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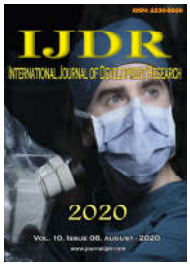

RESEARCH ARTICLE OPEN ACCESS

EFFICACY OF MOBILIZATION WITH MOVEMENT VERSUS EXERCISES IN SUBJECTS WITH LATERAL EPICONDYLITIS

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ABSTRACT

Background: Epicondylitis is defined as inflammation of epicondyle. Tennis elbow is defined as a pathologic condition of the wrist extensor muscles at their origin on the lateral humeral epicondyle. Pain is aggravated by activities involving extension of wrist.

Methods

Sample: 60 subjects between the age of 20 to 40 years were chosen for the study on the basis of inclusion criteria. Subjects were divided into 3 groups with 20 subjects in each group on the basis of random sampling technique.

Intervention: Group A received ultrasound and mobilization with movement for a period of 2 weeks at a rate opf 2 trials per week. Group B received ultrasound and exercises both stretching and strengthening exercises for a period of 2 weeks at a rate of 2 times per week. Group C received ultrasound only for a period of 2 weeks at a rate of 2 times per week.

Results: Mobilization with movement groupo improved than exercise and control group in pain free grip strength, function and there was reduced pain after the treatment. Although all the three groups showed significant improvement.

Conclusion: It can be concluded that mobilization with movement is a promising intervention in terms of pain reduction and improvement in grip strenhgth & function in subjects with lateral epicondylitis.

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INTRODUCTION

Epicondylitis is defined as inflammation of epicondyle. In July 31, 1920, Little said that tennis elbow is attributed to sprain of the pronator radii teres[1]. Then on August *7,* 1920, James B Mainell added to the treatment of tennis elbow that graduated faradic contraction with a Smat - Bristow coil will generally expendiate recovery[2]. In April , 1922 L Cooke said that it is the supinator longus muscle which is probably its cause. This muscle is now called the brachioradials, has two actions, it is both a pronator and supinator[3]. In Jan, 1923, G.M. Molony stated that it was impossible to lift a loaf of bread with hand pronated[4]. The condition was first named by Morris in 1882 as 'lawn tennis elbow and he also noted his similarity to rider's sprain[5]. More than 40 treatments have been suggested indicating that the ideal remedy have not yet advised for tennis elbow. They include immobilization, ultrasound laser, massage, electrotherapy, manipulation. NSAIDS etc.[6]

Recently researchers like Bill Vicenzino[7], A Wright[7]. Gwendejon Jull[8] etc have advocated a relatively new technique called mobilization with movement for lateral epicondylitis or tennis elbow. Tennis elbow is defined as a pathologic condition of the wrist extensor muscles at their origin on the lateral humeral epicondyle. Overuse or repetitive traum in this area causes fibrosis and microtears in the involved tissues. Nirschl referred to the microtears and the vascular ingrowth of the involved tissues as angiofibroblastic hvperplasia[9,10,11]. This Condition is also referred as lateral epicondylitis. There are many causes of tennis elbow such as direct trauma to the area as a result of a fall, motor vehicle accident, or work related injury versus overuse as seen in repetitive lifting carrying or performing fine nipu1ations of the hand, it is more common in non tennis players. Patients complain of point tenderness over the bony prominence along the outside of elbow - lateral epicondyle. Although tennis elbow commonly affects tennis players, it also affects other athletes and people who participate in leisure or work activities that require repetitive

arm - elbow and wrist movement. eg include golfers, baseball players, bowlers, gardeners or laid skippers. house or office cleaners, carpenters, mechanics and assembly line workers.[12]

Tennis elbow is divided into 3 stages:

Stage I: There is acute inflammation but no angioblastic invasion. Patient complains of pain during activity.

Stage II: This is the stage of chronic inflammation. There is some angioblastic invasion. Pit complains of pain both during activity and at rest.

Stage III : Chronic inflammation with extensive angioblastic invasion. Patient complains pain at rest, night pains, and pain during daily activities.[13]

The pain exacerbated by activities involving extension of the wrist. These include lifting a suitcase, shaking hands, turning door knobs etc. 95% of tennis elbow curs in non tennis players. The pain is also aggravated by gripping. The most common cause of tennis elbow in tennis players is a late' mechanical poor backhand, that places excess force across the extensor wad, that is. elbow leads the arm. Other contributing factors include incorrect grip size, string tension, poor racquet "dampening" and underlying weak muscles of the shoulder, elbow and arm. There is poorer elbow proprioception in subjects with lateral epicondylitis[12]. Also there is decreased blood supply to extensor carpi radialis brevis in lateral epicondylitis[13] Microscopical studies by Nirschi et al showed mainly fibroblastic tissue and vascular Incasion that led to describe the condition in 1999 as "angiofibroblastic tendinosis" [9,10,11.]

But researchers preferred to use the term for the condition as "lateral elbow tendinsis" which defines it as a degenerative process characterized by an abundance of fibroblasts, vascular hyperplasia and unstructured collagen. Recent studies showed sensory fibers containing substance - P and calcitonin gene related peptide like immunoreactivity in the origin of extensor carpi radialis brevis. Presence of these neuropeptides which is limited to a subgroup of small vessels, implies the possibility of neurogenic inflammation as a cause of perceived pain.

Symptoms of tennis elbow include: Pain slowly increasing around the outside of the elbow, less often pain may develop suddenly. Pain is worse when shaking hands or squeezing objects. Pain is made worse by stabilizing or moving the wrist with force. It is one of the most common injury in patients seeking medical attention for elbow pain. The tendinous origin of the extensor carpi radialis brevis is the area of most pathologic change. Most patients with lateral epicondylitis are between the ages of 30 - 55 years. Its prevalence is around 3 - 5%. The prevalence of tennis elbow in % in general population is 1.3% for men & 1.l% for women.[16] Mobilization with movement is a combination of the two modalities advocated.

The glide is being given passively and passive overpressure is a key to success. Mobilization with movement is nearly always at right angles to taking place and will only work in one direction[17]. Stretching exercises are used to lengthen the pathologically shortened soft tissues and thereby to increase range of motion. Eccentric exercise is a type of dynamic muscle loading where tension in the muscle develops and physical lengthening of the muscle occurs as an external force is applied to the muscle.

OBJECTIVE

Aim of Study

1. To determine the efficiency of mobilization with movement in subjects with lateral epicondylitis.
2. To determine the efficiency of exercises in subjects with lateral epicondylitis.
3. To compare the efficiency of mobilization with movement versus exercises in subjects with lateral epicondylitis.

Need of Study: To determine the best influential technique in treatment of lateral epicondylitis subjects.

Hypothesis

Experimental (H_1): Mobilization with movement will be effective than exercise on subjects with lateral epicondylitis.

Alternate Experimental Hypothesis: There will not be significant difference between mobilization with movement and exercises in subjects with lateral epicondylitis.

