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Therapeutic efficacy of mulligan's mobilization versus low level laser therapy for the management of tennis elbow: A comparative study

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Abstract
Background and Objectives: Tennis elbow is most common lesion of the elbow affecting the tendinous origin of the wrist extensors especially ECRB. In physiotherapy clinical practice, different outcome measures were used to evaluate functional recovery in tennis elbow. This study has used two outcome measures for evaluating the functional recovery in tennis elbow and they are Visual Analogue Scale (VAS) and grip strength. The objectives of this study to find out and compare the efficacy of Mulligan's MWM Versus Mulligan's MWM in combination with Low level laser therapy, to reduce pain and improve grip strength in Tennis elbow. The method used in subjects with known cases of chronic tennis elbow (three or more than three months) diagnosed by clinical confirmatory tests by the specialists; were chosen for the study. After dividing the subjects into 2 groups of 25 each, they were pre- tested using hand dynamometer for the grip strength and visual analogue scale (VAS) for pain intensity. The first group were given Mulligan`s Mobilisation with Movement and second group were given Low Laser Level Therapy and Mulligan`s Mobilisation with Movement for thrice a week for three weeks. The patients were assessed for pain intensity using visual analogue scale (VAS) and for grip strength using hand dynamometer by the end of third week. The results were computed and analyzed to see which group has better improvement. The results of the study in the group A, the VAS score came down from 6.32 to 3.28 by the end of third week of treatment and the grip strength increased from 11.36 to 14.96 lbs by the end of third week. In the group B, the VAS score came down to 2.08 from 6.48 by the end of third week. The grip strength increased from 11.68 lbs to 16.40 lbs by the end of third week. So, there was a significant improvement in grip strength and reduction in VAS in group A and group B. Also there was a significant improvement in grip strength and VAS in group B as compared to group A. The conclusion in this study, both the groups statistically showed significant response to their interventions. The mean score in case of VAS is less and in case of HGD is high for Mulligan`s MWM and Low Level Laser Therapy as compared to Mulligan`s MWM alone. Mulligan`s MWM and LLLT was found to be more effective than the Mulligan`s MWM alone to reduce the pain and to increase grip strength in treating Tennis elbow.

Keywords: tennis elbow; mulligan`s mobilisation with movement; low level laser therapy; visual analogue scale; hand grip dynamometer

1. Introduction
Tennis elbow, or tennis elbow, is arguably the most common painful, debilitating and upper extremity musculoskeletal disorders which requires early intervention if optimal recovery is to be made [1]. It is a common cause of elbow pain in the general population (1-3%). It is a common complaint among sports people and manual workers often experienced by but not exclusive to tennis players during back hand stroke. It can interface with the affected person's ability to function at work, recreation and home and imposes a financial cost on the community [2]. Tennis elbow is also known as: Lateral epicondylosis, Tennis elbow, or Tendinitis of the affected forearm extensor muscles (mainly extensor carpi radialis brevis tendonitis). The preferred nomenclature is Lateral Epicondylagia, as the suffix '-algia' denotes pain; the pathophysiology of the condition is less commonly inflammation ('-itis') or degeneration ('- osis') than it is predominantly hyperalgesia and pain ('-algia') [3]. Tennis elbow is a condition with complex etiological and pathophysiological factors, occurs in tennis players as well as housewives, artisans, and violinists. The term Tennis elbow is widely used to describe an overuse injury that is characterized By pain (aching pain or may also radiating) in or near the lateral humeral epicondyle or in the forearm extensor muscle mass, tenderness over the common extensor tendon origin mainly ECRB, marked functional impairment, mechanical hypergesia, motor and sensory deficits, muscle strength deficits, abnormal muscles activation pattern of forearm extensor muscles and poor posture of upper limb [4]. The pain on the lateral aspect of the elbow is aggravated by direct palpation over lateral epicondylar region of the elbow, by movements of the wrist, by manipulating an object such as that required when lifting a tea cup or shaking hands or dressing or desk or house work, with gripping activities and isokinetic testing, by strenuous use of the hand and forearm, by resisted contractions of the extensor muscles of the forearm, particularly the extensor carpi radialis brevis or with resisted wrist or finger extension. Isokinetic strength deficits (week grip) may also be observed. Symptoms usually exacerbate with stressful activity and improve with rest but as the condition progress, pain even occurs at rest [5]. Elbow range of motion is typically unaffected by Tennis elbow.10 The area of maximal discomfort is commonly located up to 5mm distal and anterior to lateral epicondyle.

Table 1: Location of Pain with Tennis Elbow

Lateral Epicondyle	Attachment of common extensor muscles	75%
Lateral muscle mass	Musculotendinous junction of common	17%
	Extensor just proximal to radial head	
Medial Epicondyle	Attachment of common flexor origin	10%
Posterior	Around margins of olecranon process	08%

