

Effectiveness of Mulligan's Mobilization Technique Versus Eccentric Exercises on Pain, Hand Grip Strength and Function in Subjects with Lateral Epicondylitis

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Abstract:- Background and Objectives: Lateral epicondylitis is the most common overuse syndrome in the elbow, due to injury to the muscles originate on the lateral epicondylar region of the distal humerus. This study was done to assess the effectiveness of Mulligan's Mobilization versus Eccentric Exercises in subjects with Lateral Epicondylitis. **Methods:** Lateral Epicondylitis (LE) subjects, diagnosed by Orthopedician were included according to the inclusion criteria and obtained in writing with their consent. Randomly, 60 subjects were split into two groups of 30 each. Group A received Mulligan's Mobilization where Group B received Eccentric exercises and the treatment was given for 12 sessions in 4 weeks. After the treatment, subjects were evaluated for their pain profile using visual analogue scale, grip strength by Hand dynamometer and functional activity by PRTEE questionnaire. **Results:** Paired t-test analysis was used to compare groups within each, and independent t-test analysis was performed to compare groups between each. Both groups were similarly efficient in reducing pain after 4 weeks ($p>0.05$), however Group B had a statistically significant improvement in hand grip strength and functional activities. **Conclusion:** This study concludes that, both Mulligan's Movement and Eccentric Exercise Techniques are equally effective in reducing pain, whereas Eccentric Exercise found to be very effective in improving Hand Grip Strength and functional activity. **Keywords-** Lateral Epicondylitis, Mulligan's Mobilization, Eccentric Exercises, Visual Analogue Scale (VAS), Hand-held Dynamometer, Patient Rated Tennis Elbow Evaluation Questionnaire (PRTEE Questionnaire).

I. INTRODUCTION

Lateral epicondylitis (LE) or Tennis elbow is a complex and painful musculoskeletal condition that is seen both in working and non-working populations. [1,2] It is the most common lesion in the elbow region [3]. The conditions are characterized by lateral elbow pain which increases during gripping or squeezing [4]. The maximum pathological changes are seen in the area of the Extensor Carpi Radialis Brevis tendinous origin. Therefore, it can have a major impact on the patient's social and professional life [5].

The annual incidence of Lateral epicondylitis in general practice is 4 – 7 cases per 1000 patients, with a peak in patients over 35 – 54 years of age. Dominant arm involvement is the most common [6]. Men and women are equally affected [7]. According to research, 50% of club tennis players older than 30 have at least once had lateral epicondylitis-related symptoms [8].

In lateral epicondylitis there is a degenerative tendon reaction where the most often affected component is the origin of the extensor carpi radialis brevis (ECRB), in which increased fibroblast presence, vascular hyperplasia, and disordered collagen [9].

Symptoms are aggravated during holding tools, shaking hands, and lifting a kettle which involves gripping actions of the hand. [10]

Diagnosis can be made both radiologically and physically. Ultrasonography is presented with an unclear, homogenous fibrillar structure with thin parallel hyperechoic lines and irregular and without a well-defined outline bordered which is without a continuous hyperechoic [11].

Medical management has been recommended for lateral epicondylitis like non-steroidal anti-inflammatory drugs and corticosteroid injections.

A wide array of physiotherapy treatments has been recommended for the management of lateral epicondylitis like cryotherapy, heat, friction massage, ultrasound, electrical stimulation, manipulation like mulligan mobilization, and exercise therapy like eccentric exercises[12].

In order to reduce the strain on the tendon during movement, eccentric strengthening exercises load the musculotendinous unit, causing hypertrophy and enhanced tensile strength. The tendon cells may receive a stronger stimulation to create collagen as a result of an eccentric contraction, which also prepares the tendons to withstand more force than they did during the triggering activity. [13]

Magnus Peterson and Stephen butter (2014) have suggested that eccentric strengthening is beneficial for improving outcomes in tendinopathy. [14]

Mulligan's Mobilization with Movement (MWM) is a modern technique developed by Mulligan. MWM is a form of manual therapy that includes a sustained lateral glide to the elbow joint with concurrent physiological movement. This mobilization technique is often used to correct the faulty position of the elbow joint and is widely used in the management of musculoskeletal disorders. This method works well to decrease discomfort, boost grip strength above the pain-free range, and improve the ability to bear resisted wrist extension during isometric exercise[15,16].

