

RESEARCH ARTICLE

EFFECTS OF MULLIGAN AND CYRIAX APPROACH IN PATIENTS WITH SUBACUTE LATERAL EPICONDYLITIS

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ABSTRACT

Objective: To determine and compare the effects of Deep Transverse Friction (DTF) Massage and Mill's manipulation (Cyriax) with Mobilization with movement (MWM) and Taping (Mulligan) in lateral epicondylitis patients. **Material & Methods:** A Randomized Control Trial (NCT03848117) was conducted in Physiotherapy Department of DHQ Hospital Bahawalnagar after the approval from the competent authority. Non-probability convenient sampling technique was used to collect sample. The n=30 sample size was randomly allocated in two groups as Group A i.e. the Cyriax group (DTF Massage & Mill's Manipulation) and Group B i.e. the Mulligan group (Taping & MWM), with 15 participants in each group having sub acute lateral epicondylitis. Data was collected in terms of age, gender, BMI and occupation. Patient related tennis elbow evaluation (PRTEE) questionnaire was used to determine the level of pain, functional disability and hand grip strength. Mann Whitney U statistics test was used for between the group analysis and Friedman with Wilcoxon signed ranks test was used for within the group analysis. The significance level was set at $p < 0.05$. **Results:** The mean \pm SD age of subjects in Cyriax group was 33.60 ± 6.864 years and in Mulligan group was 36.93 ± 7.741 years. MWM with taping and Mill's manipulation with DTF massage both showed significant improvement ($p < 0.001$) in pain, function ability and handgrip strength throughout the treatment duration. When comparing the both group regarding pain, Cyriax approach showed significant improvement after 2nd week while mulligan's approach showed more improvement than Cyriax approach ($p < 0.001$) in functional ability from 2nd to 3rd week. Hand grip strength in both groups did not show any significant difference ($p \geq 0.05$). **Conclusion:** Mobilization with movement & taping (Mulligan) and mill's manipulation with DTF massage (Cyriax), both are effective in improving pain, functional ability and handgrip strength in lateral epicondylitis. Cyriax approach is more effective in relieving pain in lateral epicondylitis as compare to Mulligan's approach. On the other hand, functional ability, more improve with Mulligan's approach. But both treatments are equally effective in improving hand grip strength in lateral epicondylitis.

Keywords: Tennis elbow, mobilization with movement, hand grip strength, patient rated tennis elbow evaluation (PRTEE), Deep Transverse friction massage.

INTRODUCTION

Lateral epicondylitis or tennis elbow is a painful debilitating condition of elbow joint which creates disturbance in functional activities.¹ The basic cause of epicondylitis is the continues continuous strain on the tendon which is attached near to distal segment of humerus.² Lateral epicondylitis is sometimes seen in person who had more upper limb activity such as computer use, forceful forearm pronation and supination, heavy weight lifting and repetitive lifting.^{3,4} Sub-acute lateral epicondylitis is the most common condition of elbow due to overuse of tendon of forearm muscles in controlled motion phase or sub-acute phase.⁵ The prevalence of lateral epicondylitis is 1-3% in any population and incidence is more in above 35-55 years of age as well as in females who are 42-46 years of age.^{6,7}

Lateral epicondylitis usually treated by conservative physiotherapy techniques such as acupuncture, ultrasound, electrical stimulations,

stretching & strengthening exercises, orthotics, extra corporeal shockwave therapy and laser to improve pain, inflammation, physical fitness and hand grip.^{8,9,10,11} The reoccurrence of condition can be prevented by activity modifications, supportive devices or by modifying techniques and equipment. But research evidence regarding specific interventions for sub-acute lateral epicondylitis is poor.¹² Besides conservative management, Mulligan and Cyriax approach are also used for managing lateral epicondylitis. In Mulligan approach, mobilization with movement (MWM) and taping is used for the treatment of tennis elbow. This approach is effective to reduce pain, increase in grip strength above pain free range and increase in the status to tolerate the resisted wrist extension with isometric work.^{11,12} The second modern method of lateral epicondylitis treatment is the Cyriax approach and in this method Mill's manipulation is executed instantly after deep transverse friction.^{13,14,15}

