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EFFECT OF ECCENTRIC EXERCISE VERSUS MUSCLE ENERGY TECHNIQUE ON PAIN AND FUNCTION IN TENNIS ELBOW: A COMPARATIVE STUDY

Physiotherapy

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ABSTRACT

Background: Lateral epicondylitis, or tennis elbow, is a common overuse syndrome of the extensor tendons of the forearm causing pain in the elbow and forearm and lack of strength and function of the elbow and wrist. It has been recommended that eccentric exercise programs be utilized as a primary conservative treatment for lateral epicondylitis (LET) to elongate the musculotendinous unit while applying a load. Muscle Energy Technique (MET) is a gentle manual therapy intervention targeting the soft tissues primarily, although it also makes a major contribution toward the joint mobilization. Present study compares both these techniques for effective management of tennis elbow. **Methodology:** 30 subjects with tennis elbow were selected via Inclusion and Exclusion criteria and divided into 2 groups via simple random sampling. One group received Eccentric exercise and another group received Muscle Energy Technique. Both groups received Ultrasound as a conservative management. **Results And Conclusions:** Eccentric exercise is more effective than muscle energy technique in treatment of tennis elbow.

KEYWORDS

Tennis Elbow, Eccentric exercise, Muscle Energy Technique

INTRODUCTION

The elbow, being a highly constrained synovial hinge joint, has a significant tendency to develop degeneration and stiffness. It is made up of Humeroradial joint and Humeroulnar joint. Humeroulnar articulation is made up of hour glass shaped trochlea on humeral surface and Concave shaped trochlear notch on ulnar articulating surface. Humeroradial articulating surface is made up of spherical shaped capitulum and cup shaped radial head. [1]

Lateral epicondylitis, or tennis elbow, is a common overuse syndrome of the extensor tendons of the forearm causing pain in the elbow and forearm and lack of strength and function of the elbow and wrist [2][3] It is a prevalent disorder, with a reported prevalence of at least 1.7% [4][5]. The condition affects both men and women equally, typically occurring most frequently between the third and sixth decades of life, with a peak incidence in the fifth decade [6].

Risk factors for the tennis includes Overuse, Repetitive Movements, Wrong Training, Misalignment, Flexibility Problem, Muscle Weakening or Imbalance and Individuals' Repetitive Occupations or Hobbies. [7]

In lateral epicondylitis, there is damage or tearing of the extensor muscles of the wrist near their point of origin at the 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. Research has demonstrated that the granulofibroblastic material deposited during the repair process contains free nerve endings. Repetitive microtrauma from overuse or abnormal joint biomechanics can overload the repairing tissue, distort the scar tissue, and stimulate these free nerve endings, resulting in mechanical nociceptive pain. Additionally, the blood supply to the muscle origin is limited and is believed to be further compromised after injury, making it more susceptible to reduced blood flow.[8]

It has been recommended that eccentric exercise programs be employed as the initial conservative treatment for lateral epicondylitis (LET) to promote lengthening of the musculotendinous unit under load [9]. Despite its effectiveness in managing tendinopathy, the precise mechanisms by which eccentric exercise exerts its effects remain unclear [10]. Although not fully elucidated, several hypothetical mechanisms have been proposed to explain how eccentric loading impacts the tendon, including structural adaptation of the tendon, alterations in tendon length, reduction in neurovascular ingrowth, modulation of tenocyte activity, and variations in tendon force dynamics [11]. While eccentric exercise shows promising effects in improving lateral epicondylitis (LET) lesions, the clinical significance of these improvements has not been definitively established.

Muscle Energy Technique (MET) is a gentle manual therapy intervention targeting the soft tissues primarily, although it also makes a major contribution toward the joint mobilization. It is also referred to as the active muscular relaxation technique (Liebenson, 1989 and 1990). In addition, evidence-based practice standards should be developed and implemented to improve the overall healthcare through value-added care.[12]

Unlike static stretching, which is a passive technique where the therapist performs all the work, Muscle Energy Technique (MET) is an active method that involves the patient's participation. MET is founded on the principles of autogenic inhibition and reciprocal inhibition. Autogenic inhibition MET occurs when a sub-maximal contraction of a muscle is followed by stretching the same muscle. In contrast, reciprocal inhibition MET involves a sub-maximal contraction of a muscle followed by stretching its opposing muscle. [13]

METHODOLOGY

STUDY DESIGN, SETTING AND SAMPLING

- **Study Design:** A Comparative Study
- **Study Setting:** OPD of Venus Institute of Physiotherapy and Various clinics near Gandhinagar
- **Study Duration:** 1 year
- **Sampling Technique:** Simple Random Sampling
- **Population:** Subjects with Tennis elbow

