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Original Research Article

Efficacy of Muscle Energy Technique with Plyometric Exercises in Chronic Lateral Epicondylitis

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ABSTRACT

Background & Objective: Lateral epicondylitis (LE) is soft tissue disorder of the arm characterised by pain over lateral humeral epicondyle. It is a chronic overuse injury commonly affecting the common tendinous origin of the wrist extensors. The objective of the study was to find the effectiveness of Muscle Energy Technique (MET) with Plyometric Exercises on pain, functional performance and grip strength in Chronic Lateral Epicondylitis (CLE) participants.
Study design: A randomized controlled study
Setting: Institutional based musculoskeletal Physiotherapy outpatient department.
Outcome measures: Numerical pain rated scale (NPRS), Patient rated tennis elbow evaluation (PRTEE), and Hand dynamometer (HD)
Material & Methods: 30 participants with the CLE were included in the study. They were divided into two different groups; Group A: MET with Plyometric Exercises and Ultrasound Therapy (n=15) and Group B: Conventional physiotherapy which included Ultrasound Therapy with Stretching and Strengthening Exercises (n=15). The predefined treatment protocol was given for four weeks. The pain, functional performance and grip strength were assessed at baseline and post treatment (4^{th} week) using NPRS, PRTEE and HD.
Result: There was a significant decrease in pain, improvement in functional performance and grip strength *($p<0.05$)* in both the groups. However, MET with Plyometric Exercises group was found to have a greater effect on all outcome measures in CLE participants
Conclusion: The result of this study indicates that 4 weeks of MET with Plyometric Exercises was effective in improving pain, functional performance and grip strength in Chronic Lateral Epicondylitis (CLE) participants compared to the control group.

Key Words: *Chronic Lateral Epicondylitis, MET, Plyometric Exercises, PRTEE, NPRS, Hand Dynamometer.*

INTRODUCTION

Among the working population worldwide Soft-tissue disorders of the arm which occur commonly are a frequent cause of sickness absence worldwide. [1] Among them Lateral epicondylitis is one of the most prevalent disorders of the arm. Lateral epicondylitis is generally termed as tennis elbow with clinically definition of pain over lateral epicondyle of the humerus which increases with resisted wrist extension. [2] Because of pain and functional impairment

in LE productivity is reduced. This results in heavy economic burden as patients may not be able to work for several weeks. [3,4] Lateral epicondylitis is having prevalence rate of 1-3% with highest incidence in the age group between 35-55 years with its onset gradual or sudden. The ICD -10 of Lateral Epicondylitis is M77.1.In most of the cases, it is commonly an idiopathic or a work related condition. [5]

In lateral epicondylitis there occurs a tear of extensor muscles of the wrist near its origin at lateral epicondyle. The tear occurs at the junction between muscle and bone and due to this healing is slow as there is lack of periosteal tissue overlying the bone area. It has been shown that the granulofibroblastic material laid down in the repair process contains free nerve endings. Repetitive micro trauma from overuse or abnormal joint biomechanics may overload the repairing tissue, mechanically distort the scar tissue and thus stimulate the free nerve endings sufficiently to evoke mechanical nociceptive pain. The blood supply to the muscle origin is limited and is suspected that it would be further prone to reduced blood flow after injury. [6] The inflammatory response that characterizes the disorder is an attempt to speed the rate of tissue production to compensate for an increased rate of tissue micro damage. The microdamage rate is increased because of greater internal strain to the tendon fibers over time. [6] The susceptibility of extensor carpi radialis brevis muscle to excessive strain is probably related to the added tensile load imposed on the tendon by the radial head when the tendon is stretched (e.g., wrist flexion, elbow extension and forearm pronation). In this position the tendon is further stretched over the prominence of the radial head. [7] This is further compounded by the head of the radius rotating anteriorly against extensor carpi radialis brevis during pronation of the forearm. Pain relief, preservation of movement, and muscle conditioning are the primary objectives of the rehabilitation of lateral epicondylitis. Most common treatments include rest, ice, nonsteroidal anti-inflammatory drugs, corticosteroid injections, range of motion exercises, stretching, strengthening exercises, counterforce bracing, iontophoresis, acupuncture, and ergonomic adjustments or training. [8]

