

The Effectiveness of Ultrasound Therapy with Dry Needling Technique, Ultrasound Therapy with Cyriax Manipulation and Ultrasound Therapy on Chronic Lateral Epicondylitis Patients: A Comparative Study

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Abstract

Chronic lateral epicondylitis, also known as tennis elbow, is a painful musculoskeletal disorder that primarily interferes with functional performance and is associated with recurrent mechanical stress and degenerative alterations at the common extensor tendon origin. Various conservative treatment options are available, but the best treatment for improving pain and functional outcomes remains a clinical interest. Introduction: This study aims to assess the effectiveness of dry needling and ultrasound therapy, Cyriax manipulation and ultrasound therapy, and ultrasound therapy alone in patients with persistent lateral epicondylitis. Methods: A pre-test post-test experimental comparison study was conducted among 45 participants aged 18 years and above who presented with chronic lateral epicondylitis and positive Mill's test. The participants were randomly divided into three groups of 15 subjects each. Group A received dry needling with ultrasound therapy, Group B received Cyriax manipulation with ultrasound therapy and Group C received ultrasound therapy only. The interventions were given three times a week for 12 weeks. Pain intensity and functional disability were measured by Visual Analogue Scale (VAS) and Patient-Rated Tennis Elbow Evaluation (PRTEE). The statistical analysis by one-way analysis of variance (ANOVA) showed significant differences among treatment groups for both pain reduction and functional improvement ($p < 0.001$). The highest improvement in VAS and PRTEE scores in a short time was observed in participants treated with dry needling combined with ultrasound therapy, followed by Cyriax manipulation combined with ultrasound therapy, while ultrasound therapy alone showed comparatively less improvement. The results suggest that the combination of dry needling and ultrasound therapy is superior to the other two methods in reducing pain and enhancing functional outcomes in subjects with chronic lateral epicondylitis. Therefore, dry needling may be regarded a useful addition to standard physiotherapy management of patients with persistent tennis elbow.

Keywords: Chronic lateral epicondylitis, Tennis elbow, Dry needling, Cyriax manipulation, Ultrasound therapy, Visual Analogue Scale, Patient-Rated Tennis Elbow Evaluation, Physiotherapy.

1. Introduction

Lateral epicondylitis, commonly referred to as tennis elbow, is one of the most prevalent musculoskeletal disorders affecting the elbow joint [1]. It is characterized by pain and tenderness over the lateral epicondyle of the humerus, often resulting from repetitive overuse of the wrist extensor muscles and tendons and leads to failed healing, increased presence of fibroblast, disorganised collagen in the origin [2]. Current evidence suggests that chronic lateral epicondylitis is primarily a degenerative tendinopathy involving microtears, tenderness, inflammation within the common extensor tendon, particularly the extensor carpi radialis brevis tendon [3].

Therapeutic ultrasound is widely used in physiotherapy practice due to its ability to promote tissue healing, increase local blood circulation, reduce pain, and enhance soft tissue extensibility [4,5]. Dry needling has gained increasing attention as an effective intervention for chronic musculoskeletal pain conditions and has been shown to improve pain, grip strength, and functional outcomes in patients with lateral epicondylitis [1,3,9].

Cyriax manipulation combines deep transverse friction massage to reduce pain, restore mobility, and improve functional performance [2,6]. Despite the availability of several conservative treatment approaches, limited evidence exists directly comparing dry needling combined with ultrasound therapy, Cyriax manipulation combined with ultrasound therapy, and ultrasound therapy alone in individuals with chronic lateral epicondylitis [1,6].

Patient Rated Tennis Elbow Evaluation {PRTEE} is a questionnaire for functional assessment and VAS which can be taken as a pain scoring scale to measure the intensity of pain and patients was selected according to mills test positive which is a special test for tennis elbow was performed to confirm the tennis elbow.[9]

2. Aim of the Study

The aim of the present study was to evaluate the effect of dry needling with ultrasound therapy, Cyriax manipulation with ultrasound therapy and ultrasound therapy alone on pain and functional outcome in patients with lateral epicondylitis (tennis elbow) by Visual Analogue Scale (VAS) and Patient-Rated Tennis Elbow Evaluation (PRTEE).

