Research Article

A Comparative Study to Assess the Effectiveness of Cyriax Deep Transverse Friction Massage and Mill's Manipulation in Patients With Tennis Elbow

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Abstract

Background: Lateral epicondylitis, often called tennis elbow, causes pain around the outer part of the elbow. It can make everyday activities such as gripping, lifting and carrying objects uncomfortable. Cyriax deep transverse friction massage (DTFM) and Mill's manipulation are manual therapy techniques used in physiotherapy for this condition. In previous studies, the two techniques have often been studied together and it is hard to know how the results compare when used separately.
Objective: To compare changes in pain and functional disability following Cyriax DTFM and Mill's manipulation in people with tennis elbow.
Methods: Thirty patients from Dasmesh College of Physiotherapy's outpatient department in Faridkot participated in this comparative experimental investigation. Two groups of fifteen each were formed from the participants. Group B was manipulated by Mill, and Group A was given Cyriax DTFM. Additionally, both groups got a therapeutic ultrasound and a heated pack. Three times a week for four weeks was the schedule for treatment. The Visual Analog Scale (VAS) and Patient-Rated Tennis Elbow Evaluation (PRTEE) were used to measure pain and functional impairment before and after treatment.
Results: The reported mean reduction in VAS score was 4.46 in Group A and 4.60 in Group B. The mean reduction in PRTEE score was 33.93 in Group A and 34.16 in Group B. Both groups therefore showed numerical improvement, with the mean changes being greater in Group B.
Conclusion: Participants in both groups showed improvement in pain and functional disability after four weeks. The mean reductions were slightly larger in the Mill's manipulation group.

Keywords: lateral epicondylitis; tennis elbow; deep transverse friction massage; Cyriax; Mill's manipulation; VAS; PRTEE.

INTRODUCTION

Lateral epiicondylitis, commonly known as tennis elbow or lateral epicondylitis, is a condition that causes pain and tenderness around the outer side of the elbow. Activities that require resisted wrist extension, such as gripping, lifting, and carrying objects, frequently exacerbate the pain. Tennis players are not the only ones who suffer from tennis elbow, despite its name. People whose jobs or daily activities require frequent or prolonged usage of the wrist and forearm may also be impacted.

It often involves the common extensor tendon, namely the extensor carpi radialis brevis (ECRB). Rather from being solely caused by acute inflammation, the condition is now widely recognized as a tendinopathy, in which alterations in tendon structure and its capacity to withstand strain may contribute to symptoms. Tenderness close to the lateral epicondyle, pain during resisted wrist extension, discomfort when grasping, and trouble finishing duties around the house or at work are common observations. (Vaquero-Picado et al., 2016; Lucado et al., 2022).

Because many daily jobs demand the hand and wrist to grasp or hold objects, tennis elbow can cause problems. Therefore, assessment should take into account both the degree of discomfort and how symptoms affect day-to-day functioning. While the Patient-Rated Tennis Elbow Evaluation (PRTEE) gages discomfort and difficulty with activities frequently impacted by the ailment, the Visual Analog Scale (VAS) is utilized to record pain severity. The use of condition-specific patient-reported measures in conjunction with the evaluation of pertinent physical impairments is supported by the clinical practice recommendation by Lucado et al. (2022).

Physiotherapy management may involve advice on activity modification, progressive strengthening, manual therapy and selected physical agents. There are two manual therapy techniques for tennis elbow. Cyriax deep transverse friction massage and Mill's manipulation. DTFM involves applying pressure across the symptomatic area in a direction transverse to the tendon fibers. The manipulation of Mill is a high velocity low amplitude thrust technique performed with the elbow in near end-range extension and the forearm and wrist positioned as described in the Cyriax approach. (Nagrale et al., 2009).

Both are techniques of Cyriax physiotherapy, but they are used in different ways. The DTFM is aimed at the symptomatic area of the tendon, whereas Mill's manipulation is a specific thrust at the elbow with the wrist and

forearm positioned to put the relevant tissues on tension. Some studies have combined these techniques together in the same treatment session. When presented together it is difficult to determine the contribution of each technique to the overall result. Comparison of them in separate groups, with other treatment components kept similar, may yield useful clinical information.

In view of this, the present study compares Cyriax DTFM with Mill's manipulation in people with tennis elbow over a four-week treatment period. Changes in pain and functional disability are assessed using VAS and PRTEE scores.