Muscle energy techniques (MET) are soft tissue release technique which are used to treat various musculoskeletal disorders, [9-10] which main effects on lengthening of a shortened or contractured muscle and increasing the range of motion of a restricted joint. In MET affected joints or muscles is contracted voluntary by the patient against a counterforce applied by the operator. During the procedure, the affected muscle is gently stretched to its longest pain-free range. The patient then performs a series of 3 to 5 submaximal muscle contractions of about 5 seconds each. This encourages the muscle to naturally relax and results in an improved range of motion. [11-12] Various studies in recent have been investigated [13-15] and these studies suggest that MET causes definite improvement in pain and function. Although the use of MET for LE has been described previously [16] but there is still lack of evidence regarding its efficacy in LE.

Whereas, Plyometric training focuses on the stretch-shortening cycle (SSC) by using eccentric contraction which is quickly followed by concentric contraction. [17-18] Thus, this study also focuses on eccentric exercises which can also help in the prevention and rehabilitation of tendonitis.

The aim of our study was to find the effectiveness of MET with Plyometric exercises on pain, functional performance and grip strength in CLE subjects. So the result of this study could be implicated in clinical practice. We hypothesized that MET with Plyometric exercises would be effective in CLE subject.

MATERIALS AND METHODOLOGY

The participants with lateral elbow pain referred to institutional based

physiotherapy outpatient department were screened. Inclusion criteria was - age 30-45 years, both gender, CLE (>4 weeks), unilateral involvement and pain as a chief complaint. Participants were excluded if any history of trauma, surgery, acute infections, any systemic disorders, cervical spine and upper limb dysfunction, neurological impairments, cardiovascular disease, osteoporosis, recent steroid infiltration, ossification and calcification of soft tissue, malignancies, athletes, recently underwent physiotherapy interventions in at least 3 months, unwillingness to attend all treatment sessions & assessments. Institutional based ethical clearance and informed consent was taken prior to the start of the study.

Table-I: Demographic details

Demographic Details			
Variables	**MET Group(n=15) Mean (SD)**	**Control Group(n=15) Mean (SD)**	**P-value (P>0.05)**
Age	**35.20 (±3.35)**	**38.40 (±2.79)**	**0.690**
Duration (Month)	**8.20(±2.05)**	**8.9 (±2.24)**	**0.425**
Gender	**10 Male=66.6% 5 Female=33.4%**	**9 Male=60 % 6 Female=40 %**	
Affected Side	**9 right=60% 6 Left=40%**	**12 right=80 % 3 Left=20%**	
Dominant Side	**9 right=60% 6 left=40%**	**11 right=73.3% 4 left=26.6%**	

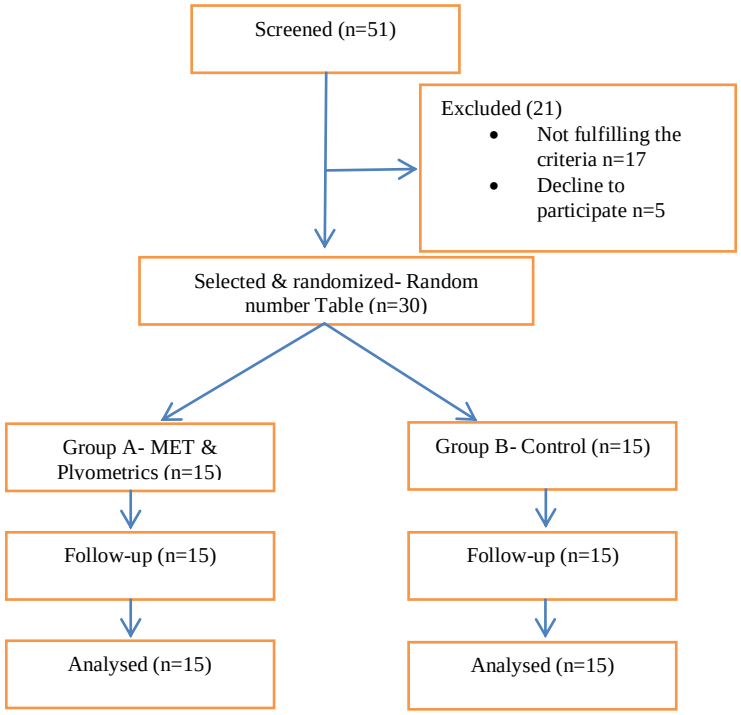

Figure 1: Sampling Flow Chart

Intervention: Both the groups were treated for the period of 4 weeks (thrice/week) with the same therapist. Group A received MET with Plyometric exercises and ultrasound same as group B and Group B received control intervention. All the participants attended full treatment protocol without any dropout. Blinding was not done for treating therapist and the participant.