Review of Literature

Leanne Bisset et al, 2006 has done research ON Mobilization with movement and exercise corticosteroid injection, or wait and see for tennis elbow : randomized trial. They did a study on 198 subjects and concluded that an approach combining elbow manipulation and exercise has a superior benefit to wait and see in the first six weeks and to steroid injection in the long term and may be recommended over corticosteroid injections[8]

Abbott JH, 2001 has done research on Mobilization with movement applied to the elbow affects shoulder range of movement in subjects with lateral epicondylagia They did a study on 23 subjects and concluded that restriction of shoulder rotation range of motion is present in patients with lateral epicondylagia, probably due to a facilitated level of shoulder rotator muscle tone. Shoulder internal and external rotation range of motion increases following mobilization with movement to the elbow, in subjects with unilateral lateral epicondylagia.[18]

Abbott JH et al, 2001 has done research on The initial effects of an elbow mobilization with movement technique on grip strength in subjects with lateral epicondylagia. They did a study on 25 subjects and found that both pain free grip strength and maximum grip strength of the affected limb increased significantly following the intervention Pain free grip strength increased by a greater magnitude than maximum grip strength.[19]

B. Vicenzino, A Wright, 1995 has done research on the Effects of a novel manipulative Physiotherapy technique on tennis elbow: a single case study. They demonstrated the beneficial effects of applying a novel manipulative physiotherapy technique on the pain and dysfunction that is clearly associated with tennis elbow.[7]

Aatit Paungmali et at 2003 has done research on Hpoalgesic and svmpathoexcitatory effects of mobilization with movement for lateral epicondylgia. They did a study on 24

subjects and concluded that mobilization with movement treatment technique exerted physiological effects similar to reported for some spinal manipulations.[20]

Vicenzjno B, 2003 has done research on Lateral epicondylagia : a musculoskeletal physiotherapy perspective. He found that manipulative therapy and taping treatments provide best results in clinical practice management of lateral epicondlagia[21].

Slater H 2006 has done research on the Effects of manual therapy technique in experimental lateral epicondylalgia. They did a study on 24 subjects and concluded that the lateral glide MWM does not activate mechanism associated with analgesia or force augmentation in subjects with experimentally induced features stimulating lateral epicondylagia.[22]

Vicenzino B et at 2001 has done research on Specific manipulative therapy treatment for chronic lateral epicondylegia produces uniquely characteristic hypoalgesia. They did the study on 24 subjects and result demonstrated a significant and substantial increase in painfree grip strength of 58% during treatment but not during placebo and conhtrol. In contrast, the 10% change in pressure - threshold after treatment, although significantly greater than placebo and control. was substantially smaller than the change demonstrated for painfree grip strength. Thus effect was only present in the effected limb.[23]

D Stasinopouls et al, 2005 has done a research on An exercise programme for the management of lateral elbow tendinopathy. They found that exercise programmes are effective in the treatment of lateral elbow tendinopathy.[24]

N ynke Smidt et al 2002 has done research on Corticosteroid injections, physiotherapy or a wait and see policy for lateral epicondylitis : a randomized trial. They did a study on 185 subjects and concluded that corticosteroids injections are the best treatment options in short term for the patients with lateral epicondylitis. The difference compared with physiotherapy and a wait and see policy were large, clinically relevant, and consistent for all the outcome measures.[25]

Tumo Pienmaki etal 1998 has done research on long term follow up of conservatively treated chronic tennis elbow patients A prospective and retrospective analysis. They did a study on 30 subjects and found that the patients in exercise group had significantly less pain and and the pain in their drawings was not so widespread as in the ultrasound group[26]

Tumo Pienmaki et at 1996 has done research on Progressive strengthening and stretching exercises and ultrasound for chronic lateral epicondylitis. They did a study on 39 subjects and concluded that progressive exercise therapy is more effective than ultrasound in treating chronic lateral epicondylitis. reducing pain and improving patients ability to work[27].

Martinez - Silverstini JA et al 2005 has done research on Chronic lateral epicondylitis comparative effectiveness of home exercise programme including streching alone versus streching supplemented with eccentric or concentric strengthening. They did a study on 94 subjects and found that there is no significant difference in outcome measures were noted among the three groups. Although there were no significant difference in outcome among the groups, eccentric strengthening did not cause subject to worsen.

Svernlov B et al 2001 has done research on Non operative treatment regime including eccentric trainiong for lateral humeral epicondylagia. They did a study on 38 subjects and concluded that the eccentric training regime can considerably reduce symptoms in majority of patients with lateral humeral epicondylagia regardless of duration and is possibly superior to conventional stretching[29].

Scott D Howitt et al 2006 has done research on lateral epicondylosis a case study of conservative care utilizing ART and rehabilitation. The study concluded that a combination of soft tissue therapy, rehabilitation and therapeutic modalities is a protocol that may be used by both allopathic and chiropractic practitioner and allow for the athletic patient to return to play as quickly as possible[30].

Mark D Klaiman et at 1998 has done research on Phonophoresis versus ultrasound in the treatment of common musculoskeletal conditions. They did a study on 49 subjects and concluded that ultrasound results in decreased pain and increased pressure tolerance in these selected soft tissue injuries. The addition of phonophoresis with fiuconmide does not augment the benefits of ultrasound alone[16].

E Haker et at 1991 has done research on pulsed ultrasound treatment in lateral epicondylgia. They did a study on 45 subjects and concluded that the use of pulsed ultrasound in lateral epicondylagia with the chosen procedure is not beneficial[31].

Burgess RC, 1990 has done research on Tennis elbow. They found that tennis elbow is not only limited to tennis players. About 95% of the reported cases occur in non players. Once the inflammatory phase has passed - a flexibility and strengthening programme is recommended. In a small percentage of cases, surgery is recommended[32].

Fotey AE, 1993 has done research on Tennis elbow. He found that most cases of this common condition are caused by occupational stress rather than racquet sports. Patients complain of elbow pain when the wrist is extended against resistance or during repetitive actions with wrist and elbow extended[33].

Fairbank SM et at 2002 has done research on The role of extensor digitorum communis muscle in lateral epicondylitis. Their results confirmed the prevalence of a positive Maudsley test in lateral epicondylitis, and also that the patients with maximum tenderness at the origin of the extensor digitorum communis slip to the middle finger had the greatest pain during middle finger extension[34].

Karen Walker - Bone et at 2004 has done research on prevalence and impact of musculoskeletal disorders of the upper limb in the general population. They concluded that upper limb pain is common in the general population and is often associated with physical signs suggestive of specific upper limb disorders. These disorders have a substantial impact on physical function and use of health care[35].

Virgil Mathiowitz et at 1985 has done research on Grip and pinch strength Normative data for adults. They took a sample

of 310 male and 328 female subjects and found that Grip strength of males improved in 14 - 24 age groups while grip strength of women improved in 21 - 24 age group[36].

Chris J Snijders et at 1987 has done research on Provocation of epicondylagia lateralis (tennis elbow) by power grip or pinching. The study concluded that both the finger flexors and the wrist and finger extensors are active during grasping and pinching. The activity of flexors and extensors increases with increases in the grasping and pinching forces HB Leung 2004 has done research on Relibilty of Hong Kong Chinese version of patient - rated forearm evaluation questionnaire for lateral epicondylitis. The study concluded that Hong Kong Chinese version of patient rated forerm evatuation questionnaire is a reliable and valid assessment tool for chronic lateral epicondlytis. Its equivalence to the original English version makes outcome assessment across cultural barrier feasible.