The condition is largely self-limiting, duration of Tennis elbow is highly variable, ranging from 3 weeks to several years, 11 prone to recurrent bouts and symptoms seem to resolve between 6 and 24 months in most patients. Dominant arm is significantly more often affected than the non-dominant arm [5]. Various other intrinsic factor including muscular or ligamentous strain, radio humeral bursitis9, stenosis of orbicular ligament, periostitis of the common extensor tendon, myofacitis calcification, anconeus compartment syndrome, disturbances of local metabolism, cervical radiculopathy are enumerated as causes of Tennis elbow in numerous studies [6]. In tennis player, the main cause of Tennis elbow is believed to be the result of micro trauma, the overuse and inflammation at the origin of the ECRB muscle as a result of repeated large impact forces created when the ball hits the racket in the backhand stroke. The risk of overuse injury is increased 2 -3 times in players with more than 2 hours of play per week and 2-4 times in players older than 40 years. In tennis player, Several authors have also found that the incidence of Tennis elbow is also elevated with the use of increased racquet weight, more tightly string racquet, wet ball, incorrect grip size, inexperience and poor backhand technique which may lead to a great force being impacted on wrist extensors [7]. The diagnosis of Tennis elbow is made clinically and it is based on a history of pain and tenderness (maximal tenderness just distal (5-10 mm) to the lateral epicondyle in the area of the ECRB muscle) localized to lateral epicondyle. Pain frequently radiate down the extensor surface of the forearm and increase with provocation tests. Grip strength may be impaired because of pain. Sixteen percent had findings present, with the most common being faint calcification along the lateral epicondyle in 20 patients (7%). Tennis elbow is clinically diagnosis by using Tennis elbow test or Cozen test and Mill's test. Reproduction of pain at the lateral epicondyle is significant for Tennis elbow. Another helpful test is the chair raise test. The patient stands behind their chair and attempts toraise it by putting their hands on the top of the chair back and lifting. In patients with Tennis elbow, pain results over the lateral elbow. The treatment of lateral epicondylalgia, a widely-used model of musculoskeletal pain in the evaluation of many physical therapy treatments, remains somewhat of an enigma. More than 90% of people respond to conservative treatment. Very few people require surgery for tennis elbow. Conservative or non-surgical treatment for tennis elbow involves rest, ice for 20 minutes up to six times daily. Do not put ice directly on the skin. Put a towel or washcloth between the ice and skin. Instead of ice cubes or chips, use frozen peas in a plastic bag, anti-inflammatory medications to help relieve pain symptoms, tennis elbow strap to reduce strain on the tendon, physiotherapy (TENS) to reduce pain and inflammation, a steroid injection into the affected area. The injection provides relief for up to three months and is seldom used more than two or three times per year. Sports Taping techniques, use of orthotic device, Manipulative technique (cyriax, wrist manipulation), Acupuncture, Ultrasound, LLLT, TENS, ESWT, Electromagnetic field and Ionization30 also use as the intervention for the management of Tennis elbow. Once pain has stopped or improved, physiotherapy exercises including Stretching which helps lengthen the sore tendon and keep the new collagens tissue soft and pliable and Strengthening exercise for the tendon and muscles in the forearm. Massage may also help. Conservative treatments like Ultrasound was not as effective (53% improved) as steroid injection (89% improved), but recurrence was less frequent after 6 to 12 months, surgery may be recommended. Surgery is 85% effective for relieving the pain. Recurrence of tennis elbow can be prevented by using braces to support the wrist, changing technique or equipment, or modifying jobs and activities if possible. Warming up before activities will help prevent problems too. Gently stretch the forearm and wrist before performing any sport or activity that can cause or aggravate tennis elbow. Specific manipulative therapy treatment for chronic lateral epicondylalgia produces uniquely characteristic hypoalgesia. The protagonists of this new treatment technique report that it produces substantial and rapid pain relief.6 Mulligan has recently described an manual therapy intervention in which a therapist applies a passive glide mobilization to a joint (usually an accessory motion) and sustains it with concurrent physiologic (osteokinematic) motion of the joint, either actively performed by the patient, or passively performed by operator.5 The technique called "mobilization with movements" (MWM), are claimed to bring about rapid pain-relieving effects and function (like enhance grip strength) immediately following their application.31 The manipulative therapy presented in this master class warrant consideration in the clinical best practice management of LE, and serve as a model for other similar musculoskeletal condition.7 The word LASER is an acronym for "Light Amplification by Stimulated Emission of Radiation". The operation of laser consisting of emitted light which is phonotic and may be visible or invisible portion of electromagnetic spectrum depending on its wavelength. LASER emission is based on the principle of absorption, spontaneous and stimulated emission of radiation. General characteristics of laser are Coherence, Collimation and divergence, Mono chromaticity, power and power density, and Polarization. Specific characteristics which are particular to the type of laser used are Frequency, Power and Emission mode. According to power, lasers are divided into High-power, Medium-power and Soft or cold laser (Low Level Laser Therapy). Low level laser therapy has recently emerged as a distinct therapeutic modality in the control of both acute and chronic pain. LLLT is a type of phototherapy and non-invasive technique, include light source (wavelength 632-1064nm) treatment that generates light of a single wavelength. LLLT emits no thermal effect, sound, or vibration and may act via non thermal or photochemical reactions in the cells, also referred to as photobiology or bio stimulation. The device used in this application usually produces either infra-red or visible red radiation and include the gallium arsenide (GaAs) or gallium aluminum arsenide infrared (GaAlAs) or helium neon (HeNe) semiconductor.32

Objectives of Study

To compare the efficacy of Mulligan's MWM Versus Mulligan's MWM in combination with Low level laser

therapy, to reduce pain and improve grip strength in Tennis elbow.

Methodology

Source of data

Patients suffering from Tennis elbow referred to physiotherapy by Physician or Orthopedic Surgeon in and around Bangalore.

Method of collection of data

Approximately 50 subjects with age group of 18 – 70 years, fulfilling the inclusion criteria and exclusion criteria were taken into the study and assigned into the two groups; group A and group B. Duration of the study was approximately 9-12 months.

