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Original Research Article

Effects of Progressive Strengthening Exercises in Chronic Lateral Epicondylitis

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ABSTRACT

Background: Tennis elbow is a work-related pain disorder of common extensor muscles, usually caused by excessive quick, repetitive movements of the wrist and forearm. These quick movements may rupture proximal attachment of long extensor muscles and cause local inflammation and pain. Progressive slow, repetitive strengthening of damaged attachment of wrist extensors so that it can better tolerate repetitive movements might be beneficial.
Objectives: To determine effects of progressive strengthening exercise programme and to compare effect of this intervention with conventional treatment (i.e. local pulsed ultrasound, deep transverse friction massage and stretching exercises) in relieving pain, improving functional disability and on maximal isometric grip strength in patients with chronic lateral epicondylitis.
Methods: Study included 30 patients with chronic lateral epicondylitis between ages 31-54 years. The subjects were randomly divided into 2 groups: Group-A and Group-B. They were treated for 6 weeks, 6 days a week once daily. Pain at rest was assessed by VAS, functional disability by PRTEE questionnaire and maximal isometric grip strength with Jamar dynamometer.
Results: Results showed significant improvement in VAS, maximal isometric grip strength and PRTEE questionnaire in both groups. Comparison of Group A and Group B was done with Wilcoxon Rank sum test and unpaired t-test. Group A showed significant improvement in VAS (P=0.0003), maximal isometric grip strength (P=0.0131) and PRTEE questionnaire (P=0.0025).
Conclusion: Progressive strengthening exercises along with conventional physiotherapy is more effective in relieving pain, improving functional disability and improving pain free maximal isometric grip strength than conventional physical therapy alone in patients having chronic lateral epicondylitis.

Key Words: Chronic Lateral Epicondylitis, Progressive Strengthening Exercises, Maximal Isometric Grip Strength

INTRODUCTION

'Tennis elbow' or lateral epicondylitis is the one of the most common lesions of the arm. [1] Lateral epicondylitis (tennis elbow) is an overuse injury involving the extensor muscles that originate on the lateral epicondylar region of the distal humerus. It is more properly termed a tendinosis that specifically involves the origin of the extensor carpi radialis brevis muscle. [2-5] It is generally work related or sport related pain disorder of the arm, usually caused by excessive, quick, repetitive movements of the wrist and forearm. These quick movements may rupture the proximal attachment of the long extensor muscles and cause local inflammation and pain. [6]

'Tennis elbow' also known as 'Lateral epicondylitis' or 'Lateral epicondylalgia' are terms used to describe a myriad of symptoms about the lateral aspect of the elbow joint. [7]

Tennis elbow is a painful and debilitating musculoskeletal condition that impacts substantially on society and challenges the healthcare industry. [8] It is characterized by pain on direct palpation over the lateral epicondylar region of the elbow joint and pain and weakness with gripping activities. [9] Activities that use the muscles that extend the wrist (e.g. pouring a pitcher or gallon of milk, lifting with the palm down) are characteristically painful and Morning stiffness usually present. [10]

Up to 50% of all tennis players experience some type of elbow pain and 75-80% of these elbow complaints are attributed to tennis elbow. [7] It can occur in tennis players due to repetitive extension of the wrist joint against a resistant force and with similar movement such as baseball, swimming, gymnastics and golf. [11] It is related to physical workplace factors among males and females to combination of high levels of physical work and low social support. [12] High physical strain at work or being employed in jobs with manual tasks seems to act as negative prognostic factor at long term. [13] Moreover, use of computers also has been associated with the development of this condition. [14] Industrial athletes have certain occupational and leisure activities that lead to overuse injuries of the forearm wrist extensors, causing pain at the lateral epicondyle. These include carpenters, bricklayers, seamstresses and tailors, politicians (excessive handshaking), and musicians (e.g., pianists, drummers).

