"Effects of Mulligan Mobilization and Tens Versus Mulligan Mobilization and Ultrasound (Us) on Hand Grip Strngth in Patients with Tennis Elbow"

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Abstract

Tennis elbow, or lateral epicondylitis, is a common overuse injury causing pain and reduced function in the lateral elbow, often leading to decreased hand grip strength. Effective physiotherapeutic interventions aim to reduce pain and improve functional outcomes. Mulligan mobilization, combined with electrotherapy modalities, has shown promising results in managing musculoskeletal conditions.

Procedure: 60 patients diagnosed with tennis elbow were selected and randomly divided into two groups of thirty each based on inclusion and exclusion criteria. Hand grip strength and pain levels (using VAS) were measured before starting treatment. Group A received Mulligan Mobilization combined with TENS, while Group B received Mulligan Mobilization combined with Ultrasound. Both groups underwent treatment three times a week for four weeks. After the treatment period, hand grip strength and pain levels were reassessed, and the data were analyzed to compare the effectiveness of the two interventions. Paired t-test and Wilcoxon signed rank test were used to analyses the data.

Result: The results showed that both interventions demonstrated clinically meaningful improvements in pain reduction and functional strength enhancement. The large effect sizes and statistical significance ($p<0.001$) across all outcome measures suggest that both treatment protocols are effective therapeutic approaches

Conclusion: Mulligan Mobilization combined with TENS showed greater improvement in hand grip strength, pain reduction, and functional ability compared to Mulligan Mobilization with Ultrasound in patients with tennis elbow. Therefore, Mulligan and TENS may be a more effective treatment option for enhancing recovery in these patients.

Keywords: Mulligan Mobilization with Movement (MWM), Transcutaneous Electrical Nerve Stimulation, Hand Grip Strength, Lateral Epicondylitis.

1. Introduction

Runge and Major were the first to define tennis elbow in 1873 and 1883, respectively. Morries gave it the term "lawn tennis arm." This term has since been used to refer to any painful lateral elbow difficulty. This illness primarily affects non-athletes (95%) and is typically linked to work habits. A tendon damage of the lateral elbow's common extensor origin is tennis elbow. Patients appear with a progressive start of pain upon wrist and finger extending motions and forearm supination, despite the fact that the pathology is in the elbow region. "Lateral epicondylitis" was the earlier name for the illness. The suffix "itis" is a misrepresentation since the condition is no longer believed to be inflammatory; instead, it is more appropriately defined as a partially curable but deteriorating overuse-underuse tendinopathy. The majority of clinicians would prefer to use the conventional phrase "tennis elbow" due to the term's length.

The pathophysiology of tennis elbow is complicated and unclear, yet similar to other tendinopathies. There are some common tendon mechanics concepts and equilibrium that are applicable. Tendons function as "springs" to improve the efficiency of muscle action; the recoil (spring effect) of tendons rises with increasing load and is most effective when the tendon is near, but not nearly at, its breaking point. Tendons will naturally deteriorate when they are not used as much and strengthen when they are under more stress. When the amount of stress is increased slowly, healthy tendons can effortlessly become stronger; however, if the loading rise is too fast or excessive, they may fail. A tendon's structure may change due to unexpected overloading, allowing a degenerative procedure to start.

An overuse injury commonly referred to as a tennis elbow is characterized by pain (aching pain or possibly radiating pain) in or near the lateral humeral epicondyle or in the forearm extensor muscle mass, discomfort over the common extensor tendon, primarily ECRB (Extensor Carpi Radialis Brevis), significant functional impairment, mechanical hypergeusia, motor and sensory deficits, muscle strength deficits, abnormal forearm extensor muscle contraction pattern, and poor upper limb position.

Pain on the outer side of the elbow tends to worsen when pressing on the lateral epicondyle, during wrist movements, or when handling objects—such as lifting a cup, shaking hands, getting dressed, doing desk work or household chores. The discomfort is also triggered by gripping tasks, isokinetic testing, and strenuous use of the hand and forearm. Additionally, pain increases with resistance against the forearm's extensor muscles, especially the extensor carpi radialis brevis, as well as during opposed wrist or finger extension.