E Oskarsoon et at 2007 has done research on Decreased intramuscular blood flow in patients with lateral epicondylitis. The study indicate that the decreased microcirculation and anaerobic metabolism in ECRB may contribute to the lateral epicondylitis symptoms.

Hans Kund et at 2008 has done research on Poorer elbow propioception in patients with lateral epicondylitis than healthy controls. They took a sample of 15 females with lateral epicondylitis and 21 healthy controls and found that propioception seems to be poorer in elbow with lateral epicondvlitis elbows than m the control elbows.[14]

Robert E Bunata et at 2007 has done research on Anatomic factors to the cause of tennis elbow. They examined 85 cadaveric elbows and found that ECRB has a unique anatomic location which makes its undersurface vulnerable to contact and abrasion against the lateral edge of capitullum during elbow motion.[40]

Jan D. Rompe et at , 2007 has done research on Validation of the patient rated tennis elbow evaluation questionnaire. They did a study on 78 subjects and concluded that patient rated tennis elbow evaluation questionnaire was a reliable reproducible and sensitive instrument for assessment of chronic lateral elbow tendinopathy.[41]

METHODOLOGY

Methodology is the most important part of any research study, which enables the researcher to form a blueprint for the study undertaken. The research methodology involves the systemic procedure by which the researcher starts from the time of initial identification of problems to its final conclusion. The present study is aimed to determine the efficacy of mobilization with movement in patients with tennis elbow and find out the effects of both mobilization with movement and exercises on reduction of pain and increase in grip strength in treatment of patients with lateral epicondylitis. This chapter presents the methodology adopted by the researcher for the study. it includes the research approach, the setting, population samping technique, selection of tool, intervention procedure, data collection and plan for analysis

Research Approach: Research approach is the most significant part of any research. The appropriate choice of the research approach depends upon the purpose of the research study, which is undertaken Experimental approach is chosen for conducting the present study, since most of the researches in the field of physical medicine demands utmost level of accuracy, a true experimental but comparative in nature design is thought to be the suitable one.

Population: A population is defined as the group of people to whom the research results are generalized, all the patients who are suffering from lateral epicondilytis were taken as universal population of the present study.

Accessible Population: Among these the respondents who were approachable to the researcher from the accessible population from whom sample was chosen. The population for the study were the patients, who came to Pacific Institute of Medical Sciences.

Reserch Setting: The study was conducted at the department of physiotherapy at Deen Daval Upadhaya Hospital, Han Nagar. New Delhi.

Sample and Sampling Technique

SAMPLE 60 subjects

As an initial step, all the subject with elbow pain complaint, were assessed by using the evaluation form to diagnose the case with necessary inclusion criteria of lateral epicondilytis. After, all this selected subject were listed out and 60 subjects among those were chosen by systemic random sampling method.

Reserch Design

Experimental but comparative in nature was chosen for the study.

Inclusion Criteria

- Both gender are included
- Age 20 - 40 years
- Positive cozen's test
- Positive mill's test

Exclusion Criteria

- Cervical radiculopathy
- Surgery of the elbow
- Injuries of the elbow with or without any deformities
- Redial tunnel syndrome
- Intra - articular pathology

Equipment Used

1. Ultrasound Machine

Company name :- International Electromedical Company

2. Frequency :- 1 MHz
3. Gel :- Ultrasound gel
4. Hand Held Dvnamometer

Company name Baseline

Tools Used

1. Thera band

Procedure of Data Collection: The subjects participated in the study were clearly explained about the procedure and the

purpose of the study, then the consent form from the subjects was obtained, and the level of pain, function and grip strength by using VAS, Hand dynamometer and questionnaire for epicondylitis from all group A. group B and group C. The experimental group A where treated with mobilization with movement and ultrasound for 4 sittings (2 times a week for 2 weeks) and the level of pain and grip strength were assessed after 2 weeks. All the subjects were asked subjectively to rate their pain using 10 point visual analogue scale, questionaire for lateral epicondylitis and grip strength was measured using hand held dynamometer. They were measured on the initial day before the treatment and on the last day of treatment after 2 weeks.

VAS measurement : The subjects were asked to rate their level of pain on a 10 point visual analogue scale on the start of treatment and on the last day after 2 weeks.

Grip strength Measurement: The subjects were seated on a chair with elbow in 90 degrees of flexion and forearm in neutral rotation. They were asked to grip the Hydraulic Hand Held Dynamometer. The readings were recorded on the start of treatment and after 2 weeks at the end of protocol in pounds.

Questionnaire Measurement: The subjects were asked to fill the questionnaire for lateral epicondvlitis on the start of treatment and at end of treatment protocol after 2 weeks.

Procedure: All the 60 subjects were evaluated using evaluation Performa and who matched the inclusion criteria were divided into 3 groups, 20 subjects in experimental group A (mobilization group) 20 subjects in experimental group B (exercise group), 20 subjects in group C (control group), A consent from was taken from the patient.

The subjects were evaluated by 2 tests

Cozen's Test: The subject's elbow is stabilized by the examiner's thumb which rests on the patient's lateral epicondyle. The patient is then asked to make a fist, pronate the forearm and radially deviate and extend the wrist while the examiner resists the motion. A positive test is indicated by a sudden severe pain in the area of lateral epicondyle of the humerus.[42,43]

Mill's Test: While palpating the lateral epicondyle. the examiner pronates the patient's forearm, flexes the wrist fully and extends the elbow. A positive test is indicated by pain over the lateral epicondvle of the humerus.

Treatment Received by Experimental Group b

Ultrasonic Therapy: The patient sits with his elbows flexed to 90 degrees and fully pronated. This brings the lateral epicondyle into prominence. The physiotherapist sits on a chair in front of the patient then ultrasound is given at the following dosage.

Mode :- pulsed (1: 4)
Dosage :- 0.5 W
Duration 10 minutes (2 minutes / cm^2 area)
No. of days 2 weeks (2 times a week)
Frequency : 1 MHz

Mobilization with movement: The patient lies supine with elbow extendrd and fully pronated. The belt lies just below the medial epicondyle and is wound around the therapist's opposite shoulder. For eg if the glide is given to right elbow, the belt is wind around the therapist's left shoulder. The therapist stands with face towards the patient's feet. With one hand the therapist stabilizes the distal humerus and with the other hand the therapist resist extension. While maintaining the glide the belt should be perpendicular to the patient's elbow so that a lateral glide is given to the radius. The glide is maintained for 5 - 10 seconds with rest interval of not more than 1 minute. 6 repetitions are given to the patient.

Treatment Received by Experimental Group B

Ultrasonic Therapy: The patient sits with his elbows flexed to 90 degrees and fulls' pronated. This brings the lateral epicondyle into prominence. The physiotherapist sits on a chair in front of the patient then ultrasound is given at the following dosage.