Inclusion criteria

Unilateral symptomatic Tennis elbow Both Male and Female Subjects with age group 18-70 years Chronic tennis elbow (three months or more duration) Tenderness over the forearm extensor origin Pain on the lateral epicondyle during resisted dorsiflexion of the wrist with the elbow in full extension

Exclusion criteria

1. Subjects with bilateral Tennis elbow
2. History of Rheumatoid diseases or Neurologic impairment including Stroke or Head injury; Severe Neck\Shoulder problem likely to cause or maintain elbow complaints
3. History of fracture of humerus or radius or ulna; Intra-articular pathology/hematoma
4. Arthritis or allied conditions; Elbow bursitis; Medial epicondylitis; Radial tunnel syndrome; Cervical radiculopathy
5. Skin problems/neighboring bacterial infection; Ossification and calcification of the soft tissues.
6. Previous surgery to elbow joint; treated previously by physiotherapy or any other kind of manual therapy in the last 3 weeks before inclusion.
7. Non cooperative patients

Materials used

1. Materials used for assessment
2. Patient’s Consent Form.
3. Assessment Performa.
4. Chair.
5. Hand held hydraulic dynamometer (Baseline. Inc. U.S.A).
6. Visual Analogue Scale.

Materials used for treatment

Table. Couch. Pillow. Mulligan’s Belt. Low Level Laser (Helium-neon laser combined with IR diode)

Procedure

Subjects meeting inclusion and exclusion criteria were recruited for study. Informed consent was obtained from them. Quasi experimental study design and Purposive sampling technique is used. The subjects were randomly assigned into two groups, group A and group B with 25 subjects in each group. Pre- treatment assessment on VAS for pain and hand grip dynamometer for Hand Grip Strength was noted for both the groups. Group A subjects underwent the Mulligan`s Mobilizations with Movement. Group B subjects underwent the Mulligan`s Mobilization with Movement and Low Level Laser Therapy. Frequency of the treatment regimen for both the groups was three times a week for a period of 3 weeks. On the same assessment parameters, Post-treatment assessment of Pain and Hand Grip Strength were taken for both the groups by the end of third week. The results were computed and analyzed to see which group has better improvement.

Outcome Measures

The outcome is measured in terms of Pain and Hand Grip Strength, using VAS and HGD respectively at following intervals: At baseline. At end of third week after starting treatment.

Procedure for measuring visual analogue scale

Patient was provided with a visual analogue scale (VAS). The VAS used in the study consisted of a continuous horizontal line 10cm in length with anchor point of ‘no pain’ (0) and ‘worst pain’(10) on the left and right ends of line respectively.69 Patient was explained before the treatment about VAS with respect to 0-10 on the scale. The patients were asked to mark pain intensity before the treatment and by the end of third week,

Procedure for measuring grip strength by hand dynamometer

Hydraulic dynamometer (Baseline Inc. U.S.A) commonly used to estimate grip strength measurement in clinical and research setting.

During the examination the patient was seated comfortably and arm was held at the patients side with shoulder adducted and neutrally rotated, elbow flexed at 90 degrees, forearm in a neutral position, and the wrist between 0- 30 degrees of extension and between 0 – 15 degrees ulnar deviation and the maximal grip readings were noted with pain free maximum contraction. The same procedure was repeated again after third week

Intervention

Subjects were randomly assigned to two groups. Informed consent was obtained from them. Group A Subjects received Mulligan`s Mobilization with Movement. Subjects were instructed to lie supine having their elbow extended and forearm pronated on a treatment table. Belt was put around patient forearm. With the patient established what active motion reproduced the patient's elbow pain; this was considered to be the `comparable sign. The comparable sign was one of the following: making a fist, gripping a rolled elastic bandage of 5 cm diameter, wrist extension un-resisted, and wrist extension resisted third finger extension un-resisted, or third finger extension resisted. If any of these motions reported as painful was designated the comparable sign, and no further motions were assessed. Then MWM was performed, consisting of a laterally-directed manual pressure to the proximal medial forearm while the subject performed the comparable sign motion (Mulligan 1995). Based on the suggestion of Mulligan (1995), up to four attempts were allowed to find the direction of the manual pressure that eliminated the comparable sign on the affected Side. The four directional options were standardized and recorded on the data form. At this time, if pain with the comparable sign was eliminated (positive response to

MWM) if pain with the comparable sign was not eliminated (negative response to MWM). Based on the suggestion of Mulligan (1995), the patient performed previously painful motion up to ten times while MWM was being applied and sustained for approximately thirty seconds. It was done for three sets with thirty seconds rest in between each set.

Group B

Subjects received Low Level Laser Therapy followed by Mulligan`s Mobilization with Movement. LLLT was given with Helium-neon laser combined with IR diode with the following parameter: wave-length 632.8nm; average power output 10 mw; emission mode modulated mode. Glasses for both the therapist and the patient were provided to avoid the possibility of irradiating the eyes with precautionary measure that never look directly along the axis of the beam. Treatment starts with preparation of treatment area. The surface to be treated was kept as dry as possible to prevent light reflection on the skin. The laser beam reaching the skin was kept as far as possible perpendicular, throughout the therapy, to ensure optimal absorption and penetration. The optic terminal was kept as close as possible to the surface being treated. The laser was locally applied to 6 sites on and around the epicondyle. Thus, the LLLT was applied at the site of inflammation and primary hyper algesia. Each point was treated for 30 sec. Mulligan`s Mobilization with Movement was applied as same as the subject of group A.

Results

Pre-treatment measurement

For Pre-treatment assessment, Pain and Hand grip strength were noted for both the groups. VAS and hand grip dynamometer were used to measure Pain and Hand Grip Strength respectively.

Post-treatment measurement

On the same assessment parameters, Post-treatment assessment of Pain and Hand Grip Strength were taken, at the end of 3 weeks, for both the groups. The readings of range of motion for each subject were recorded in an evaluation chart (Refer Annexure). The readings of all the subjects are tabulated in the master chart and taken up for statistical analysis.

Statistical test used

To find the significance between pre and post treatment measurement values of VAS and grip strength for Group A and Group B, paired t-test has been used. To compare the effectiveness between the groups, unpaired test-test was used.

