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Comparative Effect of Cyriax Therapy and Mobilization with Movement in The Management of Chronic Tennis Elbow

Yasir Chaudhary[1*], Dr. Vaishali Chaudhary[2], Dr. Monika Sharma[3]

[1*]Institute of Applied Medicines and Research, Ghaziabad
[2]Institute of Applied Medicines and Research, Ghaziabad
[3]Institute of Applied Medicines and Research, Ghaziabad

Abstract:
Background: Chronic tennis elbow (lateral epicondylalgia) is a prevalent musculoskeletal disorder that significantly impacts daily activities and occupational performance. Various physiotherapy interventions, including Cyriax therapy and mobilization with movement, are commonly employed; however, their comparative effectiveness remains unclear.
Objective: This study aims to compare the efficacy of Cyriax therapy combined with ultrasound therapy and strengthening exercises versus mobilization with movement, ultrasound therapy, and strengthening exercises in improving pain and grip strength in individuals with chronic tennis elbow.
Methods: A randomized comparative study was conducted with 30 participants diagnosed with chronic tennis elbow. They were assigned to either Group A (Cyriax therapy + ultrasound therapy + strengthening exercises) or Group B (mobilization with movement + ultrasound therapy + strengthening exercises) for a treatment duration of 10 days. Pain levels (Visual Analogue Scale, VAS) and grip strength (hand dynamometer) were assessed pre- and post-intervention.
Results: Both groups demonstrated significant improvements in pain reduction and grip strength post-treatment ($p < 0.05$). However, Group A showed a greater reduction in VAS scores and a more substantial increase in grip strength compared to Group B, suggesting superior effectiveness of Cyriax therapy.
Conclusion: Cyriax therapy, in combination with ultrasound therapy and strengthening exercises, is more effective than mobilization with movement in reducing pain and improving grip strength in individuals with chronic tennis elbow. These findings support the integration of Cyriax therapy into physiotherapy treatment protocols for managing this condition.

Keywords: Tennis elbow, lateral epicondylalgia, Cyriax therapy, Mills manipulation, mobilization with movement, ultrasound therapy, grip strength.

Introduction

Lateral epicondylalgia, commonly referred to as tennis elbow, is a prevalent musculoskeletal disorder affecting the extensor tendons of the forearm, primarily the extensor carpi radialis brevis (ECRB). It is characterized by lateral elbow pain and tenderness, often exacerbated by wrist extension and gripping activities (Coombes et al., 2015). Initially described as "Writers' Cramps" by Ranges in 1873, the term "Tennis Elbow" was later introduced by Morris in 1883 due to its high prevalence among tennis players (Shiri et al., 2006). The condition is widely recognized as a tendinopathy rather than an inflammatory disorder, resulting from chronic degenerative changes in the tendon due to repetitive microtrauma (Khan et al., 1999).

The epidemiology of tennis elbow reveals a prevalence ranging from 1% to 3% in the general population, with peak incidence between the ages of 30 and 60 years (Shiri et al., 2006). Although it affects both genders equally, studies indicate that females may experience prolonged symptoms and greater severity compared to males (Coombes et al., 2015). The dominant limb is typically more affected, suggesting an occupational or activity-related etiology (Vicenzino et al., 2003). Work-related risk factors include prolonged gripping, excessive wrist extension, and repetitive eccentric loading, which contribute to tendon overuse and structural degeneration (Boyer & Hastings, 1999).

Pathophysiology studies classify lateral elbow tendinopathy as a degenerative process rather than an inflammatory one. Microscopic examination of affected tendons reveals fibroblast proliferation, vascular hyperplasia, and disorganized collagen structure, indicating a failed healing response rather than acute inflammation (Khan et al., 1999). Cyriax (1982) categorized tennis elbow into three variants: tenoperiosteal, tendinous, and musculotendinous forms. Among these, tenoperiosteal lesions at the common extensor tendon origin are the most commonly observed in clinical practice (Bisset et al., 2006).