Both techniques have a role in repositioning of positional faults,¹⁴ controlling the fascia directly, improving muscular recruitment for enhancing static & dynamic neuro-muscular retraining by balancing the tissue length or tension relationship & motor control.¹⁵ Thus helps in reducing pain and improving grip strength and functional disability. Few Researches have done on effectiveness of Cyriax approach (deep transverse friction massage and Mill's manipulation).^{16,17,18} This approach collectively augments the blood circulation of the affected area and acts by rupturing the adhesions to elongate the scar tissue, thus helps in achieving the outcomes.¹⁹

There was enough literature available on traditional therapy for lateral epicondylitis or tennis elbow in Pakistan. But limited evidence was available regarding the use of MWM with taping and deep transverse friction massage with mill's manipulation (Cyriax approach and Mulligan approach) on pain, functional disability and hand grip strength in LE patients. The objective of the study was to determine and compare the effectiveness of Cyriax approach and mulligan approach in improving pain, functional status and hand grip strength in subacute lateral epicondylitis.

METHODOLOGY

A Randomized Control Trial (NCT03848117) was conducted in physiotherapy department of DHQ Hospital Bahawalnagar after the approval from the competent authority from March 2019-November 2019. The inclusion criteria for the recruitment in the study were; participants having sub-acute lateral epicondylitis with age 20-50 years of both genders, pain intensity on visual analogue score VAS>7 with positive mills test, cozens test and local tenderness over lateral epicondyle of the humerus were included. Individuals having elbow joint pathology, history of corticosteroid injection in the preceding 3 months, any other systemic illness like metabolic, metastatic, infective disorders, any other neurological abnormalities and allergies to kinesio tape were excluded from the study.

Total n=39 subjects were evaluated for eligibility through Non-probability convenience sampling

technique. The n=30 subjects fulfilled the inclusion criteria and were part of this trial (Figure. 1). The subjects were randomly allocated through lottery method into two groups; Cyriax approach (DTF massage & mill's manipulation) group (n=15) and Mulligan approach (Taping & MWM) group (n=15). Approval of the study was granted by Head of Department, DHQ Hospital Bahawalnagar. Prior to data collection written informed consent was obtained from the participants. The demographic variables such as age, weight, height, occupation, BMI index were obtained then patient related tennis elbow evaluation (PRTEE) pain and functional disability evaluations and hand grip strength by dynamometer through internationally accepted standard chart were completed on the same day. Each subject in both groups completed 12 sessions of Physical therapy in 4 weeks including DTF massage, mill's manipulation, MWM and taping. Each subject was evaluated for changes in symptoms on 0 week, 1st week, 2nd week, 3rd week and 4th week. The detail description of therapeutic protocol in both groups can be seen in table 1.

Each patient in Cyriax group was given 20-minute session. Each session started in sitting position and initially deep transverse friction massage was done at lateral compartment of the elbow joint and immediately after that mill's manipulation at elbow joint with flexion at wrist joint in pronated arm position. Each patient in Mulligan group was given 30 to 40minute session. Each session started in sitting position and it included mobilization with movement which was given in such a way that initially lateral glide at elbow joint was performed and after holding it, asked the patient to make a fist and open the fist. In this way, this procedure is repeated 36 times and after 12 repetitions, a short rest period was given. Taping was applied within 10 minutes after mobilization around the elbow joint over extensor carpi radialis muscles to remove the tape after 48 hours before coming for next session. The detail protocol can be seen in table 1.

