

EFFECT OF ECCENTRIC EXERCISE PROGRAMME ON PAIN AND GRIP STRENGTH FOR SUBJECTS WITH MEDIAL EPICONDYLITIS.

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ABSTRACT

**Background and Objective:** Therapeutic eccentric exercise may provide both a structural and functional benefit during tendinopathy rehabilitation. The objective is to find the effect of eccentric exercises on improvement of pain and grip strength for subjects with Medial Epicondylitis.

**Method:** Pre to post test experimental study design randomized thirty subjects with medial epicondylitis, 15 each into Group A and Group B. Group B subjects were treated with conventional therapy and Eccentric exercises. Group A subjects were treated with conventional therapy.

**Results:** When means of post intervention were compared using Independent 't' between groups there was no statistically significant difference in improvements obtained in VAS scores and grip strength. There was a statistically significant change in means of VAS score and Grip strength when means were analyzed by using Paired 't' test and Wilcoxon signed rank test within the groups with positive percentage of change.

**Conclusion:** It is concluded that four weeks of Eccentric Exercise Programme combined with conventional therapy shown significant effect on improving pain and Grip strength, however the improvement obtained has no difference when compared with control conventional treatment for Subjects with Medial Epicondylitis.

**Key words:** Medial Epicondylitis, Eccentric exercises, ultrasound therapy, Static Stretching, Grip strength, pain.

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## INTRODUCTION

Medial epicondylitis commonly referred to as “golfer’s elbow,” is characterized by pathologic changes in musculotendonous origin at the medial epicondyle characterized by pain on palpation usually occurs over the pronator teres and the flexor carpi radialis, which is worsened by resisted wrist flexion and/or forearm pronation.<sup>1</sup> Medial epicondylitis occurs much less frequently than lateral epicondylitis, although it has been identified in patients ranging from 12 to 80 years old, it predominantly occurs in the fourth and fifth decades.<sup>1,2</sup> Among diagnoses of both epicondylitis, incidence of medial epicondylitis makes up 9.8% to 20% of all cases.<sup>1,2</sup> Male and female prevalence rates are reportedly equal. Seventy-five percent of patients are symptomatic in their dominant arms.<sup>2,3</sup> The literature on epicondylitis suggests that primary etiology is due to repetitive stress or overuse of the flexor-pronator musculature<sup>2,3</sup>. Most often changes are seen in the pronator teres and the flexor carpi radialis muscles, although larger diffuse tears can occur in the Palmaris longus, flexor digitorum superficialis, and flexor carpi ulnaris.<sup>3,4</sup> Eccentric exercise provide neuromuscular benefits through central adaptation of both agonist and antagonist muscles therefore, therapeutic eccentric exercise may provide both a structural and functional benefit during tendinopathy rehabilitation.<sup>4,5,6</sup> It has been successfully used in the treatment of Achilles and patellar tendinopathies, lateral epicondylalgia.<sup>6-13</sup> It was found that there was reduced pain and increased grip strength following twelve weeks of home training eccentric exercise in patients with medial epicondylalgia.<sup>14,15</sup> Eccentric training markedly showed improved DASH score,

VAS, tenderness measurement, and wrist and middle finger extension after eccentric wrist extension exercise with standard physical therapy in chronic unilateral lateral epicondylitis.<sup>16</sup> Stanish W D stated that disruption of tendon, micro or macro takes place under specific conditions of eccentric loading, therefore in order for the tendon to heal adequately, treatment program must include specific eccentric strength rebuilding exercise.<sup>17</sup>

Despite the studies on eccentric exercise that are performed on various tendinopathies, there are limited studies that have been done on medial epicondylitis showing improvement in pain and grip strength. Therefore the study with research question whether the eccentric exercise programme does have an effect on improving pain and grip strength in subjects with medial epicondylitis? Hence, the purpose of the study with objective to find the effect of eccentric exercises on improvement of pain and grip strength for subjects with Medial Epicondylitis. It was hypothesized that there will be a significant effect of eccentric exercise programme on improving pain and grip strength for subjects with Medial Epicondylitis.