Objectives

- To assess the efficacy of dry needling combined with ultrasound therapy for pain and functional impairment in individuals with chronic lateral epicondylitis.
- To assess the efficacy of Cyriax manipulation and ultrasound therapy on pain and functional impairment in individuals with chronic lateral epicondylitis.
- To determine the efficacy of ultrasound therapy alone on pain and functional impairment in patients with chronic lateral epicondylitis.
- To assess the effect of dry needling against ultrasound therapy, Cyriax manipulation versus ultrasound therapy and ultrasound therapy alone on pain reduction as determined by Visual Analogue Scale (VAS).
- To compare the effects of dry needling along with ultrasound therapy, Cyriax manipulation along with ultrasound therapy and ultrasound therapy alone on functional improvement as measured by the Patient-Rated Tennis Elbow Evaluation (PRTEE).
- To determine the most effective treatment of the three interventions for the management of chronic lateral epicondylitis.

3. Review of Literature

Hortz and Falsone (2024) in a case series, examined the effectiveness of dry needling and exercise for patients with lateral epicondylopathy. The trial showed considerable decreases in pain, 80% to 100%, and clinically meaningful increases in function. The authors concluded that dry needling is a safe and effective intervention for short term management of lateral epicondylitis.

Ma et al. Systematic study and meta-analysis of the therapeutic efficacy of dry needling in patients with lateral epicondylitis (2024). The results showed a significant reduction of pain intensity, grip strength and elbow function. The authors reported better clinical outcomes of dry needling techniques that induce a local twitch response compared to dry needling techniques that do not induce a local twitch response. Roy et al. (2024) evaluated the effectiveness of dry needling as a specific treatment for tennis elbow. The study showed that dry needling is an effective treatment for pain relief, improvement of muscular function, decrease of muscle tightness and assisting rehabilitation by directly targeting myofascial trigger points and dysfunctional musculature. Uygur et al. (2017) evaluated the effectiveness of dry needling with the first line treatment in patients with persistent lateral epicondylitis. Authors reported that dry needling improved pain reduction and functional recovery more than traditional conservative treatment, suggesting it to be a useful strategy for persistent tennis elbow.

Shamsi et al (2015) compared ultrasound therapy and transcutaneous electrical nerve stimulation (TENS) in the treatment of tennis elbow. Results showed that all the interventions were effective in reducing pain but ultrasonic therapy showed significantly more improvement in symptom relief and functional recovery which makes it a treatment of choice.

A double-blind randomised placebo-controlled trial was conducted by Unver et al. (2021) compared continuous and pulsed ultrasound therapy in patients with lateral epicondylitis. Significant improvement in pain and functional outcomes was found in both treatment groups in comparison with placebo. The study concluded that the mode of application does not affect the effectiveness of ultrasound therapy. Pienimäki et al. (1996) evaluated the effect of Cyriax physiotherapy in chronic tennis elbow. “The results showed significant reductions in pain and improvements in grip strength and functional performance. In conclusion, Cyriax physiotherapy may be an effective conservative treatment option for lateral epicondylitis.

Stasinopoulos and Johnson (2004) investigated the efficacy of Cyriax physiotherapy including deep transverse friction massage and Mill’s manipulation in the management of lateral epicondylitis. The results showed a significant improvement in pain, grip strength and functional status and supported the clinical application of Cyriax techniques.

Although there are many studies on the individual effects of dry needling, ultrasound therapy and Cyriax manipulation for the treatment of lateral epicondylitis, direct comparisons between these interventions are lacking. Therefore, the present study was conducted to compare the effectiveness of dry needling with ultrasound therapy, Cyriax manipulation with ultrasound therapy and ultrasound therapy alone in reducing pain and improving the functional outcome among patients with chronic lateral epicondylitis.

4. Methodology

The present study was designed as a pre-test and post-test experimental comparative research to evaluate the effectiveness of dry needling combined with ultrasound therapy, Cyriax manipulation combined with ultrasound therapy and ultrasound therapy alone in chronic lateral epicondylitis. The study was conducted at Cheran College of Physiotherapy for a period of six months.