Among all the manual therapies used around the world, MWM i.e., Mobilization-With-Movement is presently acquiring immense recognition. When mobilization enables the affected joint to be moved freely without any discomfort or impairment, Mulligan's approach may be indicated. In MWM, a glide or translation is applied perpendicular to the plane of the affected movement that is being carried out when the glide is applied. [17] According to recent observations, mobilization-with-movement is gaining a solid reputation for treating a variety of musculoskeletal disorders, many of which have proven challenging to treat with other treatment modalities and manipulation techniques (such as lateral epicondylitis and De Quervain's disorder). [18-20]

In his case study, Miller (2000) detailed how using the MWM for lateral epicondylitis led to decreased pain, improved pain-free grip strength (PFGS), and improved tolerance for resisted isometric wrist extension [21].

The visual analogue scale (VAS) is a subjective, proven tool for measuring both acute and long-lasting pain. A handwritten mark on a 10-cm line that indicates a range between "no pain" and "worst pain" which is used to record scores. [22]

Strength quantification can be done more effectively, objectively, sensitively, and affordably with handheld dynamometry (HHD). During a maximal isometric

contraction, the examiner is positioned next to the patient's limb while holding a compact portable device. All of the extremities' proximal and distal muscles can be tested with the apparatus. Concurrent validity with functional testing was good, and test-retest reliability was extremely good. According to Pedro Abizanda et al., a hand-held dynamometer is reliable and practical for assessing functionality. With the exception of pinch and grip, when one attempt is sufficient, it is advised to do three attempts for other strength measurements [23].

Tennis elbow or lateral elbow tendinopathy discomfort and functional impairment can be quantitatively assessed by the patient using the Patient-rated Tennis Elbow Evaluation (PRTEE). A minimum clinically meaningful difference (MCID) value is necessary to assess trial outcomes when employed as an outcome measure in treatments trials. "PRTEE was a reliable, reproducible, and sensitive instrument for the assessment of chronic lateral elbow tendinopathy in a tennis-playing cohort. It was at least as sensitive to change as the other outcome tools tested. The PRTEE may become the standard primary outcome measure in research on tennis elbow" [24].

There are various studies that have used Mulligan's mobilization with or without combining exercise and electrotherapy modalities as a treatment protocol in Lateral epicondylitis and have been proven a beneficial effect. But there are minimum experimental data regarding the comparison of Mulligan's Mobilization versus Eccentric exercises in bringing up better outcome measures in patients with lateral epicondylitis. The purpose of this study is to find out the effectiveness of Mulligan's mobilization and Eccentric exercises in relieving pain, improving pain-free grip strength, and improving function in subjects with Lateral Epicondylitis.

➤ *Aim of the Study*

The aim of the study is to compare the Effectiveness of Mulligan's Mobilization Technique versus Eccentric Exercises on Pain, Grip Strength and Function in subjects with Lateral Epicondylitis

➤ *Objectives of the Study*

- To assess the Effectiveness of Mulligan's Mobilization Technique on Pain, Grip Strength and Function in subjects with Lateral Epicondylitis.
- To assess the Effectiveness of Eccentric Exercises on Pain, Grip Strength and Function in subjects with Lateral Epicondylitis.
- To compare the Effectiveness of Mulligan's Mobilization Technique versus Eccentric Exercises on Pain, Grip Strength and Function in subjects with Lateral Epicondylitis

II. MATERIALS AND METHODOLOGY

A. *Ethics*

All the time during the period of the study ethical issues will be followed with utmost care due to respect towards the subject's health. All the patients will be asked for their informed consent before entering into the trail. Each subject shall be explained about both beneficial and potential harmful effects of the exercise which he was supposed to receive.

The participants will be explained about the purpose of the trail. The request for termination of exercises by the subject at any time of the study shall never be denied.

B. Materials Used:

- Patient consent form.
- Treatment couch and chair
- Pillow
- Mulligan's belt.
- Dumbbell.
- Hand Grip Dynamometer (Fig-1)
- VAS Pain Scale
- Patient Rated Tennis Elbow Evaluation form.

C. Outcome Measures:

Visual Analogue Scale (VAS): The VAS was used to measure the level of pain at the time of data collection, with 0 signifying no pain and 10 denoting the greatest suffering imaginable.

Hand Grip Dynamometer: Maximum grip strength (Kg) was measured by using a Hand Grip Dynamometer.

Patient Rating Tennis Elbow Evaluation: It is outcome measure for rating pain and difficulties while performing functional activities.