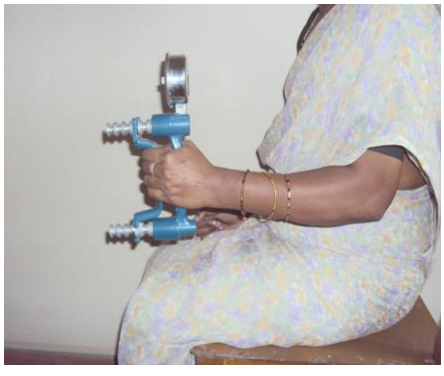

Fig 1: Measuring Grip Strength Using Hand Dynamometer

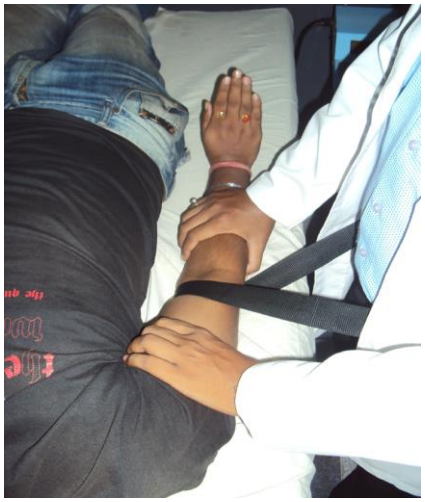

Fig 2: Mulligan's Mobilisation with Movement for Tennis elbow

Fig 3: Low Level Laser Therapy Instrument Age wise distribution in both the groups

Table 2: depicts age wise distribution of subjects in group A and group B and shows that the age group of 4th decade is most affected with 32.0% of subjects in this group

		Group		
		Group A	**Group B**	**Total**
Age	20-30	5 20%	3 12%	8 16%
	30-40	7 28%	4 16%	11 22%
	40-50	8 32%	8 32%	16 32%
	50-60	5 20%	10 40%	15 30%
Total		25 100%	25 100%	50 100%

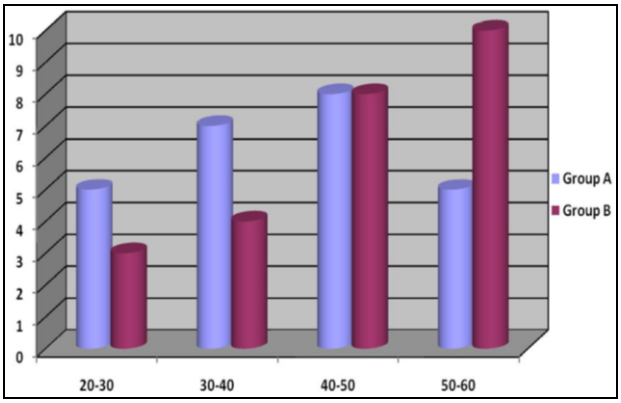

Fig 4: depicts age wise distribution of subjects in group A and group B and shows that the age group of 4th decade is most affected with 32.0% of subjects in this group.

Table 3: Distribution of subjects according to gender

		Groups		Total
		Group A	Group B	
Sex	Male	14 56%	12 48%	26 52%
	Female	11 44%	13 52%	24 48%
Total		25 100%	25 100%	50 100%

This table shows that group A consists of 56% of males and 44% of females. Group B consists of 48% of males and 52% of females. There was no significant difference between the males and females in both the groups. Hence males and females were equally distributed in both the groups.

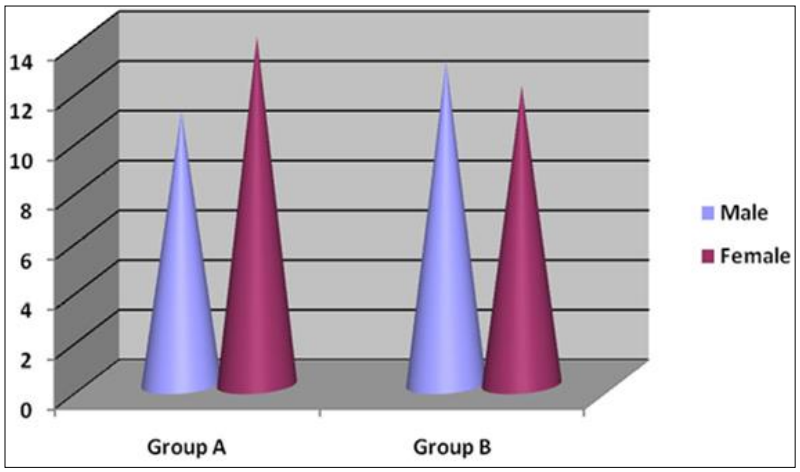

Fig 5: shows that group A consists of 56% of males and 44% of females. Group B consists of 48% of males and 52% of females.

Table 4: Comparison of pre and posttest values of vas in group a

		N	Minimum	Maximum	Mean	SD	Difference of Mean	Paired t test t & p value
Group A	VAS before treatment	25	4	9	6.32	1.314027	3.04	t= 17.10134, p = 0.000, HS
	VAS after treatment	25	2	5	3.28	0.791623		

This table shows the difference between the pre and posttest values of VAS in group A. The mean value of VAS before treatment was 6.32 with SD 1.314 and after treatment was 3.28. with SD 0.791, the paired t-value is 17.10134 and the p value is 0.000 which shows that there is highly significant difference between the pre and posttest value of VAS in group A.

