International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 17s, 2025
https://www.theaspd.com/ijes.php

The Influence Of Maitland Mobilization On Chronic Lateral Epicondylitis: A Randomized Controlled Trial

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Abstract

Background and purpose: *Chronic lateral epicondylitis (LE) was a widespread overuse injury disorder. This affects both sexes between 30 and 50 years old and is most prevalent. There was a lack of studies that investigated the effect of Maitland mobilizations on the elbow joint by using Ultrasonography scanning (US). This study was conducted to answer the influence of Maitland mobilizations on neovascularity /hypo-echogenicity, pain severity, range of motion (ROM) of wrist extension, hand grip strength, and functional disability level in patients.*

Material and methods: *The study was conducted using 60 people who were chosen at random to participate in two equal groups. The treatment group (n=30) receiving Maitland mobilization in addition the conventional therapy and control group (n=30) received conventional therapy only 3 times/ weekly for 12 sessions. The measurements were conducted before and after 4 weeks of intervention with frequency of 3 times/weekly using US , visual analogue scale(VAS) , universal goniometer, Dynamometer, and the quick disability function questionnaire(Quick DASH).*

Results: *Each group demonstrated a significant decreased in neovascularity /hypo-echogenicity on treatment group decreased contrasted with control group ($p < 0.001$), decreased pain severity, increasing ROM of wrist extension and increasing hand strength grip, decreased function disability in treatment group comparing with control group. There was statistically significant between groups decrease in VAS ($p < 0.001$), increase in wrist extension ROM ($p < 0.001$), in hand grip ($p < 0.001$) and Quick DASH questionnaire ($p < 0.001$) after 4 weeks of intervention.*

Conclusion: *Maitland mobilization with conventional therapy showed more decreased neovascularity/hypo-echogenicity, pain severity, increased ROM of wrist extension, hand grip strength, and decreased functional disability level.*

Keywords: *Ultrasonography, VAS, Goniometric, Dynamometer, the Quick DASH questionnaire.*

INTRODUCTION

LE was represented an overuse injury frequently associated with hyaline degeneration at the extensor tendon origins for wrist and finger mobility. Excessive forearm and elbow strain arises from repetitive contractions or manual tasks, exerting disproportionate stress on tendon structures. Such activities demand hand manipulations that induce localized discomfort near the lateral epicondyle. Typically, pain manifests anteriorly and distally relative to this anatomical landmark [1]. Recognized clinically as "tennis elbow," this condition dominates elbow overuse pathologies, involving tendinopathies changes within forearm extensor musculature. These muscle groups originate from the lateral epicondyle of the distal hummers [2]. Notably, only 1–3% of affected individuals attribute symptoms to tennis activities. Chronic tendon overload near humeral attachments emerges as the principal etiological factor [3]. Gender distribution shows equal prevalence, with peak incidence occurring between 30 and 50 years. Bilateral presentation remains uncommon, though the dominant arm susceptibility increases significantly. Approximately 20% of cases demonstrate symptoms exceeding 12 months [4]. Point soreness that is restricted to the anterior side of the lateral epicondyle is a typical physical finding. Extending the elbow while resisting wrist extension typically makes the discomfort worse. Swelling, weakness, and atrophy of the forearm extensor muscles are possible additional physical examination findings [5]. More specifically, it affects the extensor carpi radialis brevis muscle's origin, which is typically [1-2] cm distal to the lateral epicondyle [6].

The Maitland mobilization was defined as a method of diagnosing, evaluating, and treating neuromuscular skeletal disorders using manipulative physiotherapy. The Maitland approach treats stiffness and mechanical discomfort by using accessory and passive mobilizations. The main purpose of Maitland mobilization in grades I and II is to treat painful joints. The oscillations may inhibit the perception of painful stimuli by repeatedly activating mechanoreceptors that block nociceptive pathways at the brain stem or spinal cord levels. [7].

US assessment Joint fluid, aspiration guidance, assessment of the supporting tendons and ligaments, and limited assessment of the articular cartilage are all possible components of an US examination of the elbow [8]. The ability to conduct a dynamic examination while gathering patient input made US valuable in many situations. US makes it possible to evaluate both the cortical surface of bones and soft tissue structures [8].

