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A study on the effectiveness of the Cyriax versus mulligan's manual technique in the management of lateral epicondylitis

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Abstract
Background & Objectives: Lateral epicondylitis (LE) is most common lesion of the elbow affecting the tendinous origin of the wrist extensors especially extensor carpi radialis brevis (ECRB). Dominant arm is commonly affected with prevalence of 1-3% in the general population but increases to 19% at 30-60 years of age. Treatment for LE includes medical, surgical & physiotherapy management, which also includes Mulligan movement with mobilization (MMWM) and Cyriax physiotherapy.
Methods: The study included 60 patients which fulfilled inclusion criteria and thereby was randomly assigned into 2 groups, 30 in each group through random sampling method. Group A was treated with Cyriax physiotherapy and Group B by MMWM.
Results: The result of the study was assessed using VAS for the pain and HHD for hand grip. At the end of 4 weeks treatment, both groups showed a significant reduction in the pain level and an improvement in the grip strength, but the efficacy of MMWM was more effective in relieving pain and improving grip strength when compared to Cyriax physiotherapy.
Conclusions: In this study, the mean score in case of VAS is less and the mean score in case of HHD is high for MMWM as compared to Cyriax physiotherapy. The MMWM is better treatment than Cyriax physiotherapy in treating Lateral Epicondylitis.

Keywords: Lateral epicondylitis, pain, grip strength, deep transverse friction, mill's manipulation, MMWM

Introduction
Lateral epicondylitis (LE) is a lesion affecting the common tendinous origin of the wrist extensors [1]. It is a common complaint among sports people and manual workers often experienced by but not exclusive to tennis players during back hand stroke. It is a painful and debilitating condition which requires early intervention if optimal recovery is to be made [2].
Lateral epicondylitis serves as a blanket term for every condition affecting the lateral compartment of the elbow [3]. The most common description of the primary pathological process refers to degeneration (tendinosis) of the extensor carpi radialis brevis tendon (ECRB) usually 1-2cms of its attachment to the lateral epicondyle of the humerus which results in LE. Being primarily a mechanical type of overuse injury featuring pain associated with and aggravated by movement particularly of the wrist and decreasing in grip strength [2].
The average duration of a typical episode of LE is between 6 months and 2 years. The dominant arm is commonly affected, with prevalence of 1-3% in the general population, but this increases to 19% at 30-6- years of age and appears to be more long standing and severe in women [4, 5].

Causes for LE
Poor sports technique such as tennis back hand stroke, occupational tasks involving repetitive movements of the wrist and hands, degeneration either as a primary cause or secondary to injury, injury either as a primary cause or secondary to degeneration.

Signs and symptoms
Tenderness over the lateral aspect of the forearm- lateral epicondyle, extensor tendons, muscle

belly which may radiate into the forearm, decreased grip strength and pain on gripping, decreased strength and pain on active wrist extension, pain on resisted radial deviation and extension of the middle finger, may disturb sleep when severe, in chronic stage- usually a loss of end range elbow extension or adduction with extension (due to intimate relationship between ECRB and capsule/ligaments of the elbow complex), the condition may be irritable (can be "stirred up" easily), onset may be gradual or related to a specific incident (insidious or traumatic).

Anatomy & Biomechanics

Elbow joint is a synovial of hinge variety, the articular surface of the lower end of the humerus mainly capitulum and the trochlear articulates with the upper end of the radius (humero-radial) and upper end of ulna (humero-ulnar) respectively. Elbow is intermediate joint of the upper limb consisting mechanical link between the first segment, the upper arm and the second segment, the forearm of the upper limb [6].

The humero-ulnar joint, humero-radial joint and superior radio-ulnar joints are enclosed in a single joint capsule. The capsule is fairly large, loose and weak anteriorly and posteriorly, but reinforce its sides. The two main ligaments associated with the elbow joints are the medial (ulnar) and lateral (radial) collateral ligaments [7, 8].