## MATERIALS AND METHODS:

Pre to post test experimental study design. As this study involved human subjects the Ethical Clearance was obtained from the Ethical Committee of KTG College of Physiotherapy and KTG Hospital, Bangalore as per the ethical guidelines for Bio-medical research on human subjects. This study was registered with University No. : 09\_T031\_39085. Total 30 Subject (n=30) were recruited and study was conducted at K.T.G. Hospital Bangalore. Subjects included were with age group between 30 to 50 years<sup>1</sup>, complained pain over the medial

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epicondyle of the humerus-ulnar side<sup>4</sup> since more than four weeks, pain on palpation over forearm flexor-pronator muscles origin, pain during resisted flexion of the wrist and resisted pronation of the forearm<sup>4</sup>, local tenderness over the medial epicondyles<sup>1</sup>, positive test for Golfers Elbow<sup>1</sup>. Subject excluded were with history of Upper limb fractures and any upper limb surgery, cervical radiculopathy<sup>4</sup>, ulnar neuropathy<sup>4</sup>, elbow joint pain<sup>4</sup>, and previous treatment for medial epicondylitis within three months.

#### **Procedure of randomization:**

Subjects who fulfilled the inclusion criteria and agreed to participate in the study, an informed written consent were taken from the subjects. Subjects were randomly allocated into two groups of 15 each by using thirty pieces of paper asking subjects withdraw a paper from the box, corresponding to the paper 15 subjects with the letter "A" were enlisted under control treatment and the other 15 subjects with the letter "B" under eccentric exercises treatment.

#### **Procedure of Intervention**

Group B: treated with eccentric exercise program with conventional therapy such as static stretching, ultrasound therapy and Group A treated with conventional therapy such as static stretching and ultrasound therapy as control treatment. Both group received treatment for the duration of four weeks: five sessions in a week.

#### **Intervention for group B (Eccentric exercise group):**

An eccentric exercise was performed after warm-up. Warm-up for forearm flexor and extensor muscles with wrist movements was performed without any load for duration of 1-2 minutes followed by static

stretch of the wrist flexor muscles 30-45 sec each for 3 times.<sup>4,17</sup>

#### **Eccentric exercises for forearm flexor muscles:**

Patient sitting next to a table on which the forearm rested in supination and the elbow flexed at about 90°, the wrist slightly flexed with the palm facing the ceiling outside the table holding a weight. The weight is slowly lowered by extension of the wrist at the rate of 5-7 seconds per movement. The hand with the weight is brought back to the starting position supported by the other hand. Three sets of 5 repetitions were performed. Patients 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. Exercises were performed three sets of 10 repetitions at each treatment session, with at least a one minute rest interval between each set. When patients were able to perform the eccentric exercises without experiencing any minor pain or discomfort, the load was increased using free weights or therabands.<sup>4,17</sup>

**Static stretching:** Patient sitting next to a table on which the forearm rested in supination and the elbow flexed at about 90°, then patient was instructed to do static stretch of the wrist flexor muscles by performing passive full wrist extension and holding it in this position without discomfort for 30-45 seconds and repeat for 3 to 5 times once in a day.<sup>18</sup>

**Ultrasound therapy:** "Pulsed" mode Ultrasound therapy with on to off ratio of one to four (1:4) and a frequency of 1 MHz It was given in contact, using Electro Medical Supplies' ultrasonic coupling medium. The space averaged intensity was increased from 1 to 2 W per cm<sup>2</sup> and treatment time

was five to ten minutes during the course of treatment. Twelve treatments were given three sessions per week over four weeks.<sup>19</sup>

#### **Intervention for Group A (Control treatment):**

**Control group:** in this group subjects were given a static stretching and ultrasound therapy same as study group but there were no eccentric exercises was given. Twelve treatment sessions were given three per week over four weeks.<sup>17, 18, 19</sup>



**Figure 1: Subjects performing Eccentric exercises.**

#### **OUTCOME MEASUREMENTS:**

Measurements such as Pain using Visual analogue scale and Handgrip Strength using handgrip dynamometer were measured.<sup>20-25</sup>