The diagnosis of tennis elbow is primarily clinical, involving palpation over the lateral epicondyle, resisted wrist extension, and the Maudsley's test (resisted middle finger extension) (Fairbank & Corlett, 2002). Imaging modalities such as ultrasound and magnetic resonance imaging (MRI) may be employed in persistent cases to assess tendinopathy severity and structural changes (Mackay et al., 2003).

Despite extensive research, there is no universally accepted gold-standard treatment for lateral epicondylalgia (Smidt et al., 2002). Conservative management includes rest, bracing, corticosteroid injections, ultrasound therapy, laser therapy, transcutaneous electrical nerve stimulation (TENS), manual therapy, stretching, and eccentric strengthening exercises

(Boisanbert et al., 2004). However, the effectiveness of these interventions remains controversial due to inconsistent clinical outcomes across studies (Struijs et al., 2004).

Among physiotherapy interventions, Cyriax physiotherapy, consisting of deep friction massage and Mills' manipulation, is widely utilized for chronic tennis elbow management. Cyriax (1982) advocated this technique, emphasizing its ability to soften fibrotic scar tissue, promote vascularity, and enhance tendon extensibility (Stasinopoulos & Johnson, 2007). Deep friction massage is believed to produce reactive hyperemia, reducing pain through nociceptive modulation and endogenous opioid release (Melzack & Wall, 1965). Mills' manipulation, performed immediately after deep friction massage, aims to break adhesions at the tenoperiosteal junction, restoring tendon mobility and reducing symptom recurrence (Stasinopoulos & Johnson, 2007).

An alternative physiotherapy approach, mobilization with movement (MWM), involves concurrent passive joint mobilization and active movement. This technique, developed by Mulligan, has demonstrated positive results in improving pain and function in musculoskeletal conditions (Vicenzino et al., 2003). However, comparative studies evaluating MWM against Cyriax therapy in tennis elbow remain limited.

This study aims to compare the effectiveness of Cyriax therapy versus mobilization with movement, both combined with ultrasound therapy and strengthening exercises, in reducing pain and improving grip strength in individuals with chronic tennis elbow. Given the lack of standardized treatment guidelines, identifying the superior intervention can aid in optimizing physiotherapy protocols for managing this condition.

Methodology

This study employed a randomized comparative design to evaluate the effectiveness of Cyriax therapy (deep friction massage + Mills manipulation) versus Mobilization with Movement (MWM) in individuals with chronic tennis elbow (lateral epicondylalgia). Both interventions were combined with ultrasound therapy and strengthening exercises. The study was conducted at Ayushman Hospital, Dasna, Ghaziabad, over a period of 10 days.

A total of 30 participants diagnosed with chronic tennis elbow were recruited for the study. Patients were randomly assigned to two groups (Group A and Group B), each consisting of 15 participants. The inclusion criteria for the study included patients clinically diagnosed with chronic lateral epicondylalgia, as referred by an orthopedic specialist, with a positive Maudsley's test (pain on resisted middle finger extension) and Cozen's test (pain on resisted wrist extension). Participants were right-hand dominant, aged between 30 to 50 years, and had symptoms persisting for more than two months. Both male and female participants were included. The exclusion criteria included patients with acute exacerbation of chronic tennis elbow, radial nerve entrapment, cervical radiculopathy, fractures around the elbow joint, polyarthritis, radiohumeral bursitis, painful shoulder conditions, neurological disorders affecting upper limb strength, infections, malignancy, or systemic illness.

Participants were randomly allocated into two treatment groups using a computer-generated randomization sequence. The allocation was concealed, and the study was conducted single-blinded, where the assessor was unaware of group assignments. Group A received Cyriax therapy, which included deep friction massage applied over the lateral epicondyle for 8–10 minutes, followed by Mills manipulation to break adhesions and improve tendon mobility. This was combined with ultrasound therapy, administered in continuous mode (1.5 W/cm², 1 MHz frequency) for 8 minutes, and strengthening exercises targeting the wrist extensors, performed as 3 sets of 10 repetitions. Group B received Mobilization with Movement (MWM), which involved the application of a lateral glide to the radial head while the patient performed a pain-free gripping task. This was followed by the same ultrasound therapy and strengthening exercises administered to Group A. Both groups received their respective interventions once daily for 10 consecutive days.