A novel manual therapy strategy is the Mulligan Concept. The Mulligan Concept's unique mobility with movement (MWM) technique can be used safely and successfully to treat illnesses of the musculoskeletal and neurological systems. It presents notable distinctions from other approaches with regard to the rules of practice and methodologies. The Mulligan Concept can also be described as a combination of active mobilization techniques, such as Pilates, proprioceptive neuromuscular facilitation (PNF), and kineticcon control, with passive mobilization concepts, such as Kaltenborn, Maitland, Cyriax, and Butler. The advantage of the Mulligan Concept is that it makes it possible to acquire functional skills quickly but permanently. The Mulligan Concept's primary objective is functional restoration; hence the techniques are used in functional movements to enhance patients' day-to-day functioning.

Transcutaneous electrical nerve stimulation (TENS) is a non-pharmacological, low-cost, and secure method of pain relief. TENS is easy to use, patient-controlled, and encourages self-management. The 'gate control' hypothesis of pain provides the direct neurophysiological foundation for the analgesia provided by electrical stimulation like TENS.

2. Objectives: To evaluate the effect of Mulligan Mobilization combined with TENS & Mulligan Mobilization combined with Ultrasound therapy on hand grip strength in patients with tennis elbow.

3. Methodology

- ***Inclusion Criteria:***
  - Age group between 25-50 years
  - Both males and females' patients
  - Duration of symptoms: more than 2 weeks.
  - Clinical diagnosis of tennis elbow (pain >6 weeks, positive Cozen's/Mill's test.
  - No prior physiotherapy in the last 3 months

- ***Exclusion Criteria:***
  - Contraindications to TENS/US (e.g., pacemakers, pregnancy)
  - Recent elbow fractures or injury
  - Neurological disorders affecting the upper limb.
  - Ongoing physiotherapy or medication for the same condition

- ***Materials used***:
  - Mulligan Belt
  - Hand Grip Dynamometer (primary outcome tool)
  - Patient TENS Unit (frequency: 50-100 Hz, pulse width: 50-200 μs)
  - Therapeutic ultrasound machine (1MHz, 1.0 W/cm^2, pulsed mode)
  - VAS

4. Procedure

An experimental study will be conducted for middle aged or adult patients in and around Moradabad, Uttar Pradesh. By using convenient sampling technique, 60 participants of age group 25-60 years will be selected who will meet the inclusion criteria. Prior to participation, an inform consent form will be taken from each individual. The study will be thoroughly explained to all the participants. Participants who fulfilled the inclusion criteria and exclusion criteria were equally divided into two groups by random sampling method. 60 participants suffering from tennis elbow were available for the study and later divided in two equal halves of size 30 that constituted in two groups and further designated as "Group A " and "Group B". The patients with tennis elbow in Group A received MWM along with TENS while the patients of Group B received MWM in combination with US.

Table 1: "Descriptive Statistics and Demographic Characteristics of Treatment Groups A and B"

	N	Min	Max	Mean	SD
GROUP_A	30	1	30	15.50	8.803
AGE_A	30	25	50	37.93	7.891
PRE_VAS_A	30	5	9	7.07	1.461
POST_VAS_A	30	2	8	5.13	1.717
PRE_GRIP_ STRENGTH_A	30	15	34	23.56	5.570
POST_GRIP_ STRENGTH_A	30	18	38	27.55	5.666
GROUP_B	30	1	30	15.50	8.803
AGE_B	30	25	50	38.60	7.509
PRE_VAS_B	30	5	9	6.90	1.494
POST_VAS_B	30	2	8	4.87	1.961
PRE_GRIP_ STRENGTH_B	30	15	35	24.10	6.668
POST_GRIP_ STRENGTH_B	30	18	39	27.53	6.917

Table 2: "Pre- and Post-Intervention Comparison of VAS Pain Scores and Grip Strength Measurements by Treatment Group

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE_VAS_A	7.07	30	1.461	.267
	POST_VAS_A	5.13	30	1.717	.313
Pair 2	PRE_GRIP_STRENGTH_A	23.56	30	5.570	1.017
	POST_GRIP_STRENGTH_A	27.55	30	5.666	1.034
Pair 3	PRE_VAS_B	6.90	30	1.494	.273
	POST_VAS_B	4.87	30	1.961	.358
Pair 4	PRE_GRIP_STRENGTH_B	24.10	30	6.668	1.217
	POST_GRIP_STRENGTH_B	27.53	30	6.917	1.263