REVIEW OF LITERATURE

Nagrale et al. (2009) conducted a randomized clinical trial with 60 participants with lateral epicondylalgia. Group 1 was treated with 10 min of deep transverse friction massage and then Mill's manipulation, and the comparison group received phonophoresis with diclofenac gel and supervised exercises. The treatment was given three times a week for four weeks. Both groups improved but the combined Cyriax group improved more in pain, pain free grip strength and functional status. Because both DTFM and Mill's manipulation were employed together, the study could not determine the separate contribution of each technique.

Viswas et al. (2012) conducted a randomized clinical trial of 20 people with tennis elbow comparing supervised exercise program with Cyriax physiotherapy. Participants attended 12 sessions over 4 weeks. VAS and Tennis Elbow Function Scale were used to assess pain and functional status. Both groups improved but the exercise group improved to a greater extent. The results emphasize the importance of active rehabilitation and suggest that Cyriax physiotherapy should not be automatically considered to be superior to other treatment approaches.

Loew et al. (2014) performed a Cochrane review examining deep transverse friction massage for lateral elbow tendinitis. The review included two trials with a total of 57 participants. The authors concluded that the available evidence was insufficient to determine whether DTFM produced meaningful improvements in pain, grip strength or function. The small number of studies and their limited sample sizes made it difficult to draw firm conclusions. This review points to the need for further research on the effects of DTFM.

Lucado et al. (2019) conducted a systematic review and meta-analysis of joint mobilisation techniques for lateral elbow tendinopathy. Twenty studies were included in the review, with seven contributing to the meta-analysis. The techniques examined included mobilisation with movement, Mill's manipulation and regional mobilisation. The findings altogether suggested a beneficial effect of Mill's manipulation on pain ratings, although a clear improvement in pain-free grip strength was not demonstrated for this technique. Functional outcomes varied between studies.

Nambi et al. (2023) conducted a randomized, single-blinded, sham-controlled trial involving 60 participants with lateral epicondylalgia. Both groups received corticosteroid injection and DTFM; one group also received active Mill's manipulation, while the other received sham manipulation. The active manipulation group showed greater improvement in pain and several other outcomes. However, because DTFM and corticosteroid injection were provided to both groups, the study examined the additional effect of Mill's manipulation within a combined treatment programme rather than comparing DTFM and Mill's manipulation as separate treatments.

NEED OF STUDY

Tennis elbow is commonly treated with a combination of physiotherapy approaches, including manual therapy and physical agents. However, many published studies have examined Cyriax DTFM and Mill's manipulation together rather than comparing them separately. For example, Nagrale et al. (2009) used DTFM followed by Mill's manipulation as one combined treatment. Nambi et al. (2023) also studied Mill's manipulation as an addition to a programme that included DTFM and corticosteroid injection. These studies are useful, but they do not show clearly how the two manual techniques compare when each is used as the main manual intervention.

The evidence for DTFM is still uncertain. The Cochrane review by Loew et al. (2014) found that the available studies were not strong enough to confirm its independent benefit. Lucado et al. (2019), on the other hand, reported a positive pooled effect of Mill's manipulation on pain, although improvement in grip strength was not clearly demonstrated. There is therefore a practical reason to compare these techniques directly. In the present study, both groups receive the same background treatment, while the manual therapy technique differs. This allows their observed changes in pain and disability to be compared under similar treatment conditions.

AIM

To compare the effectiveness of Cyriax Deep Transverse Friction Massage and Mill's Manipulation in reducing pain and improving functional ability in patients with tennis elbow.

OBJECTIVES

- To assess pain intensity before and after treatment using the Visual Analogue Scale.

To assess pain and functional disability before and after treatment using the Patient-Rated Tennis Elbow

Evaluation

- To compare the pre–post changes in VAS and PRTEE scores between the two treatment groups.

HYPOTHESES

Null hypothesis (H0): There is no significant difference between Cyriax DTFM and Mill's manipulation in the change in VAS and PRTEE scores.

Alternative hypothesis (H1): There is a significant difference between Cyriax DTFM and Mill's manipulation in the change in VAS and/or PRTEE scores.

MATERIALS AND METHODS

Study design and setting

The study was conducted in the Outpatient Department of Dasmesh College of Physiotherapy, Faridkot. It followed a comparative experimental design. Treatment was planned three times per week over four weeks, giving a total of 12 sessions for each participant.