An assessment instrument for isometric grip force was the grip hand strength dynamometer for testing muscular strength, or the greatest force or tension produced by one's forearm muscles [9]. A goniometer was used to measure angles or to rotate objects to exact angular positions [10].

Using 11 questions of the Quick DASH questionnaire is a condensed Abbreviated form of the disability shoulder, arm and hand Outcome Measure that assesses physical function and symptoms in individuals with one or more upper limb musculoskeletal diseases [11].

Purpose: to analyze the influence of Maitland mobilizations on neovascularity/hypo-echogenicity, pain level, hand grip strength, ROM of wrist extension and functional disability level in patients with chronic LE.

MATERIAL AND METHODS

PARTICIPANTS

This study was a pre-test and post-test design randomized controlled trial with a two-groups. The subjects (both genders) between the age group of 30 and 50 and with body mass index (BMA) ≤ 30 Kilogram /meter^2 were selected from an outpatient clinic at the Faculty of Physical Therapy at Cairo University. They were being diagnosed and referred by an orthopedist and suffering from chronic LE criteria were diagnosed: 1) by an orthopedist as chronic LE of the dominant arm 2) The patient' age was 30-50 years [3], 3) BMA ≤ 30 (Kilograms /meter^2), 4) both genders, 5) The pain onset was more than 6 months and appeared with deep palpation of the lateral epicondyle, [12].6) Patients were graded by US scanning in Grade 1 which means (1-2) neovessels and mild focal hypo-echogenicity and Grade 2 which means (3-4) neovessels and moderate focal-hypo echogenicity [13][14]. The exclusion criteria in this study were:1) Rheumatoid arthritis, 2) pregnant women, 3) skin infection,4) neurological impairments, 5) neuromuscular diseases, 6) history of previous elbow surgery, 7) any pathology in the shoulder joint, 8) neurologic deficit in upper extremity, 9) cervical disc prolapse and radiculopathy C5-6, 10) dislocation of elbow joint, 11) recent fractures of upper extremity, 12) arthrosis of the radio-humeral joint,13) osteonecrosis, 14) participants receiving other treatment in the form of medication, that may interfere with the results [15]. The test dropout criteria in this study were 1) not participating in the intervention session more than twice in a row or more than 20% of the total intervention and, 2) the subject is sick or dies. Subject were randomly assigned into the treatment group (n=30) and control group (n=30) using simple randomization. Treatment groups were included 30 patients receiving Maitland Mobilization in addition to conventional treatment in the form of (Instructions, and elbow splint, deep friction massage, stretching and strengthening exercises for wrist extensors, continuous ultrasound and transcutaneous electrical nerve stimulation, the Control groups were included 30 patients receiving conventional treatment only, for 3 times/ week for 12 sessions. The Subject was not blind to randomization.

ETHICAL COMMITTEE STATEMENT

The Scientific Research Ethical Committee of Faculty of Physical Therapy, Cairo University, Egypt was given ethical approval (**No. P.T.REC /012 / 003517**).

PROCEDURE

The treatment groups received Maitland Mobilization with conventional treatment program intervention 3 times a week (Saturday, Monday, and Wednesday) for 12 sessions and control groups received conventional treatment program only intervention 3 times a week (Sundays, Tuesdays, Thursday) for 12 sessions supervised by physiotherapist. This study was carried out (from January 1 to December 30, 2023) by using US scanning in case of chronic LE by physicians and measurement before starting the test and after completing 12 sessions. All groups received conventional treatment programs in the form (Instructions, and elbow splint, deep friction massage, stretching and strengthening exercises for wrist extensors, continuous ultrasound therapy and Transcutaneous electrical nerve stimulation TENS).