Convenient sampling was used to enrol a total of 45 patients diagnosed with chronic lateral epicondylitis. Participants of both genders were included in the study who were aged 18 years and above, with persistent elbow pain and positive Mill's test. We excluded patients with recent upper-limb surgery, open wounds, acute pain conditions or trypanophobia.

Subjects were then recruited and randomised into three groups of 15 subjects each. Methodology Group A was given dry needling combined with ultrasound therapy. Group B was given Cyriax manipulation combined with ultrasound therapy. Group C was given only ultrasound therapy. Interventions were delivered 3 times per week for 12 weeks.

Group A received dry needling of the extensor carpi radialis brevis, extensor carpi radialis longus, and extensor digitorum communis muscles. Participants were in a comfortable position with support to the afflicted elbow and were either seated or in supine position. Skin preparation was performed with antiseptic wipes. Sterile filiform needles (0.25×25 mm or 0.25×40 mm) were inserted into identified trigger points according to standard dry needling techniques to induce a local twitch response. The needles were left in place for 30–60 seconds before removal. Following dry needling, the afflicted lateral elbow region was treated with therapeutic ultrasound according to normal physiotherapy protocols. Group B was treated with Cyriax physiotherapy (Deep transverse friction massage followed by Mill's Manipulation). The involved region of the common extensor tendon was treated and then therapeutic ultrasound was applied.

Therapeutic ultrasound was applied only to the affected lateral epicondyle area in group C with standard treatment parameters.

The Visual Analogue Scale (VAS) and the Patient-Rated Tennis Elbow Evaluation (PRTEE) were used to measure pain intensity and functional impairment before and at the end of the intervention period. Pain intensity was subjectively measured using the VAS and the PRTEE was used to assess pain and functional limitations caused by lateral epicondylitis.

The data collected were analysed using descriptive statistics (mean and standard deviation). A one-way Analysis of Variance (ANOVA) was used to compare the effectiveness of the three treatment groups. The p-value <0.05 was judged statistically significant.

Inclusion Criteria: Inclusion Criteria: Candidates of any gender, aged 18 years and above, having confirmed chronic localised lateral elbow pain, exceeding normal healing time, with positive response on clinical Mill's test and giving their informed voluntary consent were eligible to be selected.

Exclusion Criteria: Candidates will be eliminated if they have recent regional surgical procedures, open wounds or active dermatological lesions near the elbow, acute traumatic pain profiles, or an established history of trypanophobia.

Materials and Assessment Parameters

The following materials and equipment were utilized during the study:

- Dry Needles (0.25×25 mm and 0.25×40 mm)
- Therapeutic Ultrasound Machine
- Antiseptic Wipes
- Disposable Gloves
- Cotton Swabs
- Ice Pack
- Treatment Couch
- Chair

- Pillow
- Towel
- Consent Form and Assessment Sheets
- Mill's test
- Visual Analogue Scale (VAS) Form
- Patient-Rated Tennis Elbow Evaluation (PRTEE) Questionnaire

5. ASSESSMENT PARAMETERS

The following outcome measures were used to evaluate the effectiveness of the interventions:

Visual Analogue Scale (VAS)

The pain intensity of participants was assessed using the Visual Analogue Scale (VAS). It is a 10 cm horizontal line with “no pain” on one end and “worst imaginable pain” on the other end. Participants were asked to mark the position on the line that most closely described their pain severity at that moment. The VAS is a valid and reliable instrument that has been widely used to evaluate pain in musculoskeletal disorders.

Patient Rated Tennis Elbow Evaluation (PRTEE)

The Patient-Rated Tennis Elbow Evaluation (PRTEE) is a condition-specific self-reported questionnaire which evaluates pain and functional disability related with lateral epicondylitis. The questionnaire had 15 items and two subscales, pain and functional activities. numbers vary from 0-100, with higher numbers representing more pain and disability. The PRTEE is a reliable and valid outcome measure for evaluation of therapy effectiveness in patients with tennis elbow.