➤ Study Setting:

Subjects are recruited from Sandhya Institute of Physiotherapy OPD and Orthopedic OPD, Government General Hospital, Kakinada.

Study Design: Randomised control trail.

Study Type: Comparative study.

Study Duration: 6 Months.

Treatment Duration: 12 sessions in 4 Weeks.

Sampling Method: Simple random sampling method.

➤ Study Sample:

After screening a total of "72" lateral epicondylitis patients, a sample of "60" participants who were willing to take part in the study were selected, along with the patients who met the inclusion criteria. All 60 (30 in each group) subjects were randomly assigned into two treatment groups namely GROUP A: treated with Mulligan's mobilization and GROUP B: treated with eccentric exercises. Treatment sessions was given to each subject was 3 sessions per week for 4 weeks.

➤ Inclusion Criteria:

- Subjects clinically diagnosed with Lateral Epicondylitis by Orthopedician.
- Subjects age between 20-40 years

- Both Male and Female subjects.
- Visual analogue score VAS > 7, local discomfort across the lateral epicondyle of the humerus, and positive results for the Mills and Cozens tests.

➤ Exclusion Criteria:

- Any previous trauma, fracture around elbow, dislocation, bony abnormalities of elbow.
- Peripheral nerve entrapment, cervical radiculopathy.
- history of corticosteroid injection in the preceding 3 months.
- Any other associated systemic illness like metabolic, metastatic, infective disorders.
- Neurological or Neuromuscular impairments.
- Osteoporotic patients.
- Uncooperative patients.

D. Procedure

➤ Group - A: Mobilization with Movement

Subjects were given Mobilization with movement while resting supine with their elbow extended and forearm pronated. The therapist was stabilized the distal part of the arm. Belt positioned close to elbow joint line, around the subject's forearm and the therapist's shoulder. The individuals were instructed to make a painless fist as the therapist sustained a lateral forearm glide with a belt. Ten mobilizations with movement in one set is the dosage. Per session, 3 sets were distributed. Twelve sessions were used for the treatment.

➤ Group - B: Eccentric Exercises

Eccentric exercises for Lateral Epicondylitis should be done on a bed with the wrist hanging over the side and the elbow supported on the bed in full extension (as high as possible). Patients should hold themselves in this position and steadily flex their wrists until complete flexion is reached before returning to the starting position. Employ light dumbbell weights (e.g., 1-2 kg. or a small can from the kitchen cupboard). Sit down on a chair, ideally one with an armrest. Hold the weight or container with the palm facing down while resting the forearm on the armrest. Allow the wrist to now gradually descend. The wrist is raised and extended to its initial position. Patients are told to keep going through the workout even if they feel some minor discomfort. They are instructed to discontinue the exercise, though, if the pain becomes interface.

One set of exercises involved 10 repetitions from each subject. For four weeks, three days a week, three sets of 10 repetitions were completed, with at least a minute rest in between each set. The load is increased using free weights until patients are able to do the eccentric exercises without feeling any mild pain or discomfort.

III. DATA PRESENTATION AND STATISTICAL ANALYSIS

A. Data Collection Instrument

Outcome measures used for data collection were “VAS”, “Hand-held Dynamometer”, and Patient Rated Tennis Elbow Evaluation Questionnaire. The Visual Analogue Scale is used to assess pain and Hand-held Dynamometer was used for assessing the muscle strength. The Patient Rated Tennis Elbow Evaluation Questionnaire is used to measure the function.

B. Statistical Analysis

All statistical analysis was done by using SPSS software version 20.0 and Microsoft Excel 2007.

Between the Groups: Unpaired Student “t”- test was performed to assess the statistically significant difference in the mean values of between the groups for Visual Analogue Scale, Hand-held Dynamometer and Patient Rated Tennis Elbow Evaluation Questionnaire.

Within the Groups: Paired Student “t”-test was performed to assess the statistically Significant difference in the mean values of with in group for Visual Analogue Scale, Hand-held Dynamometer and Patient Rated Tennis Elbow Evaluation Questionnaire.

For all statistical analysis P-Value<0.05 was considered as statistically significant

IV. RESULT

The aim of the study was to find out the effectiveness of Mulligan’s Mobilization technique versus Eccentric exercises on pain, Grip strength and function in subjects with Lateral Epicondylitis.

The study's consort flow chart displayed how the trial was structured in terms of subject screening, random assignment, and analysis after the intervention.