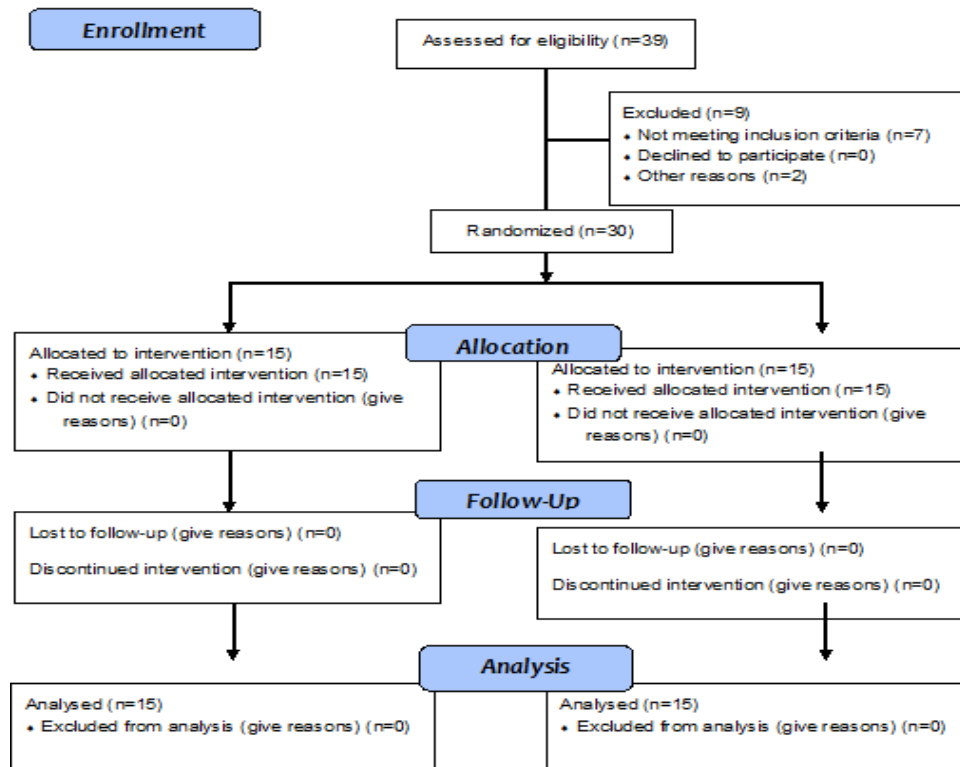


Figure 1: Consort Diagram

Table 1: Intervention Protocol

	Cyriax Approach		Mulligan Approach	
	Deep transverse friction massage and mill’s manipulation		Mobilization with movement and taping	
	Deep Transverse Friction Massage	Mill’s manipulation	Mobilization with Movement	Taping
Frequency of sessions	3 times/week	3 times/week	3 times/week	3 times/week
Duration of intervention	10-15 minutes	5 minutes	30 minutes	10 minutes
Repetitions in each session	10-20	1	36	1
Total sessions per month	12	12	12	12

The data was collected through General demographic questionnaire included age, gender, body mass index (BMI), occupation. Patient related tennis elbow evaluation scale (PRTEE index) was used to determine the severity of pain and functional disability. The PRTEE index consists of two main characteristics having fifteen subparts. Each of these characteristics is given a ten point rating scale (0= no pain/ no difficulty in task, 10= worst imaginable pain/unable to do a task). These scores are summed up to make a range from 0=best score to 100= worst score for both pain and function.^{20,21} Electronic hand dynamometer of Camry brand, model HGDD-002 reliable tool

($r=0.98$) was used to determine the hand grip strength. The electronic hand dynamometer is considered the primary clinical measure of hand grip strength according to internationally accepted normal hand grip strength ratings in Kgs in patients with various musculoskeletal conditions associated with decreased hand grip strength.²² The scoring includes max1,max 2 and mean values from standardized hand grip strength evaluation scale according to age of the patient. The results of study were presented as frequency, percentages, mean±SD, median (IQR), z-values, U-stats and p-values. The sample size is too small for normality testing. In case where the sample size is ≤ 30 , non-

parametric tests are chosen. For between-group analysis, Mann Whitney U statistics and Independent t-test were used, while for within-group analysis Friedman with Wilcoxon signed ranks test and RM-ANOVA were used. SPSS 21 was used to analyse the data. The level of significance was set at a p value less than 0.05.

