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Effectiveness of scapular muscle strengthening in management of lateral epicondylalgia

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ABSTRACT

Lateral epicondylalgia appears to be multifactorial in origin, while the clinical picture is fairly uniform. Furthermore, only 5% of the people suffering from tennis elbow actually play tennis, and therefore, the condition may rather be referred to as lateral epicondylalgia (LE). There are many studies done for physiotherapeutic management of LE. Ultrasound and wrist extensor exercises remain a mainstay in the management of LE. There are some studies suggesting a relationship between scapular muscles & LE. AIM: To assess the additional effect of scapular muscle strengthening over conventional treatment in the management of Lateral epicondylalgia. METHODOLOGY: Subjects who met with inclusion & exclusion criteria were divided into 2 groups. The experimental group was given scapular muscle strengthening exercises in addition to conventional treatment and the control group was given conventional treatment for LE. Grip strength measurement was done using Jamar's hand-held dynamometer & pain intensity and functional ability was scored using patient-rated tennis elbow evaluation (PRTEE) score on 1stday & after 3 weeks. RESULTS & CONCLUSION: Significant improvement was found in both the groups. Scapular muscle strengthening showed significantly more reduction in pain, functional disability and more improvement in grip strength than conventional treatment. Thus, scapular muscle strengthening must be included in rehabilitation plan of a patient with LE.

Keywords: *Lateral Epicondylalgia, Grip strength, Handheld dynamometer, PRTEE, Scapular muscle strength.*

1. INTRODUCTION

Tennis elbow, lateral epicondylitis, lateral epicondylosis, and lateral epicondylalgia are all terms that have been used to describe pain in the region of the lateral epicondyle of the humerus.[1-2]Early investigators believed that the pain experienced at the lateral epicondyle was a result of an acute inflammatory condition at the origin of the common wrist extensors.[3] However, the absence of inflammatory cells during histological examination as well as evidence of wrist extensor tendon degeneration [4-6] has also lead to the use of the term lateral epicondylosis. Lateral epicondylalgia (LE), originally described as lawn tennis elbow,14 but only 5% of the people suffering tennis elbow actually play tennis, and therefore, the condition may rather be referred to as lateral epicondylalgia(LE). LE is characterized by pain in the region of the lateral epicondyle of the humerus.15In addition to the involvement of the common wrist extensors, the lateral collateral ligament, and radial nerve has also been identified as possible sources of lateral epicondylar pain.[7-9] Because the pathoanatomic origin is largely unknown, it has been recently recommended to use a more general term, lateral epicondylalgia (LE), to describe the pain experienced in the region of the lateral epicondyle.[2] LE is a common disease with significant consequence in the general population. The prevalence of LE has been reported as high as 12.2% in occupational settings. In addition, 27% of patient with LE report severe limitations with activities of daily living, 17 such as lifting bags or boxes. The dominant arm is commonly affected, with a prevalence of 1– 3% in the general population. LE is one of the most common causes of elbow and forearm pain encountered in a clinical practice commonly associated with resistant wrist or finger extension and gripping activities.[10-13]. It is usually caused by repetitive wrist extension that leads to overuse injury.

The current theory is that the process of LE begins with an overuse injury that leads to micro-tearing of extensor carpi radialis brevis muscle and occasionally the extensor digitorum communis muscle. These muscles play important role in gripping. There are several studies supporting the reduction of grip strength in patients with LE on the affected side. Due to pain & reduced grip strength, the patient faces many functional difficulties like wringing clothes, strong gripping, opening locks, opening jars, etc. To rate the pain & functional disability, PRTEE (patient rated tennis elbow evaluation), VAS (Visual Analogue Scale), NPRS (Numerical Pain Rating Scale) are commonly used for a patient with LE. Grip strength is commonly assessed using Jamar HHD (Hand Held Dynamometer), sphygmomanometer, etc. Functional disabilities are not only because of wrist extensor pathology but it may be

because of pain, reduced grip strength or due to reduced strength and endurance of scapular muscles in LE.[2] There are several studies available which are supporting the link between scapular muscles & LE. Kinetic chain theory suggests that the kinetic force required at the distal joint is generated by proximal musculature. The weakness of proximal muscle strength or poor stability of proximal muscle requires more work at distal joints and can produce distal pathology like LE. The kinetic chain theory provides a theoretical foundation for linking the importance of scapular musculature to muscle performance at the elbow.