Sample Size: 30 subjects, calculated from following formula:

$$N = 4\sigma^2 (Z_\alpha + Z_\beta)^2 / D^2$$

Where, N= Sample size
σ = Standard Deviation
Zα = Level of desired significance (1.96)
Zβ = Desired Power (0.84 for 80% power)
D = Effect size (Mean difference)

Selection Criteria

Inclusion Criteria:

- Subjects willing to participate
- Both Male and Female Subjects
- Age between 18- 50 years
- Diagnosed as tennis elbow
  Pain over lateral elbow increased with palpation, gripping and resisted wrist extension
  Pain more than 6 weeks
  Subjects with positive Mill's test and cozen's test

Exclusion Criteria:

- Subjects on steroids or any other medications for pain at present
- Any physical or manual therapy treatment of the elbow pain
- Previous surgeries around elbow
- Recent trauma or fracture near elbow

MATERIALS REQUIRED

- Assessment form
- Consent form
- Pen, Pencil and Paper
- Mat and Plinth
- Thera-band
- Table
- Patient-Rated Tennis Elbow Evaluation Questionnaire (PRTEE)
- Ultrasound

OUTCOME MEASURES:

Numeric Pain Rating Scale (NPRS): [14]

- The NPRS (Numeric Pain Rating Scale) is a single-dimensional tool used to assess pain intensity in adults. Like the visual analogue scale (VAS), it ranges from no pain to worst possible pain, offering anchors for severity extremes. The NPRS can be administered verbally or provided graphically for self-reporting purposes.
- A 10-point numeric scale with 0 representing one pain extreme (e.g., no pain), and 10 representing the other pain extreme (e.g., "pain as bad you can imagine" and "worse pain imaginable"). Patients are instructed to select the numerical value on a segmented scale that most accurately represents their pain intensity, with scores ranging from 0 to 10. Higher scores correspond to more intense pain levels.
- Reliability: High test-retest reliability has been observed in both literate and illiterate patients with rheumatoid arthritis (r=0.96 and 0.95, respectively) before and after medical consultation.
- Validity: For construct validity, the NPRS was shown to be highly correlated to the VAS in patients with rheumatic and other chronic pain conditions (pain>6 months) range from 0.86 to 0.95.

Patient-Rated Tennis Elbow Evaluation Questionnaire (PRTEE) [15]

- PRTEE has demonstrated sufficient clinical measuring properties. It demonstrated excellent reliability (ICC 0.89, 0.83, and 0.89, respectively) in the pain, function, and total scores.
- The reliability was assessed by subgroups (chronic vs. acute; men vs. women; work-related vs. non-work-related), the ICCs showed good reliability, and the score was greater than 0.75

METHODOLOGY

Procedure:

1. Subjects with tennis elbow pain more than 6 week will be recruited from OPD of Venus Institute of Physiotherapy and Clinics near Gandhinagar
2. They were assessed for inclusion and exclusion criteria and assessment form and consent form will be taken
3. Selected subjects were randomly divided into 2 groups after assessing for NPRS and grip strength:
4. Group A: Eccentric Exercise + Ultrasound
5. Group B: Muscle Energy Technique+ Ultrasound
6. The treatment regimen lasted for six weeks, after which post-treatment NPRS scores and grip strength were assessed.
7. Result and Conclusion

Group A: Eccentric Exercise+ Ultrasound [16]

- The wrist extensor eccentric strengthening exercise group performed wrist muscle eccentric contraction exercises using The dumbbell, with the affected side forearm in the state of internal version made after placing the forearm on the edge of the table and with the hand placed outside the table.
- The exercises were performed slowly, extending the affected hand with the help of the unaffected hand during wrist extension. The unaffected hand also assisted the affected hand during the eccentric control exercise, ensuring that the exercise was conducted within a pain-free range.
- Each exercise set consisted of 15 repetitions. Five sets were performed, with a 1-minute break between each set.

Group B: Muscle Energy Technique+ Ultrasound [17]

- In this technique therapist stabilizes, the subject's arm distally with one hand, and the subject's forearm will be supinated with the therapist's other hand until resistance or discomfort will be detected.
- While the position will held, the subject briefly pronated the forearm (isometric contraction approximately 75% of maximal) against resistance for a period of 5 s, followed immediately by slightly increased supination until resistance will met once again.
- After each period of 5 seconds of relaxation, the procedure was repeated five times within a single treatment session.
- This technique was applied in 5 sessions/week for 6 weeks

Ultrasound [18]

- Pulsed mode
- 20% duty cycle
- intensity of 1.5 w/cm^2
- Frequency of 1MHz,
- 5 to 7 minutes
- 3 days a week for 6 weeks

RESULTS

Study variable was taken before starting sessions on both groups and at the end of the study, study variable was NPRS and PRTEE.