The effectiveness of the interventions was assessed using two primary outcome measures, recorded pre-treatment (Day 1) and post-treatment (Day 10). Pain intensity was measured using the Visual Analogue Scale (VAS), which ranged from 0 (no pain) to 10 (worst imaginable pain) (Melzack & Wall, 1965). Grip strength was assessed using a hydraulic hand dynamometer, with participants seated, their elbow at 90° flexion, and their forearm in a neutral position. Participants were instructed to exert maximum grip force three times, with a 1-minute rest interval between attempts, and the mean of the three trials was recorded.

The intervention procedures were standardized for both groups. Ultrasound therapy was administered with the patient seated in a supported backrest chair, the affected forearm in pronation, and the elbow flexed at 90°. A sterile ultrasound gel was applied to the lateral epicondyle to ensure optimal wave transmission, and therapy was performed in continuous mode at 1.5 W/cm² for 8 minutes. In Group A, Cyriax therapy was performed by applying deep friction massage with the thumb perpendicular to the common extensor tendon for 8–10 minutes. Following this, Mills manipulation was performed, where the patient's arm was abducted and medially rotated, and the therapist applied full forearm pronation and wrist

flexion before executing a sudden elbow extension maneuver. This manipulation was applied once per session for 10 sessions. In Group B, MWM was applied by delivering a lateral glide to the radial head while the patient actively performed pain-free gripping movements, repeated for 3 sets of 10 repetitions per session.

The eccentric wrist strengthening exercises were included in both groups and were performed with the forearm supported, allowing the hand to move freely. Each patient completed 3 sets of 10 repetitions per session, with 1-minute rest intervals between sets. These exercises aimed to improve tendon endurance and reduce strain on the lateral epicondyle.

Statistical Analysis
All statistical analyses were conducted using SPSS software (Version 10.0). Data were checked for normality using the Shapiro-Wilk test, confirming that all variables followed a normal distribution. A paired t-test was used to evaluate within-group differences between pre-treatment (Day 1) and post-treatment (Day 10) scores for pain intensity (VAS) and grip strength. An independent t-test was employed to compare post-treatment differences between Group A (Cyriax therapy) and Group B (MWM therapy).

Descriptive statistics, including mean, standard deviation (SD), and confidence intervals (CI), were calculated for each outcome measure. The effect size for each intervention was determined using Cohen's d, where values of 0.2, 0.5, and 0.8 represented small, medium, and large effects, respectively. Statistical significance was set at $p < 0.05$ for all analyses.

Between-group comparisons assessed whether Cyriax therapy was superior to MWM in improving pain and grip strength. The mean difference in VAS scores and grip strength measurements between groups was reported with 95% confidence intervals (CI) to determine clinical significance. Additionally, a repeated measures ANOVA was performed to assess interaction effects between treatment types and time.

The results were presented using bar graphs and tables, displaying the percentage improvement in pain reduction and grip strength enhancement. The primary hypothesis was that Group A (Cyriax therapy) would demonstrate greater improvements than Group B (MWM therapy), and statistical analysis was structured to test this assumption.

Results
A total of 30 participants diagnosed with chronic tennis elbow were included in this study. They were randomly assigned to two groups: Group A (Cyriax therapy + ultrasound therapy + strengthening exercises, n = 15) and Group B (Mobilization with Movement + ultrasound therapy + strengthening exercises, n = 15). No participants dropped out during the intervention period, and all completed the 10-day treatment protocol successfully.

Baseline Characteristics
The mean age of participants in Group A was 41.13 ± 4.2 years, while in Group B, it was 42.3 ± 3.9 years. The gender distribution was 6 males and 9 females in Group A and 5 males and 10 females in Group B. Baseline Visual Analogue Scale (VAS) scores and grip strength measurements were comparable between the two groups ($p > 0.05$), indicating homogeneity at the start of the study.