Mode:-pulsed(l :4)
Dosage :- 0.5 W
Duration :- 10 minutes (2 minutes / cm^2 area)
No. of days :- 2 weeks (2 times a week)
Frequency :- 1 MHz

Then the patient was given the following exercise protocol : -

First general stretching of shoulder. elbow, and wrist is given for 5 minutes as warm up with the patient standing.

The patient is then made to sit on a chair with elbow flexed to 90 degrees

1) wrist flexion :- 3 sets of 10 with yellow colour thera band
2) wrist extension :- 3 sets of 10 with yellow colour thera band
3) elbow flexion :- 3 sets of 10 with yellow colour thera band
4) elbow extension :- 3 sets of 10 with yellow colour thera band
5) finger flexion / extension :- for 1 minute with rubber band
6) forearm pronation / supination :- 3 sets of 10 with yellow colour thera band.

Treatnent Received by Control Group

Ultrasonic Therapy: The patient sits with his elbows flexed to 90 degrees and fully pronated. This brings the lateral epicondyle into prominence. The physiotherapist sits on a chair in front of the patient then ultrasound is given at the following dosage.

Mode:-pulsed(1 :4)
Dosage :- 0.5 W
Duration :- 10 minutes (2 minutes / cm^2 area)
No. of days :- 2 weeks (2 times a week)
Frequency :- 1 MHz

Plan for data analysis : Paired t - test. Wilcoxon Signed Rank test , Kruskal - Wallis Test and ANOVA is used to analyze the data for inter group analysis. Mean variation is used to analyze data for intra group analysis. P value is used to determine the level of significance at 5%.

DATA ANALYSIS & RESULT

Observation and Data Analysis: Statistics were performed by using SPSS 11. Results were calculated by using 0.05 level of significance.

Using statistical formula for the mean, for a given number of subjects, mean of different variables were calculated by :

$$\overline{X} = \frac{\Sigma X}{N}$$

where, N = Number of subjects
X = each subjects value

Standard Deviation (o)

$$S = \sqrt{\frac{\Sigma x^2}{N}}$$

x = deviation of score from mean
N = Number of subjects

Anova – one Factor (F)

$$F = \frac{MS}{MS_e}$$

Where,

MS = Number of subjects
MS = each subjects value
t-test of dependent means

$$t = \frac{M_1 - M_2}{S_{DM}}$$

$$S_{DM} = \sqrt{\left[\frac{(N_1 - 1)(S\frac{2}{1}) + (N_2 - 1)(S\frac{2}{2})}{N_1 + N_2 - 2}\right]\left[\frac{1}{N_1} + \frac{1}{N_2}\right]}$$

$$S = \sqrt{\frac{\Sigma x^2}{N}}$$

df = $N_1 + N_2 - 2$

where :
SMD = Standard deviation of themean difference
D = difference between a pair of means.
M = mean

It is a major output of research. Data has been analyzed between three groups.

Understanding has been made in different sections.

1. Intragroup Analysis
2. Intergroup Analysis

Percentage of Males and Females out of Total subjects included in the study

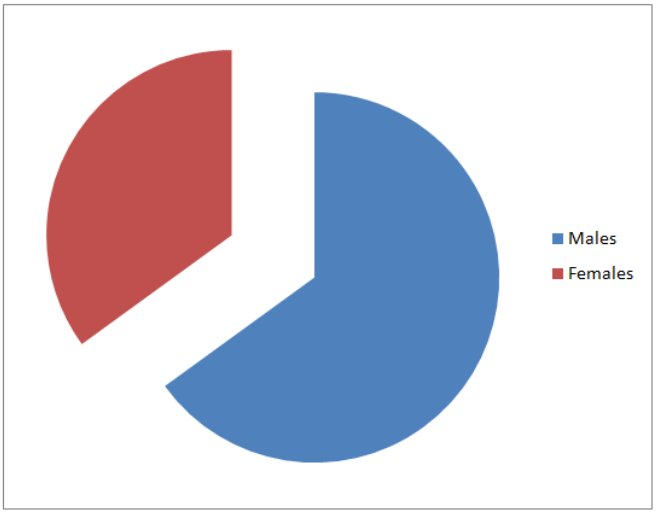

Fig. 5.1. The pie chart describes percentage of male and female subjects included in the study which comes out to be 35% and 65% respectively

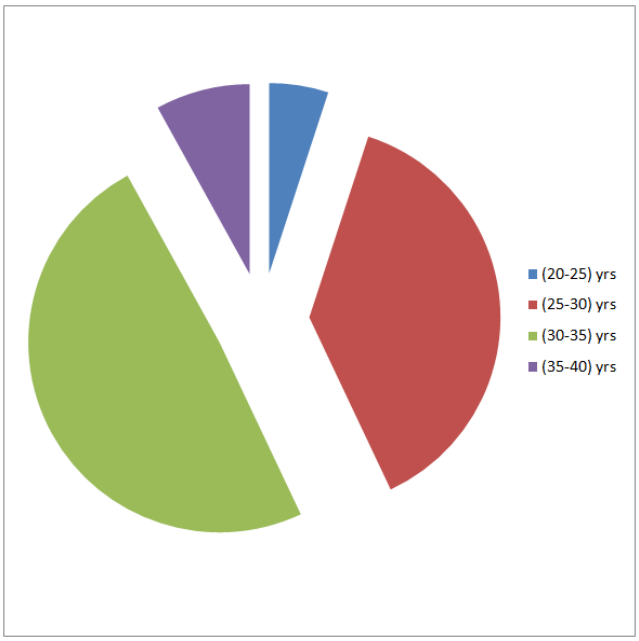

Fig. 5.2. Percentage of Age wise distribution of the subjects included in the study

Fig. 5.2 The pie chart describes the age wise distribution of subjects included in the study which comes out to be 5% between 20-25 years, 38% between 25-30 years, 49% between 30-35 years and 8% between 35-40 years respectively.

Intragroup Analysis

Table 1.1.

Groups	Age (Mean ± SD)
Group A	34.65 ± 7.05
Group B	35.5 ± 3.95
Group C	36.75 ± 3.38

The above table describes mean and standard deviation of age for the subjects of group A, group B and group C which comes to be 34.65 ± 7.05, 35.5 ± 3.95, 36.75 ± 3.38 respectively.

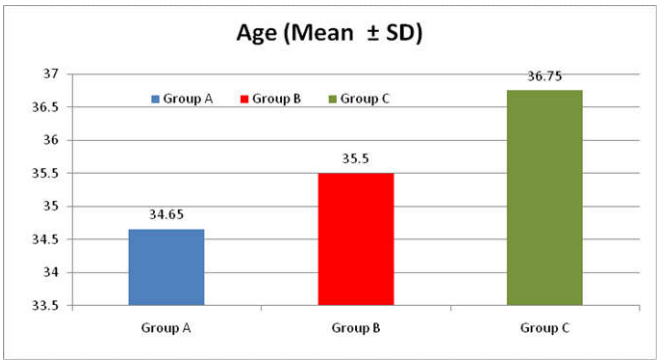

Fig 5.3. Comparison of mean value for Age between Group A, Group B and Group

The above graph describes mean and standard deviation of age for the subjects of group A, group B and group C which comes out to be 34.65 ± 7.05, 35.5 ± 3.95, 36.75 ± 3.38 respectively.