The superficial muscle that originates at lateral epicondyle of the humerus includes anconeus, extensor carpi radialis brevis, extensor carpi radialis longus, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris and brachioradialis. The deep muscles of the back of the forearm include supinator, abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus and extensor indicis. Studies have shown that ECRB is active during grasp and release activities of the hand, except those performed in supination. The ongoing activity of ECRB makes it vulnerable of overuse and is more likely to be inflamed in lateral epicondylitis.

When the upper extremity is in the anatomical position the long axis of the humerus and the long axis of the forearm form an acute angle medially when they meet at the elbow. This angle is called "carrying angle". This is slightly greater in women than in men. In women it is about 0°-15°, in men it is about 0°-5°. An increase in angle is considered to be abnormal and it is called "cubitus valgus". The carrying angle disappears when the forearm is pronated with the elbow in extension and in full flexion [8].

Pathology and Pathomechanics

The current interest in racquet, paddle tennis, squash and tennis predisposing large number of the population to the possibility of elbow injuries. The use of racquet greatly increases the length of the forearm lever (resistance arm) and subjects the elbow complex structures to great stresses.

The classical lateral epicondylitis is caused by repeated forceful contractions of the wrist extensors, primarily ECRB. The tensile stress created at the origin of the ECRB may cause microscopic tears that lead to inflammation of the lateral epicondyle. Repeated tensile stress on the elastic tendon may result in microscopic tears at the musculotendinous junction and result in tendinitis [9].

Cyriax application

It is performed by using deep transverse friction (DTF) in a combination with mill's manipulation which is performed immediately after DTF. Considered a Cyriax invention, the two components must be used together in the order. Patient must follow the protocol three times a week for 4 weeks.

DTF is performed only at the exact site of the lesion, with the depth of friction tolerable to the patient [10]. The effect is so localized that, unless the finger is applied to the exact site and friction given in the right direction relief cannot be expected. DTF must be applied transversely to the specific tissue involved, unlike superficial massage given in the longitudinal direction parallel to the vessels, which enhances circulation and return of fluids. The therapist's finger and patient's skin must move as a single unit, otherwise subcutaneous fascia could lead to blister formation or subcutaneous bruising [11].

DTF is applied for 10 minutes, after the numbing effect has been achieved, every other day or at a minimum interval of 48 hours, because of the traumatic hyperemia induced, to prepare the tendon for the manipulation. If DTF is applied correctly, it will quickly result in an analgesic effect over the treated area and is not at all painful for the patient. Application of DTF leads to immediate pain relief, the patient experiences a numbing effect during the session and reassessment immediately after shows reduction in paint and increase in strength and mobility [12, 13].

Mulligan's MWM technique

Mulligan explains that MMWM with passive overpressure is the key to success. The positional hypothesis is that the MMWM is nearly always right angles to the plane of the movement taking place and will only work in one direction. MMWM are all biomechanically based and when the correct MMWM is repeated several times the joint's option to stay on track seems to return. MMWM addresses the problems of movement pain and restriction, and when treated they are painless. MMWM applied to the extremities in a different direction to the movement glide taking place to correct positional faults [14].

Grip strength measurement

For measuring the grip strength and held dynamometer is used. The grip dynamometer with adjustable hand spacing provides and accurate evaluation of the force of grip [15, 16]. The dynamometer has 5 adjustable spacing at 1, $1^{1/2}$, 2, $2^{1/2}$ and 3 inches. The standard eyes grip test position is, the shoulder should be adducted, elbow flexed to 90°, forearm mid prone (neutral) and the wrist in 0°-15° of extension and 0°-15° of ulnar deviation. The right and left hands are tested alternatively and the force of each is recorded. The test is placed at a rate to eliminate fatigue [16].