**Visual Analogue Scale:** A linear rating scale, where a 10 cm line is presented to the subjects with “No Pain” and “Maximum pain” at either ends of the line. The subject was requested to place a mark on the line that corresponds to the current level of pain intensity perceives. The distance from the point of no pain to the mark was measured in centimeters and used as pain intensity index in numerical.<sup>20,21</sup>

**Handgrip Strength Measurement:** The use of the instrument was illustrated to the participants prior to testing. The grip strength affected hand was measured using a standard adjustable handgrip dynamometer in standing position with the shoulder in 180 degrees of flexion, elbow 0 degree flexion and wrist in 15 to 30 degrees of extension. The handle of

the dynamometer was adjusted properly. The base of the dynamometer was rested on first metacarpal and the handle was rested on middle of four fingers. The subject was asked to squeeze the dynamometer with maximum isometric effort, which was maintained for about 5 seconds being careful to squeeze only once for each measurement. No other body movement was allowed. The subject was strongly encouraged to give maximum effort. Three readings were taken giving 30 seconds rest period in between to avoid fatigue. Handgrip dynamometer was calibrated before each assessment. The mean of three best readings was taken as obtained in upper limb position. The result of each trial was recorded in pounds.<sup>22-25</sup>

#### **STATISTICAL METHODS:**

Descriptive statistical analysis was carried out in the present study. Out Come measurements analyzed are presented as mean  $\pm$  SD. Significance is assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as statistically significant difference. Paired ‘t’ test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre-intervention to post-intervention with calculation of percentage of change. Independent ‘t’ test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means of variables between two groups with calculation of percentage of difference between the means. Statistical software: The Statistical software namely SPSS 16.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

**RESULTS:**

From table-1 shows that in Group A there were 15 subjects with mean age of 38.60 years and there were 4 males and 11 female subjects were included in the study. In Group B there were 15 subjects with mean age 38.47 years and there were 7 males and 8 female subjects were included in the study. There is no significant difference between mean ages between the groups. The table-2 shows that there is a statistically significant change in means of VAS

score and Grip strength when means were analyzed from pre intervention to post intervention within the groups with positive percentage of change showing that there is increase in post means and negative percentage of change showing there is decrease in post means. The table-3 shows that there is no statistically significant difference in pre- intervention means and Post intervention means of VAS scores and grip strength when compared between Group A and Group B.

**Table 1: Basic Characteristics of the subjects studied**

		Group A	Group B	Between the groups Significance <sup>a</sup>
<b>Number of subjects studied (n)</b>		15	15	--
<b>Age in years (Mean± SD)</b>		38.60± 5.87 (31-47)	38.47± 6.33 (95-72)	p=0.955 (NS)
<b>Gender</b>	Males	4	7	Gender
	Females	11	8	
	Significance	0.000	0.000	
<b>Side</b>	Right	7	9	Side
	Left	8	6	
<b>Total number of subjects</b>		15	15	30

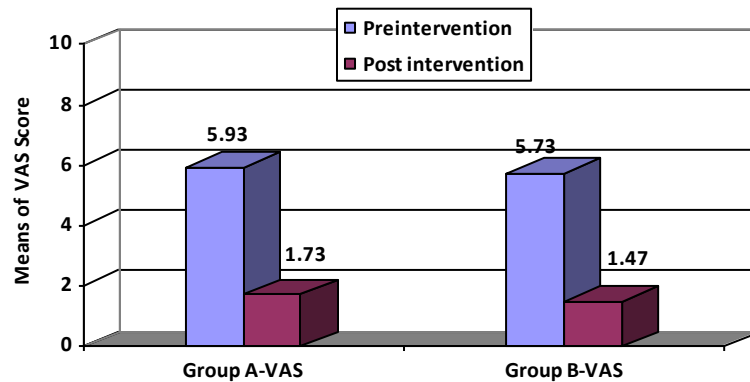
a - Pearson Chi-Square

**Table 2: Analysis of variables VAS Score and Grip Strength within the Group A and Group B (Pre to post test analysis)**