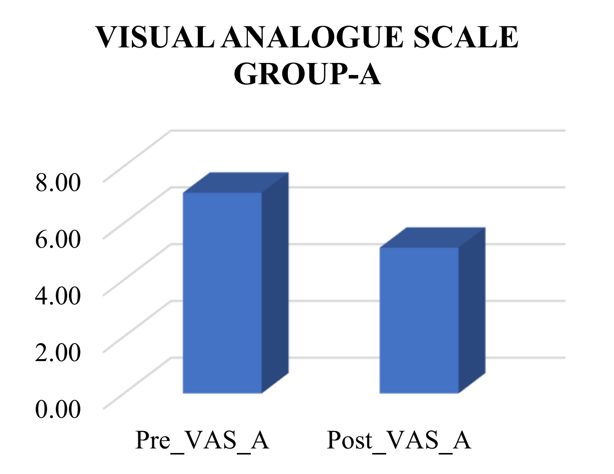
Table 3: "Pearson Correlation Coefficients Between Pre- and Post-Treatment Outcome Measures"

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	PRE_VAS_A & POST_VAS_A	30	.890	.000
Pair 2	PRE_GRIP_STRENGTH_A & POST_GRIP_STRENGTH_A	30	.979	.000
Pair 3	PRE_VAS_B & POST_VAS_B	30	.926	.000
Pair 4	PRE_GRIP_STRENGTH_B & POST_GRIP_STRENGTH_B	30	.985	.000

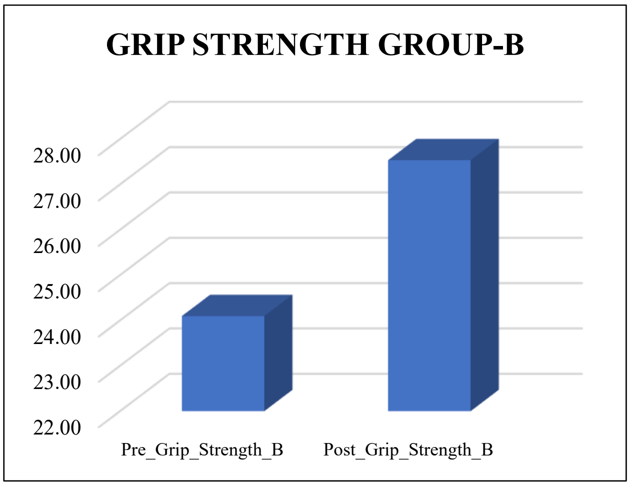
Table 4: "Paired Sample t-Test Results Comparing Pre- and Post-Treatment VAS Pain Scores and Grip Strength"

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PRE_VAS_A - POST_VAS_A	1.933	.785	.143	1.640	2.226	13.491	29	.000
Pair 2	PRE_GRIP_STRENGTH_A - POST_GRIP_STRENGTH_A	-3.990	1.162	.212	-4.424	-3.556	-18.815	29	.000
Pair 3	PRE_VAS_B - POST_VAS_B	2.033	.809	.148	1.731	2.335	13.771	29	.000
Pair 4	PRE_GRIP_STRENGTH_B - POST_GRIP_STRENGTH_B	-3.437	1.208	.221	-3.888	-2.986	-15.580	29	.000