Objective of the study

1. To compare the effectiveness of Deep Transverse Friction Massage (DTF) and Mulligan's Mobilization with Movement (MMWM) in reduction of pain significantly on the Visual Analogue Scale (VAS).
2. To compare the effectiveness of Deep Transverse Friction Massage (DTF) and Mulligan's Mobilization with Movement (MMWM) in improving the Grip Strength by using Hand Held Dynamometer (HHD).

Methodology: Source of Data

All patients who are coming to Kempegowda institute of medical sciences, hospital and research center and Kempegowda institute of physiotherapy with Lateral Epicondylitis who are fulfilling the inclusion and the exclusion criteria.

Method of Collection of Data
Sample size: 60 patients (30 in each group)
Period of study: 1 year
Study design: Comparative study
Sampling method: Random sampling method

Inclusion Criteria
- Patients between 30-60 years of age.
- Patients who are positive for Cozen's test and Kaplan's sign.
- Pain over the lateral side of the elbow that was provoked by palpation of the lateral epicondyle region and gripping tasks.
- Pain had to be experienced over the lateral epicondyle during at least one of the following: resisted static contraction of the wrist extensors or ECRB muscle or stretching of the forearm extensor muscles.

Exclusion Criteria
- Cervical spine or upper limb problems (referred pain).
- Neurological impairments.
- Cardiovascular diseases.
- Neuromuscular diseases.
- Osteoporosis
- Recent steroid infiltration.
- Active infection.
- Rheumatoid arthritis.
- Ossification and Calcification of the soft tissue.
- Acute lateral epicondylitis.
- Malignancies.
- Hemophilia.
- Aversion to manual contact.
- Previous therapy for the elbow joint.

Materials
Materials Used for Assessment
- Patient's Consent Form.
- Assessment Proforma.
- Chair.
- Hand Held Dynamometer.
- Visual Analogue Scale.

Materials Used for Treatment
- Table.
- Couch.
- Pillow.
- Mulligan's Belt.

Procedure
All the patients with lateral epicondylitis were assessed and those who fulfilled the inclusion criteria alone where selected and assigned to Cyriax and MMWM groups. Before starting the treatment, the patient was position comfortably and assessed thoroughly about his or her condition. The following study included 60 patients between 30-60 years of age and was randomly assigned into 2 groups, 30 in each group. Group I were treated with Cyriax Physiotherapy and Group II were treated with MMWM.
The study was conducted at the outpatient clinic of the Department of Physical Medicine and Rehabilitation, Kempegowda Institute of Physiotherapy, Bangalore. Subjects were diagnosed by a certified medical practitioner as having Lateral Epicondylitis. Prior to include, subjects were informed about the study and a written consent was taken from the subjects. All patients were initially questioned about age, sex, occupation and duration of elbow pain (the symptomatic or painful elbow). Patients were closely questioned on past and present medications.

Procedure for Measuring VAS
All the subjects were evaluated for pain. VAS method was used (Melzack and Wall 1994) to measure the pain; for this ten-centimeter scale was taken to understand the intensity of pain in the individual. Recording was done before and after the treatment session.

Procedure for Measuring Grip Strength
1. The patient is made to sit on a chair with shoulder adducted, elbow in 90°, elbow flexed to 90°, forearm mid prone (neutral) and the wrist in 0°-15° of extension and 0°-15° of ulnar deviation. Position 2nd and 3rd were selected to give the full range of muscle action. The patients were instructed to squeeze the dynamometer three times at each position. The average of three grip tests is calculated and recorded. By taking the average of three tests at each position, we minimize any skewing of the data due to a one-time high intensity squeeze or a particularly weak one-time squeeze.
2. Base readings were recorded prior to the beginning of testing. Participants returned 3 times a week on alternate days for therapy and dynamometer testing was performed. In testing multiple hand strength positions, by taking the average of three tests at each position we have a complete look at hand functionality and have potential false positives. In results the people with the weakest readings experienced the largest percentage of improvements.