Mill sign

Mill's Test is one of the often utilised orthopaedic special tests in the clinical diagnosis of lateral epicondylitis (tennis elbow). The test is designed to challenge the wrist extensor muscles, especially the extensor carpi radialis brevis (ECRB), the muscle most often implicated in tennis elbow. It is regarded a reliable clinical technique to reproduce symptoms of lateral epicondylitis.

Interventional Procedures (IP)

Participants who met the inclusion criteria were included after informed consent. They were assessed using Visual Analogue Scale (VAS) and Patient Rated Tennis Elbow Evaluation (PRTEE). Forty five participants diagnosed with chronic lateral epicondylitis were selected in total and divided into 3 groups consisting of 15 participants in each. All interventions were delivered 3 times each week for 12 weeks.

Group A: Dry Needling With Ultrasound Therapy

Subjects in group A were treated with dry needling and followed by ultrasonic therapy. Dry needling was conducted on the extensor carpi radialis brevis (ECRB), extensor carpi radialis longus (ECRL) and extensor digitorum communis (EDC) muscles. The participant was positioned comfortably in either sitting or supine with the afflicted elbow supported in modest flexion. Palpation was used to identify the lateral epicondyle and associated trigger points. The treatment area was disinfected using antiseptic wipes and sterile filiform needles (0.25 × 25 mm or 0.25 × 40 mm) were inserted into the identified trigger points with a guide tube. The needles were placed in a perpendicular or slightly oblique direction to the skin over the muscle to be injected. and out approach to elicit local twitch response and held for approximately 30–60 seconds before removal. Ultrasound therapy was given over the afflicted lateral epicondylar region post dry needling. The participants were counselled regarding soreness after needling and instructed to do gentle stretching exercises and apply ice as and when required.

Group B: Cyriax Manipulation with Ultrasound Therapy

Group B subjects were treated with Cyriax physiotherapy and ultrasound. Treatment consisted of deep transverse friction massage performed to the common extensor tendon at the lateral epicondyle for many minutes, followed by Mill's manipulation. For Mill's manipulation, the therapist placed the participant's elbow in extension, forearm in pronation and wrist in flexion. A controlled high-velocity thrust was delivered by the therapist at the end range of movement. The involved area was subjected to ultrasound therapy, as is routine in physiotherapy, after Cyriax manipulation.

Group C: Ultrasound therapy only

Group C participants were given ultrasound therapy only. An ultrasound head was placed over the area of the lateral epicondyle using a suitable coupling medium. Treatment was performed according to the parameters of standard therapeutic ultrasound for chronic soft tissue pathologies. Participants were treated 3 times a week for 12 weeks.

Outcome Evaluation

Pain intensity and functional disability were assessed using a visual analogue scale (VAS) and the Patient-Rated Tennis Elbow Evaluation (PRTEE) prior to treatment and after the 12-week intervention period. The pre and post intervention scores were recorded and analysed to determine the effectiveness of the respective treatment interventions.

Statistical Assessment:

The data were all analysed using descriptive mean value data analysis. The distribution of age and gender of the sample is presented in Table 1.

6. RESULTS

A total of 45 patients with chronic lateral epicondylitis completed the research. The sample consisted of 22 males and 23 females. Most of the participants were between 41–50 years of age (n = 19), followed by 31–40 years (n = 17), 51–60 years (n = 5) and 18–30 years (n = 4). Table 1 presents the demographic distribution of the study participants.

Age	Male	Female	Total
18-30	3	1	4
31-40	6	11	17
41-50	9	10	19
51-60	4	1	5
Total	22	23	45

Table 1 selected subject categories

Comparison of Pre-Test and Post-Test VAS Scores

Table 2 shows the mean, SD and variation of VAS scores in Groups A, B and C respectively while Figure 1 shows the graphical depiction.

	Test	Mean	SD	Variance
GROUP A	Pre Test	7.33	0.894	0.80
	Post Test	1.93	0.794	0.63
GROUP B	Pre Test	8.2	1.145	1.31
	Post Test	4.8	0.938	0.88
GROUP C	Pre Test	8.0	0.959	0.92

	Post Test	4.8	0.938	0.88
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Table 2 Comparison of pre-test and post-test VAS scores (mean, SD, and variance) among Groups A, B, and C.