Participants and sample size

The study included 30 participants with tennis elbow. Fifteen participants were included in Group A, which received Cyriax DTFM, and 15 in Group B, which received Mill's manipulation. The study material available for this manuscript does not describe the method used to generate the allocation sequence or conceal group assignment. These details should be confirmed from the original study records and should not be assumed.

Inclusion criteria

- Adults aged 20–60 years.
- Both male and female patients.
- Pain during gripping and resisted wrist extension of dominant hand.
- Pain on VAS more than 5.
- Pain during passive wrist flexion with the elbow extended.
- Tenderness over the lateral epicondyle.
- Chronic symptoms lasting more than 3–4 months.

Exclusion criteria

- Neurological impairment or neuromuscular disease.
- Recent elbow fracture or open wound.
- Cervical radiculopathy or peripheral nerve entrapment.
- Corticosteroid injection within the previous six months.
- Previous elbow surgery.
- Relevant dermatological conditions around the treatment area.

Outcome measures

Pain intensity was measured using the Visual Analogue Scale (VAS), a 0–10 scale on which 0 represents no pain and 10 represents the worst imaginable pain (Huskisson, 1974). Functional disability was assessed using the Patient-Rated Tennis Elbow Evaluation (PRTEE). This 15-item questionnaire measures pain and difficulty with everyday activities. The total score ranges from 0 to 100; a higher score indicates greater pain and disability (Rompe et al., 2007). Both measures were recorded before treatment began and after the four-week intervention period.

Common treatment components

Both groups received the same background treatment. A hot pack was applied over the affected elbow for 10 minutes, followed by therapeutic ultrasound at 3 MHz, 1 W/cm², continuous mode (100% duty cycle), for five minutes. The use of a hot pack as part of a multimodal treatment programme has been reported in research involving lateral epicondylitis (Özmen et al., 2021). Therapeutic ultrasound has also been investigated in this condition, although published findings are not uniform (Ünver et al., 2021; Lucado et al., 2022). These modalities were kept the same in both groups so that the main planned difference between groups was the manual therapy technique.

TREATMENT

Group A: Cyriax deep transverse friction massage

At each session, participants in Group A first received a hot pack over the affected elbow for 10 minutes. Therapeutic ultrasound was then applied at 3 MHz, an intensity of 1 W/cm² and continuous mode (100% duty cycle) for five minutes. These modalities were common to both groups. The ultrasound parameters are reported as used in the study protocol; they should not be interpreted as a universally recommended setting for every patient with lateral elbow tendinopathy.

Cyriax deep transverse friction massage was then applied over the symptomatic common extensor tendon and teno-osseous region near the lateral epicondyle. The participant was positioned comfortably with the elbow

flexed and the forearm supinated. The therapist identified the most tender area and applied firm friction across, rather than along, the tendon fibres, while stabilising the forearm. The technique was delivered for 10 minutes per session, three times per week for four weeks, for 12 planned sessions. The positioning and application are consistent with the procedure described by Nagrale et al. (2009). Pressure should be adjusted according to the participant's tolerance, and the technique should be stopped if symptoms become unacceptable.

Group B: Mill's manipulation

Participants in Group B received the same hot-pack and ultrasound applications as Group A and followed the same treatment schedule. The manual therapy component was Mill's manipulation instead of DTFM. Keeping the common modalities and treatment frequency consistent helped ensure that the planned difference between the groups was the manual therapy technique.

For Mill's manipulation, the participant was seated. The affected shoulder was positioned in approximately 90° of abduction with sufficient internal rotation to orient the olecranon upwards. The therapist maintained the forearm in pronation and the wrist in full flexion while positioning the elbow near end-range extension. One hand stabilised the wrist and forearm, while the other controlled the elbow region. A carefully controlled high-velocity, low-amplitude thrust was then delivered at the end range of elbow extension by a clinician trained in the technique. The positioning and hand placement follow the description provided by **Nagrale et al. (2009).** As this is a thrust manipulation, it should only be performed after appropriate screening for contraindications and with informed consent.

Procedure

Participants were screened to confirm that they met the inclusion and exclusion criteria. VAS and PRTEE scores were recorded before the first treatment session. Participants then received the intervention assigned to their group, together with the common hot-pack and ultrasound applications. Treatment was scheduled three times per week for four weeks. At the end of the programme, VAS and PRTEE were recorded again. Pre- and post-treatment scores were used to describe changes within each group and to compare the outcomes between groups.