This injury is a major challenge, as it is difficult to treat, prone to recurrence and may last for several weeks or months with average duration of a typical episode reported to be between six months and two years. [15]

Conservative treatment program for people with lateral epicondylitis have focused primarily on the pain control by ultrasound, anti-inflammatory medication, phonophoresis followed by rehabilitation program including flexibility and strengthening. Acupuncture, orthotics, taping, extra corporeal shock wave therapy, LASER, ionization have also been studied for management of lateral epicondylitis. [7] Activity modifications such as avoidance of grasping in pronation and substituting controlled supination during lifting may relieve symptoms. [16]

There are several recommendations regarding prevention, treatment, and avoidance of recurrence that are largely speculative including Stretches and progressive strengthening exercises to prevent re-irritation of the tendon. [17] There is little evidence to support the value of these interventions for prevention, treatment, or avoidance of recurrence of lateral epicondylosis. [18]

Progressive resistance exercise (PRE) is a method of increasing the ability of muscles to generate force. Across many conditions, PRE was shown to improve the ability to generate force, with moderate to large effect sizes that may carry over into an improved ability to perform daily activities. [19] The principles of progressive resistance exercise (PRE) for increasing force production are (1) to perform a small number of repetitions until fatigue, (2) to allow sufficient rest between exercises for recovery, and (3) to increase the resistance as the ability to generate force increases. These principles are detailed in the guidelines of the American College of Sports Medicine (ACSM). [20] If a lack of force generation by muscles is an impairment contributing to an inability to perform everyday activities, then this provides a rationale for physical therapists to apply the principles of PRE when designing treatment programs. [19]

Progressive, slow, repetitive strengthening of the damaged attachment of the wrist extensors so that it can better tolerate repetitive movements might be beneficial. In chronic lateral epicondylitis, progressive strengthening exercise therapy is found more effective than ultrasound in reducing pain and improving patients' ability to work. [6] Scientific evidence in favour of any specific treatment for lateral epicondylitis is poor. [21]

Due to lack of scientific evidence, the purpose of this study is to determine the effects of progressive strengthening exercises programme in patients with chronic lateral epicondylitis and to compare the effects of progressive strengthening exercises and conventional physiotherapy treatment with conventional physiotherapy treatment in patients with chronic lateral epicondylitis.

MATERIALS AND METHODS

An experimental study was conducted to find the effects of progressive strengthening exercises programme in relieving pain, on maximal isometric grip strength and on functional outcome in patients with chronic lateral epicondylitis at Government Physiotherapy College, Civil Hospital Campus, Ahmedabad. All the patients were referred from Orthopedic Out Patient Department, Civil Hospital, Ahmedabad. The sample size consisted of 30 (Thirty) patients who were diagnosed with Chronic Lateral Epicondylitis, as per the inclusion Criteria and exclusion Criteria. The total duration of study was 6 weeks. The patients were treated in physiotherapy department daily for a period of 6 weeks, one session daily. The patients also performed the exercise programme four to six times daily at home.

Inclusion criteria for the study were patients: 1) between Age: 30 – 60 years, 2) Sex : both sex, 3) Local tenderness on palpation over the lateral epicondyle, 4) Clinically diagnosed patients of lateral epicondylitis with minimum duration of 3months and 5) Positive Mill's test. Patients having cubital osteoarthritis, carpal tunnel syndrome, rheumatic arthritis, cervical radicular syndrome, severe cervical spondylitis, painful shoulder or rotator cuff tendonitis, previous trauma, fracture or surgical procedure around the elbow, history of immobilization of elbow, any neurological disorder like stroke, head injury, restriction of the wrist motions, osteoporosis or pathological disorder like malignancy or referred pain were excluded from the study.

Procedure:

Subjects referred from orthopedic OPD were screened for their suitability as per inclusion and exclusion criteria. The selection of subjects was done by simple random sampling. A total of thirty subjects were selected for the study and assigned to either the control or experimental groups according to their order of appearance.

Assessment:

On the first visit, a complete Orthopedic Assessment of patients was done. Subjects who were found suitable for the participation in the study were requested to sign Consent Forms. Pre-participation Patients had completed a pain and functional disability questionnaire including visual analogue scale (VAS) and patient rated tennis elbow evaluation (PRTEE) questionnaire. Pain under strain was also assessed during testing of muscle strength. Isometric grip strength was measured with Jamar Hydraulic Hand Dynamometer. Three measurements were made and maximum value of repetitions was recorded.

Clinical Intervention:

Study participants were requested to continue normal activities and avoid other forms of treatment for the duration of the study, apart from routine physician management. Subjects other than the designated protocol were not permitted to administer any other forms of electrotherapy or other techniques (steroids, acupuncture, or taping) during the intervention period of the trial.