Technique of DTF application
Position the patient comfortably with the elbow fully supinated and in 90° of flexion. Locate the anterolateral aspect of the lateral epicondyle (facet of the lateral epicondyle, where ECRB originates the most common site of pain in patients with lateral epicondylitis) and identify the area of tenderness. Apply DTF with the side of the thumb tip applying the pressure in a posterior direction on the teno-osseous junction. Maintain this pressure while imparting DTF in a direction towards your fingers, which should be positioned on the other side of the elbow for counter pressure. DTF is applied for 10 minutes; after the numbing effect has been achieved prepare the tendon for Mill's manipulation.

Technique of Mill's Manipulation
It should be performed immediately after the DTF provided that the patient has full range of passive elbow extension. Position the patient on a chair with a back rest and the therapist should stand behind the patient. Support the patient's arm under the crook of the elbow with the shoulder joint adducted to 90° and medially rotated. The forearm will automatically fall into pronation. Place thumb of your other hand in the web space between the patient's thumb and index finger and fully flex the patient's wrist and pronate the forearm.
Move the hand supporting the crook of the elbow on to the posterior surface of the elbow joint and while maintaining full wrist flexion and pronation, extend the patient's elbow until you feel that all the slack has been taken up in the tendon. Apply a minimal amplitude, high velocity thrust by simultaneously side flexing your body away from your arms and pushing smartly downwards with the hand over the

patient's elbow. This maneuver is conducted only once at each treatment session because it is not a comfortable procedure for the patient and the effects of the treatment often become fully apparent over the following few days.

Mulligan's Technique

The patient is lying on his back with his arm on the plinth and forum supinated. Wrap the Mulligan's belt around therapist's shoulder and patient's forearm so that the proximal edge is in level with the elbow joint. Stabilize the lower end of patient's humerus with one hand and support the forearm with the other. The stabilizing hand and forearm lie within the belt and elbow should rest in the flexor crease of the hip.

Now glide the ulna laterally with the belt by moving the shoulder gently upwards, little force is used. Provided there is no pain the patient then actively bends or extends his wrist while maintaining the mobilization. Perform the glides of 3 sets of 10 glides in elbow extension. When MMWM has been repeated 10 times, patient should then be able to clinch the fist with less discomfort without the concurrent mobilization.

Statistical Software

The Statistical Software namely SPSS 10.0 was used for the analysis of the data and Microsoft Word and Microsoft Excel was used to generate graphs and tables.

Result

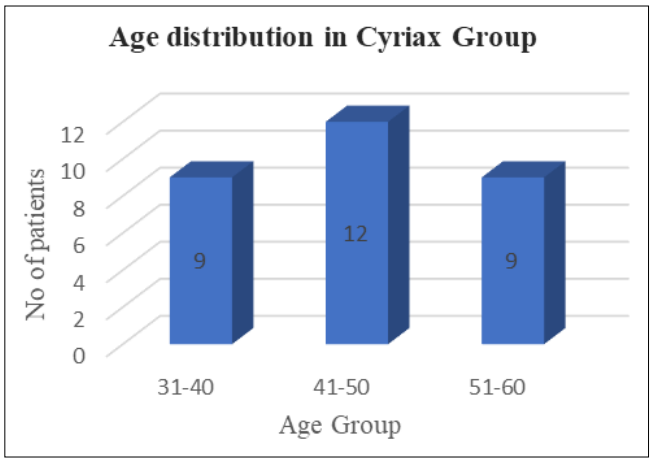
The present study comprising of 60 subjects were divided into two groups *viz*, Cyriax group consisting of 30 (50.0%) subjects and the rest of 30 (50.0%) in MMWM group. Among the 30 subjects in Cyriax group there were 12 (40.0%) males and 18 (60.0%) were females. In case of MMWM 13 (43.33%) males and 17 (56.67%) were females. Thus, there is a preponderance of female subjects in both the groups in this study. The mean ± SD of age in Cyriax group was 45 ± 8.6 years and for MMWM group it was 45 ± 8.6 years. Nevertheless, there was no statistical significance between the age distributions of subjects in both groups.