The treatment groups received Maitland mobilization for 15 minutes/3 times a week for 12 sessions done by a physical therapist [16] and the conventional treatment programs was carried out in all session, in the form of Deep Transverse Friction Massage DTFM was applied transversely to the specific tissue which enhances circulation and return of fluids. Firm pressure was applied to compress the extensor tendons, their origins, and the musculotendinous junctions between the underlying bone and the fingertips and the massage was performed for 5 minutes [17]. Then received static stretching exercise of the forearm extensors was performed for 30 seconds, with a total of 6 repetitions and a 30-second rest interval between each session. With the elbow resting on the plinth and the wrist joint free outside the plinth, the patient was in a supine reclining posture. The therapist used one hand to hold the wrist joint while stretching the forearm extensors with the other and received Strengthening exercise to increase the tendon's collagen alignment and promote the building of cross links, both of which raise the tendon's tensile strength. Exercises for strengthening slowly extend the patient's wrists while keeping the posture starting with isometric exercises with the elbow flexed 90 degrees will begin with two to three sets of ten repetitions then progress to five sets of ten repetitions than progressive with lifting weight. 1 pound of weight was being added and performed 3 sets of 10 repetitions were be performed, then progress to 5 sets [9] [18].

Ultrasound therapy was performed from a seated position with elbow flexion or a supine lying position with the elbow rested on the plinth, in circular motion around the region of common extensor origin the parameters of ultrasound, Frequency 3 MHz, Treatment time 7 min, duty cycle 100%, and continuous mode 100%. [19]

Transcutaneous electrical nerve stimulation helps in the relief of pain and it was performed from a sitting position. The electrodes will be applied above and below the elbow joint on the site of pain, Pulse duration: 100 us, Time: 15 min, Frequency Min: 100 MHz, Frequency Max: 100 MHz, Type of program: convention mode [20]. The control group received the conventional treatment program only without the Maitland mobilization.

THE OUTCOME

The data of age, body height, body weight, BMI, were measured before the intervention started. The primary outcome in this study on both groups were be assessment before and after treatment programs to investigate the influence of Maitland mobilization on chronic lateral epicondylitis which measured [I] Neovascularity/Hypo-echogenicity by using the US scanning to evaluate the elbow on the radial surface and forearm rested on an examination bed while the patient sat in a chair with their elbow flexed 90° and wrist pronated, this test was measured by a Radiologist [21]. [II] Pain severity was measured by the VAS, this scale applies a 10 cm line with (0 to 10 killing agony) to enable continuous data processing. The level of feeling pain was detected by marking his degree of pain intensity along the line; it was possible to determine how much suffering of pain severity.

[III] ROM of wrist extension was measured by a universal Goniometer; the patient was sated with the forearm was pronated, the wrist resting over the edge of a table or plinth, and the elbow bent to a 90-degree angle. The patients were instructed to extend their wrist joints in order to assess wrist extension and the goniometer was positioned parallel to the ulnar and parallel to the longitudinal axis of the fifth metacarpal bone, and the fingers were at zero positions. Each action was recorded 3 times [22].

[IV] Hand grip muscle strength was measured by dynamometer, the participant was sated with their elbow 90° degrees flexed, their shoulder adducted, and their wrist and forearm in a neutral posture. The patients were asked to press the dynamometer as hard as possible on the affected side and stop when they felt discomfort. This was done on average for three repeats with 20-second rest intervals. [9]. [V] Functional disability level was measured by Quick DASH questionnaire, each patient answered all the items of pain during function by suitable value to him; there is 11-item Quick DASH Questionnaire was designed to assess the patient's health state during the previous week. A scale score from 0 (no disability) to (most severe disability) was calculated using the scores for every item. The questionnaire was inquired about the level of difficulty involved in carrying out various physical tasks. [11].

Test by using US scanning was performed by a Radiologist Dr. Hatem, professor of diagnostic radiology and another measurement testing (pain intensity level, ROM of wrist extension, hand grip strength and functional disability level) were collected by the Doctor of Physical Therapy.

STATISTICAL ANALYSIS

The Shapiro-Wilk test was used to verify the data's normality before analysis began. To check for group homogeneity, Levene's test for homogeneity of variances was used. There was homogeneity of variance and a normal distribution of the data. The age, weight, height, and BMI were compared across groups using an unpaired t- test. The chi- squared test was used to compare the distribution of sexes. Neovascularity and hypo-echogenicity were compared across groups using the Mann-Whitney test, and pre- and post-treatment comparisons were made using the Wilcoxon signed ranks test. To assess the effects of treatment (between groups) and time (before vs. post), as well as the interaction between time and treatment, on Quick DASH questionnaire, wrist extension range of motion, hand grip strength, and visual analogue scale, a mixed MANOVA was performed. Bonferroni adjustments were used for the multiple comparisons that followed. For every statistical test, the significance threshold was set at $p < 0.05$. The statistical program for social sciences (SPSS) version 25 for Windows was used to conduct the statistical analysis.