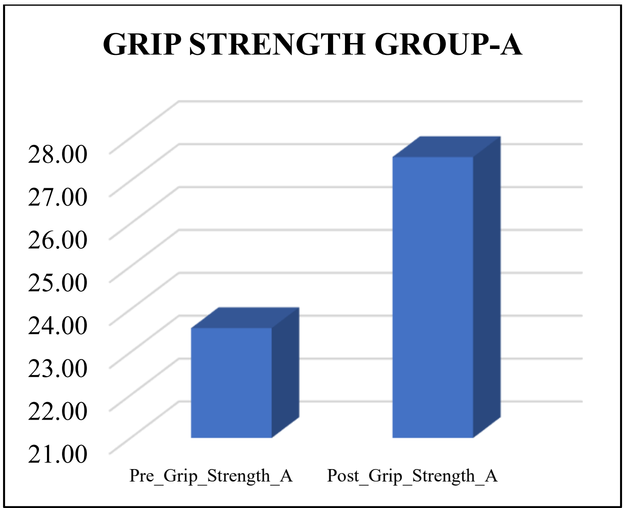
GRAPHS



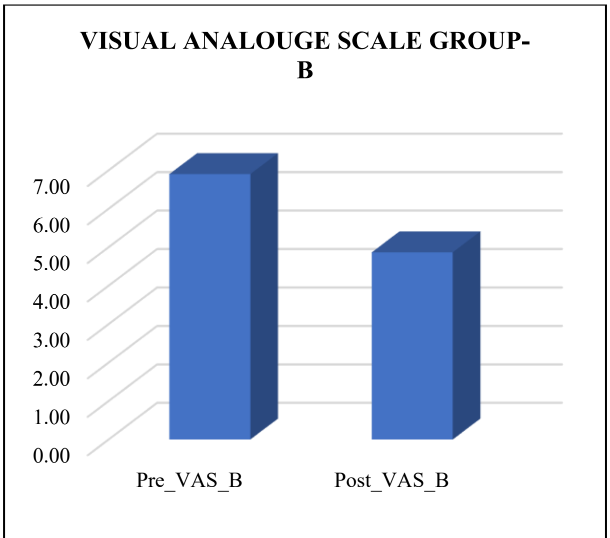
Graph 1: "Pre- and Post-Treatment VAS Pain Score Group A



Graph 4: "Pre- and Post-Treatment Grip Strength Group



Graph 2: "Pre- and Post-Treatment Grip Strength Group A



Graph 3: Pre- and Post-Treatment VAS Pain Score Group B

5. Results

Both treatments showed gains in functional strength and pain reduction that were clinically significant. Both treatment procedures appear to be therapeutically effective based on the statistical significance ($p<0.001$) and high effect sizes observed across all outcome metrics. The clinical usefulness of both therapies for enhancing patient outcomes is supported by the significant pre-post correlations, which show consistent and dependable treatment responses.

In this comparative study, 60 participants (30 in each group) had their grip strength and pain levels (VAS ratings) evaluated in relation to two therapy regimens. With a mean age of 37.93 years (SD=7.891) for Group A and 38.60 years (SD=7.509) for Group B, both groups showed comparable baseline characteristics.
After the session, pain scores in both treatment groups decreased statistically significantly. The VAS pain scores of Group A significantly decreased, going from 7.07 (SD=1.461) to 5.13 (SD=1.717), with a mean decrease of 1.933 points ($t=13.491$, $p<0.001$). In a similar vein, Group B showed a mean decline of 2.033 points ($t=13.771$, $p<0.001$) from 6.90 (SD=1.494) to 4.87 (SD=1.961). Consistent individual response patterns were shown by the substantial connection between the pain scores before and after therapy in both groups (Group A: $r=0.890$, Group B: $r=0.926$).

Both groups showed significant improvements in grip strength post-treatment. Group A participants increased from 23.56 kg (SD=5.570) to 27.55 kg (SD=5.666), representing a mean improvement of 3.990 kg ($t=-18.815$, $p<0.001$). Group B demonstrated similar gains, improving from 24.10 kg (SD=6.668) to 27.53 kg (SD=6.917), with a mean increase of 3.437 kg ($t=-15.580$, $p<0.001$). The correlations between pre- and post-treatment grip strength measurements were exceptionally high (Group A: $r=0.979$, Group B: $r=0.985$).

6. Discussion

The purpose of the current study was to evaluate how well two physiotherapeutic approaches reduced discomfort and increased grip strength in patients suffering from lateral epicondylitis, also known as tennis elbow. The effectiveness of the interventions was highlighted by the statistically and clinically substantial improvements in grip strength and pain severity shown by both treatment groups.

Both Group A and Group B experienced a significant decrease in pain levels as determined by the Visual Analog Scale (VAS). The mean decline for Group A was 1.933 points, whilst Group B's was somewhat higher at 2.033 points. These results are in line with other research showing that by altering nociceptive pathways, therapies including TENS, mobilization with movement (MWM), and physiotherapy regimens successfully reduce pain [25, 26, 31]. It appears that the interventions consistently had favorable results for all participants, regardless of the initial level of pain, as seen by the excellent correlation between pre- and post-treatment pain scores ($r=0.890$ and $r=0.926$ for Group A and Group B, respectively).