STATISTICAL ANALYSIS

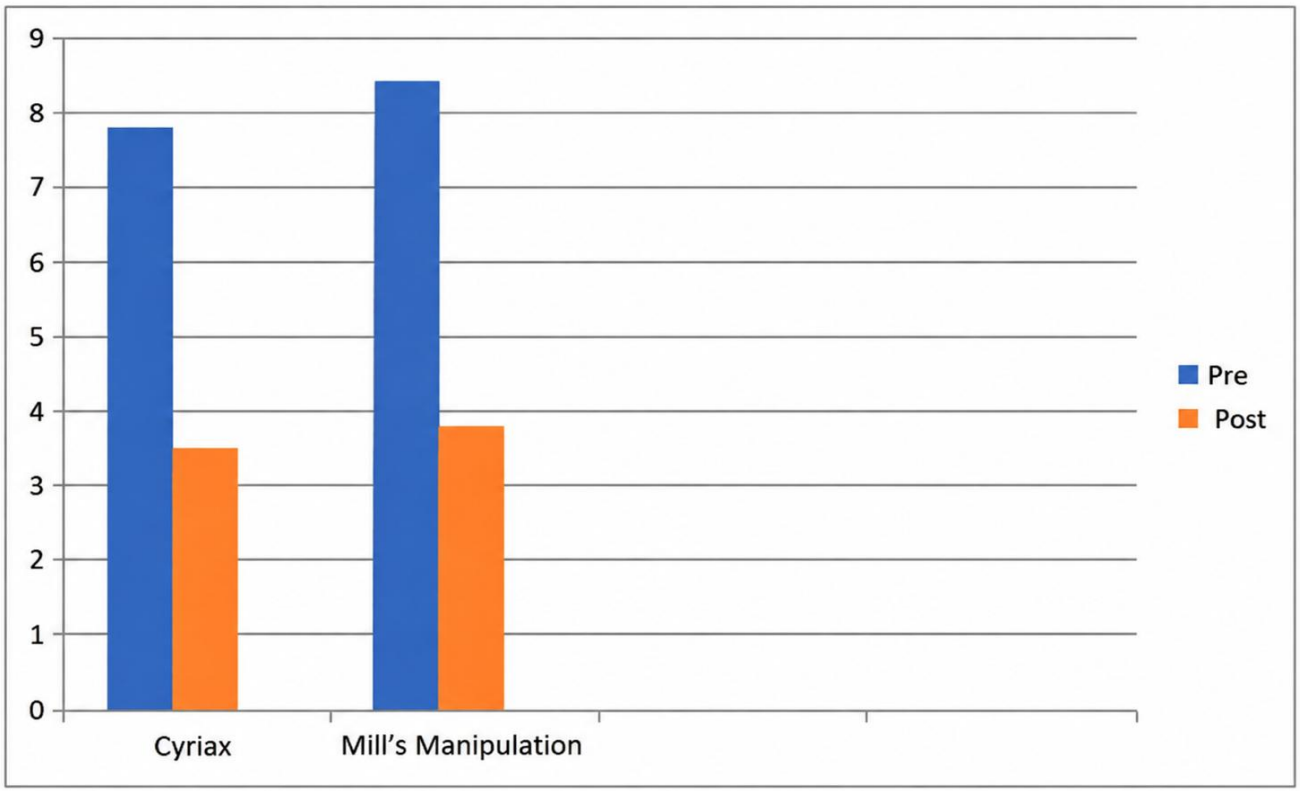
The data were analysed using SPSS and that paired comparisons were performed within each group.

RESULTS

Thirty participants were included in the supplied study summary, with 15 participants in each group. Group A received Cyriax DTFM and Group B received Mill's manipulation. Both groups also received a hot pack and therapeutic ultrasound, with treatment planned three times weekly for four weeks.