RESULTS

The mean age of participants was 35.27±7.38 and n=19 were male and remaining n=11 were female. The majority of participants have normal BMI (24.25±3.03). Regarding the occupation mostly male are related to computer/desk work (n=5) and female were house wives (n=4). The further detail can be seen in figure 2.

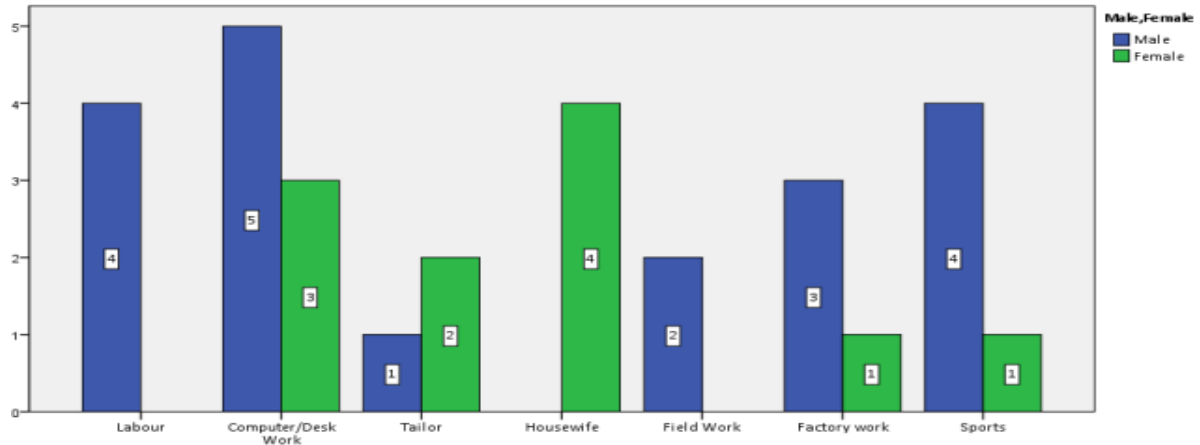


Figure 2: Occupation of Study Participants

In cyriax group as well as in mulligan group, regarding total pain, functional disability and hand grip strength variables, both groups showed significant improvement in overall sessions. (p<0.05) In Cyriax group, from 0 to 4th week results showed significant improvement in pain (34(8) ver. 4(6), p=0.001) and in functional disability (71(20) ver. 14(5), p=0.001) and also in hand grip strength

(24.76±6.47 ver. 48.49±9.26, p<0.001). While in mulligan approach, from 0 to 4th week results also showed significant improvement in pain (35(2) ver. 7(2), p=0.001) and in functional disability (77(19) ver. 12(13), p=0.001) and also in hand grip strength (24.69±7.32 ver. 46.31±11.25, p<0.001). (Table 4 & Figure 3)

Table 4: Within-group changes in pain and functional disability

	Cyriax approach				Mulligan approach		
	Median (IQR)	z-score	p-value	Median (IQR)	z-score	p-value	
Pain	0 week	34(8)	-3.413	0.001 ^a	35(2)	-3.415	<0.001 ^a
	1 st week	23(16)	-3.412	0.001 ^b	29(6)	-3.415	<0.001 ^b
	2 nd week	12(4)	-3.428	0.001 ^c	22(10)	-3.411	<0.001 ^c
	3 rd week	9(4)	-3.448	0.001 ^d	12(3)	-3.420	<0.001 ^d
	4 th week	4(6)	-3.422	0.001 ^e	7(2)	-3.420	<0.001 ^e
Functional disability	0 week	71(20)	-3.416	0.001 ^a	77(19)	-3.418	<0.001 ^a
	1 st week	51(24)	-3.413	0.001 ^b	57(34)	-3.412	<0.001 ^b
	2 nd week	39(37)	-3.411	0.001 ^c	28(6)	-3.422	<0.001 ^c
	3 rd week	24(4)	-3.415	0.001 ^d	19(8)	-3.421	<0.001 ^d
	4 th week	14(5)	-3.412	0.001 ^e	12(13)	-3.408	<0.001 ^e