Within-Group Comparisons
Pain Reduction (VAS Score)
In Group A, the mean VAS score significantly decreased from 7.53 ± 0.96 (pre-treatment) to 2.60 ± 0.94 (post-treatment) ($p < 0.05$). Similarly, in Group B, the VAS score reduced from 7.6 ± 0.95 to 4.27 ± 0.99 ($p < 0.05$). Although both groups showed significant improvements, Group A demonstrated a greater reduction in pain compared to Group B.

Grip Strength Improvement (kg force, Hand Dynamometer)
In Group A, the mean grip strength increased from 9.13 ± 0.87 kg to 20.07 ± 1.69 kg ($p < 0.05$). In Group B, the grip strength improved from 9.4 ± 1.25 kg to 14.93 ± 2.05 kg ($p < 0.05$). While both groups showed statistically significant improvements, Group A exhibited a larger increase in grip strength compared to Group B.

Between-Group Comparisons
Post-treatment VAS scores were significantly lower in Group A than in Group B ($p = 0.005$), indicating that Cyriax therapy provided superior pain relief. Likewise, post-treatment grip strength was significantly higher in Group A compared to Group B ($p = 0.01$), suggesting that Cyriax therapy resulted in better functional improvement.

Effect Size and Clinical Significance
The effect size (Cohen's d) for pain reduction was 1.2, indicating a large effect in favor of Cyriax therapy. The effect size for grip strength improvement was 1.0, also indicating a large effect. The repeated measures ANOVA showed a significant

interaction effect ($p < 0.05$) between time and treatment type, confirming that Cyriax therapy had a greater impact on pain and strength improvements compared to MWM therapy.

Discussion

The present study aimed to compare the effectiveness of Cyriax therapy (deep friction massage and Mills manipulation) versus Mobilization with Movement (MWM) in conjunction with ultrasound therapy and strengthening exercises in the management of chronic tennis elbow. The results demonstrated that both interventions significantly improved pain levels (VAS scores) and grip strength, but Cyriax therapy produced superior outcomes in both measures compared to MWM. These findings highlight the importance of manual therapy techniques in enhancing functional recovery and pain modulation in lateral epicondylalgia.

Pain Reduction and Mechanisms of Cyriax Therapy

The significant reduction in VAS scores in both groups aligns with previous studies suggesting that manual therapy combined with ultrasound and strengthening exercises is an effective approach for tennis elbow management (Smidt et al., 2002). However, Group A (Cyriax therapy) exhibited greater pain relief than Group B (MWM therapy) ($p = 0.005$), indicating that deep friction massage and Mills manipulation may provide superior analgesic effects.

The effectiveness of Cyriax therapy in reducing pain can be attributed to its biomechanical and neurophysiological effects. Deep friction massage stimulates mechanoreceptors and nociceptors, inducing a localized analgesic effect through the Gate Control Theory (Melzack & Wall, 1965). Furthermore, deep friction massage promotes reactive hyperemia, which enhances oxygenation and metabolic exchange at the tenoperiosteal junction, facilitating tendon healing (Stasinopoulos & Johnson, 2007).

Mills manipulation, performed immediately after deep friction massage, helps break adhesions and elongate the extensor tendons, reducing mechanical strain on the common extensor origin. Studies have shown that manipulative therapy can modulate nociceptive input and reduce myofascial trigger points, thereby improving pain perception and range of motion (Vicenzino et al., 2003). The superiority of Cyriax therapy in pain reduction is consistent with findings from Bisset et al. (2006), who reported that manual therapy was more effective than corticosteroid injections in the long-term management of lateral epicondylalgia.

Grip Strength Improvement and Functional Recovery

Grip strength significantly improved in both groups ($p < 0.05$), but Group A (Cyriax therapy) demonstrated a greater increase compared to Group B (MWM therapy) ($p = 0.01$). This improvement can be attributed to enhanced tendon extensibility, pain reduction, and neuromuscular activation following Cyriax therapy.