This revealed that in MMWM group the mean ± SD of VAS score before treatment was 6.20 ± 1.42 and after treatment it was 1.33 ± 0.48. In case of Cyriax group the mean ± SD of VAS score before treatment was 6.07 ± 1.34 and after treatment it was 2.30 ± 0.47.

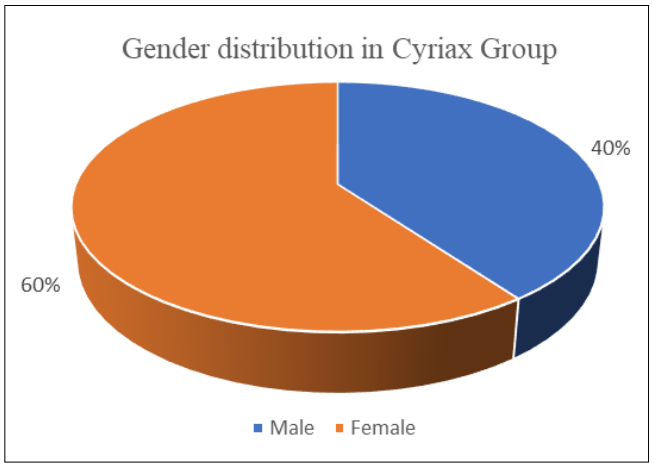
The mean ± SD of HHD score at 2nd position for MMWM group before treatment was 18.20 ± 4.57 and after treatment it was 26.07 ± 4.78. Whereas in case of Cyriax group it was observed to be 20.23 ± 5.42 before treatment and 23.13 ± 5.58 after treatment.

The mean ± SD of HHD score at 3rd position for MMWM group before treatment was 20.63 ± 4.51 and after treatment it was 34.70 ± 5.63. Whereas in case of Cyriax group it was observed to be 22.67 ± 5.86 before treatment and 31.47 ± 5.82 after treatment.

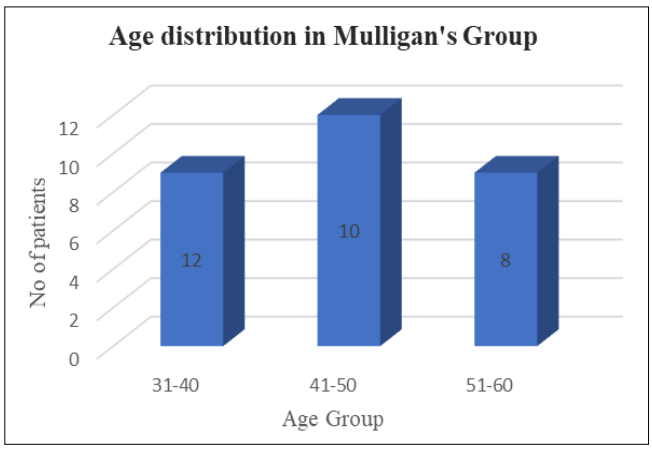
The VAS score and the HHD score which was recorded before and after the treatment were analyzed statistically. It was noticed that the changes in the mean score of VAS for MMWM group compared between before treatment (6.20 ± 1.42, $p > 0.374$) and after treatment (1.33 ± 0.48, $p < 0.001$). And for changes in the mean score of HHD at 2nd position before treatment (18.20 ± 4.57, $p > 0.121$) and after treatment (26.07 ± 4.78, $p < 0.033$). The changes in the mean score of HHD at 3rd position before treatment (20.63 ± 4.51, $p > 0.137$) and after treatment (34.70 ± 5.63, $p < 0.033$). And it was noticed that the changes in the mean score of VAS for Cyriax group compared between before treatment (6.07 ± 1.34, $p > 0.374$) and after treatment (2.30 ± 0.47, $p < 0.001$). And for changes in the mean score of HHD at 2nd position before treatment (20.23 ± 5.42, $p > 0.121$) and after treatment (23.13 ± 5.58, $p < 0.033$). The changes in the mean score of HHD at 3rd position before treatment (22.67 ± 5.86, $p > 0.137$) and after treatment (31.47 ± 5.82, $p < 0.033$). It may be seen here that in MMWM's group the changes were noticed and was significant at the end of 12th treatment session and even for Cyriax group the changes were noticed and was significant at the end of the 12th treatment session. And both groups were statistically significant.