Muscle Energy Technique with Plyometric Exercises [19]

Patient Position for Muscle Energy Technique –Patient seated in chair with elbow flexion, forearm in supination & wrist in neutral position.

Procedure: Stabilization of humerus distally with one hand and forearm is

supinated with the therapist other hand until resistance or discomfort is detected. Patient is than asked to briefly pronate the forearm (isometric contraction approximately 75% of maximal) against resistance for a period of 5 seconds, immediately therapist slightly increases supination until resistance is met once again (Figure 2). After periods of 5 seconds of relaxation, the procedure was repeated 5 times during a single treatment session. Dosage: 5 repetitions for total of 10 minutes, 3 times a week for 4 weeks.

Patient Position for Plyometric Exercises: [20] Patient seated in chair with hand hanging over the edge of chair, elbow in full extension, forearm pronation, wrist in full extension. **Procedure:** Patient flexes the wrist slowly while counting to 20, then returns to the starting position with the help of the other hand. Patients were told to continue with the exercise even if they experienced mild pain. However, they were told to stop the exercise if the pain became disabling. The load was increased using free weights, when the patient was able to perform the eccentric exercises without experiencing any minor pain or discomfort. Dosage: 5 sets of 8 repetitions with 1 minute rest between each set. 3 times per week for 4 weeks.

Conventional Physiotherapy:

Pulsed Ultrasonic Therapy [5,21]

Site: Tenoperiosteal junction of the extensor carpi radialis brevis**,** At 1:4 Pulse Ratio**,** Frequency: 1MHz**,** Intensity: 1.5 W/cm^2**,** Duration: 5 minutes. **Dosage**: 3 Session per Week, Total 12 session.

Strengthening exercises [5,21]

Procedure - Isometric contractions with the elbow in flexion to 90°, with the hand of unaffected arm applying manual resistance over the dorsum of the supinated arm of affected side. Pain free isometric contraction of the wrist extensors was initiated and held for 5 to 10 seconds. **Dosage**: 15 contractions per session, 3 times per week for 4 weeks.

Progression - Includes forearm pronation as the starting position and increasing resistance.

Stretching exercises [5,21]

Procedure: Forearm pronation, elbow extension; the wrist being palmar-flexed using the other hand of patient or with the help of wall. This was held for few seconds and then released**. Dosage**: 10 stretches per session, 3 times per week, for 4 weeks.

Outcome Measures

Pain was assessed by 11 Point NPRS. The NPRS is a reliable and valid pain assessment scale in CLE. [22] Functional Disability was measured by PRTEE (English & Gujarati, a 15-item questionnaire) [23,24] designed to measure forearm pain and disability in patients with LE. The PRTEE was found to be a reliable, reproducible and sensitive instrument for the assessment of pain and disability in CLE subjects. The hand grip strength was evaluated using Jamar hand dynamometer (HD) which has been used extensively in studies [25] for assessing hand function. All outcome measures were used to assess baseline value and progressions at 4th week.

Figure 2: MET Application

Statistical Analysis

All statistical analysis for the subjects in both the groups was done using SPSS 22 for windows software. The level of significant was set at 95% (p=0.05). Descriptive analysis was used to calculate Mean and Standard deviation. The inter group comparison of demographic details were performed using independent “t” test. Non parametric Mann Whitney “U” Test was used for inter group and Wilcoxon Sign Rank Test for intra group comparisons.

