

The Efficacy of Eccentric Training Versus Concentric Training Along With Therapeutic Ultrasound Therapy for Pain and Functioning in Subjects with Lateral Epicondylitis

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Abstract

Background: Lateral Epicondylitis is a disabling musculoskeletal condition leading to pain and/or tenderness around the elbow. A common presentation may show pain and tenderness over the lateral epicondyle of the humerus, the radial head, the fascia, between the origins of extensor muscles as well as radiating into the forearm.

Materials & Methodology: Patients with Lateral Epicondylitis (n=20) were included in this study and patients with fracture of upper limb, radiculopathies, undergoing steroid therapy, rheumatoid arthritis were excluded from the study. A comparative study was done where two groups were made, Group A (n=10) received Eccentric exercise along with Ultrasound Therapy and Group B (n=10) received Concentric exercise along with Ultrasound Therapy. Treatment was given for 3 times a week for 3 weeks. Pain was assessed using Numerical Pain Rating Scale and functional disability was assessed using Patient Rated Tennis Elbow Evaluation.

Results: Group A showed significant decrease in pain and functioning as compared to Group B. Mean pre NPRS of eccentric subjects was 6.70 which was significantly higher than mean post NPRS 6.30 (p<0.001). Mean pre NPRS of concentric subjects was 6.30 which was significantly higher than mean post NPRS 2.60 (p<0.001). Mean pre PRTEE of eccentric subjects was 53.90 which was significantly higher than mean post PRTEE 12.85 (p<0.001). Mean pre PRTEE of concentric subjects was 55.45 which was significantly higher than mean post PRTEE 23.50 (p<0.001)

Conclusion: The study concluded that Eccentric exercise along with Ultrasound Therapy is more effective than Concentric exercise along with Ultrasound Therapy.

Keywords: Lateral Epicondylitis, Eccentric Exercise, Concentric Exercise.

Introduction

Lateral Epicondylitis is a disabling musculoskeletal condition leading to pain and/or tenderness around the elbow.¹ It is a degenerative or failed healing tendon response characterised by the increased presence of fibroblasts, vascular hyperplasia, and disorganised collagen in the origin of the extensor carpi radialis brevis (ECRB). It occurs due to work or sport related pain disorder usually caused by excessive quick, monotonous, repetitive eccentric contractions and gripping activities of the wrist. The patient mainly complains of pain and decreased function, both of which may affect activities of

daily living.² The estimated annual incidence in general population is 1-3%.³ It is clinically diagnosed by pain over the lateral epicondyle of humerus, resistive wrist extension and middle finger extension. If left untreated it may lead to chronic pain syndrome, sensitivity and pain in lateral epicondyle.² A common presentation may show pain and tenderness over the lateral epicondyle of the humerus, the radial head, the fascia, between the origins of extensor muscles as well as radiating into the forearm. Many people complain of weak and painful grasp, eventually shaking hands along with which turning a door handle, picking up a milk carton or carrying a briefcase may cause severe pain around the

lateral epicondyle.⁴

The main goals of treating Lateral Epicondylitis are to reduce pain, recovery time and overload over the arm along with improvement in function. Physiotherapy is a conservative treatment that is usually used for treating patients with Lateral Epicondylitis. Conservative treatment involve orthotics, cryotherapy, extracorporeal shock wave therapy (ESWT), ultrasound(US), laser, acupuncture, massage, manipulation-mobilization, therapeutic exercises, and pharmacological treatment.⁵