A possible explanation for the superior grip strength improvement in Cyriax therapy is its combined effect on tendon mobility and muscle activation. Mills manipulation, by breaking adhesions, reduces mechanical restriction on the extensor carpi radialis brevis (ECRB), allowing better force transmission during gripping activities (Boyer & Hastings, 1999). Additionally, deep friction massage enhances proprioceptive feedback, leading to improved motor control and wrist stability (Shiri et al., 2006). These findings are consistent with studies that have demonstrated manual therapy-induced neuromuscular facilitation and increased recruitment of extensor muscle fibers after treatment (Coombes et al., 2015).

The MWM technique, though beneficial, primarily focuses on joint mobilization rather than direct tendon manipulation. While previous research supports MWM as an effective intervention for pain modulation and movement restoration (Vicenzino et al., 2003), the results of this study suggest that MWM alone may not be as effective as Cyriax therapy in improving grip strength.

Comparison with Previous Research

The results of this study align with findings from previous clinical trials. Cyriax (1982) emphasized that deep friction massage followed by manipulation produced superior results compared to exercise therapy alone. Similarly, Stasinopoulos & Johnson (2007) reported that Cyriax physiotherapy led to greater improvements in pain and function than traditional physiotherapy modalities. Bisset et al. (2006) further supported these findings, indicating that manual therapy approaches such as Cyriax and Mills manipulation provided longer-lasting relief compared to corticosteroid injections.

A systematic review by Trudel et al. (2004) concluded that manual therapy techniques, including friction massage, joint mobilization, and stretching exercises, were effective in reducing pain and improving grip strength in chronic lateral epicondylalgia patients. Furthermore, Smidt et al. (2002) demonstrated that patients treated with manipulative therapy had significantly better functional outcomes than those receiving a “wait-and-see” approach or corticosteroid injections.

The present study also confirms the findings of Mackay et al. (2003), who reported that chronic tennis elbow patients exhibit tendon thickening, collagen disorganization, and increased vascularity, all of which respond favorably to mechanical stimulation through manual therapy techniques.

Clinical Implications

The findings of this study suggest that Cyriax therapy should be considered as a first-line physiotherapy intervention for chronic tennis elbow due to its combined effects on pain modulation, grip strength improvement, and tendon healing. Given the cost-effectiveness and ease of application, integrating deep friction massage and Mills manipulation into clinical practice can enhance treatment outcomes for lateral epicondylalgia patients.

Additionally, the results highlight the importance of strengthening exercises in rehabilitation. Regardless of the manual therapy approach used, progressive resistance training for the wrist extensors remains crucial for maintaining long-term functional improvements (Chang et al., 2019). Future research should explore optimal exercise protocols in conjunction with manual therapy to further enhance therapeutic outcomes.

Limitations and Future Research

This study has several limitations. The short duration (10 days) and small sample size (n = 30) limit the generalizability of the findings. Future studies should incorporate larger sample sizes and extended follow-up periods to assess the long-term effectiveness of Cyriax therapy. Additionally, the lack of a placebo control group limits the ability to determine whether treatment effects were due to specific manual therapy interventions or non-specific therapeutic effects. Future research should also explore the combined effects of Cyriax therapy with other physiotherapy interventions, such as shockwave therapy and dry needling, for a more comprehensive treatment approach.

Conclusion

This study demonstrates that Cyriax therapy (deep friction massage + Mills manipulation) is more effective than Mobilization with Movement (MWM) in reducing pain and improving grip strength in patients with chronic tennis elbow. The findings suggest that Cyriax therapy should be incorporated into clinical physiotherapy protocols as a preferred manual therapy technique for lateral epicondylalgia management. Future studies with larger sample sizes, long-term follow-ups, and multimodal treatment comparisons are warranted to further refine evidence-based management strategies for chronic tennis elbow.

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