Treatment

In general, conservative management is the most frequent approach among patients with LE. Conservative treatment modalities such as ultrasound, iontophoresis, and acupuncture have been shown to be effective but lack of long-term efficacy is further confounded by the high recurrence rates. The efficacy of conservative treatment approaches remains elusive secondary to questions with long-term management and high recurrence rates. A recent study reported between a 29% to 38% recurrence rate in individuals receiving conservative treatment management. In the only study with a 2 year follow after physiotherapy intervention found that over half the patients reported ongoing pain and functional loss, secondary to a relapse of LE symptoms.

2. AIM & OBJECTIVES

Aim: To assess the additional effect of scapular muscle strengthening over conventional treatment in the management of Lateral epicondylalgia.

Objectives:

- To assess the effect of scapular muscle strengthening along with conventional treatment in reducing pain and improving hand grip strength and functional ability in patients with lateral epicondylalgia.
- To assess the effect conventional treatment in reducing pain and improving hand grip strength and functional ability in patients with lateral epicondylalgia.
- To compare the effect of scapular muscle strengthening with conventional treatment versus conventional treatment in reducing pain & improving hand grip strength and functional ability in patients with lateral epicondylalgia.

3. METHODOLOGY

Total 30 subjects who met with inclusion and exclusion criteria were selected from physiotherapy OPD, Civil Hospital, Rajkot. Their inform consents were obtained. Subjects were selected on the basis of following criteria:

3.1. Inclusion criteria:

• Reported a primary complaint of unilateral lateral elbow pain on the dominant hand.
• Patients aged 35 to 55 years.
• Presented with and at least one of the following positive clinical tests.

i. Passive stretching of extensors (Mill's sign).
ii. Pain at the lateral epicondyle during maximal volitional contraction (MVC) of the wrist extensors (Cozen's sign).
iii. Pain at the lateral epicondyle while resisting the extension of the middle digit (Maudsley's test).

3.2. Exclusion criteria:

- Hospitalization or Surgery for the upper quarter within the last 6 months.
- Any radiculopathy or neurological signs and symptoms in the upper extremity.
- History of corticosteroid injections in last 6 months.
- Patients who were not willing to participate.

These subjects were divided into 2 groups A & B (15 in each group) who were blinded to the group they belonged to. The pre & post-test evaluation was conducted. The subjects were evaluated for their current level of pain at the lateral epicondyle using PRTEE (The Patient-Rated Tennis Elbow Evaluation) and grip strength by HHD. The intervention was provided to the subjects assigned to respective groups.

- Group A: received concentric and eccentric wrist extensor strength training and ultrasound (Continues, 1.2W/cm^2, 8 min).
- Group B: received scapular muscle strengthening along with concentric and eccentric wrist extensor strength training and ultrasound (continuous, 1.2W/cm^2, 8 min).

At the end of 3 weeks, intervention subjects underwent post-test evaluation of grip strength & PRTEE (The Patient-Rated Tennis Elbow Evaluation) to compare the effectiveness of the intervention.

3.3. Scapular muscle strengthening:

Fig. 1: Upper trapezius strengthening

Fig. 2: Middle trapezius strengthening

Fig 3: Lower trapezius strengthening

Fig. 4: Serratus anterior strengthening

Four main Scapular stabilizing muscles were included for strengthening: Upper trapezius, Middle trapezius, Lower trapezius & Serratus anterior (as shown in fig-1, 2, 3, 4 respectively).

All the four muscles underwent a 10RM test for planning the strengthening programme for scapular muscles. Initially strengthening was started using muscles' 10 RM weight.

Patients were instructed to perform 2 sets of 10 repetitions for each scapular muscle strengthening exercise with 2-5 minutes of rest between sets. When the patient performed the strengthening exercise with no rest of less than 1 minute of rest between sets, patients were re-assessed for 10 RM. And the strengthening was started with second 10 RM weight.

3.4. Conventional exercise protocol

- Ultrasound:

Fig. 5: Ultrasound Treatment

Local ultrasound was given to the subjects over the lateral epicondyle. Continuous ultrasound using frequency: 1 MHz & Intensity: 1.2 W/Cm^2 was given to the subjects for 8 minutes.

- Wrist Extensor exercise:

Fig. 6: Wrist Extensor treatment

Each subject was provided wrist extensor exercises with elastic resistance band. Elastic resistance bands were chosen because it makes the experiment more reproducible. The strengthening exercises was to be performed in a seated position, with the elbow flexed, the forearm resting on the table and hand over the edge, to allow full wrist motion during exercise. The resistance band will be held by the handle and fixed on the floor with the ipsilateral foot. Concentric exercise was performed with the forearm in pronation by moving slowly from full passive wrist flexion to full wrist extension. The eccentric exercise was performed by slowly lowering from full wrist extension to full wrist flexion. Subjects performed two sets of ten repetitions once, for 6 days/week. 2 to 5 minutes of rest was given between sets. The appropriate resistance band (light, medium, or heavy) was determined by a ten-repetition trial. The length of the resistance band was adjusted so that it be somewhat difficult to perform ten repetitions. During the initial trial, the length of the resistance band was marked with a permanent ink marker to avoid variability of resistance between