RESULTS

All subjects successfully completed the intervention and there were no side effects from the intervention. Statistical tests were conducted on 30 subjects in the treatment group and 30 subjects in the control group who completed the study. The characteristic of the subject is shown in Table 1

Characteristic of Subject

No	Variable	Treatment group (n=30; 50%)	Control group (n=30; 50%)	Mean Differences	t-value	Probability value
		Mean ± SD Standard Deviation	Mean ± SD Standard Deviation			
1	Age (year(s))	42.60 ± 4.74	43.17 ± 5.31	-0.57	-0.44	0.66
2	Body Weight (kg(s))	74.12 ± 6.65	75.27 ± 4.98	-1.15	-0.76	0.45
3	Body Height (cm(s))	165.43 ± 3.48	166.47 ± 3.43	-1.04	-1.16	0.25

4	**Body Mass Index (kg/m²)**	**27.09 ± 2.39**	**27.15 ± 1.50**	**-0.06**	**-0.13**	**0.89**
5	**Sex, n (%)**					
	Female(s))	12 (40%)	13 (43%)		**χ^2 = 0.07**	**0.79**
	Male(s))	18 (60%)	17 (57%)			

[a.] **Unpaired -t–test, [b]) Chi Squared test ;*) Significant (p > 0.05).**

Table 2 shows there was a significant decrease in the Neovascularity / Hypo-echogenicity post treatment compared with that pre-treatment in the treatment group and control group (P > 0.001). There was a significant decrease in Neovascularity and Hypo-echogenicity of the treatment groups post treatment compared with that of the significantly decreased as compared control groups (P < 0.001). Table 2

Analysis of Neo-vascularity/ Hypo-echogenicity result between groups

	Treatment Group (n=30; 50%)	Control Group (n=30; 50%)	U- value; Mann-Whitney test value	Probability value
	Median interquartile range	Median interquartile range		
Pre treatment	3 (3-2)	3 (3-2)	420	0.60
Post treatment	0 (1-0)	2 (2-1)	65	0.001
Z- value	-5.01	-5.39		
Probability value	0.001	0.001		

[A]) Mann-Whitney test. [b]) Wilcoxon signed ranks test. *) Significant (p < 0.001).

Effect of treatment on VAS, wrist extension ROM, hand grip strength and Quick DASH questionnaire. There was a significant interaction of treatment and time (F = 527.14, p = 0.001, = 0.97). There was a significant main effect of time (F = 5341.51, p = 0.001, = 0.99). There was a significant main effect of treatment (F = 50.36, p = 0.001, = 0.78).

Table 3 shows that within group comparison: There was a significant decrease in pain level and Quick DASH questionnaire of the treatment groups and control groups post treatment compared with that pretreatment (p > 0.001). There was a significant increase in hand grip and wrist extension ROM of the treatment groups and control groups, post treatment compared with that pre-treatment (P > 0.001).

Table 3 shows that between- groups' comparisons: There was no significant difference between groups pre-treatment (p > 0.05). Comparison between groups post treatment revealed a significant decrease in VAS Effect size (ES = 1.63) and Quick DASH questionnaire (ES = 4.49) and a significant increase in hand grip (ES = 0.72) and wrist extension ROM (ES = 4.7) of treatment groups compared with that of control groups (P < 0.01). Table 3

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 17s, 2025
https://www.theaspd.com/ijes.php

Analysis of Visual Analogue Scale, hand grip strength, wrist extension range of motion and Quick disability functional Questionnaires between groups