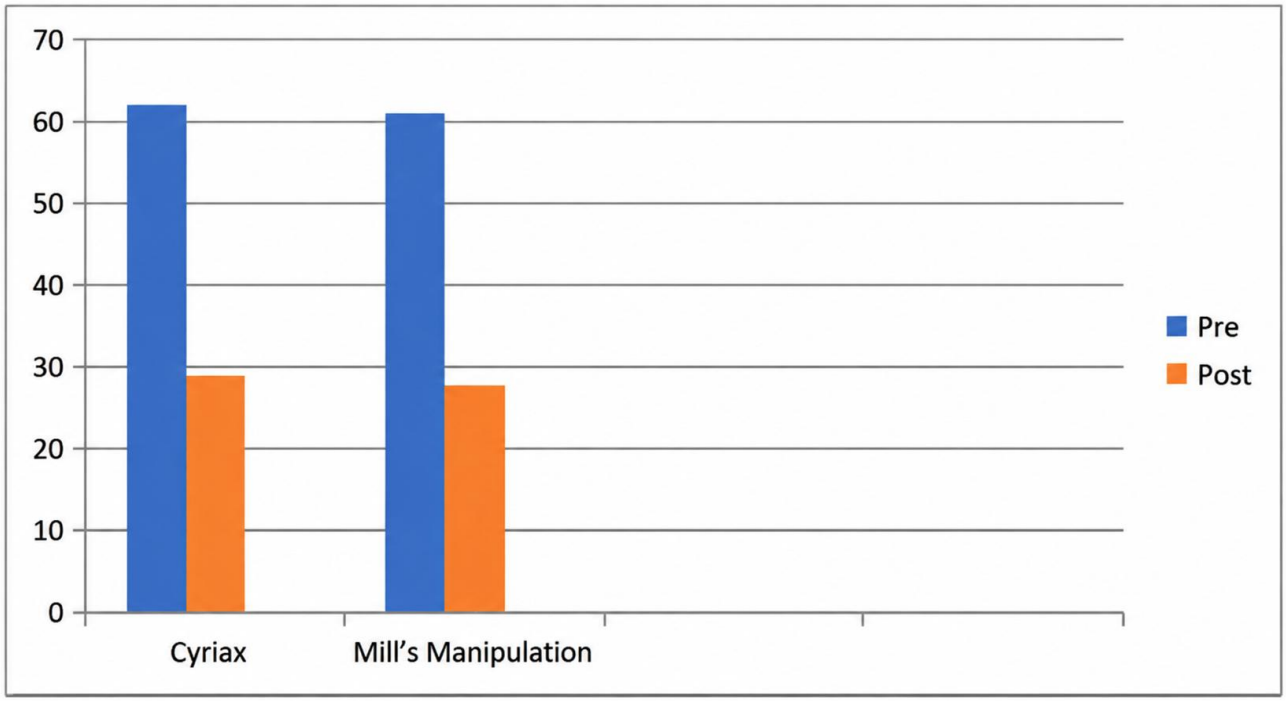
Group-1			**Paired Difference**							
	Mean	Std Deviation	Std Error Mean	95% Confidence interval of Difference		T (a)	df	Sig-(2) tailed	Z value (NPS) (B)	Effect Size
				Lower	Upper					
Difference	4.46	3.98095	1.02788	2.45203	6.48131	4.3455	14	0.001	-3.25 p=0.01 (large)	+0.062
Post test VAS Difference in Pre test and Post test PRTEE	33.93	41.6738	10.76014	12.84346	55.84346	3.1536	14	0.01	-2.455 p=0.01 (large)	+0.062

COMPARISON OF PRE AND POST VAS



Group-2			Paired Difference							
	Mean	Std Deviations	Std. Error Mean	95% confidence interval of the difference		t(a)	df	Sig(2) tailed	Z value(NPS) (b)	Effect size(r)
				Lower	Upper					
Difference	4.6	0.68571	4.25298	4.25298	4.94702	25.98	14	0.001	-3.349 p=0.01 (large)	+0.06
Post test VAS Difference in Pre test and Post test PRTEE	34.16	64.4881	1.5311	1.5311	66.80218	2.1519	14	0.05	-2.470 p=0.01(large)	+0.06

COMPARISON OF PRE AND POST VAS AND PRTEE SCALE VALUES GROUP B



Within-group changes

Outcome	Group A: DTFM	Group B: Mill's
VAS mean reduction	4.46	4.60
PRTEE mean reduction	33.93	34.16
Reported VAS p-value	0.001	0.001
Reported PRTEE p-value	0.01	0.05

Group A showed a mean reduction of 4.46 points in VAS and 33.93 points in PRTEE. Group B showed a mean reduction of 4.60 points in VAS and 34.16 points in PRTEE. The reported p-values suggest pre–post changes within the groups.