Sixty patients were enrolled in the trial after a total of 72 subjects were evaluated for eligibility. Every participant who satisfied the study's eligibility requirements underwent a baseline evaluation before being randomly assigned to two equal groups, each of which has 30 patients.

The results of this study were analysed based on the outcome parameter, which includes Visual Analogue Scale, Hand-held Dynamometer and Patient Rated Tennis Elbow Evaluation Questionnaire.

Frequency tables and percentages were used to present all qualitative factors. The range of each quantitative variable's mean and standard deviation (SD) were reported (maximum – minimum). The results were analysed using the paired t-test and the independent sampling test. P <0.05 was considered to be significant.

V. DISCUSSION

The study results demonstrated better trends of improvement in the Eccentric Exercise group on Grip

Strength and Function than in Mulligan’s Mobilization group. But both techniques showed significant improvements in reducing pain. within the group, both techniques showed significant improvements in reducing pain and increase in grip strength and function when comparing mean and p-value. But when compared between these groups Eccentric Exercises showed statically significant improvement when compared to Mulligan’s mobilization group.

Microtears in the Extensor Carpi Radialis Brevis (ECRB), typically brought on by excessively fast, monotonous, repetitive eccentric contractions and gripping motions of the wrist, are the source of the work- or sports-related condition known as lateral epicondylitis [27,28]. Due to the overuse of the ECRB muscle in patients with lateral epicondylitis and the compromised leverage system that results from the lateral epicondyle's slope, a fulcrum effect is created around the prominent radial head, which increases tension in the surrounding soft tissues, especially when the forearm is working in the hyper pronated position [29,30].

The results of the study showed a statically significant improvement in Grip strength and PRTEE Questionnaire in both the groups (p-value0.000) in pre and posttests values, who receive 4 weeks of therapy within the Mulligan mobilization group. But there is no significant difference in reducing pain between the groups (p-value 0.131906).

Group A which received Mulligan mobilization has experienced a significant change with a p-value of 0.00. Miller (2000) presented similar data, demonstrating that individuals with Lateral Epicondylitis who had MWM recovered to full function. [31]

Gokan Doner et al. demonstrated that the neurophysiological mechanism of early hypoalgesia development in the mulligan group was based on the activation of peripheral mechanoreceptors and the suppression of nociceptors. Presynaptic suppression of nociceptive afferent activity results from the peripheral mechanoreceptors' activation of apical spinal neurons as a result of the joint mobilisation. [32]

The mechanism for pain relief in mulligan mobilization -Paungmali et.al (2004) showed that mobilization with movement produces sensory input sufficient to recruit and activate descending pain. Inhibitory systems that result in some or all of the pain-relieving effects. It produces hypoalgesia effects during and following its application, as well as sympatho-excitatory effect. [33]

Bill Vicenzino (2006) proposed that tennis elbow results from the ulna and radius being misplaced in reference to the humerus; the discomfort could be relieved by lateral gliding to the elbow joint to realign the ulna and radius[34].

Group B which received eccentric exercise has a significant change with a p-value of 0.00 and the results of the study are similar to studies conducted by Peterson et al concluded that eccentric graded exercise reduced pain and increased muscle strength in chronic tennis elbow more effectively than concentric graded exercise (p<0.00)[35].

Eccentric exercises appear to reduce pain and improve function, reversing the pathology of lateral epicondylitis.[36] Since tendinopathies are not inflammatory conditions, they show histological evidence of a failed healing response, and even the degenerative paradigm is not really applicable, the combination of mechanical and biochemical causes has recently gained more appeal. Traditionally, pain in tendinopathy has been attributed to inflammatory processes.

Theoretically, the pain mechanism might be explained by microscopic tendon disruption and the mechanical breakdown of collagen, however clinical and surgical evidence cast doubt on this theory. The pain associated with tendinopathy may also be influenced by substance P and chondroitin sulphate[Khan, 2000][37]. Also, the decrease in pain may be a result of a lengthening of the Musculo-tendinous junction creating less strain and allowing a greater range of motion. Given that various chemical irritants and neurotransmitters may cause pain in tendinopathy, the biochemical hypothesis has gained popularity.

Patients with Achilles tendinopathy have been discovered to have high levels of the neurotransmitter glutamate. The normal prostaglandin E2 levels in these patients revealed that the tendons did not exhibit any symptoms of inflammation. [Alfredson, 1999][38].