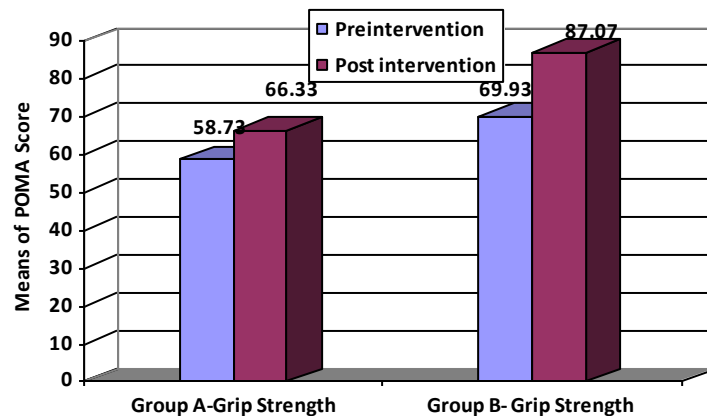
	Pre intervention (Mean±SD) min-max	Post intervention (Mean±SD) min-max	Z value <sup>a</sup> ( Non parametric) <sup>a</sup>	t value <sup>b</sup> ( Non parametric) <sup>b</sup>	Significance (1-tailed) P value <sup>b</sup>	Percentage of change	Effect size r	95%Confidence interval of the difference	
								Lower	Upper
Group A									
VAS in cm	5.93± 0.88 (5- 7)	1.73± 0.96 (0-3)	-3.437 p=0.001 **	12.322	0.000 **	-70.82%	+0.91 ( Large)	3.469	VAS in cm
Grip Strength in lbs	58.73± 22.04 (39- 98)	69.93± 24.80 (49-112)	-3.413 p=0.001 **	-8.929	0.000 **	19.07%	+0.22 ( Small)	-13.890	Grip Strength in lbs
Group B									
VAS in cm	5.73± 1.03 (4- 7)	1.47± 0.64 (1-3)	-3.473 p=0.001 **	23.482	0.000 **	-74.34%	+0.92 ( Large)	3.877	VAS in cm
Grip Strength in lbs	66.33± 20.08 (46- 99)	87.07± 27.93 (56-123)	-3.408 p=0.001 **	-5.596	0.000 **	31.26%	+0.39 ( Medium)	-28.680	Grip Strength in lbs

\*\* Statistically Significant difference p<0.05; NS- Not significant; a. Wilcoxon Signed Ranks Test. b. Paired t test.