Table 1.2

Groups	Grip Strength	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	35.95 ± 19.65	58.55 ± 18.94
Group B	34.85 ± 11.11	44.55 ± 11.87
Group C	34.00 ± 5.19	38.5 ± 4.41

The above table describes mean and standard deviation of grip strength at pre and post interval. For group A it comes out to be 35.95 ± 19.65, 58.55 ± 18.94 respectively. For group B it comes out to be 34.85 ± 11.11, 44.55 ± 11.87 respectively. For group C it comes to be 34.00 ± 5.19, 38.5 ± 4.41 respectively.

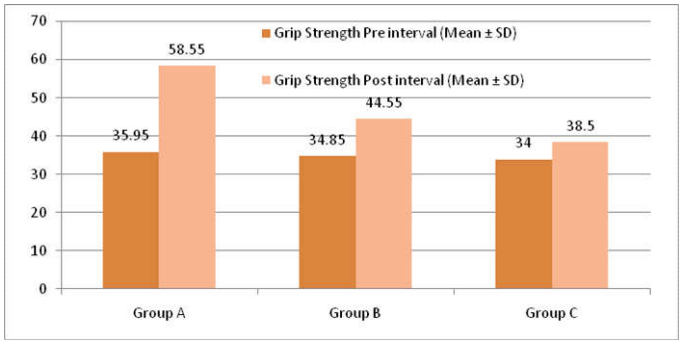

Fig. 5.4. Comparison of mean value of Grip Strength at Pre and Post interval between Group A, B and C

The above graph describes mean and standard deviation of grip strength at pre and post interval. For group A it comes out to be 35.95 ± 19.65, 58.55 ± 18.94 respectively. For group B the values are 34.85 ± 11.11, 44.55 ± 11.87 respectively. For group C the values are 34.00 ± 5.19, 38.5 ± 4.41 respectively.

Table 1.3

(Pre Vs Post) Interval	t value	P value
Group A	-15.30	P < 0.05
Group B	-9.159	P < 0.05
Group C	-7.18	P < 0.05

It describes Paired t – test done between pre and post interval of grip strength for group a, group B and group C. The t values are -15.30 (P < 0.05), -9.159 (P < 0.05), -7.18 (P < 0.05)

Table. 1.4

Groups	Pain	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	8.2 ± 0.75	0.98 ± 0.38
Group B	8.19 ± 0.78	1.86 ± 0.85
Group C	8.17 ± 0.64	2.86 ± 1.55

The above table describes mean and standard deviation of VAS at pre and post interval. For group A the values are 8.2 ± 0.75, 0.98 ± 0.38. For group B the values are 8.19 ± 0.78, 1.86 ± 0.85 respectively. For group C the values are 8.17 ± 0.64, 2.86 ± 1.55 respectively.

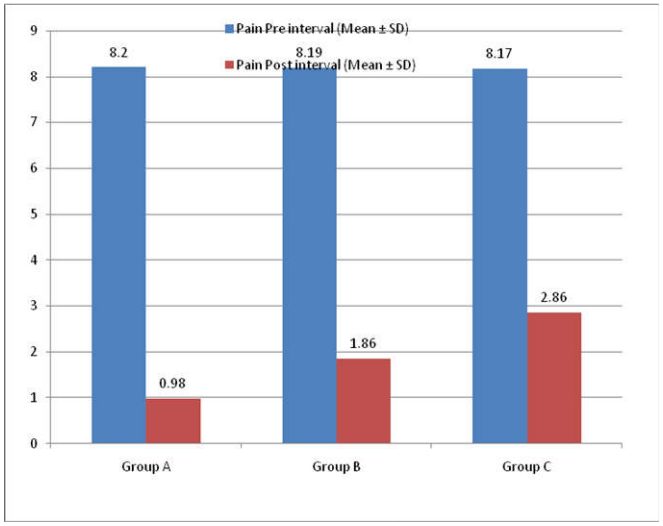

Fig. 5.5. Comparision of mean value of VAS at Pre and Post interval between Group A, B and C

The above graph describes mean and standard deviation of VAS at pre and post interval. For group A the values are 8.2 ± 0.75, 0.98 ± 0.38. For group B the values are 8.19 ± 0.78, 1.86 ± 0.85 respectively. For group C the values are 8.17 ± 0.64, 2.86 ± 1.55 respectively.

Table 1.5

(Pre Vs Post) Interval	t value	P value
Group A	33.92	P < 0.05
Group B	23.50	P < 0.05
Group C	12.89	P < 0.05

It describes Paired t – test done between pre and post interval of VAS between for group a, group B and group C. The t values are 33.92 (P < 0.05), 23.50 (P < 0.05), 12.89 (P < 0.05) respectively.

Table. 1.6

Groups	Pain	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	30.80 ± 6.90	7.20 ± 1.64
Group B	30.25 ± 3.98	10.75 ± 3.53
Group C	30.65 ± 4.00	13.30 ± 2.43

The above table describes mean and standard deviation of pain at pre and post interval. For group A the values are 30.80 ± 6.90, 7.20 ± 1.64 respectively. For group B the values are 30.25 ± 3.98, 10.75 ± 3.53 respectively. For group C the values are 30.65 ± 4.00, 13.30 ± 2.43 respectively.

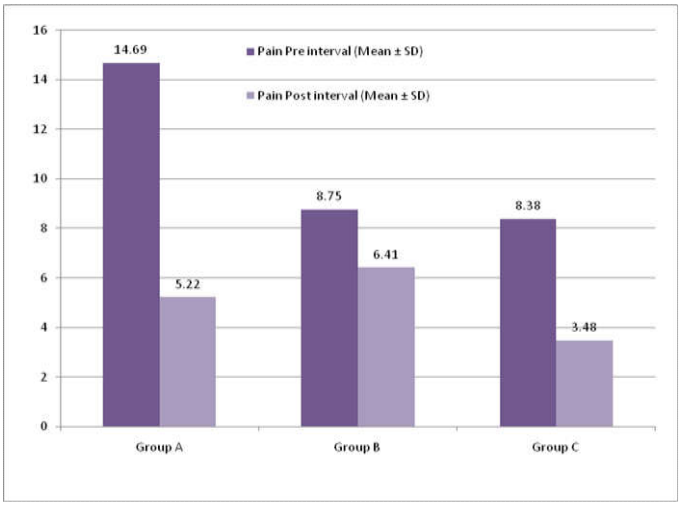

Fig. 5.6. Comparison of mean value of Pain and Pre and Post interval between Group A, B and C

The above graph describes mean and standard deviation of pain at pre and post interval. For group A the values are 30.80 ± 6.90, 7.20 ± 1.64 respectively. For group B the values are 30.25 ± 3.98, 10.75 ± 3.53 respectively. For group C the values are 30.65 ± 4.00, 13.30 ± 2.43 respectively.