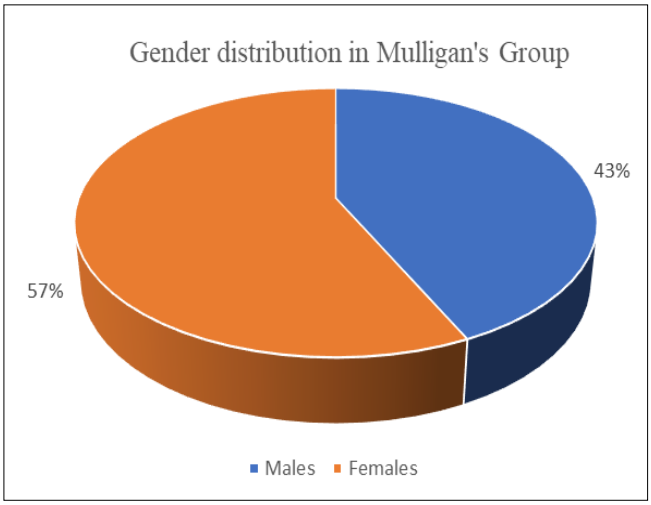
Graph 1: Bar graph showing the age distribution of Cyriax group



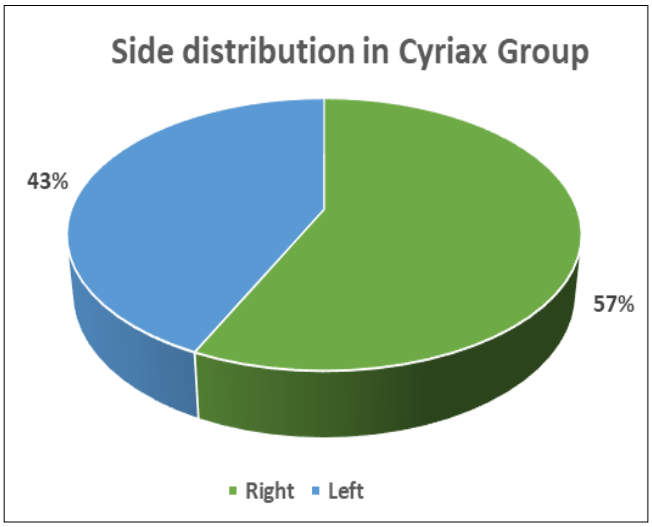
Graph 2: Pie chart showing the gender distribution of Cyriax group



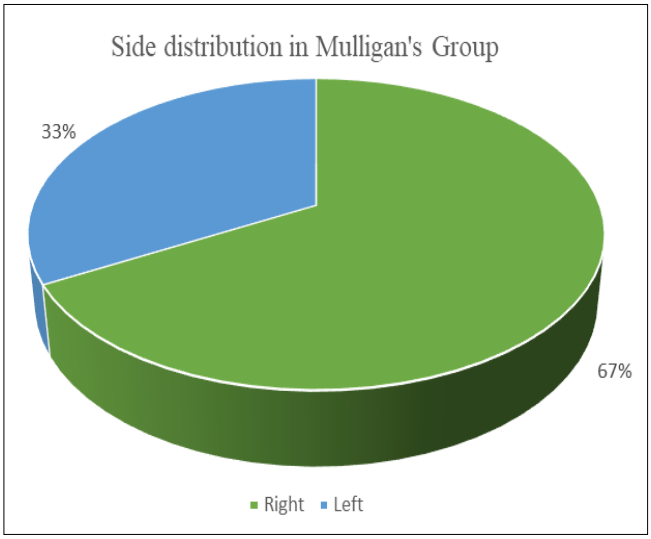
Graph 3: Bar graph showing the age distribution of Mulligan's group