**Chart- 1: Analysis of VAS score within the Group A and Group B (Pre to post test analysis)**



**Chart- 2: Analysis of means of Grip Strength within the Group B (Pre to post test analysis)**

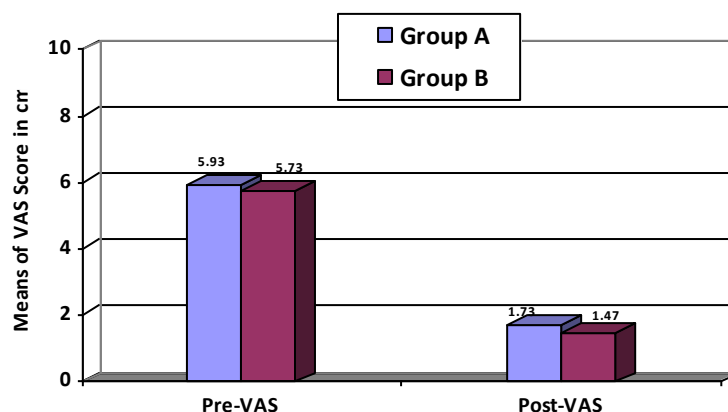


**Table 3: Comparison of means of VAS Score and Grip Strength between the groups.**

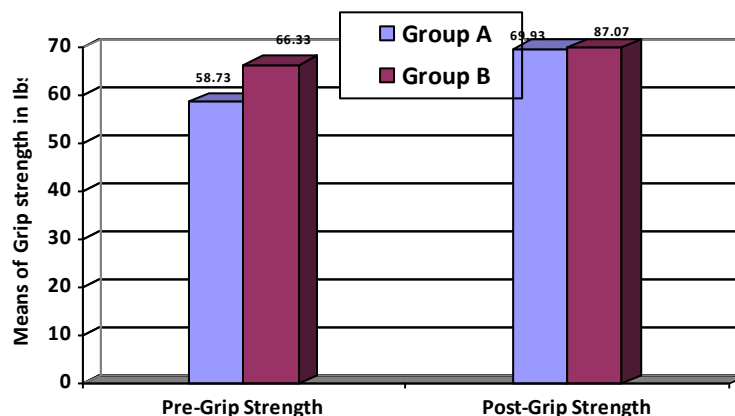
		Percentage of difference	Effect size	Z value <sup>a</sup> (Non Parametric)	t value <sup>b</sup> ( Parametric) <sup>b</sup>	Significance (1-tailed) P value <sup>b</sup>
<b>VAS in cm</b>	Pre	-3.43%	+ 0.10 ( Small)	-.457 P=0.648	0.570	p=0 .573 (NS)
	Post	-16.25%	+0.15 ( Small)	-1.266 P=0.067	0.894	p=0 .379(NS)
<b>Grip Strength in lbs</b>	Pre	12.15%	+0.17 ( Small)	-1.829 P=0.067	-0.987	p=0 .332 (NS)
	Post	21.83%	+0.30 ( Medium)	-2.263 P=0.024	-1.776	p=0 .087(NS)

\*\* Statistically Significant difference p<0.05; NS- Not significant a. Mann-Whitney Test; b. independent t test.

**Chart- 3: Comparison of means of VAS Score between Group A and Group B**



**Chart- 4: Comparison of means of grip strength between Group A and Group B**



**DISCUSSION**

Analysis from the results found in both the groups there is a statistically significant improvement in means of VAS score and Grip strength in group B subjects who received Static Stretching, ultrasound and Eccentric exercises and in group A subjects who received only Static Stretching and ultrasound

therapy. However group B subjects shown greater improvement in percentage of change, there is no statistically significant difference in improvement when post intervention means were compared between the groups.

In Group B there is a statistically significant decrease in means of VAS scores with percentage of change -

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74.34% and significant increase in means of Grip Strength scores with percentage of change of 31.26%. The improvements could be due to 4 weeks of intervention that included static stretching, ultrasound therapy and eccentric exercise programme. Studies of the histological nature of the Epicondylitis have shown that the condition on either side of the elbow, is a degenerative or failed healing tendon response characterized by the increased presence of fibroblasts, vascular hyperplasia, and disorganized collagen.<sup>3</sup> Eccentric training results in tendon strengthening by stimulating mechanoreceptors in tenocytes to produce collagen, which is probably the key cellular mechanism that determines recovery from tendon injuries.<sup>4,5</sup> In addition, eccentric training may induce a response that normalises the high concentrations of glycosaminoglycans. It may also improve collagen alignment of the tendon and stimulate collagen cross-linkage formation, both of which improve tensile strength as supported by experimental studies on animals.<sup>4,5</sup> It was been proposed that the positive effects of exercise programmes for tendon injuries may be attributable to either the effect of stretching, with a lengthening of the muscle-tendon unit and consequently less strain experienced during joint motion or the effects of loading within the muscle-tendon unit, with hypertrophy and increased tensile strength in the tendon. It was stated that during eccentric training the blood flow decreases in the area of damage and this leads to neovascularization, the formation of new blood vessels, which improves blood flow and healing in the long term<sup>4</sup>. Eccentric exercise provide neuromuscular benefits through central adaptation of both agonist and antagonist muscles therefore, therapeutic eccentric exercise may provide both a structural and functional benefit

