18	19.04±9.70	20.00		

**VAS between Group Analyses**

Table 3 shows the results of Mann-Whitney U test results. Between group analysis of 1 and 2 showed no statistical significant difference ( $p > 0.05$ ). Therapeutic ultrasound and Phonophoresis with naproxen showed equal effects in alleviating the pain in the patients of lateral epicondylitis.

**Table 3: VAS between Group Analyses**

<b>Test Statistics</b>	
Mann-Whitney U	155.00
Wilcoxon W	345.00
Z	-0.51
Asymp. Sig. (2-tailed)	0.60
Exact Sig. [2*(1-tailed Sig.)]	0.64

**Within-Group Analysis Grip Strength**

Table 5 displays the findings from a paired-t test, which compared grip strength before and after treatment within each group. In Group 1, the average grip strength before treatment was  $36.46 \pm 8.82$ , and it significantly increased to  $50.59 \pm 11.33$  after 4 weeks of treatment. Similarly, in Group 2, the average grip strength before treatment was  $31.12 \pm 4.87$ , and it substantially improved to  $52.02 \pm 9.70$  after treatment. Importantly, in both groups, there was a statistically significant difference ( $p < 0.001$ ) observed when comparing grip strength before and after treatment.

**Table 4: Within-Group Analysis Grip Strength**

**Paired T test**

		N	Mean±SD	t	Asymp. Sig. (2-tailed)
Group 1- Therapeutic ultrasound	Grip strength pre-treatment	21	$36.46 \pm 8.82$	-8.94	
	Grip strength post-treatment	19	$50.59 \pm 11.33$		0.00
Group 2- Phonophoresis with Naproxen	Grip strength pre-treatment	21	$31.12 \pm 4.87$	-7.624	
	Grip strength post-treatment	18	$52.02 \pm 9.70$		0.00

**Grip Strength between Group Analyses**

Table 5 presents the outcomes of an independent t-test, which was used to compare Group 1 and Group 2. The results indicate that there is no statistically significant difference between these two groups ( $p > 0.05$ ). In other words, when it comes to enhancing grip strength in patients with lateral epicondylitis, both therapeutic ultrasound and Phonophoresis with Naproxen have similar effects.



**Table 5: Grip Strength between Group Analyses**

<b>Independent Samples Test</b>				
		<b>N</b>	<b>Mean±SD</b>	<b>Sig. (2-tailed)</b>
Grip strength between-group 1 and 2	Group 1- Therapeutic ultrasound	19	50.59±11.33	0.68
Group 2- Phonophoresis with Naproxen	18	52.02±9.70		

**Discussion**

Lateral epicondylitis, colloquially referred to as "tennis elbow," is a medical condition characterized by inflammation leading to pain at the point of origin of the wrist extensors, specifically on the lateral epicondyle of the humerus bone (1). The primary aim of this study was to assess and compare the therapeutic effectiveness of two treatment modalities, namely phonophoresis with naproxen and ultrasound therapy, with regard to their impact on pain reduction and the improvement of grip strength in individuals afflicted with lateral epicondylitis.

In the current study, a total of 42 participants were included, with 21 individuals in each of the two groups. Group 1 had 67% male participants and 33% female participants, while in Group 2, 42.9% were males, and 57.1% were females. The Wilcoxon Signed-Rank Test revealed significant findings: In Group 1, the median value for pain levels (before treatment) was 60.00, and it substantially decreased to 20.00 after treatment. Similarly, in Group 2, the median pain level (before treatment) was 70.00, and it also significantly decreased to 20.00 after treatment.

Additionally, there was a statistically significant difference ( $p < 0.001$ ) observed in both groups when comparing pre-treatment and post-treatment pain levels. Furthermore, concerning grip strength, the pre-treatment mean in Group 2 was  $31.12 \pm 4.87$ , and it notably increased to  $52.02 \pm 9.70$  after treatment, showing a statistically significant improvement ( $p < 0.001$ ). In the analysis comparing Group 1 and Group 2, no statistically significant difference was observed ( $p > 0.05$ ). Consequently, the study concludes that therapeutic ultrasound and Phonophoresis with Naproxen yielded comparable effects in terms of enhancing grip strength and reducing pain in patients with lateral epicondylitis.

In support to these findings, AR Wobma did an evidence-based medical review in 2020 and found that all three trials (by Luksurapan et al., Monisha et al., and Oktayoglu et al.) revealed decrease of mild to moderate knee pain with the use of phonophoresis with NSAIDs (10). In current study its effect was seen on lateral epicondylitis and additionally grip strength was also measured.

In contrast to this study, another study by SN Ramakrishnan and colleagues in 2019 looked at how well pain-relieving gel with ultrasound and plain ultrasound work in treating temporomandibular joint diseases, which affect the jaw joint. Their study found that both plain ultrasound and ultrasound with aceclofenac gel can be helpful for treating these jaw joint issues. While it's worth noting that phonophoresis with the gel showed a slight improvement in pain ratings and CRP levels compared to plain ultrasound, this difference wasn't big enough to be considered statistically

significant (7). However, in recent study, when Group 1 and Group 2 was compared, results didn't show any significant difference between them ( $p > 0.05$ ).

#### **4.0 CONCLUSION, LIMITATION AND RECOMMENDATIONS**

##### **Conclusion**

In conclusion therapeutic ultrasound and Phonophoresis with Naproxen showed equal effects in improving grip strength and reducing pain in the patients of lateral epicondylitis.

##### **Limitations**

The sample size of the study was short. Moreover, there were dropouts in both groups which further reduce the sample size. The study design was quasi experimental and participants were not randomly assigned to the treatment groups. Duration of the intervention was four week, so the long term effects and potential relapse of symptoms were not measured.

##### **Recommendations**

- Future studies should consider using randomized controlled trials to reduce selection bias and enhance validity.
- Future studies with, larger sample size to provide a more comprehensive representation and to increase statistical power is recommended.
- Future research could incorporate a broader age range and better balanced gender distribution.
- Conduct follow-up assessments at 3, 6, and 12 months to determine the durability of treatment effects.
- Use of variety of tools and methods to assess pain, grip strength, and other related symptoms for a comprehensive understanding are recommended for future studies.
- Future studies are recommended with the inclusion of a control group that doesn't receive any form of treatment to ascertain the efficacy of the interventions against natural progress or placebo effect.
- Future studies by using single or double-blinding methods to reduce the risk of bias and placebo effects are recommended.
- Future studies are recommended with Inclusion of measurements related to participants' quality of life, pain pressure threshold, satisfaction level and other outcomes to understand the broader impacts of the treatments.

**Conflict of Interest:** None

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