	Treatment group (n=30; 50%)	Control group (n=30; 50%)	Mean difference (95% Confidence interval)	Probability value	Effect size
	Mean ± SD Standard Deviation	Mean ± SD Standard Deviation			
Visual Analogue Scale(score)					
Pre treatment	6.57 ± 1.04	6.27 ± 1.31	0.3 (-0.31: 0.91)	0.33	
Post treatment	2.23 ± 0.68	3.57 ± 0.94	-1.34 (-1.76: -0.91)	0.001	1.63
Mean difference (95% Confidence interval)	4.34 (3.99: 4.68)	2.70 (2.36: 3.04)			
% of change	66.06	43.06			
	p = 0.001	p = 0.001			
Hand Grip Strength (lb.)					
Pre treatment	63.07 ± 16.27	67.70 ± 18.13	-4.63 (-13.54: 4.27)	0.30	
Post treatment	104.20 ± 23.03	88.13 ± 21.55	16.07 (4.54: 27.59)	0.007	0.72
Mean difference (95% Confidence interval)	-41.13 (-43.87: -38.39)	-20.43 (-23.17: -17.69)			
% of change	65.21	30.18			
	p = 0.001	p = 0.001			
Range of Motion of Wrist Extension (degree(s))					
Pre treatment	29.00 ± 5.69	27.60 ± 5.01	1.40 (-1.37: 4.17)	0.32	
Post treatment	70.40 ± 6.55	42.00 ± 5.50	28.40 (25.27: 31.53)	0.001	4.7
Mean difference (95% Confidence interval)	-41.40 (-42.59: -40.21)	-14.40 (-15.59: -13.21)			
% of change	142.76	52.17			
	p = 0.001	p = 0.001			
Quick Disabilities of Arm, Shoulder & Hand function Questionnaires					
Pre treatment	45.97 ± 2.83	45.23 ± 3.77	0.74 (-0.99: 2.46)	0.39	
Post treatment	14.77 ± 1.41	21.83 ± 1.72	-7.06 (-7.88: -6.25)	0.001	4.49
Mean difference (95% Confidence interval)	31.20 (30.19: 32.21)	23.40 (22.39: 24.41)			
% of change	67.87	51.74			
	p = 0.001	p = 0.001			

A) Mixed MANOVA. b) Bonferroni.

DISCUSSION

This study was examined the influence of the Maitland mobilization technique on chronic LE by using US scanning to observe neovascularity and hypo-echogenicity changing on the extensor muscle. The current study was agreement with Emre and Onur, 2024, which show the ability of the US scanning to detect changes in muscle thickness and to assess and provide feedback for training of muscles in patients with chronic muscle disease after using the Maitland mobilization when comparing between the two groups [21]. Based on the findings of the study revealed that, after 4 weeks of intervention, 3 sessions /weekly, the result showed there are a significant differences between two groups regarding improvements in the treatment groups more than in the control groups in the prevention and healing of the formation of the neovascularity and hypo-echogenicity, decreased the pain level, increasing the ROM of wrist extension, increasing hand grip strength, and improving functional disability level in patients with chronic LE of the affected arm.

Based on the present study's data analysis revealed that there are important effects of using Maitland mobilization on the elbow joint with the conventional physical therapy program in preventing formation of neo-vascularity and hypo-echogenicity, and there was more improvement in the treatment groups than in the control groups, There was an important decrease in Neo-vascularity/ Hypo-echogenicity post treatment compared with that pre-treatment in the treatment and the control groups ($p > 0.001$). There was a significant decrease in Neo-vascularity/ Hypo-echogenicity of treatment groups post treatment compared with that of control groups ($p < 0.001$). It was probable that Maitland mobilization enhances muscle function, mobility, flexibility, neurophysiological responses' and psychological response.

The small amplitude oscillatory and distraction movements of the Maitland mobilization stimulate the proprioceptors and mechanoreceptors. By repeatedly activating mechanoreceptors linked to myelinated (alpha beta) and (alpha delta) fibers at the spinal cord or brain stem level, the oscillation may, through manipulation, have an inhibitory influence on the perception of painful stimuli. ROM increases and discomfort decreases as a result of these non-stretch movements [16] [24].

This study demonstrated that both groups' wrist joint range of motion significantly increased and their pre- and post-intervention pain levels significantly decreased. However, when comparing the treatment groups Maitland mobilization with conventional therapy treatment to the control groups conventional therapy alone, there was a more notable decrease in pain and a more notable gain in ROM. The pre-interventional VAS values were 6.57 ± 1.04 in the treatment groups and 6.27 ± 1.31 in the control groups, whereas the post-interventional VAS values were -1.34. There was an important decrease in pain intensity of the treatment groups contrasted with that of the control groups post treatment ($p = 0.001$).