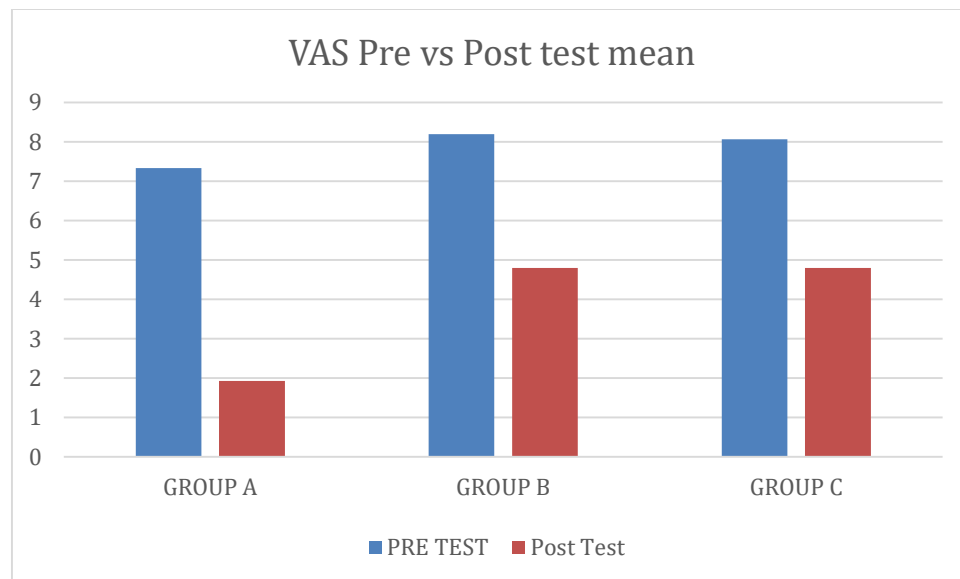


Figure 1 VAS Pre vs Post test mean of 3 groups

The mean VAS scores at baseline were similar among the three groups with Group A 7.33 ± 0.89 , Group B 8.20 ± 1.15 and Group C 8.00 ± 0.96 . After intervention, pain intensity decreased in all groups. Group A (Dry Needling + Ultrasound Therapy) had the highest reduction in pain with mean VAS score from 7.33 to 1.93. Group B (Cyriax Manipulation + Ultrasound Therapy) had the reduction in pain from 8.20 to 4.80. Group C (Ultrasound Therapy Alone) had the reduction in pain from 8.00 to 4.80.

These results indicate that all three therapies are effective in pain reduction, the most improvement being in Group A.

Comparison of Pre-Test and Post-Test PRTEE Scores

The mean, standard deviation (SD), and variance values of the Patient-Rated Tennis Elbow Evaluation (PRTEE) scores are presented in Table 3, and the graphical representation is shown in Figure 2.

	GROUP A	Mean	SD	Variance
GROUP A	Pre Test	88.33	5.05	25.52
	Post Test	36.73	6.39	40.78
GROUP B	Pre Test	88	5.44	29.57
	Post Test	46.73	8.76	76.78
GROUP C	Pre Test	88.33	5.04	25.38
	Post Test	56.8	8.65	74.88

Table 3 Comparison of pre-test and post-test PRTEE scores (mean, SD, and variance) among Groups A, B, and C.