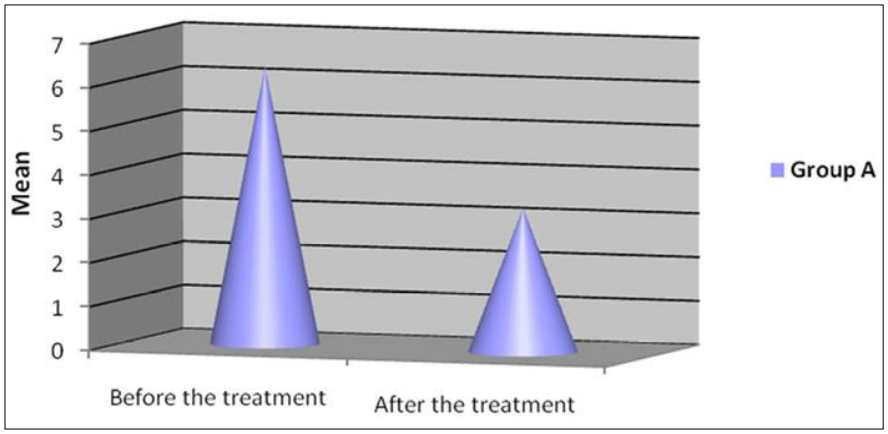

Fig 6: shows the difference between the pre and posttest values of VAS in group A. The mean value of VAS before treatment was 6.32 and after treatment it was 3.28.

Table 5: Comparison of pre and posttest values of grip strength in group a

		N	Minimum	Maximum	Mean	SD	Difference of Mean	Paired t test t & p value
Group A	HGD before treatment	25	6	18	11.36	2.984404	-3.600	t= 15.5885, p = 0.000, HS
	HGD after treatment	25	8	22	14.96	3.115552		

This Table shows the difference between pre and posttest values of grip strength in group A. The mean value of grip strength before treatment was 11.36 with SD 2.984404 and after Treatment was 14.96 with SD 3.115552, the paired t-value is 15.5885 and the p value is 0.000 which shows that there is highly significant difference between the pre and posttest vales of grip strength in group A.

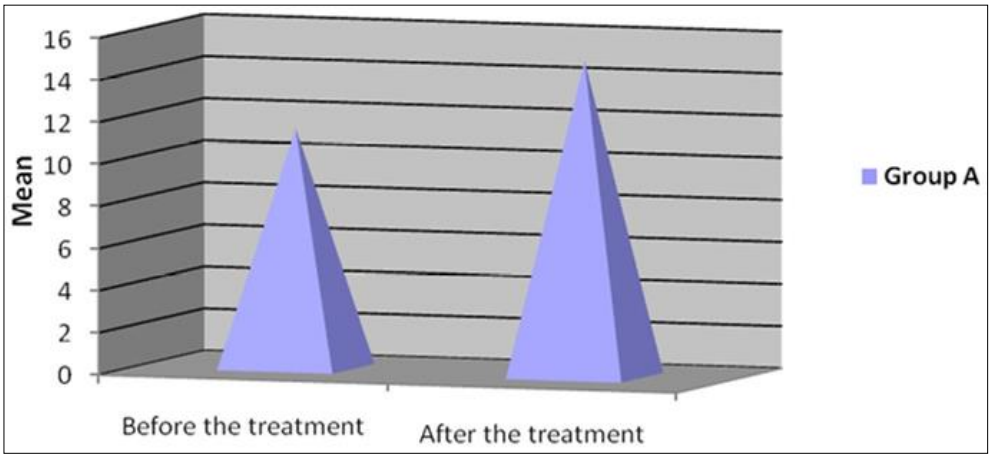

Fig 7: shows the difference between pre and posttest values of grip strength in group A. The mean value of grip strength before treatment was 11.36 and after treatment it was 14.96.

Table 6: Comparison of pre and posttest values of vas in group b

		N	Minimum	Maximum	Mean	SD	Difference of Mean	Paired t test t & p value
Group B	VAS before treatment	25	4	9	6.48	1.417745	4.40	t= 21.13692, p = 0.000, HS
	VAS after treatment	25	1	4	2.08	0.77033		

This Table shows the difference between pre and posttest value of VAS in group B. The mean value of VAS before treatment was 6.48 with SD 1.417 and after treatment was 2.08 with SD 0.077, paired t-value is 21.13692 and the p value is 0.000 which shows that there is highly significant difference between pre and posttest values of VAS in group B.

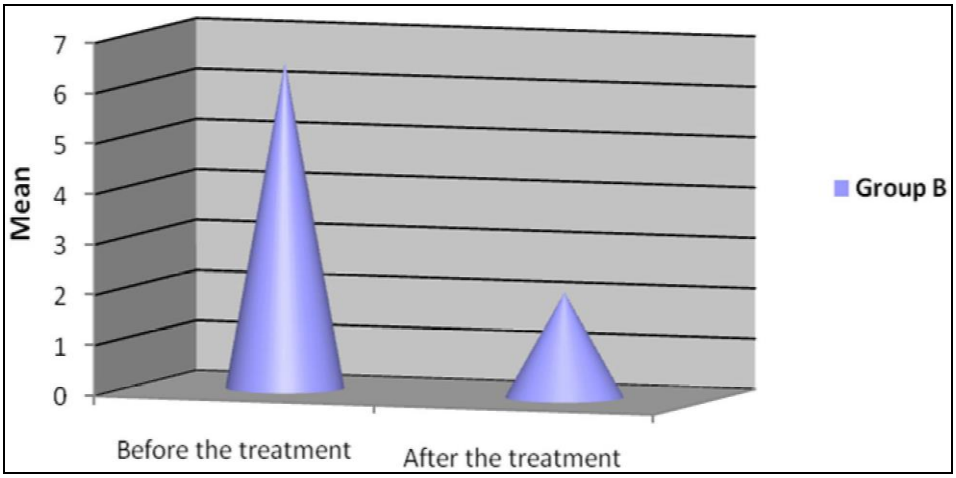

Fig 8: shows the difference between pre and posttest value of VAS in group B. The mean value of VAS before treatment was 6.48 and after treatment it was 2.08.