Materials and Method

An approval for the study was obtained from the Institutional Ethical Committee. A randomized Control trail was conducted in subjects with Lateral Epicondylitis in Physiotherapy OPD of Tertiary Care Hospitals of Miraj. Sample was achieved by simple random sampling method. A total of n=20 subjects were selected. All the subjects were screened for inclusion criteria i.e. Both males and females of age 25-50 years, Subjects with positive Cozen's test and Mill's test, willingness of subjects. Subjects excluded were those having recent fractures of upper limb, subjects undergoing steroid therapy, rheumatoid arthritis, history of neurological deficit and unwilling subjects. Subjects were divided into two groups with: Group A=10 subjects Group B=10 subjects. Subjects were briefed about the nature of the study and intervention. The demographic data including age, height, gender, weight, side affected, duration of symptoms was collected through data sheet. Subjects were given written consent prior to the intervention. Group A subjects were treated with Therapeutic Ultrasound Therapy and Eccentric exercise and Group B was treated with Therapeutic Ultrasound Therapy and Concentric exercise. The data was collected pre-treatment and post-treatment using Numerical Pain Rating Scale(NPRS)⁶ and Patient Rated Tennis Elbow Evaluation Questionnaire(PRTEEQ)⁷.

NUMERICAL PAIN RATING SCALE: Pain intensity is measured on a 11-point pain intensity numerical rating scale, where 0=no pain and 10=worst possible pain.10 Reliability=0.94⁶.

PATIENT RATED TENNIS ELBOW EVALUATION QUESTIONNAIRE: It is a 15-item self-reported questionnaire to measure perceived pain

and disability in people with tennis elbow. It has three subscales: pain, usual activities and specific activities. Each of the items of the PRTEE is scored on a 0–10 scale, where 0 is 'no pain' or 'no difficulty' and 10 is 'worst ever' or 'unable to do. Reliability and internal consistency were excellent (PRTEE pain subscale, 0.94; PRTEE specific activities subscale, 0.93; PRTEE usual activities, 0.85).⁷

ULTRASOUND THERAPY: The patient was positioned in sitting position with pillow placed under the arm. The area to be examined was exposed and cleaned. The ultrasound probe was placed over the point of maximal tenderness in the region of the lateral epicondyle⁸. Treatment duration was 6 minute.⁸ A coupling gel was applied to the probe and patients were given the device 3 times a week over a 3-week period.⁸ Parameters: Mode= Pulsed output, Frequency= 1 MHz, Intensity= 0.8-1.5 watt/cm², Duration= 6 minutes.

ECCENTRIC EXERCISE: It was performed on a bed with the elbow supported on the plinth in full extension, forearm in pronation, wrist in extended position (as high as possible), and the hand hanging over the edge of the bed². In this position, subjects flexed their wrist slowly until full flexion is achieved, and then return to the starting position². Subjects were instructed to continue with the exercise even if they experience mild pain². However, they were instructed to stop the exercise if the pain becomes disabling². They performed three sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set². When subjects were able to perform the eccentric exercises without experiencing any minor pain or discomfort, the load was increased using free weights or therabands.².

CONCENTRIC EXERCISE: Sit on a chair next to a table that has an edge or an overhang. Bend the elbow to 90°; palm should be facing the floor. Slowly lower the weight, then slowly raise it toward the ceiling.⁹ In this position, subjects extended their wrist until full extension is achieved, and then return to the starting position. Subjects were instructed to continue with the exercise even if they experience mild pain. However, they were instructed to stop the exercise if the pain becomes disabling. They performed three sets of 10 repetitions at each treatment session, with at least a 1 min rest interval between each set. When subjects were able to perform

the concentric exercises without experiencing any minor pain or discomfort, the load was increased using free weights or therabands.

Findings

The subjects were divided into two groups i.e. Group A (n=10) and Group B (n=10). Table 1 show that, there were 7(70%) female subjects and 3(30%) male

subjects with lateral epicondylitis receiving eccentric exercise along with ultrasound therapy. Data analysis was performed with SPSS version 20.0. The level of significance for Numerical Pain Rating Scale and Patient Rated Tennis Elbow Evaluation Questionnaire was calculated by applying an unpaired t-test. And there were 5(50%) female subjects and 5(50%) male subjects with lateral epicondylitis receiving concentric exercise along with ultrasound therapy.