during tendinopathy rehabilitation. It has been successfully used in the treatment of Achilles and patellar tendinopathies, as well as lateral epicondylalgia.<sup>6-12</sup> In prospective case series found reduced pain and increased grip strength following twelve weeks of home training eccentric exercise in patients with medial epicondylalgia.<sup>4,16</sup> Eccentric training markedly showed improved DASH score, VAS score, tenderness measurement, and wrist and middle finger extension after eccentric wrist extension exercise with standard physical therapy in chronic unilateral lateral epicondylitis.<sup>15,16</sup> Stanish W D stated that disruption of tendon, micro or macro takes place under specific conditions of eccentric loading, therefore in order for the tendon to heal adequately, and the treatment program must include specific eccentric strength rebuilding exercise.<sup>17</sup> Therefore in present study the eccentric exercises might have shown improvement in group B subjects. Ultrasound treatment enhances blood flow, increases membrane permeability, and alters connective tissue extensibility and nerve conduction in the tissue.<sup>19</sup> Effects also included stimulation of protein synthesis with fibroblast activation, increase in surrounding fluid flow. Acoustic microstreaming, the unidirectional movement of fluids along cell membranes, occurs as a result of the mechanical pressure changes within the ultrasound field. Microstreaming may alter cell membrane structure, function and permeability, which has been suggested to stimulate tissue repair. Effects of cavitation and micro streaming that have been demonstrated in vitro include stimulation of fibroblast repair and collagen synthesis, tissue regeneration and bone healing. Ultrasound interacts with one or more components of inflammation, and earlier resolution of inflammation, accelerated fibrinolysis, stimulation



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of macrophage, heightened fibroblast recruitment, accelerated angiogenesis, increased matrix synthesis, denser collagen fibrils and increased tissue tensile strength. Kaliman et.,al stated that ultrasound resulted in decreased pain and increase pressure tolerance in the soft tissues injuries.

Static stretching was given to muscle-tendon unit by slowly placing it in a maximal position of stretch and sustaining it there for an extended period of time which is extremely effective for increasing tendon flexibility. Stretching exercises can alleviate pinched nerves in your forearms while reducing the amount of nerve impulses going into the muscles that causes the pinching. By its effect of lengthening muscles, stretching promotes flexibility, that is, the ability to have a full range of motion about your joints. Static stretching is commonly used due to its effectiveness in the maintenance and improvement of joint range of motion owing to possible changes in the viscoelastic properties of the muscle.<sup>18</sup>

When the improvements in pain and grip strength of group B subjects means were compared with Group A subjects there is no significant difference, however Group A subjects showed significant decrease in means of VAS scores with Percentage of change of 70.82% and significant increase in means of Grip Strength scores with Percentage of change of 19.07%. The improvement could be due to static stretching and ultrasound therapy. The four week duration of eccentric training has not shown much beneficial effect when combined with conventional treatment. Further long duration studies may need to rectify the effect of eccentric exercises.

However, there is no statistically significance difference in improvement of VAS score and Grip strength between the groups, based on the finding in this study found that there is a significant effect of

Eccentric Exercise Programme combined with conventional therapy on Pain and Grip Strength for Subjects with Medial Epicondylitis. Hence the present study rejects null hypothesis.

### **LIMITATION**

Sample size was small, level of upper limb activity was not considered, No homogenous groups was taken. The standardization of resistance for eccentric exercises was not made. The study finding are limited to pain and grip strength measurement, other functional outcomes were not studied.

### **RECOMMENDATIONS**

Further study can be done with large sample with long duration and with follow up. Further study can be done with control group using other standardized outcomes. Further study can be carried on specific gender or work or sport relative medial epicondylitis using other standardized outcomes.

### **CONCLUSION**

It is concluded that four weeks of Eccentric Exercise Programme combined with conventional therapy shown significant effect on improving pain and Grip strength, however the improvement obtained has no difference when compared with control conventional treatment for Subjects with Medial Epicondylitis.

### **Acknowledgement**

Authors were expressing their sense of gratitude's to the people who helped and encouraged them for the guidance and completion of this study. I sincerely acknowledge my indebtedness to Asha. D, Associate Professor and Bhargava Kumar Bhaskar, my friend, consider myself fortunate for the constant encouragement and support given throughout the study.

**Conflicts of interest:** None

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**How to cite this article:**

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