D.stasinopoulos et al - By causing tenocytes' mechano-receptors to make collagen, which is likely the primary cellular mechanism governing tendon injury repair, eccentric training strengthens tendons. A reaction that normalises the elevated amounts of glycosaminoglycans may also be brought on by eccentric training. Additionally, it might enhance the collagen's alignment within the tendon and promote the creation of collagen cross-links, both of which increase tensile strength. [39]

According to the eccentric strengthening theory, loading the muscle-tendon unit will cause hypertrophy and boost tensile strength. This in turn lessens the strain these activities place on the tendon. The tendon's cells may receive a stronger stimulus from eccentric contraction, which can increase collagen production and increase the tendon's resistance to force. Another advantage of eccentric strengthening has recently been confirmed to be a reduction in neovascularization. Neovascularization is thought to be a contributing element to pain in LE and other tendinopathies [Calfee, 2008] [40]. Compared to concentric execution, eccentric execution produces more force with less energy use and oxygen use.

Objectively the visual analog scale pain rating dropped from 9/10 to 3.5/10 (week 4) in both groups. Average grip strength testing from two trials changed from 22 lbs to 37 lbs. with no pain reproduction reported. we can conclude that the effect of eccentric exercise training on stimulating tendon remodeling and producing muscular adaptive responses has led to a reduction in pain and improvement in grip strength and function in subjects with lateral epicondylitis.

Based on the data analysis, the present study found that four weeks of Mulligan’s mobilization technique and Eccentric Exercises are statically significant when compare to pre and post-tests. But when compared between the group's Eccentric Exercises showed statically significant improvement in grip strength and function in subjects with lateral epicondylitis.

VI. CONCLUSION

In this study post interventions performance level has increased when compared to pretest level of performance in reducing Pain and improving Grip strength and Function in Eccentric Exercises group. This study concludes that, both Mulligan’s Mobilization and Eccentric Exercise Techniques is equally effective in reducing pain, but Eccentric Exercises found to be very effective in improving Hand Grip Strength and functional activity. So, Eccentric Exercises group is more effective than Mulligan’s mobilization technique where P value <0.05.

Hence it can be recommended that Eccentric Exercises are more effective, useful technique than Mulligan’s mobilization.

➤ *Limitations*

- The present study only involved thirty patients per group, and there was no follow-up information, thus the interventions' long-term effects are yet unknown.
- Lack of a real control group compromises the study's internal validity.

➤ *Recommendation*

- The study can be conducted with larger sample size.
- The study can be conducted with longer duration and with a control group.

VII. TABLES & GRAPHS

Table 1: Analysis of Mean scores of pre & post-tests VAS, HGS and PRTEE within the group A

Group A	Outcomes	Mean	SD	P value
Pair 1	Pre VAS	7.33	1.124441	0.000
	Post VAS	4.83	0.773854	
Pair 2	Pre HGS	12.40	1.476249	0.000
	Post HGS	15.30	0.932183	
Pair 3	Pre PRTEE	73.83	12.14874	0.000
	Post PRTEE	42.03	6.477991	

Table 2: Analysis of Mean scores of pre & post VAS, HGS and PRTEE within group B

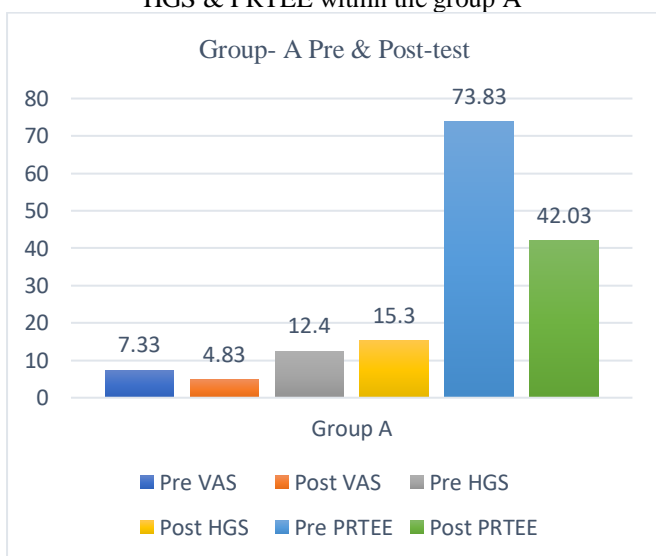
Group B	Outcomes	Mean	SD	p value
Pair 1	Pre vas	7.27	1.080655	0.000
	Post vas	5.13	0.808717	
Pair 2	Pre HGS	12.63	1.607811	0.000
	Post HGS	14.97	0.935261	