exercise sessions. Empirically, a lighter resistance band was tried on smaller subjects or those with more pronounced pain. Subjects who had severe pain with the use of the lightest resistance band was instructed to perform the exercises without the resistance band and to begin using the lightest resistance band one week later if the pain is not worse. Subjects were instructed to increase the resistance in the band when they can perform three sets easily and without a notable increase in pain. The resistance was increased by shortening the band in 1-inch increments from the initial length mark. Subjects were reevaluated at three weeks after randomization and initiation of treatment.

3.5. Outcome measures

Outcome measures were taken on 1st day & after 3 weeks.
Pain & disability were measured using PRTEE. Grip strength was measured using Jamar hand-held dynamometer (Saehan).

- PRTEE:

Patients were given PRTEE scale to fill. Patients have described both the subscales- Pain subscale and Disability subscale. Patients were instructed about the scoring system from 0 to 10. If patients were unsure because they have rarely performed an activity in the past week, then they were encouraged to estimate their average difficulty. Because this would be more accurate than leaving it blank. If they never perform an activity and they were not able to estimate then they were asked to leave it blank and the question was substituted from an average score of that subscale.

- Grip strength:

Standard position recommended by the American Society of Hand Therapists (ASHT) was used to evaluate the grip strength using Handheld dynamometer. Grip strength was measured using "pain-free grip strength test", the patients are supposed to slowly squeeze a dynamometer until they begin to feel discomfort. They were asked to hold the position for 5 seconds. The pain-free grip strength was measured three times, and the mean value was calculated and used for analysis.

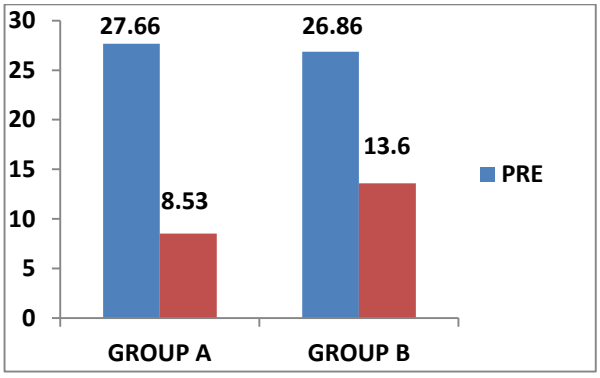
Outcome measures Specific instructions were given to each subject before the test. No verbal encouragements were given during the test. Grip strength readings were recorded in kilograms. A minimum of 1 minute rest period was allowed between efforts to minimize the effects of fatigue. The dynamometer was reset to zero prior to each reading. Grip Bar of the dynamometer was adjusted so that patient's second joint can just be bent to grip HHD (ACSM Guidelines).

4. RESULT

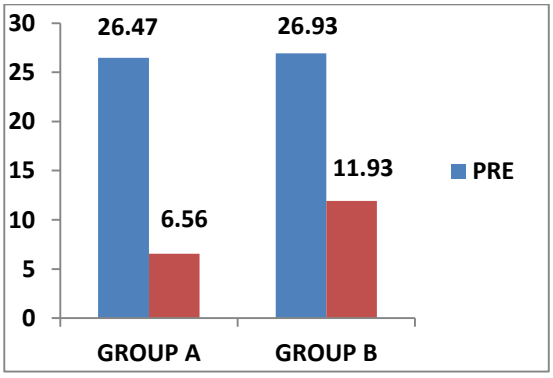
30 subjects were allocated in the study. Subjects received 3 Weeks of treatment and were analyzed with grip strength & PRTEE scale. Age & Gender distribution was also analyzed in both groups. Descriptive statistics were used to describe sample characteristics. The significance level selected was 0.05.