RESULT

The demographic details (age; *p=0.690*, duration of condition; *p=0.425*) of groups were homogenous with *p>0.05(Table-I).* Pre-treatment NPRS *(p=0.714),* PRTEE *(p=0.171)* and HD *(p=0.202)* shows no significant difference *(p>0.05) (Table-II).* All the subjects in both groups show positive effect in pain, functional performance and grip strength. Pre and post treatment comparison for NPRS *(Group-A:p=0.001, Group-B: p=0.002), PRTEE (Group-A: p=0.001, Group-B: p=0.001)* andHD *(Group-A: p=0.00)* shows significant difference *(p<0.05)* whereas the HD *(Group-B: p=0.063)* did not shows significant difference.*(Table-III).* Post treatment inter group comparison of NPRS *(p=0.000), PRTEE (p=0.000)* and HD *(p=0.001)* shows highly significant difference *(p<0.05)* among groups *(Table-IV)* proving met with plyometric exercises, an effective treatment in improving pain, functional performance and grip strength.

Table: I

Pre-Treatment Group Comparison							
Outcome	MET with Plyometric			Control			P-Value (>0.05)
	Min	Max	Mean (SD)	Min	Max	Mean (SD)	
NPRS	3	8	6.10 (1.75)	4	8	5.93 (1.38)	0.714
PRTEE	51	64	57.80 (3.68)	52	65	59.66 (3.33)	0.171
HD	22	42	31.86 (5.50)	20	41	34.53 (5.47)	0.202
Table-II							
Post-Treatment Group Comparison							
Outcome	MET with Plyometric			Control			P-Value (>0.05)
	Min	Max	Mean (SD)	Min	Max	Mean (SD)	
NPRS	1	2	1.33 (0.48)	2	6	3.33 (1.23)	0.000
PRTEE	4	20	10.23 (4.42)	20	52	31.36 (7.47)	0.000
HD	36	52	45.60 (5.19)	27	46	37.53 (5.47)	0.001

Table-III

Intragroup NPRS,PRTEE and HD Comparison									
		MET with Plyometric Exercises				Control Group			
		Min	Max	Mean (SD)	P-Value	Min	Max	Mean (SD)	P-Value
NPRS	Pre	3	8	6.10 (1.75)	0.001	4	8	5.93 (1.38)	0.002
	Post	1	2	1.33 (0.48)		2	6	3.33 (1.23)	
PRTEE	Pre	51	64	57.80 (3.68)		52	65	59.66 (3.33)	0.001
	Post	4	20	10.23 (4.42)		20	52	31.36 (7.47)	
HD	Pre	22	42	31.86 (5.50)		20	41	34.53 (±5.43)	0.063
	Post	36	52	45.60 (5.19)		27	46	37.53 (±5.47)	

DISCUSSION

In previous studies varieties of treatment have been attempted but none of the studies have strong suggestion to any particular treatment. [26] The current study was for 4 weeks duration in which MET with Plyometric exercises was compared with control and found significant improvement in pain, hand grip strength and functional performance compared to control group. The effect in MET group is superior compared to control group and this may be because MET lengthens the shortened muscle and thereby increasing ROM. [14,15] The analgesic effect in MET group may be because of MET influence on golgi tendon organ which transmit impulses to the posterior horn cell and has an inhibitory effect on the increased motor stimulus at the anterior horn cell causing autogenic inhibition after post-isometric relaxation. [27] In this study load of plyometric exercises was increased according to the symptoms of the patients. The role of plyometric exercises remains uncertain and it is believed that due inflammation, free nerve endings cause pain which don't allow movement to happen. Plyometric exercises reduce inflammation and realigns collagen fibres near to the periosteum. [20]

This study has shown that MET with plyometric exercises has good results over control group in all the domains considering pain, grip strength and functional performance. But grip strength has relatively poor outcome that can be because

of the duration of the condition. Because more the duration more chances of wasting of the muscles thus one needs to focus in grip strengthening in CLE patients. Hereby we come to a conclusion that MET with plyometric exercises can be applied in CLE patients.

Our study has certain limitations like lack of blinding, smaller sample size and long term follow up which can be taken into consideration for future research. Future research should also compare MET with other soft tissue release techniques like Myofascial Release technique, Active release technique etc.

In summary, our results suggest that MET with plyometric exercises improve pain, functional performance and grip strength in CLE subjects.

CONCLUSION

We conclude that in CLE participants, 4 weeks of treatment with MET with plyometric exercises improves pain, hand grip strength and functional performance compared to control group.

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Conflict of interest

We declare that there were no conflicts of interest in the entire journey of the study.

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