All the subjects were randomly selected and allocated into 2 groups, 15 in each group. Group A (Experimental group): In this group patients were given Progressive Strengthening Exercises and conventional therapy (i.e. Ultrasound + Deep transverse friction massage + stretching exercises), and Group B (Control group): In this group patents were given Conventional therapy (i.e. Ultrasound + Deep transverse friction massage + stretching exercises).

The treatment for each group was continued for six weeks during which time they had no other treatment. The questionnaires, clinical examination and isometric grip testing were done with the exactly same protocols after the treatment period i.e. at the end of six week.

Progressive Strengthening Exercises Programme: [6]

The 15 patients in this group were trained in a four set strengthening exercise programme. Each programme included ten repetitions in two or three series for each exercise. The forth step was a versatile occupational training programme. Every exercise period ended with stretching for at least 30 seconds in both flexion and extension and each individual movement was done slowly while the patient counted to ten. The patients were also asked to perform the exercise programme four to six times daily at home.

STEP 1

Clenching fist strongly
Resisted wrist extension
Resisted wrist flexion
Wrist rotation with a stick

STEP 2

Resisted exercises against an elastic band for wrist extension, flexion, radial deviation and ulnar deviation

STEP 3

Patient asked to perform combined wrist rotary movements using e.g. table top as a support. Direction of resistance and direction of movement was as below.

- Upwards, resisted from below
  - Towards the little finger
  - Towards the thumb
- Downwards, resisted from above
  - Towards the little finger
  - Towards the thumb

Patient was in standing position and asked to press hands against a wall.

STEP 4

This was an occupational training programme, including:
Soft ball compressing exercises
Transferring buttons from cup into another
Twisting a towel into the roll
Rotating hand on a table, in both direction, etc.

Figure 1: Clenching fist strongly

Figure 2: Resisted wrist extension (manually)

Figure 3: Resisted wrist extension (using dumbbell)

Figure 4: Resisted wrist flexion (manually)

Figure 5: Resisted wrist flexion (using dumbbell)

Figure 6: Wrist rotation with a stick

Figure 7: Wrist extension against an elastic band

Figure 8: Wrist flexion against an elastic band

Figure 9: Wrist radial deviation against an elastic band

Figure 10: Pressing hands against a wall

Figure 11: Twisting a towel into roll

Conventional Therapy Programme:
Patients allocated in this group were given ultrasound therapy, deep transverse friction massage and stretching exercises for wrist extensors and flexors. Detail protocol of treatment was as given below.

Ultrasound: [22]
Dosage used was as follow.
Mode: Pulsed
Duty cycle: 20%
Frequency: 1 MHz
Intensity: 1 Watt/ cm^2
Duration: 5 minutes/ session
The radiated area was 5 cm^2 over the common extensor origin.

Deep transverse friction massage (DTFM): [23]
Friction massage was carried out by using both thumbs distal to lateral epicondyle; Direction of movement was transverse across the fibers of common extensor origin. Movements of thumbs (transverse friction movement) were of small amplitude and regulated pressure, throughout the treatment was given. [23]

Stretching exercises of wrist extensors and flexors: [24]
Patient was sitting in a chair adjacent to the plinth with the forearm supported. The patient's forearm was stabilized with one hand by therapist proximal to wrist joint and dorsal aspect of subject's hand was grasped with other hand and stretch force applied in direction of wrist flexion for stretching of wrist extensors. For stretching of wrist flexors, subject's volar aspect of hand was grasped and stretch force is applied in the direction of wrist extension. Stretching was maintained for 15 – 20 seconds. Five repetitions of stretching with interval of 30 seconds were given. [24]

Outcome Measures:
Visual Analogue Scale: Visual analogue scale is used to represent measurement quantities, in terms of a straight line placed horizontally on paper. The subject is asked to place a mark on that line, which is 10 cm in length. The left end of line represents no pain and right end represents severe pain. Visual analogue scale is considered to be one of the best methods available for the estimation of the intensity of pain. VAS has been found to be easy to administer, highly reliable and valid tool in the clinical measurement of acute and chronic pain. [25]

Figure 12: Stretching of wrist flexors (manually)

Figure 13: Stretching of wrist extensors (manually)