Table 1.7

(Pre Vs Post) Interval	t value	P value
Group A	-3.93	P < 0.05
Group B	-3.928	P < 0.05
Group C	-3.929	P < 0.05

It describes Paired t – test done between pre and post for pain for group A, group B and group C. The t values are -3.93 (P < 0.05), -3.928 (P < 0.05), -3.929 (P < 0.05) respectively.

Table : 1.8

Groups	Pain	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	58.60 ± 14.69	14.1 ± 5.22
Group B	57.90 ± 8.75	18.45 ± 6.41
Group C	58.5 ± 8.38	23.95 ± 3.48

The above table describes mean and standard deviation of pain at pre and post interval. For group A the values are 58.60 ± 14.69, 14.1 ± 5.22 respectively. For group B the values are 57.90 ± 8.75, 18.45 ± 6.41 respectively. For group C the values are 58.5 ± 8.38, 23.95 ± 3.48 respectively.

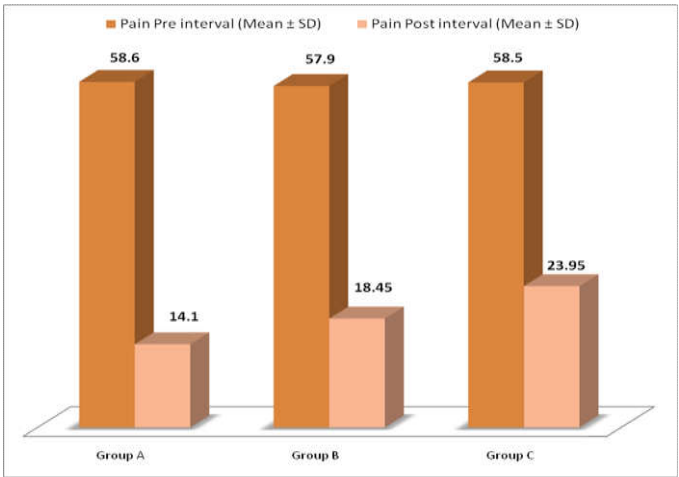

Fig. 5.7. Comparison of value of Function at Pre and interval between Group A, B and C

The above graph describes mean and standard deviation of pain at pre and post interval. For group A the values are 58.60 ± 14.69, 14.1 ± 5.22 respectively. For group B the values are 57.90 ± 8.75, 18.45 ± 6.41 respectively. For group C the values are 58.5 ± 8.38, 23.95 ± 3.48 respectively.

Table 1.9

(Pre Vs Post) Interval	t value	P value
Group A	-3.92	P < 0.05
Group B	-3.92	P < 0.05
Group C	-3.923	P < 0.05

It describes Paired t test done between pre and post interval for function for group A, group B and C. The t values are -3.92 (P < 0.05), -3.921 (P < 0.05), -3.923 (P < 0.05) respectively.

SECTION 2 – INTERGROUP ANALYSIS

Table 1.10

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Grip Strength	0.107	P > 0.05
VAS	0.006	P > 0.05

It describes the ANOVA for mean values at pre interval for grip strength and VAS to check for changes between group A, group B, group C. The values were 0.107 (P > 0.005), 0.006 (P > 0.05) respectively.

Table 1.11

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Pain	2.90	P > 0.05
Function	0.67	P > 0.05

It describes the ANOVA for mean values at pre interval for pain and function to check for changes between group A, group B, group C. The values were 2.90 (P > 0.005), 0.67 (P > 0.05) respectively.

Table 1.12

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Grip Strength	12.21	P < 0.05
VAS	16.01	P < 0.05

It describes the ANOVA for mean values at pre interval for grip strength and VAS to check for changes between group A, group B, group C. The values are 12.21 (P < 0.005), 16.01 (P < 0.05) respectively.

Table 1.13

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Pain	31.91	P < 0.05
Function	22.64	P < 0.05

It describes the ANOVA for mean values at pre interval for pain and function to check for changes between group A, group B, group C. The values are 31.91 (P < 0.05), 22.64 (P < 0.05) respectively.

Table 1.14

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Grip Strength	70.51	P < 0.05
VAS	9.432	P < 0.05

Table 1.15

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Pain	16.18	P < 0.05
Function	8.58	P < 0.05

Table 1.16. Comparison of values for Grip Strength, VAS, Pain and Function between Group A Vs Group B, Group A Vs Group C and Group B Vs Group C

Variables	Group A Vs B		Group A Vs C		Group B Vs C	
	t value	P value	t value	P value	t value	P value
Pre Grip Strength	0.218	P > 0.05	0.429	P > 0.05	0.310	P > 0.05
Post Grip Strength	2.800	P < 0.05	4.609	P < 0.05	2.136	P < 0.05
(Pre – Post) GS	7.098	P < 0.05	11.284	P < 0.05	4.227	P < 0.05
Pre VAS	0.041	P > 0.05	0.113	P > 0.05	0.066	P > 0.05
Post VAS	-4.171	P < 0.05	-5.242	P < 0.05	-2.508	P < 0.05
(Pre – Post) VAS	2.595	P < 0.05	4.097	P < 0.05	2.052	P < 0.05
Pre Pain	0.308	P > 0.05	0.084	P > 0.05	-0.317	P > 0.05
Post Pain	-4.071	P < 0.05	-9.302	P < 0.05	-2.657	P < 0.05
(Pre – Post) Pain	2.525	P < 0.05	3.917	P < 0.05	1.673	P > 0.05
Pre Function	0.183	P > 0.05	0.145	P > 0.05	-0.055	P > 0.05
Post Function	-2.330	P < 0.05	-7.017	P < 0.05	-3.328	P < 0.05
(Pre – Post) Function	1.416	P > 0.05	3.053	P < 0.05	1.875	P < 0.05

It describes the ANOVA for mean values at pre interval for grip strength and VAS to check for changes between group A, group B, group C. The values are 70.51 ($P < 0.05$), 9.432 ($P < 0.05$) respectively. It describes the ANOVA for mean values at pre interval for pain and function to check for changes between group A, group B, group C. The values are 16.18 ($P < 0.05$), 8.58 ($P < 0.05$) respectively. Table 1.16 describes about the comparison for Grip Strength, VAS, Pain and Function at Pre interval, Post interval and (Pre-Post) interval between Group A Vs Group B, Group A Vs Group C and Group B Vs Group C. The t and P value are given above. The above results define that there are significant changes within group A, group B and group C. The results show that group A responds better than group B and group C. This shows that treatment protocol given in group A is better than group B and group C. Thus null hypothesis is rejected and experimental hypothesis is accepted. The results found that mobilization with movement is more effective in reducing. Pain and increasing grip strength and function in subjects with lateral epicondylitis than exercises alone. This is because of correction of positional faults which have occurred following injury.