Graph 4: Pie chart showing the gender distribution of Mulligan's group



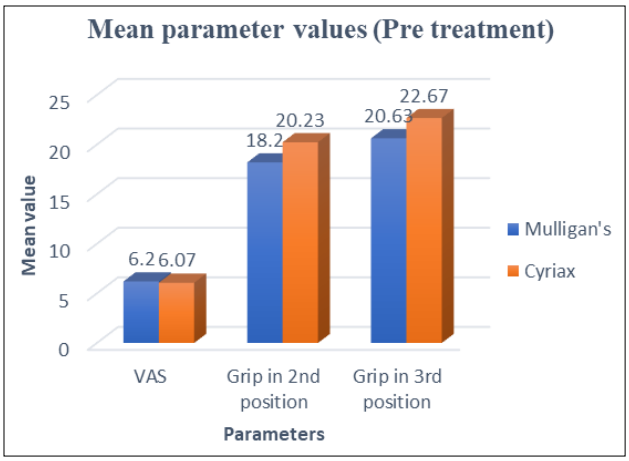
Graph 5: Pie chart showing the side distribution of Cyriax group



Graph 6: Pie chart showing the side distribution of Mulligan's group

Table 1: Descriptive statistics of vas and grip strength during Pre-treatment

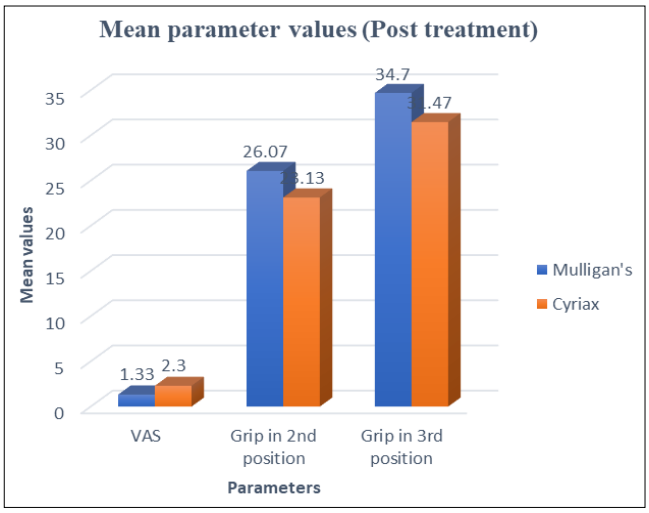
Pre-Treatment			
Parameter	**Group**	**Mean ± SD**	**p- value**
VAS	Mulligan's	6.20 ± 1.42	0.374
	Cyriax	6.07 ± 1.34	
Grip in 2nd position	Mulligan's	18.20 ± 4.57	0.121
	Cyriax	20.23 ± 5.42	
Grip in 3rd position	Mulligan's	20.63 ± 4.51	0.137
	Cyriax	22.67 ± 5.86	



Graph 7: Bar graph showing descriptive statistics of VAS and Grip Strength during pre-treatment