Figure 14: Self-stretching of wrist flexors

Figure 15: Self-stretching of wrist extensors

Maximal Isometric Grip Strength: Grip strength is a reliable, objective measure of isometric strength of hand. [26] Maximum isometric grip strength was measured in kilograms using Jamar hydraulic hand dynamometer. Measurement was taken with subject in sitting, elbow flexed at 90 degree with forearm in neutral position and wrist in extension and ulnar deviation. Three measurements were made and maximum value of repetitions was recorded.Reliability and validity of Jamar dynamometer is already established. [27]

Figure 16: Maximal Isometric Grip Strength measurement using Jamar hydraulic hand dynamometer

Patient Rated Tennis Elbow Evaluation Questionnaire: Formerly known as the Patient rated forearm evaluation questionnaire (PRFEQ) is recently changed to the Patient rated tennis elbow evaluation questionnaire PRTEE) to indicate that the measure is specifically designed for tennis elbow. It is a15 item questionnaire designed to measure forearm pain and disability in patients with tennis elbow. The PRTEE allows the patients to rate their levels of tennis elbow pain and disability on scale of 0 to 10.It consists of 2 subscales: 1) Pain subscale having 5 items and 2) Functional subscale, in this specific activities having 6 items and usual activities having 4 items. A total score can be computed on a scale of 100.Reliability and validity of PRTEE questionnaire was checked in previous studies. [28]

STATISTICAL ANALYSIS AND RESULT

The outcome measures were pain measured on visual analogue scale, functional measurement by PRTEE (Patient rated tennis elbow evaluation) questionnaire and maximal isometric grip strength with Jamar hydraulic hand dynamometer taken on the 1st day & after completion of training i.e. at the end of six weeks.

Data analysis was performed by using SPSS software.

The table 1.1 shows the gender, age and duration of symptoms distribution of the 30 subjects participated in the study.

Table 1.1: Gender, age and duration of symptoms distribution of the patients

	Group A	Group B
Male Count (%)	8 (53.33%)	7 (46.67%)
Female Count (%)	7 (46.67%)	8 (53.33%)
Age (Years)	43.067 ± 6.573	41 ± 7.672
Duration of symptoms under 6 months	6	7
Duration of symptoms above 6 months	9	8

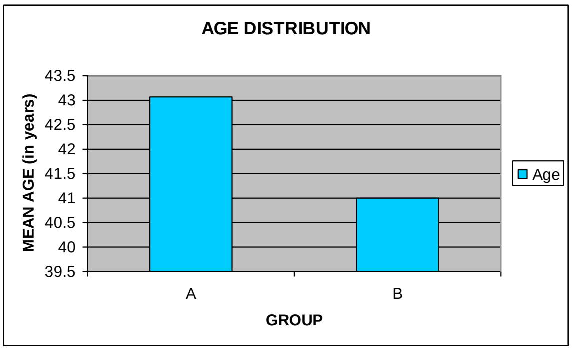

Figure 17: Age distribution of patients

Data Analysis of Pain Scores as On Vas Scale

Since the data was not normally distributed, Wilcoxon matched-pairs signed test was applied for comparison of pre treatment and post treatment pain scores as on VAS within Group A and Group B and Wilcoxon ranked sum (Mann-Whitney) test was applied for comparison of post treatment VAS score between Group A and Group B.

By analyzing pain scores as on VAS as outcome measures for both the groups, following results were obtained. (Table 1.2 and 1.3)