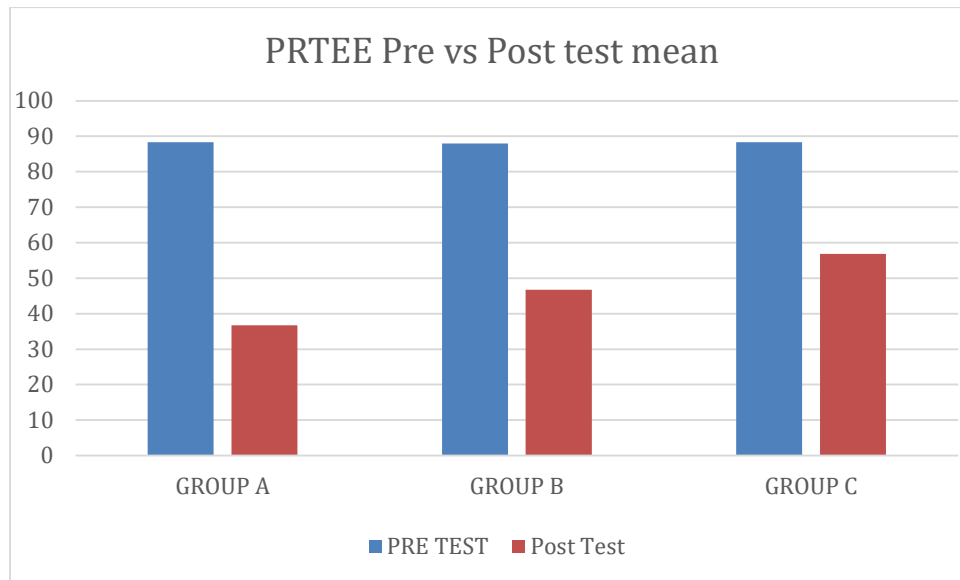


Figure 2 PRTEE Pre test vs Post test mean of 3 groups

The pre-test PRTEE scores were similar in all the three groups (mean values 88.33 ± 5.05 for Group A, 88.00 ± 5.44 for Group B and 88.33 ± 5.04 for Group C). After the intervention, significant improvement was noted in all groups. The PRTEE score in Group A decreased the most, from 88.33 to 36.73. Group B showed a reduction from 88.00 to 46.73 while Group C showed a reduction from 88.33 to 56.80.

The results indicate that all interventions were effective in improving the functional status and reducing disability related to tennis elbow, but the combination of dry needling and ultrasound therapy produced the greatest improvement.

Between-Group Comparison of Post-Test VAS Scores

The post-test mean and variance values of VAS scores are presented in Table 4, while the comparison of mean post-test VAS scores among the three groups is illustrated in Figure 3.

VAS	Average	Variance
Group A	5.4	0.68
Group B	3.4	1.97
Group C	3.2	1.49

Table 4 Post-Test Mean and Variance of Visual Analogue Scale (VAS) Scores in Groups A, B, and C

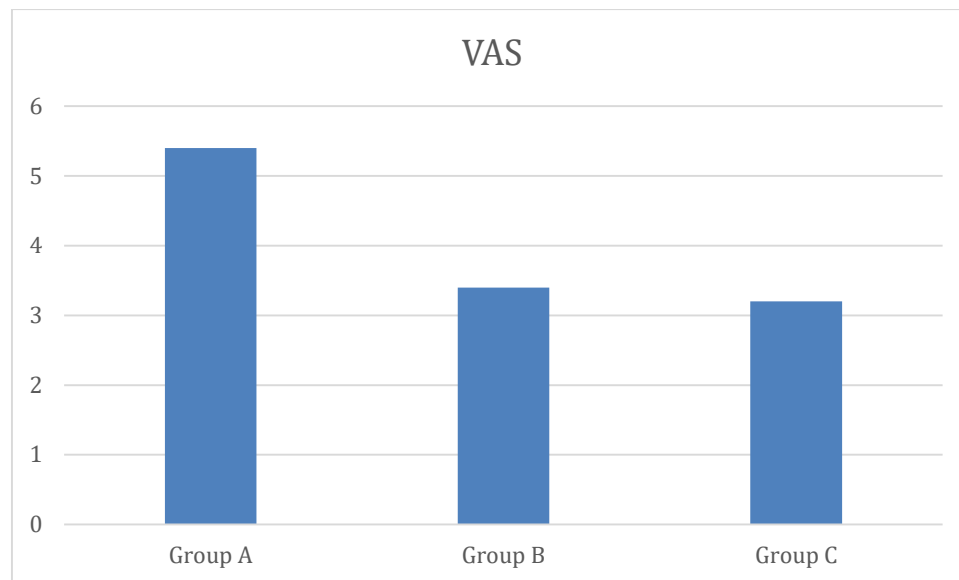


Figure 3 . Comparison of Mean Post-Test VAS Scores Among Groups A, B, and C

Group A demonstrated the lowest post-test pain score (Mean = 5.4, Variance = 0.68), followed by Group B (Mean = 3.4, Variance = 1.97) and Group C (Mean = 3.2, Variance = 1.49). To determine whether the observed differences among the groups were statistically significant, a one-way Analysis of Variance (ANOVA) was performed (Table 5).