Table 2: Descriptive statistics of vas and grip strength during post treatment

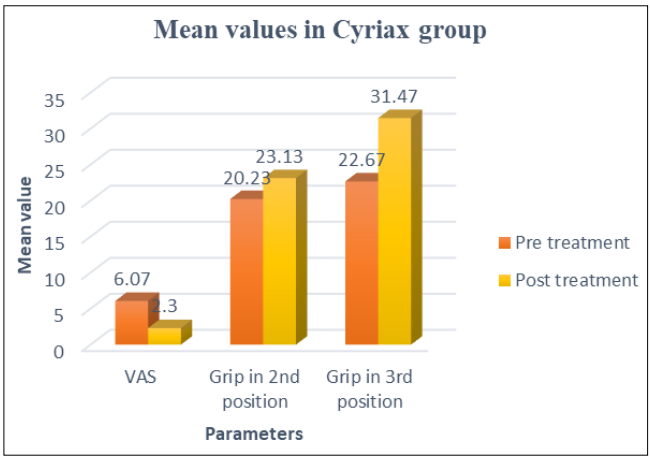
Post-Treatment			
Parameter	**Group**	**Mean ± SD**	**p- value**
VAS	Mulligan's	1.33 ± 0.48	<0.001
	Cyriax	2.3 ± 0.47	
Grip in 2nd position	Mulligan's	26.07 ± 4.78	0.033
	Cyriax	23.13 ± 5.58	
Grip in 3rd position	Mulligan's	34.7 ± 5.63	0.033
	Cyriax	31.47 ± 5.82	



Graph 8: Bar graph showing descriptive statistics of VAS and Grip Strength during post-treatment

Table 3: Descriptive statistics of vas and grip strength during pre and post treatment in CYRIAX group

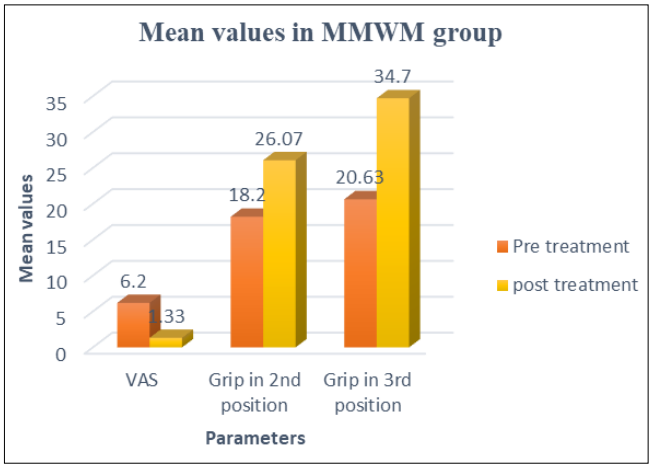
CYRIAX Group			
Parameter	**Group**	**Mean ± SD**	**p- value**
VAS	Pre	6.07 ± 1.34	0.374
	Post	2.3 ± 0.47	<0.001
Grip in 2nd position	Pre	20.23 ± 5.42	0.121
	Post	23.13 ± 5.58	0.033
Grip in 3rd position	Pre	22.67 ± 5.86	0.137
	Post	31.47 ± 5.82	0.033



Graph 9: Bar graph showing descriptive statistics of VAS and Grip Strength during pre and post treatment in Cyriax group

Table 4: Descriptive statistics of vas and grip strength during pre and post treatment in MMWM group

MMWM Group			
Parameter	**Group**	**Mean ± SD**	**p- value**
VAS	Pre	6.2 ± 1.42	0.374
	Post	1.33 ± 0.48	<0.001
Grip in 2nd position	Pre	18.2 ± 4.57	0.121
	Post	26.07 ± 4.78	0.033
Grip in 3rd position	Pre	20.63 ± 4.51	0.137
	Post	34.7 ± 5.63	0.033



Graph 9: Bar graph showing descriptive statistics of VAS and Grip Strength during pre and post treatment in MMWM group

Conclusion

In this study, taking into consideration the two parameters pain and grips strength using VAS and Hand Held Dynamometer score was determined. Since, the mean score of VAS is less in case of Mulligan's Mobilization with Movement compared to Cyriax Physiotherapy and mean score of Hand Held Dynamometer is high in case of Mulligan's Mobilization with Movement as compared to Cyriax Physiotherapy. Hence, the Mulligan's Mobilization with Movement is better than Cyriax Physiotherapy in treating Lateral Epicondylitis.

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