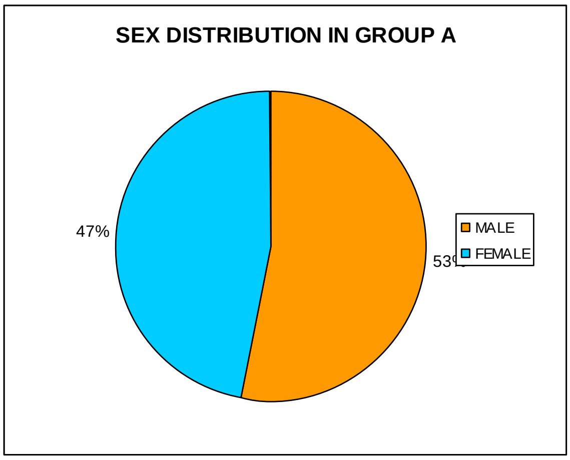

Figure 18: Sex distribution in Group A

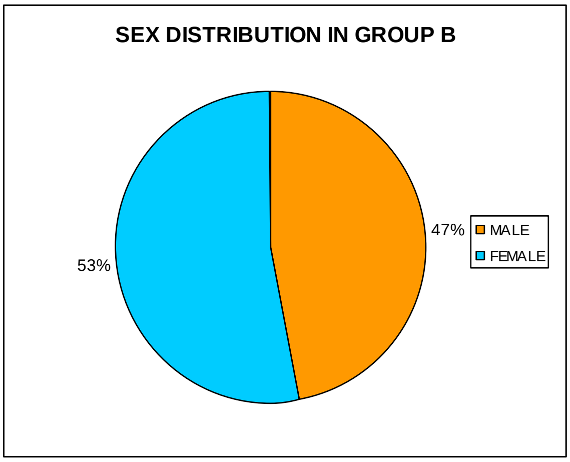

Figure 19: Sex distribution in Group B

Table 1.2: Comparison of pre treatment and post treatment pain scores as on VAS within Group A and Group B

Group	Pre treatment		Post treatment		W value	p value
	Mean	SD	Mean	SD		
Group A	7.00	1.690	2.40	1.242	120	<0.0001
Group B	6.933	1.387	4.667	1.280	120	<0.0001

Table 1.3: Comparison of post treatment VAS score between Group A and Group B

Group	Mean	SD	W value	p value
Group A	2.400	4.667	146.50	0.0003
Group B	4.667	1.447	318.50	

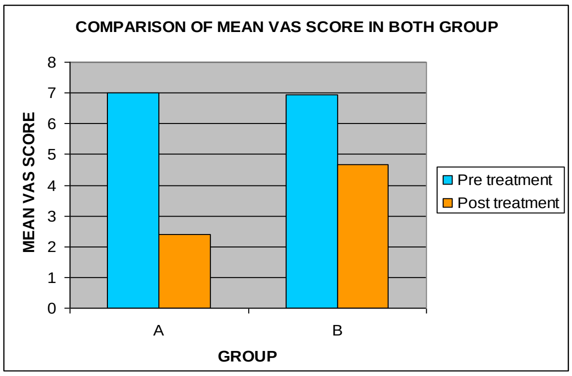

Figure 20: Comparison of mean VAS Score in both Groups

Data Analysis of Maximal Isometric Grip Strength

Paired t test was applied for comparison of pre treatment and post treatment maximal isometric grip strength within Group A and Group B and unpaired t test was applied for comparison of post treatment maximal isometric grip strength between Group A and Group B.

By analyzing data of maximal isometric grip strength as outcome measures for both the groups, following results were obtained. (Table 1.4 and table 1.5)

Table 1.4: Comparison of pre treatment and post treatment maximal isometric grip strength within Group A and Group B

Group	Pre treatment isometric grip strength (in kg.)		Post treatment isometric grip strength (in kg.)		t value	p value
	Mean	SD	Mean	SD		
Group A	17.540	5.272	27.540	9.751	8.232 with 14 d.f.	<0.0001
Group B	18.133	5.371	19.911	5.708	4.469 with 14 d.f.	<0.0005

Table 1.5: Comparison of post treatment Maximal isometric grip strength between Group A and Group B

Group	Mean	SD	t value	p value
Group A	27.644	9.751	2.651 with 28 d.f.	0.0131
Group B	19.911	5.708		

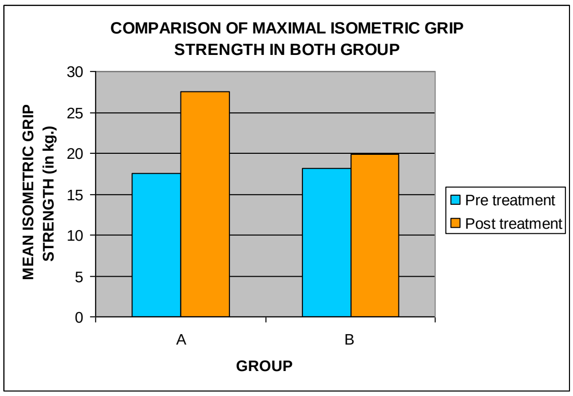

Figure 21: Comparison of Maximal isometric grip strength in both groups

Data Analysis of PRTEE Questionnaire Score

Since the data was not normally distributed, Wilcoxon matched-pairs signed test was applied for comparison of pre treatment and post treatment PRTEE questionnaire score within Group A and Group B and Wilcoxon ranked sum (Mann-Whitney) test was applied for comparison of post treatment PRTEE questionnaire score between Group A and Group B.