Table 7: Comparison of pre and posttest values of grip strength in group b

		N	Minimum	Maximum	Mean	SD	Difference of Mean	Paired t test t & p value
Group B	HGD before treatment	25	6	18	11.68	2.92575	-4.720	t= 16.857, p = 0.000, HS
	HGD after treatment	25	12	22	16.40	2.58099		

Table 5.6 shows the difference between pre and posttest value of grip strength in group B. The mean value of grip strength before treatment was 11.68 with SD 2.92575 and after treatment was 16.40 with SD 2.58099, paired t-value is 16.857 and the p value is 0.000, which shows that there is highly significant difference between pre and posttest values of grip strength in group B.

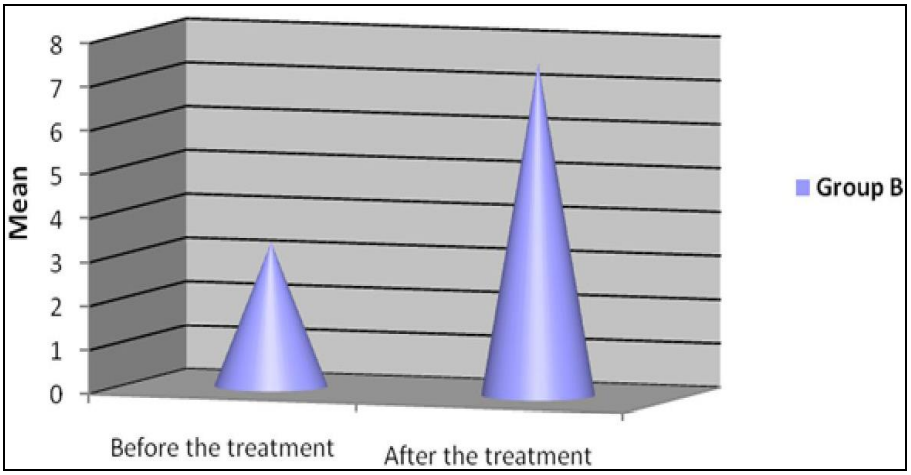

Fig: 9 shows the difference between pre and posttest value of grip strength in group B. The mean value of grip strength before treatment was 11.68 and after treatment was 16.40.

Table 8: Comparison of pre vs posttest values of vas among group a and group b

	Mean	Mean Difference	Unpaired t test t and p value	Result
Diff Pre and Post VAS Group A	3.04	-1.360	t = 4.357 p = 0.000	P<0.05 HIGH SIG
Group B	4.40			

This Table 10 shows the difference of pre Vs posttest value of VAS between group A and group B. The mean value of group A was 3.04 and for group B was 4.40, unpaired t value is 4.357 the p value is 0.000 which shows that there is highly Significant difference of pre Vs posttest value of VAS between group A and group B, also group B shows significant improvement than group A. Therefore the study rejects the null hypothesis and accepts the alternate hypothesis.

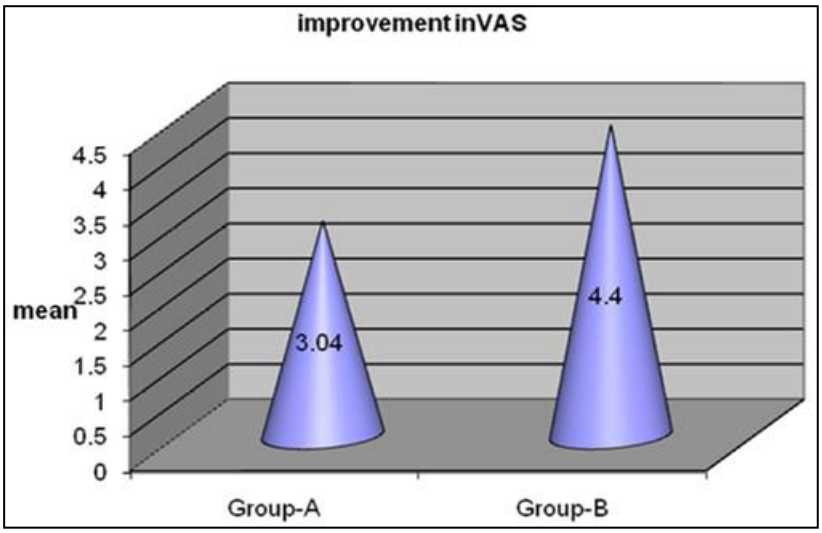

Fig 10: shows the difference of pre Vs posttest value of VAS between group A and group B. The mean value of group A was 3.04 and for group B was 4.40.

Table 9: Comparison of pre vs posttest values of grip strength among group a and group b

	Mean	Mean Difference	Unpaired t test t and p value	Result
Diff Pre and Post HGD Group A	3.60	-1.120	t = 3.086 p = 0.003	P<0.05 High Sig
Group B	4.72			

This table shows the difference of pre Vs posttest value of grip strength between group A and group B. The mean value for group A was 3.60 and for group B was 4.72, unpaired t value is 3.086. The p value is 0.003 which shows that there is highly significant difference of pre Vs posttest value of grip strength between group A and group B, also group B shows significant improvement than group A.