Joint mobilizations most likely attempt to guide the tissue remodeling process, decrease the growth of fibrosis tissue, and lessen the development of tendon adhesions and crossing collagen bridges to surrounding tissues. Additionally, this affects fluid dynamics, which modifies pain processes by reducing the buildup of inflammation [16].

The study's pre-interventional wrist extension ROM values were 29.00 ± 5.69 degrees in the treatment groups and 27.60 ± 5.01 degrees in the control group respectively in contrast, post-interventional values of ROM for wrist extension The average difference in wrist ROM between groups post treatment was 28.40 degrees. There was an important increase in wrist extension ROM of the treatment groups compared with that of the control groups post treatment ($p = 0.001$). Both the groups showed improvement in ROM but there were improved more in ROM of in the treatment groups than in the control groups. The conventional approach appeared to have extremely important outcomes in pain reduction and range of motion improvement because joint motion and mobilization techniques help to maintain extensibility of the articular and per-articular structures by focusing directly on the tension of perarticular tissue to prevent complications from trauma and immobilization, and they also help to relieve pain due to their neurophysiologic effect on the joint ROM increases and discomfort decreases as a result of these non-stretch movements [24].

Based on the findings of this study was the standard difference in hand grip strength between groups pretreatment was -4.63 lb. There was no discernible change in hand grip strength between treatment and control groups pre-treatment ($p = 0.30$). The mean difference in hand grip strength between groups post treatment was 16.07 lb. There was an important increase in hand grip strength of the treatment group compared with that of the control group post treatment (p = 0.007). Joint mobilization is likely to mitigate capsular limitations and break adhesions, distract affected tissue, provide lubrication and mobility for normal articular cartilage, and reduce inflammation [16].

Based on the findings of this study a progressive, stepwise exercise program it was suggested; eccentric exercise strengthens tendons can encourage recovery without causing harm. By encouraging tenocyte mechanoreceptors to make collagen, the primary cellular mechanism controlling tendon injury repair. Strengthening may increase the tendons collagen alignment and promote the formation of cross links, both of which increase the tendon's tensile strength [9].

Our findings show that the exercises that enhance the stresses applied to bones, ligaments, and tendons will preserve and, in general, improve their strength and ability to operate. The management of chronic lateral epicondylitis syndrome appears to follow the same idea. This study's progressive exercise treatment began with gentle soft tissue stretching activities and progressed to strengthening exercises. [9] [18]

In the study the pre-interventional values of Quick DASH questionnaire for functional disability were 45.97 ± 2.83 degrees in the treatment groups and 45.23 ± 3.77 in the control group respectively whereas post-interventional values of functional disability 14.77 ± 1.41degrees' in the treatment groups and 21.83 ± 1.72 degrees in the control group consequently. Changes in the functional impairment within groups for medial rotation showed statistically an extremely important difference in values post-interventional in both groups and appeared to decrease in functional disability. Both groups demonstrated improvement in decreased functional disability but there were more improvements in decreased functional disability in the treatment groups compared to the control groups. The improvement in both groups' functional independence may be explained by reduced discomfort and ROM, which reduces suffering from everyday tasks, pain from certain daily duties, and trouble raising and moving the arm. The Maitland's mobilization mainly consists of rhythmic oscillatory movements which stimulate the Type II dynamic mechanoreceptors and by this way can inhibit the Type IV nociceptive receptors. The Maitland's rhythmic oscillations have an effect on circulatory perfusion and fluid flow. This helps in facilitating fluid exchange and dispersing the chemical irritants resulting in reversal of ischemia, edema and inflammation cycle. Hence, the joint effusion and pain was relieved due to reduction of the pressure over nerve endings [16] [24].

CONCLUSIONS

In conclusion, The Maitland mobilization with conventional treatment influences the treatment of chronic lateral epicondylitis in the treatment group than in the control group. There were statistically significant differences in the experimental treatment group than in the control Group after 12 sessions for 4 weeks of treatment.

ACKNOWLEDGMENTS

We thank all volunteers who participated in the study.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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