^a0 week vs. 1st week, ^b1st week vs. 2nd week, ^c2nd week vs. 3rd week, ^d3rd week vs. 4th week, ^e0 week vs. 4th week

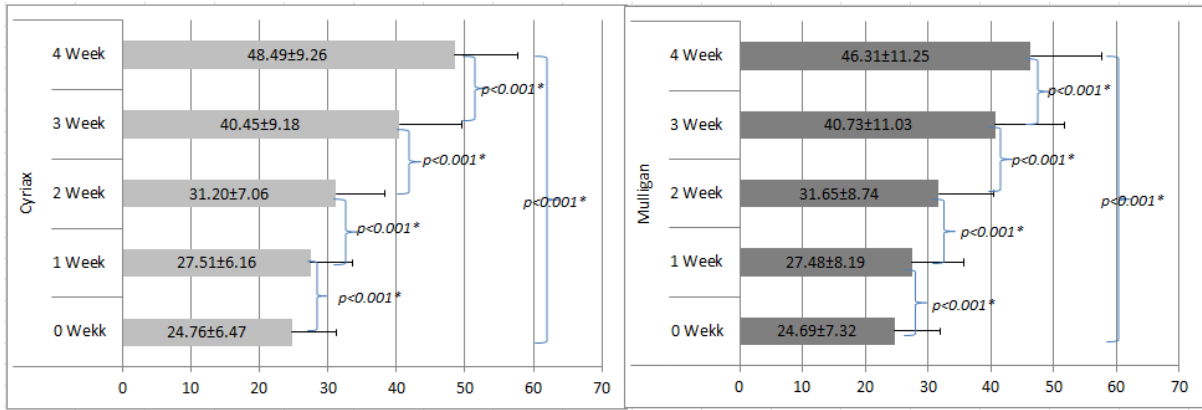


Figure 3: Hand grip strength within the groups

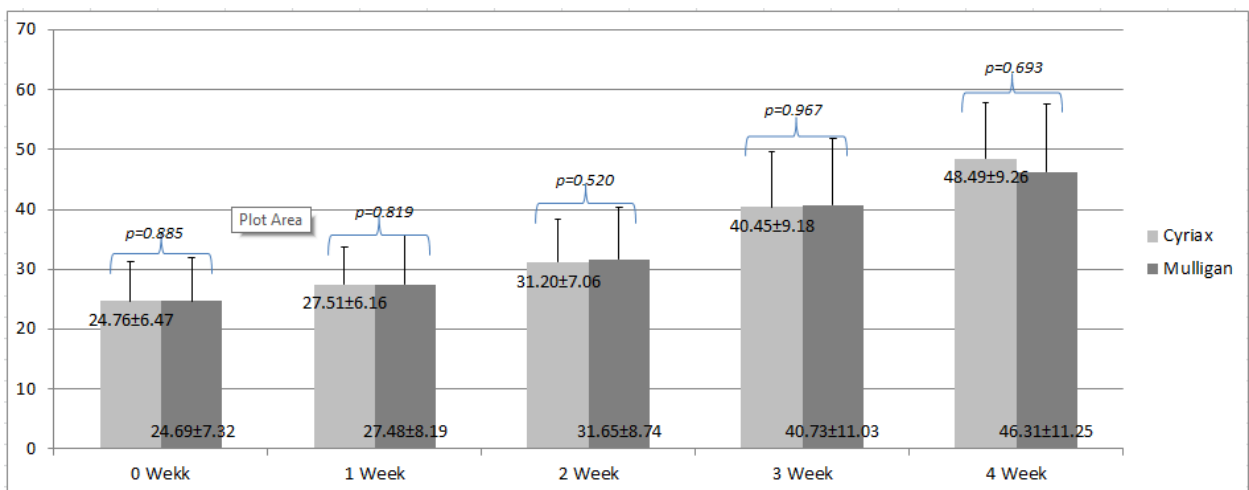
While comparing both groups, there was no significant difference observed between the groups regarding pain and functional disability at 0 week and 1st week. ($p \geq 0.05$) ($p > 0.05$) but more regarding functional disability, in 4th week, no

significant difference ($p > 0.05$) was found between the groups. (Table 5) For hand grip strength variable, there was no significant difference ($p > 0.05$) found between the groups in all weeks and overall sessions. (Figure 4)