Age Distribution:

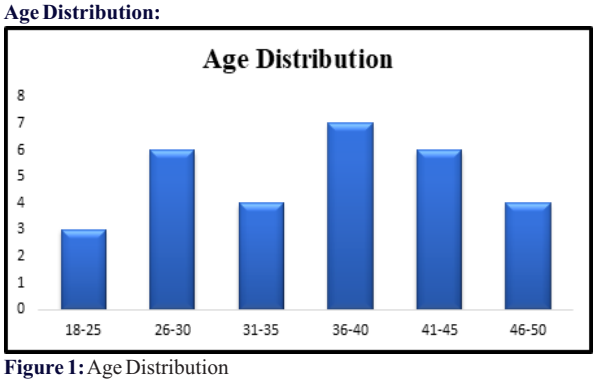

Figure 1: Age Distribution

Age group was between 18-50 years. Among a total of 30 tennis elbow subjects, 3 were between 18-25 years, 6 were between 26-30 years, 4 were between 31-35 years and 7 were between 36-40 years. The mean age of participants was 35±15 years.

Gender Distribution:

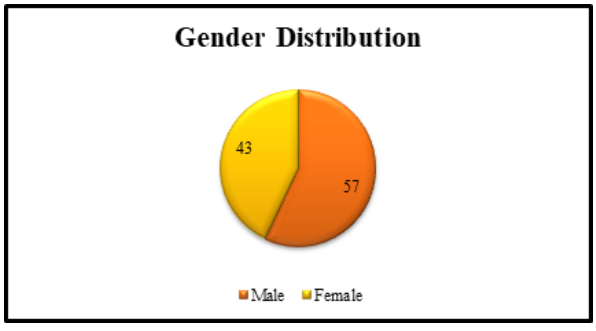

Figure 2: Gender Distribution

Out of a total of 30 subjects with tennis elbow, 43% were female and 57% were male.

Data Analysis:

Statistical analysis was conducted on the data collected from 30 patients. Data was analyzed using SPSS Version 25.0. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired 't' test used for comparing data within each group and independent 't' test for comparing between the groups. Data was considered statistically significant with P<0.05 and highly significant at p<0.01. Pre and post mean difference of NPRS shows 1.4 in group A and 1.9 in group B. Pre and post mean difference of PRTEE shows 15.07 in group A and 10.23 in group B. As p<0.05 there is significant difference between two groups.

Table 1: Paired "t" Test Values For NPRS

Group	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A	1.4	0.63	6.83	P<0.05
Group B	1.9	0.52	10.16	P<0.05

Table 1 and Figure 6 shows mean values of NPRS. In group A it is 1.4±0.63 and in group B it is 1.9±0.52.

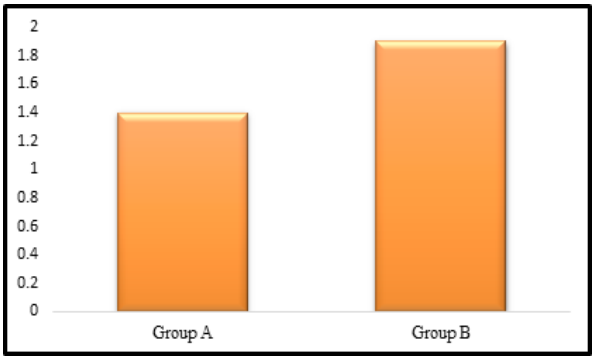

Figure 3: Mean Values of NPRS

Table 2: Paired "t" Test Values For PRTEE

Group	Mean Difference	Standard Deviation	"t" Value	"p" Value
Group A	15.07	12.43	4.69	P<0.05
Group B	10.23	8.89	4.57	P<0.05

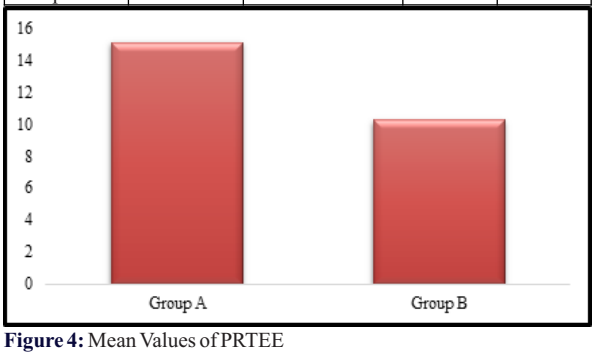

Figure 4: Mean Values of PRTEE

Table 2 and Figure 7 shows mean values of PRTEE. In group A it is 15.07±12.43 and in group B it is 10.23±8.89.