DISCUSSION

The results found that mobilization with movement is more effective in reducing Pain and increasing grip strength and function in subjects with lateral epicondylitis than exercises alone. This is because of correction of Positional faults which have occurred following injury According to Brian Mulligan 1993 minor Positional faults occur following injury or strain , resulting in movement restriction and pain. With MWM these Positional faults are corrected, pain free function is restored which accounts for improvement following MWM.[17] Stretching results in Improvement in pain and function because with stretching there is lengthening of muscle tendon unit and consequenty less strain experienced during joint motion. Eccentric training results in tendon strengthening by stimulating mechanoreceptors tenocytes produces collagen, which determines recovers' from tendon injuries. Also it improves collagen alignment of tendon and stimulates collagen cross linkage formation, which improves tensile strength.[24] Ultrasound improves the extensibility of collagen, which causes re - orientation of collagen fibers. causing greater elasticity without loss of strength and thus decreasing joint stiffiess.[44] Bissett L etal 2006 found that Physiotherapy combining elbow manipulation and exercise has a superior benefit to wait and see in first 6 weeks and to corticosteroid injections after first 6 weeks . which is due to correction of Positional fault , production of new collagen and less strain experienced during joint motion.[8] B Vicenzino etal 1995 found beneficial effect of applying a novel physiotherapy technique on pain and dysfunction in tennis elbow in due to positional fault.[7] Abbott JH etal 2001 found that MWM is a promising intervention modality for the treatment of patients with lateral epicondylagia due to correction of positional fault. Adolfsson L etal 2001 found that eccentric training considerably reduces the symptoms in a majority of patients with lateral epicondylitis due to formation of collagen. increased concentration of glycosaminoglycans. improved tensile strength[29] Gay RE etal 2005 found that eccentric training and stretching significantly increased pain free grip strength in subjects with lateral epicondylitis due to decreased strain on muscles during elbow motion.[28]

Limitations of Study

- Study was conducted over a short period of time
- Sample size was small.
- Equal distribution of subjects between groups in relevance to age.
- Availability of patiens.

Conclusion

It can be concluded that mobilization with movement (MWM) provides better result in terms of pain reducation and improvement in grip strength and function. However, the efficiency of the practitioner play a major role in bringing out the desired result. The present study concluded that MWM is effective in treating patients with lateral epicondylitis.

Summary

Future Study

1. Inclusion of more number of subjects

2. Adequate follow up
3. Long term study may be undertaken

Epicondylitis is defined as inflammation of epicondyle. Tennis elbow is defined as a pathologic condition of the wrist extensor muscles at their origin on the lateral humeral epicondyle. Pain is aggravated by activities inving extension of wrist. To determine the efficacy of mobilization with movement in subjects with tennis elbow and to see the effectiveness of newer technique foc the benefit of the population. Authors such as Bisset L, B Vicenzino Abbott JH have found that mobilization with movement is a promising intervention for lateral epicondylitis. But authors such Adolfsson L , Gay RE on the other hand have found that eccentric exercises are more useful in lateral epicondylitis. Subjects were screened on the basis of inclusion criteria and 60 subjects which were selected for the study were randomly divided into 3 groups. Group A was given mobilization with movement and ultrasound. Group B was given eccentric and stretching exercises with ultrasound and Group C which acted as control group was given ultrasound only. Results showed that all groups showed significant improvement in pain reduction. grip strength and function but group A showed better results than group B and group C. It can be concluded that mobilization with movement is more effective in reducing pain and improving grip strength and function than exercises and ultrasound.[55]

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APPENDIX

Appendix – 1

Consent Form

Tel **APPENDIX – 1**

Consent Form

I, ……. Willing and voluntarily agree to participate in the research study under the direction of the ……

I, understand that the purpose of the study is to see the "To compare the Efficacy of mobilization with movement versus exercises in subjects with lateral epicondylitis."

I understand that there is no risk involvement to my health and if any, it is being explained to me. I understand that I have the right to seek information regarding the study and can contact ……I understand that my confidentiality and anonymity is protected and further I have to terminate my participation at any time. I have read and received a copy of this consent form.

…….

Signature of patient
Name :-
Address :-
contact
Date :-

APPENDIX – 2

Assessment Form

IDENTIFICATION ADTA

Name
Age
Gender
Occupation
Dominance

CHIEF COMPLAINTS HISTORY

A) History of present illness
B) History of past illness
C) Occupational history
D) Medical history
E) Surgical history
F) Personal history
G) Drug history

VITAL SIGNS

Pulse
Blood pressure
Temperature
Weight
Height

PAIN ASSESSMENT

Site
Onset
Nature
Character
Type
Aggravating factor
Relieving factor
Irritability

OBSERVATION

Colour of skin
Skin condition
Any scar
Deformity
Bon and soft tissue contour
Built
Attitude
Posture

PALPATION

Tenderness
Swelling
Odema
Warmth
Crepitus

EXAM INATION

Sensation
Reflexes
Manual muscle testing :- Flexors
Extensors
Supination
Pronation
Wrist flexion
Wrist extension

Range of motio

Movement	Active	Passive
Elbow flexion		
Elbow extension		
Forearm pronation		
Forearm supination		
Wrist flexion		
Wrist extension		

Special Tests

Special test	Positive	Negative
Cozen's test		
Mill's test		

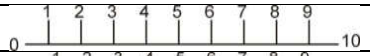
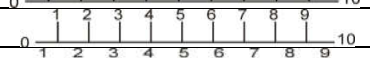
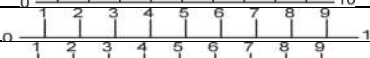
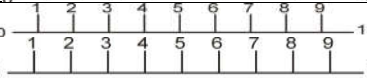
Provisional diagnosis
Investigations

APPENDIX – 3

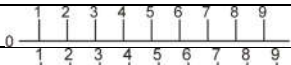
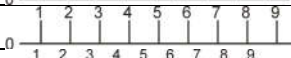
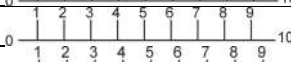
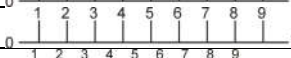
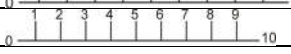
Questionaire for Lateral Epicondylitis

Questionaire for Lateral Epicondylitis: Please provide an answer for all questions. If you do not perform an activity please provide an estimate of the pain or difficulty you would expect if you perform the activity. Please note the average amount of pain in your arm over the past week by writing a number between 0-10 where '0' means did not have any pain and '10' means you had worst pain imaginable.

Pain with affected arm

Question	
When you are at rest	
When doing a task with repeated arm movement	
When carrying a plastic bag of groceries	
When your pair was at least	
When your pain was at its worst	

Function with affected arm

Specific activities	
Turning a door knob	
Carrying a Plastic bag of groceries	
Lifting a full coffee cup or glass to your mouth	
Opening a Jar	
Pulling up pants	
Wringing out a facecloth or dishrag	
Usual activities	
Personal care activity (i.e. dressing, washing)	
Household Work (maintenance, cleaning)	
Work (your usual job) or main activity if not employed	
Recreation or sporting activities	

Appendix – 4

Data Collection Form

NAME OF PATIENT :…….
AGE :- …….
SEX :- ……..

VISUAL ANALOGUE SCALE MEASUREMENTS

PRETREATMENT :- ……..
POST TREATMENT :- ……

GRIP STRENGTH MEASUREMENTS

AT THE START OF TREATMENT

1ST READING :-…….
2ND READING :-……
3RD READING :-…….

MEAN :…….