Pair 3	Pre PRTEE	72.40	10.02961	0.000
	Post PRTEE	47.47	6.257318	

TABLE 3 Analysis of Mean scores in post VAS, HGS and PRTEE between groups A& B

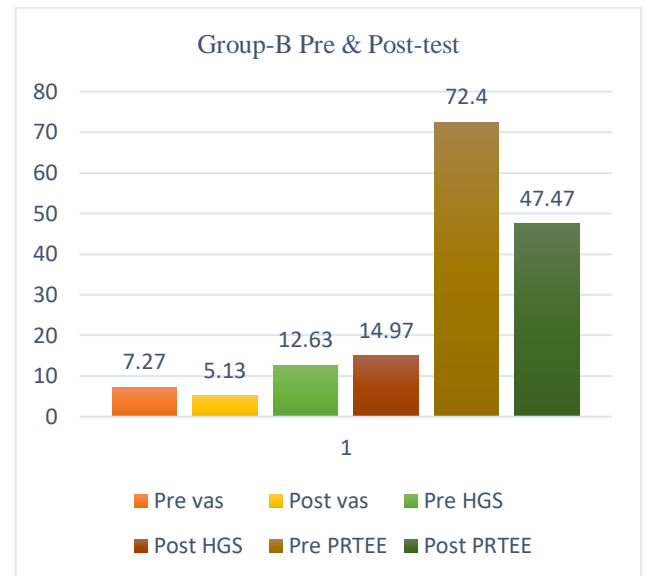
Groups		mean	SD	P - value
Pair 1 VAS	MWM	3.766	0.773854	0.13190
	Eccentric Exercise	3.966	0.808717	
Pair 2 HGS	MWM	14.40	0.932183	0.00
	Eccentric Exercise	15.57	0.935261	
Pair 3 PRTEE	MWM	42.03	6.477991	0.002
	Eccentric Exercise	47.47	6.257318	

Graph - 1 Analysis of mean scores of pre and post VAS, HGS & PRTEE within the group A



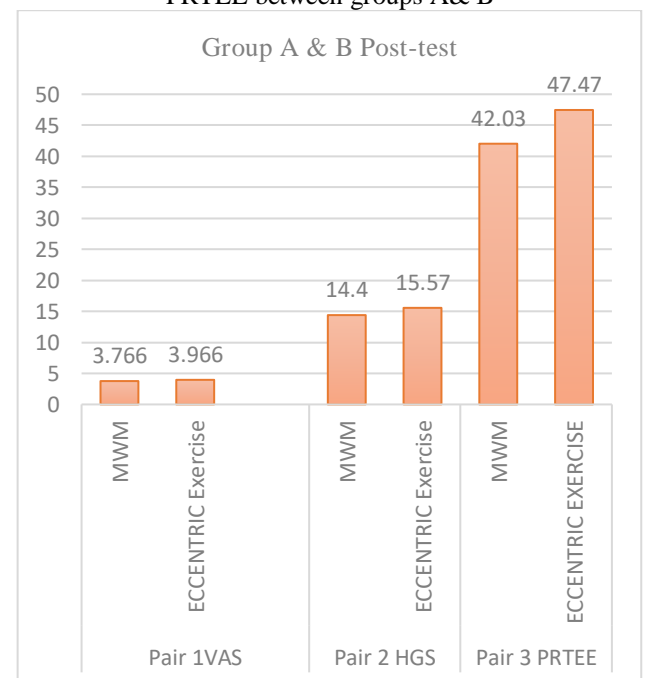
Results: The above Graph shows changes in Pre-test and Post-test values of VAS, HGS & PRTEE mean score within the Group- A which were found to be statistically significant ($p < 0.05$)

Graph-2: Analysis of Mean scores of pre & post VAS, HGS & PRTEE within group B



Results: The above Graph shows changes in Pre-test and Post-test values of VAS, HGS & PRTEE mean score within the Group- B which were found to be statistically significant ($p < 0.05$)

Graph -3: Analysis of Mean scores in post VAS, HGS & PRTEE between groups A& B



Results: The above Graph shows changes in Post-test values of VAS, HGS & PRTEE mean score between Group A & B. There was no significant difference between the post-test VAS mean scores i.e., ($p > 0.05$) in the MWM and Eccentric Exercise groups. But Post-test values of HGS & PRTEE mean scores between Group A & B which were found to be statistically significant ($P \text{ value} < 0.005$).

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