Table 5: Between-group comparison for pain and functional disability

	Cyriax approach Median(IQR)	Mulligan approach Median(IQR)	U-stats	p-value
Pain	0 week	34(8)	86.50	0.274
	1 st week	23(16)	66	0.053
	2 nd week	12(4)	9.50	<0.001*
	3 rd week	9(4)	30.50	<0.001*
	4 th week	4(6)	7(2)	46
Functional disability	0 week	71(20)	108.50	0.868
	1 st week	51(24)	109.50	0.901
	2 nd week	39(37)	31.50	<0.001*
	3 rd week	24(4)	40.50	<0.001*

*Level of significance $p \leq 0.05$



*Level of significance $p \leq 0.05$

Figure 4: Hand grip strength between the groups

DISCUSSION

The objective of the study was to determine and compare the effectiveness of Cyriax approach and mulligan approach in improving pain, functional status and hand grip strength in subacute lateral epicondylitis. It was also hypothesized that Cyriax approach is significantly effective in improving pain, functional disability and hand grip strength than Mulligan's approach in patients with subacute lateral epicondylitis. The Cyriax approach significantly improved pain, while functional ability with Mulligan approach improved significantly. Both groups regarding hand grip strength were equally effective.

In Cyriax approach, earlier pain improvement is due to DTF massage which augment vasodilatation and thus blood flow is increased to the area, which caused chemical irritants removal and increased the transport of endogenous opioids and increased destruction of pain provoking waste metabolites.^{23,24} Mill's manipulation, given immediately after DTF, intended to stretch the scar tissue within the teno-oseous junction by breaking adhesions, thus the area became mobile and pain free.²⁵ Two studies from past literature also showed improvement in pain by Cyriax approach and mulligan approach.^{26,27} One study was conducted by Madhusmita Koch and his colleagues to find out the effectiveness of Cyriax and eccentric strengthening and stretching exercises. Sample size was sixty n=60 and they found that Cyriax treatment was significantly effective in improving pain and hand grip strength.²⁶ This study is similar to current study in treatment duration, measuring tools and in results. Bill Vicenzino et al find out the efficacy of Mulligan's MWM in pain relief and to correct positional fault not only in tennis elbow but also in all other musculoskeletal disorders. They noticed the improvement in pain and mobility of the joint.²⁷ The current study also showed that mulligan approach also has role in improving pain.

According to the results of the current study, mulligan approach was more effective in improving functional status of lateral epicondylitis patients. The mechanism of MWM was that slight positional faults (not readily visible on X-rays) occur due to any injury or strain resulted in movement

limitations or pain. But when correctional mobilization is maintained, function is restored without pain and many repetitions will bring long lasting improvements.¹⁴ The reason was that MWM is almost always perpendicular to the plane of movement and hence will work in only one path. When correct MWM is repeated many times, the joint memory to keep on path seems to return back.²⁸ Taping has been found effective in lessening the pain and restoring the joint function, maintaining and establishes proper structural arrangement by harmonizing the tissue length-tension association sustained for prolonged period. Therapeutic tape not only approximate the elasticity of human skin but also allow the longitudinal stretch to 140% to its resting length.^{29,30} Specifically, the tape application to over stretched muscle decreased nociceptive stimulus by creating convolutions in the skin thus to reduce extra pressure in the mechanoreceptors underneath the dermis.³¹ That is why mulligan approach overall is very much effective not only in relieving pain as well as immediately in improving functional status.