Source of Variation	SS	df	MS	F	P-value
Between Groups	42.84	2	21.42222	15.47706	<0.005
Within Groups	58.13	42	1.384127		

Table 5 One-Way ANOVA Analysis of Post-Test VAS Scores Among the Three Study Groups

The ANOVA revealed a statistically significant difference in post-test VAS scores among the three groups ($F = 15.477$, $p < 0.005$). Since the calculated p-value was less than the level of significance, the null hypothesis was rejected. This indicates that the interventions differed significantly in their effectiveness in reducing pain among patients with chronic lateral epicondylitis.

Between-Group Comparison of Post-Test PRTEE Scores

The mean and variance values of PRTEE scores after the test are displayed in Table 6. Graphical comparison is shown in Figure 4.

PRTEE	Average	Variance
Group A	51.78	82.95
Group B	41	107.53
Group C	31.78	70.33

Table 6 . Post-Test Mean and Variance of Patient-Rated Tennis Elbow Evaluation (PRTEE) Scores in Groups A, B, and C

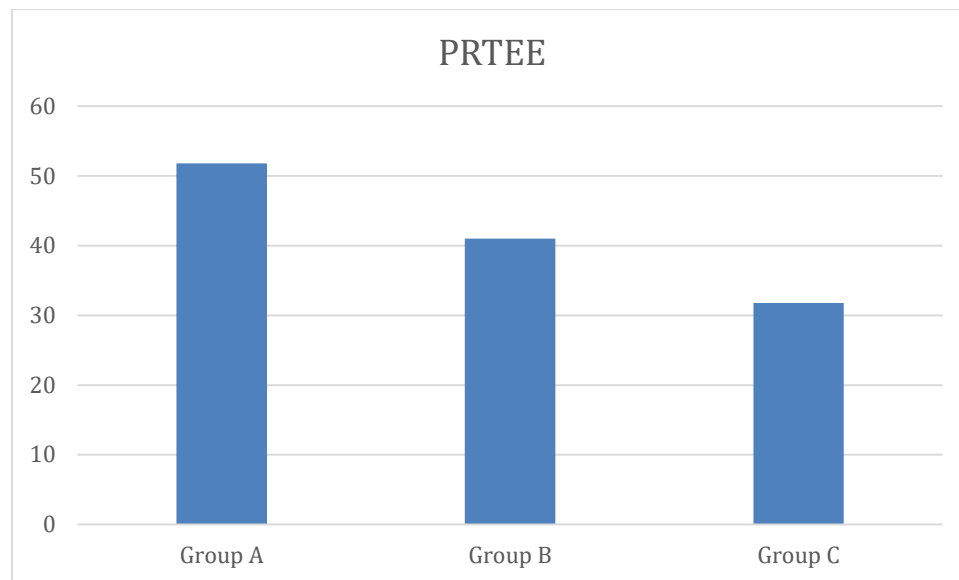


Figure 4 Comparison of Mean Post-Test PRTEE Scores Among Groups A, B, and C

Group A showed the most improvement in functional outcome with mean PRTEE score of 51.78 and variance of 82.95. The mean score for Group B was 41.00 with a variance of 107.53 and the mean score for Group C was 31.78 with a variance of 70.33.

One-way ANOVA was used to compare the post-test PRTEE ratings among the 3 groups (Table 7). There was statistically significant difference between the groups ($F = 16.136$, $p < 0.005$) (analysis). The p-value obtained was less than the preset level of significance, hence the null hypothesis was rejected.