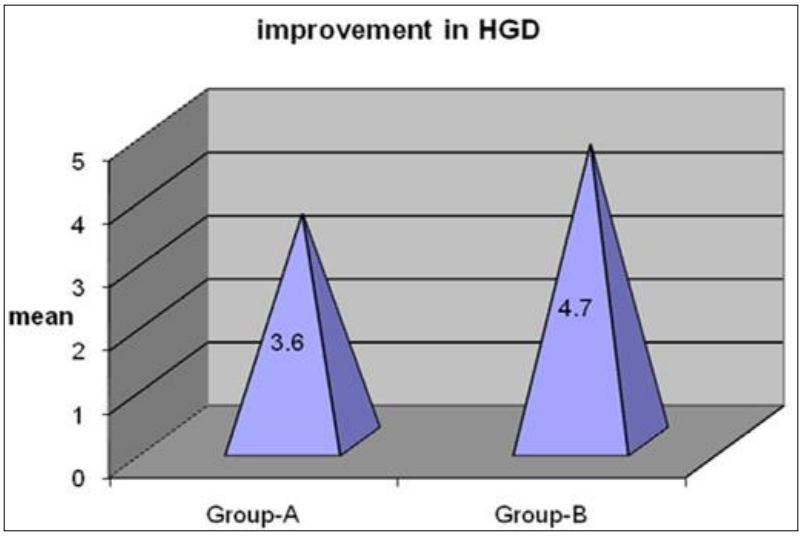

Fig 11: shows the difference of pre Vs posttest value of grip strength between group A and group B. The mean value for group A was 3.60 and for group B was 4.72.

Discussion

Tennis elbow is arguably the most common painful, debilitating and upper extremity musculoskeletal disorders.1 This is a condition with complex etiological and pathophysiological factors, occurs in tennis players as well as housewives, artisans, and violinists. The term is widely used to describe an overuse injury that is characterized by pain in or near the lateral epicondyle or in the forearm extensor muscle mass, tenderness over the common extensor tendon origin mainly ECRB, marked functional impairment, mechanical hypergesia, motor and sensory system deficits, muscle strength deficits, abnormal muscles activation pattern of forearm extensor muscles and poor posture of upper limb.5, 6, 7, 8

Tennis elbow has been demonstrated to occur in up to 50% of tennis players. The typical patient is a man or woman aged 35-55 years who either is a recreational athlete or one who engages in rigorous daily activities.

The anatomic basis of the injury to the extensor carpi radialis brevis origin appears to be multifaceted, involving hypo vascular zones, eccentric tendon stresses, and a microscopic degenerative response.

However, this condition is not limited to tennis players and has been reported to be the result of overuse from many activities. Any activity involving wrist extension and/or supination can be associated with overuse of the muscles originating at the Lateral Epicondyle. Tennis has been the activity most commonly associated with the disorder.

The risk of overuse injury is increased 2 -3 times in players with more than 2 hours of play per week and 2-4 times in players older than 40 years. Several risk factors have been identified, including improper technique, size of racquet handle, and racquet weight.

Upon examination, the patient has a point of maximal tenderness just distal (5-10 mm) to the lateral epicondyle in the area of the ECRB muscle. Wrist extension or supination (but not flexion or pronation) against resistance with the elbow extended should provoke the patient's symptoms.

Although many treatments have been advocated, but which modality works best, for both conservative and operative treatment choices is still under construction.80

The aim of this study was to compare the combined effects of MWM and LASER along with MWM alone in chronic cases of Tennis elbow. Mulligan MWM is a useful technique for eliminating the pain of a previously painful active movement, in patients with lateral epicondylalgia. MWM resulted in a significant increase in both pain-free grip strength and maximum grip strength from pre-intervention to post-intervention for the affected limb in both the groups. But in this study it was seen that subjects in group B showed better results with combined effect of LASER and MWM.

Total fifty subjects were included in the study after satisfying the inclusion criteria. Group A consists of twenty five subjects in which 56% were males and 44% were females and group B consists of twenty five subjects in which 48% were males and 52% were females. Hence males and females were equally distributed in both the groups. Based on age the 4th decade was mostly effected group in this study by 32.0%.

Group A and Group B subjects were tested prior to treatment for pain using VAS and grip strength using hand dynamometer. After a brief explanation about the treatment, Group A subjects were subjected to Mulligan`s Mobilisation with movement of three sets for ten times with thirty seconds of rest in between the sets for a duration of thrice a week for three weeks and group B subjects were subjected to Mulligan`s Mobilisation with Movement of three sets for ten times with thirty seconds of rest between each sets and Low Level Laser Therapy given with Helium-neon laser combined with IR diode with the following parameter: wave-length 632.8nm; average power output 10 mw; emission mode modulated mode for thrice a week for three weeks. At the end of three weeks subjects were again tested for VAS and grip strength.

The result of this study shows that there is highly significant difference between pre Vs post test values of VAS and grip strength in group A and group B in which the p value is 0.000.

The difference of pre Vs post test values of VAS between group A and group B: The mean value for group A was 3.04 and for group B it was 4.40. The unpaired t value was 4.357 and p value was 0.000 which shows that group B shows highly significant improvement than group A. The pre Vs post test value for grip strength between group A and group B: The mean value of group A was 3.60 and for group B it

was 4.72. The unpaired t value was 3.086 and p value was 0.003 which shows that group B shows highly significant improvement than group A. Therefore the study rejects the null hypothesis and accepts the alternate hypothesis.

Neurophysiological and central nervous system processes affected by nocioception and chronic pain. It has also been suggested that important cause of chronic pain may be maladaptive plasticity of the spinal cord neurons and that peripheral injury triggers an initial change in the excitability of the neurons, but the excitability perseveres beyond the period of acute peripheral pathology.

Pain has been described as an unpleasant experience which we associate with tissue damage or express in terms of tissue damage, or both. Low level laser therapy has recently emerged as a distinct therapeutic modality in the control and management of both acute and chronic pain.