By analyzing data on PRTEE questionnaire as outcome measures for both the groups, following results were obtained. (Table 1.6 and 1.7)

Table 1.6: Comparison of pre treatment and post treatment PRTEE questionnaire score within Group A and Group B

Group	Pre treatment		Post treatment		W value	p value
	Mean	SD	Mean	SD		
Group A	31.267	10.762	11.967	4.904	120	<0.0001
Group B	32.233	11.531	21.000	8.531	120	<0.0001

Table 1.7: Comparison of post treatment PRTEE questionnaire scores between Group A and Group B

Group	Mean	SD	T value	p value
Group A	11.967	4.904	159.00	0.0025
Group B	21.000	8.531	306.00	

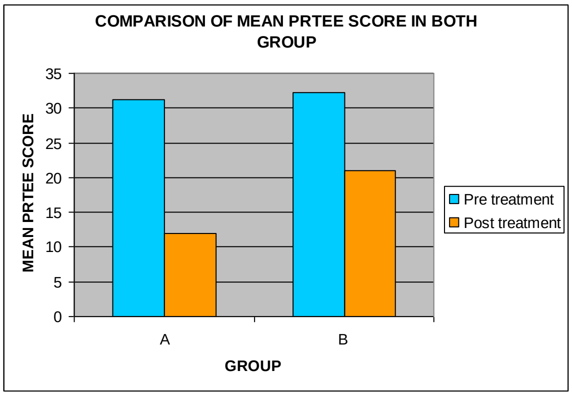

Figure 22: Comparison of mean PRTEE Score in both groups

DISCUSSION

The results of present study showed that reduction in pain, improvement in functional status and improvement in maximal grip strength was appreciably significant in both the groups. The results indicated that the progressive strengthening exercise therapy when given along with conventional therapy resulted in significantly better subjective and objective outcomes then conventional therapy alone in patients with chronic lateral epicondylitis.

Tennis elbow is traditionally described as an overuse injury where the ability of the tendon to repair itself becomes overwhelmed. It was suggested that tissue experiencing lower strain levels, predisposes specific regions of the tendon to structural weakening. [29] This leads to hampering the subject's activities of daily living. To measure this functional disability PRTEE questionnaire was chosen as an outcome measure. According to McDermid (2001), it is a primarily client self rated perception of pain and functional scale that is a reliable and valid measure of disability. [28]

The characteristic of tennis elbow is the pain present on direct palpation over the lateral epicondylar region and with gripping activities. Visual analogue scale is the most commonly used scale to observe the subjective pain therefore it was taken as an outcome measure. [30]

According to Pienemaki (2002), there is a strong association between pain on palpation at the lateral epicondyle, pain provocation by manual tests and maximum grip strength. [31] According to Stratford et al (1993), the maximum grip strength demonstrated the greatest responsiveness to change following an intervention. [32] This was the reason for selecting the maximum grip strength as an outcome measure.

The electrotherapeutic modality given was ultrasound. Pain relief by ultrasound occurs by directly influencing the transmission of painful impulses by eliciting changes within the nerve fibers and elevating pain threshold. [33] Whereas indirect pain reduction occurs as a result of increased blood flow and increased capillary permeability to the affected area. This effect of pain reduction was reflected by reduction on the score of VAS.