Since tennis elbow severely hinders everyday activities requiring the use of the wrist and forearm, an improvement in grip strength is an essential functional outcome for patients with the condition. The average grip strength increased by 3.990 kg in Group A and 3.437 kg in Group B. In line with previous studies on rehabilitation regimens that encourage tendon loading and muscular conditioning, both increases were statistically significant ($p<0.001$) [12, 22, 23]. Remarkably, the remarkably high correlation values for increases in grip strength ($r=0.979$ and $r=0.985$) show consistent and strong function gains after therapy.

The underlying physiological justification of the used treatments is supported by the improvements in grip strength and pain that have been noted. According to previous research, MWM enables biomechanical realignment and functional restoration by combining mobilization and active movement, while TENS may lessen pain through gate control mechanisms and neuromodulation [25, 22]. Both strategies support conservative, non-pharmacological treatments for lateral epicondylitis, which are in line with recent evidence-based recommendations.

Nevertheless, its favorable outcomes, the study had certain drawbacks. Although sufficient for drawing preliminary conclusions, the sample size may restrict the findings' applicability to larger groups. Additionally, knowledge of long-term efficacy and recurrence prevention is limited by the short-term follow-up. According to earlier studies, relapse is prevalent in the absence of consistent therapeutic action and lifestyle adjustment, and symptoms can last up to two years [18, 20].

Longer follow-up times, larger and more varied populations, and comparisons of these therapies with surgical alternatives or placebo controls should also be included in future research. Additionally, investigating the combination of these approaches may result in benefits that are synergistic for both functional restoration and pain reduction.

In the end, patients with lateral epicondylitis saw a significant reduction in discomfort and an improvement in grip strength following both treatment regimes. The findings highlight the value of structured rehabilitation in the management of chronic musculoskeletal disorders like tennis elbow and support the efficacy of physiotherapy-based interventions as first-line treatments.

In patients with lateral epicondylitis, this comparative study assessed the effects of two physiotherapeutic therapy modalities on grip strength and pain intensity. The findings offer strong proof that both therapies are successful in improving patient outcomes in a way that is clinically significant.

The Visual Analog Scale (VAS), which measures pain, showed statistically significant reductions in both therapy groups. Groups A and B had significant statistical significance ($p<0.001$), with decreases of 1.933 and 2.033 points, respectively. The physiological principles behind pain management with manual therapy techniques like Mobilization with Movement (MWM) and therapeutic modalities like TENS complement these findings. High correlation values show that these methods are reliable in reducing the nociceptive burden related to tennis elbow because of the consistent reduction in pain experienced by all individuals.

Functional benefits were also notable, especially in grip strength. After therapy, Group A's grip strength increased by an average of 3.990 kg, while Group B's increased by 3.437 kg. These gains are crucial since grip strength is a key metric for evaluating lateral epicondylitis healing and a direct predictor of upper limb functional capability. The findings are consistent with tendon rehabilitation principles, which stress regulated loading to promote tendon healing and enhance muscle-tendon function [11, 12].

The results of the study have several clinical repercussions. First, they advocate for the first-line treatment of tennis elbow through the use of organized, non-invasive physiotherapy procedures. The reported results further support conservative treatments, since conservative treatment is successful in more than 90% of cases and surgical interventions are rarely necessary [10, 17]. Second, these therapies are especially well-suited for home-based or outpatient management due to their excellent efficacy and safety profile, which improves accessibility and adherence.

Furthermore, the findings highlight the significance of individualized care that focuses on both functional restoration and symptom alleviation. Restoring wrist function and grip strength allows people to resume daily living activities, employment, and leisure activities, while pain reduction enhances quality of life. This study's combined emphasis on strength and pain is consistent with the more general objective of holistic rehabilitation.

Although encouraging, the report admits its shortcomings. Recurrence rates and long-term treatment durability are not revealed by the brief assessment period. Furthermore, even though the groups' baseline demographics were comparable, the limited sample size might limit more extensive generalization. Larger participant samples, longer-term results, and the impact of mixing various modalities for greater benefits should all be examined in future studies.

7. Conclusion, each of the therapy regimens assessed in this study—whether they involved TENS, MWM, or other physiotherapeutic interventions—proved to be successful in helping people with tennis elbow manage their discomfort and strengthen their grip. Their continued use in clinical practice is validated by the notable benefits that have been reported. Particularly in chronic disorders like lateral epicondylitis, these findings provide important data to the expanding body of research that supports non-pharmacological and non-invasive therapy alternatives for musculoskeletal pain and dysfunction.

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