The statistical analysis was done within the groups and between the groups for following the outcome measures

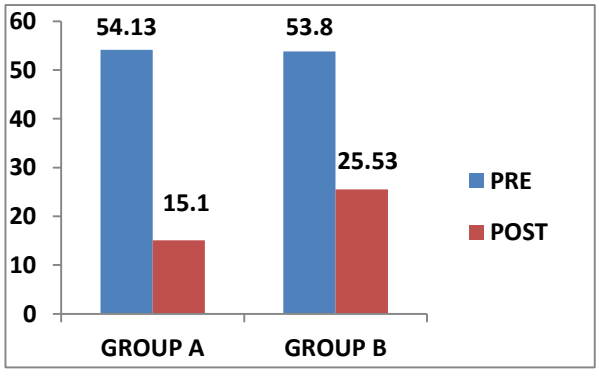
1. PRTEE: Pain score
2. PRTEE: Disability score
3. Total PRTEE score
4. Grip strength



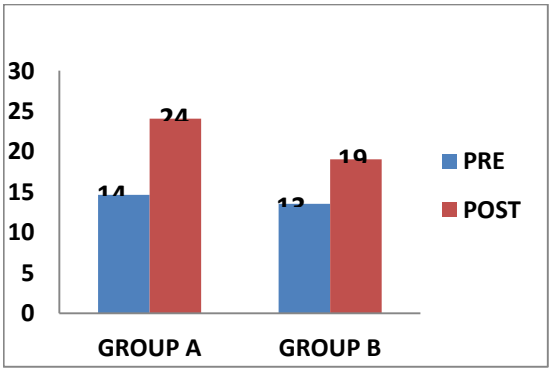
Graph 1: PRTEE –Pain Score



Graph 2: PRTEE –Disability Score



Graph 3: Total PRTEE Score



Graph 4: Grip strength

Graph-1 shows mean value of pre & post pain score in both the groups. The mean value of pain score reduces in both the groups after 3 weeks. But it reduces more in group A. Graph-2 shows mean value of pre & post-disability score in both the groups. The mean value of disability score reduces in both the groups after 3 weeks. But it reduces more in group A. Graph-3 shows mean value of pre & post total PRTEE score in both the groups. The mean value of Total PRTEE score reduces in both the groups after 3 weeks. But it reduces more in group A. Graph-5 shows mean value of pre & post Grip strength both the groups. The mean value of grip strength improves in both the groups after 3 weeks. But it improves more in group A.

PRTEE-pain score, PRTEE-disability score, and total PRTEE score were analyzed using nonparametric tests. e.g.Intragroup analysis was done using Wilcoxon sign rank test and Intergroup analysis was done using Mann Whitney U test.

Grip strength was analyzed using parametric test. For Grip strength, the Intragroup analysis was done using Paired t-test and Intergroup analysis was done using Unpaired t-test.

Intragroup analysis: Statistical analysis was done using wilcoxon sign rank test for Pain score, Disability score & Total PRTEE score in both the groups. For grip strength, the analysis was done using a paired t-test.

Table 1 shows Group-A intragroup analysis And Table 2 shows Group B intragroup analysis.

Table 1: Group-A Intragroup analysis

		Pain score	Disability score	Total PRTEE score	Grip strength
Mean	Pre	27.66	26.47	54.13	14.56
	Post	8.53	6.56	15.1	24.06
p Value		0.0007	0.0007	0.0001	<0.0001
W		120	120	120	-
t value		-	-	-	9.77

Table 2: Group-B Intragroup analysis

		Disability score	Pain score	Total PRTEE score	Grip strength
Mean	Pre	26.86	26.93	53.8	13.55
	Post	13.6	11.93	25.53	19.06
p Value		0.0005	<0.0001	0.0007	<0.0001
W		78	120	120	-
t value		-	-	-	8.52

The analysis concludes that there is a statistically significant reduction in pain score, disability score & statistically significant improvement in grip strength in both Experimental and Control group.

It shows the effectiveness of conventional treatment and scapular muscle strengthening with conventional treatment, both.

Intergroup analysis: Statistical analysis was done using Mann Whitney U test for Pain score, Disability score & Total PRTEE score. Grip strength was analyzed using unpaired t-test.

Table 3 shows intergroup analysis for all four outcome measures.

Table 3: Intergroup analysis

		Pain score	Disability score	Total PRTEE score	Grip strength
Mean	Group A	19.13	19.9	39.03	10.06
	Group B	13.26	15	28.26	5.5
SD	Group A	7.61	9.47	16.29	3.98
	Group B	4.28	9.77	11.25	2.5
Mann Whitney U		60.5	81.5	27	-
t value		-	-	-	2.10
p Value		0.032	0.205	0.004	0.044

This analysis concludes that there is the statistically significant difference in pain score, total PRTEE score & for grip strength. In Disability score, there is a clinically significant difference but the difference is statistically non-significant.

It means, Clinically, Pain and Disability have been reduced and Grip strength has been improved more in Group A than in Group B.

5. CONCLUSION

The results showed statistically significant improvement in all the outcome measures in both the groups we found somewhat more improvement in the experimental group and is statistically significant for pain score, total PRTEE score & grip strength but not disability score. Clinically, Disability has been reduced. The study concludes that scapular muscle strengthening exercises are more effective in treating LE patients for improving pain and grip strength.

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