Table 1: Gender Distribution of subjects with lateral epicondylitis receiving eccentric and concentric exercise along with ultrasound therapy

Gender	Eccentric		Concentric		Total	
	Frequency	%	Frequency	%	Frequency	%
Females	7	70	5	50	12	60
Males	3	30	5	50	8	40
Total	10	100	10	100	20	100

After the application of the unpaired t-test the outcome exhibited a significant ($p=0.01$) reduction in pain and in Eccentric exercise with Ultrasound therapy (Group A) as compared to Concentric exercise with Ultrasound therapy (Group B). And there was a high significance ($p<0.01$) reduction in functional disability in Eccentric exercise with Ultrasound therapy (Group A) as compared to Concentric exercise with Ultrasound therapy (Group B). Table 2

Table 2: Descriptive statistics of subjects with lateral epicondylitis receiving eccentric or concentric exercise along with ultrasound therapy on pain using Numerical Pain Rating Scale (NPRS) and on functioning using Patient Rated Tennis Elbow Evaluation Questionnaire (PRTEE) and its comparison using unpaired t test.

Group Statistics	Group	N	Mean	Std. Deviation	Unpaired t statistic	p value
Pre NPRS	Eccentric	10	6.70	1.25	0.65	0.53
	Concentric	10	6.30	1.49		
Post NPRS	Eccentric	10	1.60	0.97	2.89	0.01
	Concentric	10	2.60	0.52		
Pre PRTEE	Eccentric	10	53.90	11.80	0.29	0.77
	Concentric	10	55.45	11.96		
Post PRTEE	Eccentric	10	12.85	7.82	3.54	<0.01
	Concentric	10	23.50	5.44		

Mean pre NPRS of eccentric subjects was 6.70 and mean pre NPRS of concentric subjects was 6.30. Mean post NPRS of eccentric subjects was 1.60 which was significantly lower than mean post NPRS of concentric subjects was 2.60 ($p=0.01$). Pain on wrist extension was reduced post-treatment in both the groups but significantly reduced in Group A i.e. Eccentric exercise along with Ultrasound Therapy. Mean pre PRTEE of eccentric subjects was 53.90 and mean pre PRTEE of concentric subjects was 55.45. Mean post PRTEE of eccentric subjects was 12.85 which was significantly lower than mean post PRTEE of concentric subjects was 23.50 ($p<0.01$). Therefore, functioning was improved

post-treatment in both the groups but significantly improved in Group A i.e. Eccentric exercise along with Ultrasound Therapy performing eccentric exercise along with ultrasound therapy.

Table 3: Descriptive statistics of subjects with lateral epicondylitis receiving eccentric or concentric exercise along with ultrasound therapy on pain using Numerical Pain Rating Scale (NPRS) and on functioning using Patient Rated Tennis Elbow Evaluation Questionnaire (PRTEE) and its comparison using paired t test.

Group Statistics	Group	N	Mean	Std. Deviation	Paired t statistic	p value
Pre NPRS	Eccentric	10	6.70	1.25	10.58	<0.001
Post NPRS	Eccentric	10	1.60	0.97		
Pre NPRS	Concentric	10	6.30	1.49	41.05	<0.001
Post NPRS	Concentric	10	2.60	0.52		
Pre PRTEE	Eccentric	10	53.90	11.80	8.75	<0.001
Post PRTEE	Eccentric	10	12.85	7.82		
Pre PRTEE	Concentric	10	55.45	11.96	9.28	<0.001
Post PRTEE	Concentric	10	23.50	5.44		

Paired t test was done to compare between subjects with lateral epicondylitis receiving eccentric and concentric exercise along with ultrasound therapy.

It was found that Mean pre NPRS of eccentric subjects was 6.70 which was significantly higher than mean post NPRS 6.30 ($p<0.001$). Mean pre NPRS of concentric subjects was 6.30 which was significantly higher than mean post NPRS 2.60 ($p<0.001$). Mean pre PRTEE of eccentric subjects was 53.90 which was significantly higher than mean post PRTEE 12.85 ($p<0.001$). Mean pre PRTEE of concentric subjects was 55.45 which was significantly higher than mean post PRTEE 23.50 ($p<0.001$).