Table 3: Independent "t" Test Values

Outcome Measure	"t" Value	"p" Value
NPRS	-1.66	P<0.05
PRTEE	0.13	P<0.05

Table 3 shows Independent "t" test for NPRS and PRTEE. It is -1.66 for NPRs and 0.13 for PRTEE, which correctly shows between group analysis of Group A and Group B.

DISCUSSION

Outcome of the study is to compare the Effect of eccentric exercise versus Muscle energy technique on pain and function in Tennis Elbow: A comparative study. Total 30 patients between age of 18-50 years were taken.

Present study shown there is more significant effect seen in Eccentric group than MET group. Both groups shown statistically significant effect pre and post measurement but there is greater improvement seen in Eccentric group in between group analysis.

It is theorized that eccentric exercise might inhibit the production of substances that contribute to pain in tendinosis. Tendinosis pain is also associated with Neovascularization. Eccentric exercise has the potential to inhibit the growth of blood vessels in tendinosis, thereby potentially reducing associated pain. Normal tendons and ligaments consist mostly of Type I collagen, with smaller amounts of Type III collagen. When tendinosis was developed, some of collagen is injured and breaks down. In chronic tendinosis the body is not able to repair the collagen properly. The tenocytes cultured from tendinosis continue to produce abnormal collagen outside of the body; the tenocytes produced collagen with abnormally high Type III to Type I ratios.

Eccentric training was found to increase collagen synthesis, whereas this was unchanged in the healthy tendons. Specifically, there was increased peritendinous Type I collagen, which is the main type of collagen in normal tendons, and this occurred without a corresponding increase in collagen degradation. These changes corresponded with a decrease in pain levels. Eccentric exercise can potentially increase tendon mass due to the augmented deposition of type I collagen. This boost in type I collagen production could be particularly advantageous, as fibroblasts in tendinosis-affected areas typically produce a higher proportion of the mechanically weaker type III collagen compared to those in healthy tendons. Therefore, eccentric exercise might help fortify the tendon and safeguard it against future overuse injuries.

It was claimed that Eccentric Training results in tendon strengthening by stimulating mechanoreceptors in tenocytes to produce collagen, which is the key cellular mechanism that determines recovery from tendon injuries. Moreover, eccentric training can trigger a response that normalizes elevated concentrations of glycosaminoglycans. It may also improve collagen alignment of the tendon and stimulate collagen cross-linkage formation, both of which improve tensile strength of tendon. Mechanical loading during eccentric exercise accelerates the metabolism of tenocytes, which may enhance the speed of repair. [19]

MET also showed better improvement and This could be explained by the hypothesis suggested in 1997 study, Taylor et al. proposed that combining contractions and stretches, as utilized in Muscle Energy Technique (MET), could be more effective in generating viscoelastic changes than passive stretching alone. This is attributed to the greater forces involved, which enhance viscoelastic changes and passive extensibility. Applying MET to enhance the extensibility of myofascial tissue seems to affect not just the viscoelastic and plastic properties of the tissue, but also autonomic-mediated alterations in extracellular fluid dynamics and fibroblast mechanotransduction.[20]

Magnus Peterson et al. did a study on A randomized controlled trial of eccentric vs. concentric graded exercise in chronic tennis elbow (lateral elbow tendinopathy) and concluded that Eccentric graded exercise reduced pain and increased muscle strength in chronic tennis elbow more effectively than concentric graded exercise.[14] This study supports our finding.

Ravichandran Hariharasudhan et al. did a study on Effectiveness of muscle energy technique and Mulligan's movement with mobilization in the management of lateral epicondylalgia. Their result concludes that mobilization with the movement of elbow appears to be more effective manual technique in treating tennis elbow in comparison with MET. Their results correlate our finding.[17]

CONCLUSION

Results of present study confirms that Eccentric exercise is more effective than muscle energy technique in treatment of tennis elbow.

Conflict Of Interest

There Is No Conflict Of Interest.

Abbreviations

LET: Lateral Elbow Tendinopathy, MET: Muscle Energy Technique, PRTEE: Patient-Rated Tennis Elbow Evaluation Questionnaire, NPRS: Numeric Pain rating Scale, VAS: Visual Analogue Scale, SPSS: Statistical Package for The Social Sciences

Ethical Approval

Ethical approval was not required.

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