According to Byl, NN (1992) cycloaminoglycan and hydroxyproline which were the essential components for collagen production were increased following low dose pulsed ultrasound. Cavitation and acoustic streaming facilitate collagen synthesis. This increased rate of collagen synthesis in tendon results in healing and increased tensile strength of tendon. [33]

Binder A et al (1985) studied the effectiveness of ultrasound in lateral epicondylitis patients. He compared ultrasound with placebo. He found improvement in pain score, weight lifting test and grip strength. [34] Pulse ultrasound was not found to be effective as a sole treatment in treating chronic epicondylar pain. Similar procedure used in the study by Haker and Lundenberg (1991) in which they report no beneficial effect for pulsed ultrasound over placebo ultrasound. [9]

Deep transverse friction massage was given in both the groups. In tendonitis, as there is a lack of tendon extensibility, [35] increased extensibility and mobility to the tendon was promoted by deep transverse friction massage. Increased mobility to the tendon was accompanied by increased functional performance of the subjects. This was reflected in decreased score of functional component of PRTEE questionnaire.

In the experimental group, progressive strengthening exercises given. As it was hypothesized according to Pienemaki et al (1996), strengthening the damaged attachment of wrist extensors resulted in better repetitive wrist movements performed by the subjects. [6]

Pain at rest and under strain declined significantly more in experimental group. This shows that active exercises may have an effect on pain experience in patients. Reported pain under strain represents painful isometric muscle work. Pain has an important role underlying decreased muscle function and cannot be ignored in analysis of results from muscle function tests.

Additionally characteristics of a patient's occupation affect the ability to work. Different types of work produce different strains on the upper limb in different patients and, therefore, the change in ability to work in PRTEE questionnaire noted within each group is important. In the experimental group, significant improvement occur in functional outcome, hence improvement in ability to do their usual work occur than control group.

Early mobilization is reported to have good beneficial effects on the tensile strength of connective tissue scars in muscle injury in acute cases (Celberman et al, 1988; Kannus et al, 1992). [36, 37]

The rationale stressing the epicondylar attachment of ECRB through progressive eccentric and concentric resistance exercises results in the production 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, [38] 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. Other possible explanations for the positive 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.

Eccentric exercises seem to be stressful to myotendinous unit (Appell, 1990) [39] and a trend from avulsion – type failures in remobilization, has been noted in animal knee ligament studies (Larsen et al, 1987). [40] Therefore, a progressive, stepwise exercise programme can promote healing without traumatisation. It was claimed that the 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. Strengthening may improve collagen alignment of the tendon and stimulate cross linkage formation, both of which improve the tensile strength of tendon. [41]

Literatures suggest that strengthening and stretching both are main components of exercise programme, because tendons must be flexible along with strong. Positive effects of exercise programme for tendon injuries may be attributable to lengthening of muscle tendon unit by stretching and strengthening exercise which could achieve loading effect within muscle tendon unit along with hypertrophy and increased tensile strength of the tendon. [41]

The damaged epicondylar attachment area is an osteotendineal region with the properties of inflamed and atrophied tendon and, in prolonged cases, bony atrophy too. Tipton et al (1987) say that "prescribed exercises which increase the forces being transmitted to ligaments, tendons and bones will maintain and generally increase the strength and functional capacity of these structures". The same principle seems to be valid in the treatment of chronic tennis elbow syndrome. The progressive exercise treatment used in this study started with slow soft tissue – stretching exercises. The whole programme exercised muscles, tendons and ligaments and also the osteotendinous insertion region, and the forth step was a more intensive occupational programme to promote patients' daily living and ability to work.

The results were in support to the study carried out by Pienimaki et al (1996) to explore effectiveness of progressive stretching strengthening exercise to compare this treatment with the results of local pulsed ultrasound in chronic lateral epicondylitis. [6]

Martinez et al (2005) studied the Comparative Effectiveness of a Home Exercise Program Including Stretching Alone versus Stretching Supplemented with Eccentric or Concentric Strengthening among ninety four subjects for six week. He concluded that significant improvement occur in all three group in with pain-free grip strength, Patient-rated Forearm Evaluation Questionnaire, Disabilities of the Arm, Shoulder, and Hand questionnaire, Short Form 36, and visual analog pain scale. No significant differences in outcome measures were noted between the three groups. [42] The findings were consistent with the findings of the experimental study.

Limitation of our study were: 1) the sample size was small so the results cannot be generalized to population, 2) long term follow up was not carried out to provide results about endurance, and 3) home programme taught to the patients was not supervised.

CONCLUSION

Progressive strengthening exercises programme along with conventional physical therapy intervention is more effective in relieving pain, improving functional disability and improving pain free maximal isometric grip strength than conventional physical therapy alone in patients having chronic lateral epicondylitis.

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