Discussion

Our study showed that Eccentric exercise along with Therapeutic Ultrasound Therapy (Group A) and Concentric exercise along with Therapeutic Ultrasound Therapy (Group B) both were effective for pain relief and functioning associated with Lateral Epicondylitis. But improvement with Eccentric exercise along with Therapeutic Ultrasound Therapy was much greater as compared to Concentric exercise along with Therapeutic Ultrasound Therapy. This study confirmed that Eccentric exercise along with Therapeutic Ultrasound Therapy is

capable of producing hypoalgesic effect by the end of 3rd week. There was significant improvement ($p < 0.01$) in the Eccentric group as compared to Concentric group. Improvement in NPRS and PRTEE in both the groups were observed.

The rationale for the protocol of this regimen is that stressing the attachment of the ECRB through progressive eccentric and concentric resistance exercises results in the formation of a dense collagenous scar in the area of attachment; thus, pain is eliminated. This idea is supported by the work of Curwin and Stanish,⁹ who wrote that the tension created through eccentric contractions allows the formation of new fibrous tissue at the musculotendinous unit, making it more resistant to damage. Effects of eccentric training on tendonitis include “lengthening” of the muscle-tendon unit, which might result in less strain during elbow joint motion, or “loading” of the muscle-tendon unit, which might increase the tensile strength of the tendon and cause hypertrophy of the muscle belly. Both eccentric and concentric contractions increase muscle strength, but the former improve muscle strength more than the latter. Curwin and Stanish postulated that only eccentric contractions sufficiently produces the tension necessary for forming fibrous tissue at the musculotendinous structure, allowing adaptation to increased tension. These powerful contractions often result in soreness and potential damage to the muscle itself. On the basis of these findings, Walmsley et al stated that the addition of concentric contractions decreases muscle tension during the training regimen, thus minimizing muscle soreness and damage.⁹

In the previously published RCT, the effectiveness of home exercise programme was compared with ultrasound. Pienimaki et al found that the home exercise programme was more effective treatment than ultrasound at the end of the treatment. However, their treatment protocol was totally different to that employed in the present report and research should continue to investigate the long-term effects of their treatment methods.²

There are many different approaches to the treatment of chronic lateral epicondylitis, such as phonophoresis or iontophoresis, corticosteroid injections, extracorporeal shockwave therapy, topical nitric oxide, and bracing.

These are commonly provided independently or as part of standard physical therapy. With respect to eccentric training for chronic lateral epicondylitis, Croisier et al⁸ compared isokinetic eccentric wrist extensor training to standard physical therapy. Pain reduction, disability questionnaire scores, and muscle strength were significantly better in the eccentric group. The effects of eccentric training on pain scores were very similar to the present study. Interestingly, the control groups in both studies also showed similar changes in pain. Different disability questionnaires were used, and those results are not directly comparable. Additionally, Croisier et al chose not to measure wrist extension strength pre-treatment and only compared groups post-treatment, at which point the eccentric group were 1-10% stronger on the involved side while the standard treatment group were 28-38% weaker on the involved side.³

Conclusion

In this study there was significant difference between Eccentric exercise and Concentric exercise along with Therapeutic Ultrasound Therapy protocol in treating Lateral Epicondylitis. Eccentric exercise along with Therapeutic Ultrasound Therapy was more beneficial than the Concentric exercise along with Therapeutic Ultrasound Therapy in eliminating pain and improving function.

The Eccentric and concentric exercise we describe is inexpensive, effective and convenient. Patients must have tolerance for pain. Also, the patient must be provided with detailed instruction sheet to enable them to safely perform the exercises at home. Limitation being that Group B i.e. Concentric exercise along with Therapeutic Ultrasound Therapy had exactly 50% female subjects and 50% male subjects but Group A had 70% female subjects and 30% male subjects. Therefore, the study is bias as the Eccentric group did have equal number of males and females as the Concentric group. Further, research might be carried out on the long-term effect of the exercises with a large population.

Conflict of Interest: None.

Source of Funding: Self.

Ethical Clearance: The ethical clearance was obtained from The Institutional Ethical Committee of

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