Numerical comparison between groups

The mean reduction in VAS was 0.14 points greater in Group B than in Group A (4.60 compared with 4.46). The mean reduction in PRTEE was 0.23 points greater in Group B (34.16 compared with 33.93). These are small descriptive differences. Without a verified between-group statistical test, they should not be interpreted as proof that Mill's manipulation is more effective.

DISCUSSION

This study compared Cyriax DTFM and Mill's manipulation in people with tennis elbow. Pain intensity and functional disability were assessed using VAS and PRTEE before and after four weeks of treatment. According to the available study summary, both groups showed reductions in pain and PRTEE scores. The mean reductions were 4.46 points in VAS and 33.93 points in PRTEE in Group A, and 4.60 points in VAS and 34.16 points in PRTEE in Group B. The numerical changes were slightly larger in Group B. However, the differences between the group means were small, and a verified between-group analysis is not available. It would therefore be inappropriate to conclude that one technique was superior on the basis of these figures alone.

Participants receiving DTFM showed improvement over the treatment period. The technique involves applying friction across the tendon fibres over the symptomatic region. It has traditionally been used with the aim of influencing pain and local tissue symptoms, but the exact mechanisms and the extent of its independent clinical benefit remain uncertain. The Cochrane review by Loew et al. (2014) found insufficient evidence to confirm clinically important benefits of DTFM for lateral elbow tendinopathy. For this reason, the improvement observed in Group A should be understood as a change following the full treatment programme, not as proof that DTFM alone caused tissue healing.

Group B also showed improvement in pain and functional disability. This is consistent with the systematic review by Lucado et al. (2019), which reported a positive pooled effect of Mill's manipulation on pain ratings. However,

the review did not show a clear improvement in pain-free grip strength for this technique, and functional outcomes varied across the included studies. Pain reduction and improvement in function are related, but they are not necessarily the same outcome.

The trial by Nagrale et al. (2009) is relevant because it reported greater improvement after a Cyriax treatment programme than after phonophoresis combined with supervised exercise. However, the Cyriax programme included both DTFM and Mill's manipulation. It is therefore not possible to identify which of the two techniques was responsible for the reported improvement. The present study separates the techniques into two groups, which provides a more direct comparison of the outcomes associated with each manual therapy approach.

Viswas et al. (2012) reported improvement in both the supervised exercise and Cyriax groups, with greater improvement in the exercise group. This finding is important because it reminds us that manual therapy is only one part of tennis elbow rehabilitation. The clinical practice guideline by Lucado et al. (2022) supports resisted wrist-extensor exercise for people with subacute or chronic lateral elbow tendinopathy and indicates that selected elbow mobilisation or manipulation may help with short-term pain and pain-free grip when appropriate. The guideline also notes that evidence for deep transverse friction massage is conflicting.

Siva et al. (2025) reviewed DTFM used alongside conventional physiotherapy for different tendinopathies and reported possible improvements in pain and disability. These findings support further study of DTFM as an adjunct to rehabilitation. However, the review considered combined treatment programmes and different tendon conditions. It does not provide a direct answer to whether DTFM is more or less effective than Mill's manipulation when treating lateral elbow tendinopathy.

An important point when interpreting the present findings is that both groups received a hot pack and therapeutic ultrasound in addition to their assigned manual therapy. These shared treatments may also have contributed to the improvements seen in both groups. The study therefore compares two treatment programmes that share the same physical agents but differ in their manual therapy component. It does not measure the isolated effect of DTFM or Mill's manipulation. In addition, the absence of verified between-group statistics limits the conclusions that can be drawn about comparative effectiveness.

In clinical practice, both approaches may be considered as part of an individualised rehabilitation programme, taking account of the patient's symptoms, preferences, tolerance and any contraindications. Manual therapy should not replace education, appropriate load management and progressive strengthening. For persistent or chronic symptoms, exercise-based rehabilitation remains an important part of care, in line with current clinical guidance.

CONCLUSION

Both groups showed numerical improvement in pain and functional disability after the four-week treatment programme. The mean reductions in VAS and PRTEE were greater in the Mill's manipulation group than in the DTFM group. It is therefore possible concluded that Mill's manipulation is more effective than Cyriax DTFM.

This study had a few limitations. The sample size was relatively small, which may limit the generalisability of the findings. Participants were recruited from a limited geographical area, so the results may not represent the wider population. Furthermore, the study focused only on the dominant hand. Future studies should also include patients with involvement of the non-dominant hand to provide a broader understanding of lateral elbow tendinopathy and its treatment outcomes.

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