Past literature also showed the effectiveness of mulligan approach and Cyriax approach individually in improving functional status.^{32,33} Amro et al. conducted a study to investigate the effects of conventional treatment alone with the of combination of Mulligan techniques and traditional treatment in patients with lateral epicondylitis. The results showed that the combination of Mulligan techniques with traditional treatment showed significant improvement than conventional treatment alone. They applied the same mulligan approach as in current study included MWM and taping, with similar outcome variables, almost with same sample size i.e. treatment duration of 4 weeks, measuring tools i.e. PRTEE and hand grip strength and also having similar results.³² Another pilot study conducted by Rajadurai Viswas et al. to compare the efficacy of supervised exercise program and Cyriax approach in the treatment of tennis elbow. This study was carried out with 20 patients. Pain intensity with VAS and functional outcome by Tennis Elbow Function Scale (TEFS) were used. Both approaches were found to be significantly effective in improvement of pain and functional status.³³ This study goes parallel to the

current study in treatment duration i.e. 4 weeks and in the effectiveness of Cyriax physiotherapy.

In current study, both groups showed significant improvement in hand grip strength in overall sessions in all the weeks ($p \leq 0.05$). Tipton et al. recommended that this technique not only increase and maintain the force being transmitted to ligaments, tendon and bones but also increase the strength and functional ability of these structures.³⁴ Early mobilization is very much effective on increasing the tensile strength of connective tissue scars in muscle damage and can also augment the number and size of collagen fibrils besides increasing the cross-sectional area of tendons comparatively to tendons of inactive controls.^{35,36} Regarding Cyriax approach, Paungmali et al. found similar results with improved pain-free grip, pressure pain threshold, and sympatho-excitation following the application of Cyriax physiotherapy.³⁷ Different past studies on both approaches showed evidence regarding effect on hand grip strength.^{38,39,40,41,42} Such as one past study done by Abott JH et al. to demonstrate a beneficial early response to a manual therapy technique i.e. (MWM) for tennis elbow. The results of the study indicate that MWM was effective in 92% of subjects to be able to perform pain-free functional activities, and also improving grip strength immediately after that.³⁸ Another study was done by Moneet Kochar and Ankit Dogra on 66 patients who were classified in to three groups to determine the efficacy of different therapy schedules for lateral epicondylitis patients. Four outcomes were Visual analogue score, weight test, isometric grip strength and patient assessment test. The First group (MWM group) showed more improvement in overall outcome variables.³⁹ Similarly, Hafizur Rahman et al. conducted a randomized control trial to compare the effect of Mulligan mobilization with movement and supervised exercise program and results showed that both techniques showed the improvements in the hand grip strength and pain.⁴⁰ One more past study was done by Nagrale et al. on cyriax physiotherapy (DTF massage in combination with Mill's manipulation) in treating lateral epicondylalgia. In this randomized clinical trial, Cyriax physiotherapy was compared with phonophoresis and supervised exercise. Result of

the both groups improved significantly from the start of treatment.¹¹ Another pilot study was done by Shamsoddini et al. to determine the initial effects of taping technique regarding wrist extension, pain and grip strength of hand in tennis elbow patients. Hand-held dynamometer for wrist extension and grip strength and visual analogue scale (VAS) used for pain. Significant changes were found in wrist extension ($p=0.006$) and in grip strength ($p=0.001$) between effected and unaffected arm. Thus Taping technique showed an impressive effect on all outcome variables in individuals with lateral epicondylitis.⁴¹ the current study also showed improvement in hand grip strength.

The results of the study were only applicable for the population of patients visiting DHQ Hospital Bahawalnagar, the data was not evaluated on gender based difference as both male and female has different level of physical activity due to different musculoskeletal strength and participation level and hence effectiveness of interventions on outcomes also varies.^{42,43} The sample size was small and treatment duration was less, so long term improvement in functional disability was not observed, limited resources.

CONCLUSION

Mobilization with movement & taping (Mulligan) and mill's manipulation with DTF massage (Cyriax), both are effective in improving pain, functional ability and handgrip strength in lateral epicondylitis. Cyriax approach is more effective in relieving pain in sub-acute lateral epicondylitis as compare to Mulligan's approach. On the other hand, functional ability, more improve with Mulligan's approach. Moreover, Mulligan approach is more effective in improving functional disability than Cyriax approach. But both treatments are equally effective in improving hand grip strength in sub-acute lateral epicondylitis.

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