Neuro pharmo logical effect of Laser mediated analgesia produce the significant alteration on synthesis, release and metabolism of range of neurochemicals which produces the significant alteration in CNS and peripheral neuro-chemistry. These includes increases the level of central inhibitory neurotransmitter GABA with decrease level of excitatory neurotransmitter glutamic acid, increases the Serotonin and Acetylcholine release, endogenous opiate release such as

endorphins which is secrete by brain to modulate pain (opiate mediated control theory), significantly decreases in level of catecholamine neurotransmitter dopamine in midbrain and medulla, decreases the mitochondria density in axon of peripheral nerve and decreases in histamine level and mast cell numbers.

Neurophysiological effect of Laser mediated analgesia, some studies have suggest that it may alter endogenous electrophysiology (resting membrane potential, mechanical stimulation threshold, conduction of peripheral nerve, excitability of nerve cell etc.), while others have demonstrated the significantly affect on electrical evoked potential in term of conduction latency and amplitude and selective suppressions of activity in small diameter nocioceptive afferents. However, these studies are conflicting and frequently contradictory in nature and dosage- dependent [9].

Laboratory studies suggest that Laser it may help to achieve the pain relief by promoting healing of underlying lesion by increasing anti-inflammatory effects through reduced prostaglandin synthesis reduction, stimulating collagen production, increased ATP production by the mitochondria, decreased edema by increasing lymphatic flow, alters DNA synthesis and improving the function of damaged neurological tissue [8].

A large number of clinical trials suggest that LLLT is useful for chronic pain. Ottar vasselien jr *et al*. 40 (1992) stated that LLLT has a significant effect over placebo in decreasing pain and improving grip strength on affected side. Simunovic Z *et al*. 76 (1998) (n=274) concluded that best results were obtained using combination of both Trigger points and Scanner technique than thetechnique alone. Lam LK and Cheing GL77 (2007) reported that LLT was more effective than sham or no treatment. Bjordal JM78 (2008) stated that possibly 632 nm wavelengths directly to the lateral elbow tendon insertions is provided better pain relief and less disability in LE, both alone and in Conjunction with an exercise regimen in 13/18 Randomized Control Trials. Oken O *et al* 37 (2008) stated that LLLT was better than effects of brace or ultrasound treatment in tennis elbow. All reviewers concluded that the evidence for TENS in chronic pain was inconclusive.

There was significant force augmentation following intervention in either group. For both the groups, maximal grip force changed with a significant mean difference of -1.12. Before that treatment in group A subjects the grip strength was 11.36 with SD 2.984404 and after the treatment it was 14.96 with SD 3.115. The mean difference was -3.600 and p test value was which means it is highly significant.

In contrast to group B subjects the mean difference was -4.720 and p test value was 0.000 which shows it is highly significant. Before the intervention the grip strength mean value was 11.68 with SD 2.92575 and after the intervention it was 16.40 with SD 2.58099. This difference was seen due to the combined effect of LASER and MWM. MWM intervention may activate mechanisms that influence central sensitization as suggested to occur in it31 and LASER helped in reducing the acute or chronic pain by neuro pharmo logical effect of LLLT, neurophysiological effect of LLLT and by promoting healing of underlying lesion.93 This study had only fifty subjects which is a small sample size. There is a probability that the result obtained for the study was biased and larger sample size may give a clearer picture.

Conclusions

In this study both the groups showed significant response to the treatment protocol. VAS and grip strength increased after a combined intervention of LLLT and MWM for a period of thrice a week for three weeks. LLLT was given by Helium-neon laser combined with IR diode with the wave-length 632.8nm; average power output 10 mw; emission mode modulated mode to 6 sites on and around the epicondyle. Each point was treated for 30 sec. MWM of three sets of ten glides with thirty seconds rest in between each set and each glide was sustained for approximately thirty seconds.

References

1. Bisset L, Paungmali A, Vicenzino B, Beller E. A systematic review and meta-analysis of clinical trials on physical interventions for lateral epicondylalgia. Br J Sports Med. 2005; 39(7):411-22.
2. Brukner P, Khan K. Clinical Sports Medicine, Sydney: McGraw-Hill, 1993.
3. Vicenzino B, Wright A. Effect of a novel manipulative physiotherapy technique on tennis elbow: a single study. Manual therapy. 1995; 1:30-35.
4. Hutson AM. Work-Related Upper Limb Disorders: Recognition and Management. 1997; 54:62.
5. Abbott JH, Patla CE, Jensen RH. The initial effects of an elbow mobilization with movement technique on grip strength in subjects with lateral epicondylalgia. Manual Therapy. 2001; 6(3):163-169.
6. Vicenzino B, Paungmali A, Buratowski S, Wright A. Specific manipulative therapy treatment for chronic lateral epicondylalgia produces uniquely characteristic hypoalgesia. Manual Therapy. 2001; 6(4):205-212.

7. Vicenzino B. Lateral epicondylalgia: a musculoskeletal physiotherapy perspective. Manual Therapy. 2003; 8(2):66-79.
8. Manchanda G, Grover D. Effectiveness of movement with mobilization compared with manipulation of wrist in case of Tennis elbow. Indian Journal of Physio therapy and Occupational, 2008, 2(1).
9. Norris C. Sports injuries diagnosis and management, Butterworth Heinemann 3rd ed, 2005, 412-417.
10. Abbott JH. Mobilization with movement applied to the elbow affects shoulder range of movement in subjects with lateral epicondylalgia. Manual Therapy. 2001; 6(3):170-7.
11. Binder AI, Hazelman BL. Lateral humeral epicondylitis-a study of natural history and the effect of conservative therapy. British Journal of Rheumatology. 1983; 22:73-76.
12. Smidt N, Lewis M, DA VDW, Hay EM, Bouter LM, Croft P. Tennis elbow in general practice: course and prognostic indicators of outcome. Journal of Rheumatology. 2006; 33(10):2053-59.