AFTER 2 WEEKS

1ST READING :-…….
2ND READING :-……
3RD READING :-…….
MEAN :…….

APPENDIX – 5

MASTER CHART

Group – A

S.No.	Name	Sex	Age	Pre Grip Strength	Post Grip Strength	Pre VAS	Post VAS	Pre Pain	Post Pain	Pre Function	Post Function
1	Rashmi	F	38	33	56	7.8	1.9	35	8	46	11
2	Navin	M	40	18	57	6.6	0.9	36	6	66	10
3	Sushila	F	40	33	52	9.5	1	38	8	81	11
4	Sarita	F	40	10	40	9.5	1	32	7	64	8
5	Tikam	M	40	32	64	8.9	0.5	38	8	57	14
6	Indra	F	31	22	50	8.1	0.9	36	9	43	12
7	Mona	F	20	16	39	8.8	0.5	32	7	80	15
8	Madhu	F	40	17	26	7	1.7	35	9	66	21
9	Usha	F	20	39	66	7.7	1.5	19	8	38	11
10	Asha	F	30	40	60	8.5	0.8	20	6	49	13
11	Mangla	F	30	65	80	7.4	1	33	7	54	20
12	Pukraj	M	40	17	40	7.9	1	31	8	60	17
13	Deepak	M	40	50	70	7.7	1.1	34	8	65	16
14	Raj Kumar	M	40	80	103	8	1.1	31	8	68	13
15	Shabana	F	34	30	53	8.8	1.2	33	9	62	15
16	Indu	F	40	35	50	8.7	1	10	2	24	4
17	Mohan	M	40	80	100	8.1	0.6	30	5	40	8
18	Sohan	M	25	35	55	7.9	0.3	30	8	68	21
19	Neha	F	32	32	50	8.5	0.9	32	7	72	26
20	Deepa	F	35	35	60	8.6	0.8	31	6	69	16

GROUP – B

S. No.	Name	Sex	Age	Pre Grip Strength	Post Grip Strength	Pre VAS	Post VAS	Pre Pain	Post Pain	Pre Function	Post Function
1	Anju	F	37	26	45	8.3	2.5	27	13	56	14
2	Anita	F	32	26	39	8.2	1.8	30	15	57	25
3	Surbhi	F	40	24	38	8.4	1.6	27	6	48	11
4	Mohini	F	30	21	31	8.5	1.8	32	14	69	27
5	Kanta	F	32	44	53	9.8	1	29	2	56	31
6	Ranjana	F	39	68	74	8	1.3	28	6	58	20
7	Rakhi	F	30	33	39	8	1.9	29	11	60	21
8	Anjana	F	40	32	38	8.1	2	32	13	63	19
9	Mahesh	M	32	37	39	8.7	2.5	34	15	68	15
10	Sumitra	F	37	50	63	8.3	1.7	32	10	52	23
11	Sushma	F	34	50	72	9	1.4	33	9	49	28
12	Pramod	M	39	35	42	7.5	2	28	10	55	19
13	Hiramani	F	32	37	43	9.5	1.7	27	8	52	11
14	Sushil	M	39	28	36	8.4	1.5	27	12	76	20
15	Deepak	M	40	28	40	8	5	23	8	55	9
16	Gaurav	M	38	30	38	7.9	2.3	26	13	48	18
17	Laxmi	F	36	27	37	6.9	1.5	30	11	50	15
18	Radha	F	40	35	42	6.5	1	39	10	56	9
19	Rahul	M	28	29	36	7.2	1.8	35	13	52	11
20	Rajeev	M	35	37	46	8.6	1	37	16	78	13

GROUP – C

S.No.	Name	Sex	Age	Pre Grip Strength	Post Grip Strength	Pre VAS	Post VAS	Pre Pain	Post Pain	Pre Function	Post Function
1	Asha	F	30	35	40	8.5	3	30	11	46	20
2	Sampat	M	34	37	40	7.5	2.7	34	15	62	26
3	Rajendra	M	34	30	35	9.2	0.9	26	11	51	20
4	Vimla	F	40	33	40	8	5.5	32	10	54	25
5	Sushila	F	37	33	35	8	2.2	30	15	58	28
6	Sarita	F	40	36	39	8.5	1.1	36	18	52	27
7	Malti	F	40	25	31	8.5	1.1	39	14	68	21
8	Rita	F	38	27	30	10	1.9	29	15	74	21
9	Jai	M	40	33	38	8	2.5	36	12	64	20
10	Nirmal	M	30	40	42	7.5	2.3	38	15	65	22
11	Ashok	M	40	44	45	7.6	3.7	28	10	49	24
12	Prabhas	M	35	26	33	7.5	2.2	32	14	57	20
13	Nisha	F	40	30	40	7.7	4.4	29	13	40	18
14	Manisha	F	40	37	43	7.5	4.2	28	15	58	28
15	Usha	F	38	30	40	8.5	6.5	30	12	68	25
16	Sarita	F	35	30	32	8	5	27	14	63	28
17	Somnath	M	33	38	45	7.9	1.4	25	11	50	25
18	Rukmani	F	36	36	40	8	1.8	28	13	60	24
19	Syara	F	40	40	40	8.2	2.6	28	10	58	27
20	Vikram	M	35	40	42	8.9	2.2	28	18	64	30

APPENDIX – 6

DATA ANALYSIS SAMPLE

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	20	18.00	52.00	35.6000	8.28696
Pre Grip Strength	20	10.00	80.00	35.9500	19.65619
Post Grip Strength	20	26.00	103.00	58.5500	18.94445
MD (Pre-Post) Grip Strength	20	9.00	39.00	22.6000	6.60462
Pre VAS	20	6.60	9.50	8.2000	.75114
Post VAS	20	.30	1.90	.9850	.38835
MD (Pre-Post) VAS	20	5.30	8.50	7.2150	.95105
Pre Pain	20	2.00	9.00	30.8000	6.90995
Post Pain	20	2.00	9.00	7.2000	1.64157
MD (Pre-Post) Pain	20	8.00	30.00	23.6000	5.94182
Pre Function	20	24.00	81.00	58.6000	14.69479
Post Function	20	4.00	26.00	14.1000	5.22041
MD (Pre-Post) Function	20	20.00	70.00	44.5000	12.72172
Valid N (listwise)	20				

T-Test

Paired Samples Test

	Paired Differences					t	df	Sig. (2 – tailed)
	Mean	Std. Deviation	Std. Error Mean	95% confidence interval of the difference		t	df	
				Lower	Upper	t	df	
Pair 1 Pre post Strength – Post Grip Strength	22.6000	6.60462	1.47684	-25.6911	-19.5089	-15.303	19	.000
Pair 2 Pre Vas – Post Vas	7.2150	.95105	.21266	6.7699	7.6601	33.927	19	.000

NPar Tests

Wilcoxon Signed Ranks Test

Test Statistics

	Post Pain – Pre Pain	Post Function – Pre Function
Z	-3.930	-3.921
Asymp. Sig. (2-tailed)	.000	.000

a. Based on positive ranks
b. Wilcoxon Signed Ranks Test

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