Source of Variation	SS	df	MS	F	P-value
Between Groups	2805.762	2	1402.881	16.13594	<0.005
Within Groups	3390.714	39	86.94139		

Table 7 One-Way ANOVA Analysis of Post-Test PRTEE Scores Among Groups A, B, and C

These findings indicate that the treatment interventions produced significantly different effects on functional recovery and disability reduction. Among the three interventions, Dry Needling combined with Ultrasound Therapy (Group A) demonstrated superior clinical effectiveness compared to Cyriax Manipulation combined with Ultrasound Therapy (Group B) and Ultrasound Therapy alone (Group C).

Summary of Findings

The results of the present study demonstrated significant improvement in pain and functional outcomes with all the three therapies in patients with chronic lateral epicondylitis. But, the maximum reduction in pain intensity and disability scores was seen in subjects treated with Dry Needling with Ultrasound Therapy (Group A) when compared to Cyriax Manipulation with Ultrasound Therapy (Group B) and Ultrasound Therapy Alone (Group C). The ANOVA results for both VAS and PRTEE ratings were

statistically significant which further proves the superiority of the combined dry needling and ultrasonic therapy intervention.

DISCUSSION

The purpose of the present study was to examine the efficacy of dry needling plus ultrasound therapy, Cyriax manipulation plus ultrasound therapy and ultrasound therapy only in patients with chronic lateral epicondylitis. The results showed statistically significant differences between the three treatment groups for both pain reduction and functional improvement, as assessed using the Visual Analogue Scale (VAS) and the Patient-Rated Tennis Elbow Evaluation (PRTEE) and verified with mill's test.

The better results of dry needling plus ultrasound therapy group may be related to the physical effects of dry needling on myofascial trigger points and degenerative tendon tissue. Dry needling generates a local healing response, increases blood flow, decreases discomfort and promotes tissue remodelling. The combination with ultrasound therapy, which increases the extensibility of tissues and local metabolic activity, can enhance the therapeutic effects with greater pain relief and functional recovery.

The results of the present study are in agreement with Hertz and Falsone (2024), who showed significant pain reduction and functional improvements after dry needling in patients with lateral epicondylopathy. Similarly, Ma X et al. (2024) found that dry needling significantly reduced pain intensity, grip strength, and elbow function in patients with lateral epicondylitis. Roy et al. (2024) also highlighted the benefits of dry needling in reducing muscular tightness and improving rehabilitation outcomes.

Those who received Cyriax manipulation and ultrasound therapy also showed improvement in pain and functional status. Positive benefits may be due to deep transverse friction massage and Mill's manipulation which aid to mobilise adhesions, enhance tendon healing and restore normal movement patterns. These results corroborate the research of Stasinopoulos and Johnson (2004) who found significant improvements in pain and grip strength after Cyriax physiotherapy.

Although ultrasound therapy alone showed clinical improvement, the magnitude of improvement was relatively less compared to the combined treatment groups. This result is in agreement with the previous study by Shamsi et al. (2015) and Unver et al. (2021) found that ultrasound therapy is effective in the management of lateral epicondylitis but may be more effective when combined with other therapeutic modalities. In conclusion, the study results suggest that the combination of dry needling and ultrasound therapy is a more holistic treatment approach for chronic lateral epicondylitis as it targets pain pathways and tendon abnormalities. Therefore, this combined intervention could be considered a valuable treatment option for improving clinical outcomes of patients with chronic tennis elbow.

CONCLUSION

It was found that the three therapies, i.e., dry needling with ultrasound therapy, Cyriax manipulation with ultrasound therapy and ultrasound therapy alone were helpful in management of chronic lateral epicondylitis. However, there were marked differences between treatment groups in terms of pain reduction and functional improvement.

Among the three interventions, dry needling with ultrasound therapy showed maximum improvement in Visual Analogue Scale (VAS) and Patient-Rated Tennis Elbow Evaluation (PRTEE) scores indicating better efficacy in pain relief and functional improvement. Cyriax manipulation along with ultrasound therapy also showed beneficial effects but was less effective than dry needling along with ultrasound therapy. The lowest improvement was obtained with ultrasound therapy alone in all 3 groups.

These data confirm the effectiveness of combined dry needling and ultrasound therapy for physiotherapeutic intervention in patients with persistent lateral epicondylitis. Long-term success of this therapy strategy can be confirmed by other studies with larger sample size and longer follow-up period.

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