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Effectiveness of Muscle Energy Technique versus Myofascial Mobilization in Improving Functional Outcome in Sub-Acute Non-Specific Low Back Pain: A Randomized Controlled Trial

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ABSTRACT

Background: The low back pain (LBP) is a common musculoskeletal condition. There is limited evidence comparing muscle energy technique (MET) versus myofascial mobilization in managing sub-acute Non-specific low back pain (NSLBP). The study's aim is to evaluate the effectiveness of MET and myofascial mobilization in reducing pain intensity and functional outcomes in NSLBP.

Methodology: A clinical trial was performed at Sindh Institute of Physical Medicine and Rehabilitation on 60 participants. Outcome measures used were visual analogue scale (VAS) and Roland Morris Disability Questionnaire (RMDQ) to determine pain and disability respectively at baseline and at post-intervention. Subjects were randomized into experimental and control groups which received MET and myofascial mobilization respectively. However, both groups received standard therapy of transcutaneous electrical nerve stimulation (TENS) and general muscle strengthening exercises. SPSS version 23 was used for analysis of data. Wilcoxon signed ranked test employed to comparison of baseline and after treatment outcomes within the group. The Mann-Whitney test was employed for between-group differences. A p-value below 0.05 was considered as significant.

Results: The mean age was 40.9± 8.9 in group A and 44.9±9.3 in group B. 17 (28.3%) were females, and 43 (71.7%) were males. Intra-group analysis revealed statistically significant decrease in pain-like symptoms and level of disability in each group ($p < 0.01$). However, inter group analysis showed pain and disability were statistically insignificant (p-value > 0.05).

Conclusion: It is concluded that MET and myofascial mobilization are equally beneficial for LBP in alleviating pain intensity and disability.

Keywords: Disability, Exercise, Muscle Energy Technique, Muscle pain, Myofascial Mobilization, Manual Therapy.

Clinical Trial Registration: Prospective registration was done at the clinicaltrial.gov (NCT05428280).

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INTRODUCTION

Low back pain (LBP) is considered as leading to distressing condition and pain which is not caused with particular identifiable disease, or inflammatory condition is identified as Non-Specific Low Back Pain (NSLBP)[1]**.** A survey stated that years lived with disability of LBP contained 64.9 million in 2017. [2] The global prevalence of LBP in countries such as Bangladesh (20.1%), Iran (14.8), China (34.1%), India (8.4), United Kingdom (9.0%) and Pakistan (19.5%).[3] The prevalence of LBP has increased since the late 20th century and perhaps will keep on increasing in response to the aging population and sedentary lifestyle of the people.[2]

The evidence and literature suggest NSLBP as a most common type and defined it as lumbar muscle tightness, stress, and pain of unknown etiology.[1] Acute, sub-acute and chronic LBP persist for about 6 weeks or less, between 7 to 12 weeks and longer than 12 weeks respectively.[4] The several factors associated with presence of LBP include heavy weight, bad posture, low socioeconomic history and sedentary lifestyle.[1]

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There are various manual therapy treatments available to treat LBP conditions.[5] The MET is an active treatment method and was introduced by Fred Mitchell in 1948. Moreover, MET treats soft tissue, mobilizes joints, relaxes fascia and tightened muscles, reduces pain and improves blood circulation. The MET uses controlled muscle contraction precisely, and the therapist applies resistance.[6] On the other hand, MFR is another effective therapeutic technique used to treat NSLBP. MFR is manual treatment which includes applying minimum load, prolong stretching to the muscle and fascia to achieve the ideal length of fascial tissue. MFR is considered as manual medicine technique which is used to improves muscle spasm in low back region.[7]

There literature available regarding the effects of conservative management on NSLBP showed that MET and MFR are considered as effective intervention techniques for many musculoskeletal disorders. But as far as the authors knowledge there is still scarcity in literature comparing MFR and MET in managing sub-acute NSLBP. Hence, the aim of the research is to determine the effects of MET and MFR in decreasing symptoms like pain and functional outcomes in sub-acute NSLBP.

METHODOLOGY

A single blinded RCT was performed at OPD of Sindh Institute of Physical Medicine and Rehabilitation, Karachi. The ethical considerations of the study were approved by the IRB of Dow University of Health Sciences (Ref: IRB-2122/DUHS/Approval/2021/502). A sample size of 60

patients was calculated using pass version 2 software, two independent sample t-tests with 95% confidence interval and 80% power of test with mean, SD for functional disability, which was equally divided into both groups, with 30 in each group Calculated sample size was an estimated target population of 60 patients within 4 months using a finite population correction factor is 30 patients per group.[8] Non-probability purposive sampling technique was used to recruit participants. Considered criteria of inclusion comprised of both males and females with the age range 30 to 55 years, participants diagnosed with sub-acute LBP between 7-12 weeks of symptoms with history of first episode and a positive test of tight soft tissues such as erector spinae and quadratus lumborum. However, the individuals with malignancy of spine, fracture related to spine, stenosis of the foramen, radiculopathy and other nerve root and its compression related symptoms such as sciatica, cord compression, paralysis, dystrophies of muscles, postural dysfunctions, epilepsy and related disorders, any previous history of trauma, unexplained weight loss and depression were excluded.

All the participants were first screened and those who fulfill the inclusion criteria were explained about the objective, benefits and risks of participation and voluntary participation were ensured by taking consent. Those who gave the informed consent were included in the study and were randomly assigned into experimental and control groups by the help of a computer-generated randomization sheet. Group A received MET and group B received Myofascial mobilization. However, both groups received standard therapy of transcutaneous electrical nerve stimulation (TENS) and lumbar muscles exercises for strength gain. VAS and RMDQ were assessed as outcome measures for each individual participant to determine symptoms such as pain and functional related outcomes respectively at pre-treatment and at the post-intervention i.e. after 4 weeks, 12 sessions of total treatment sessions. The consort flow diagram is shown as figure-1 as follows:

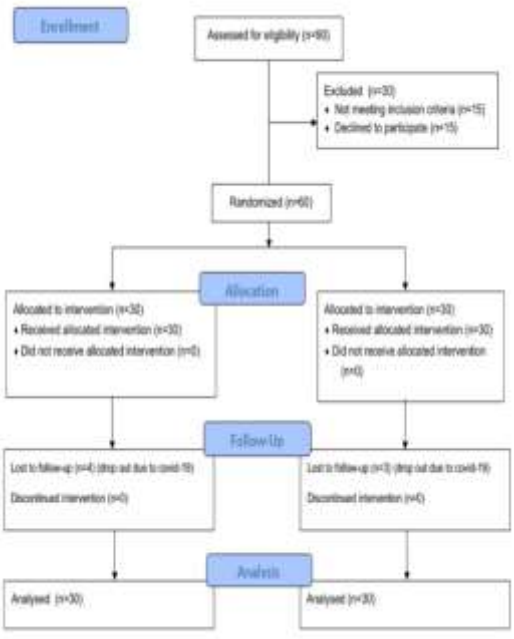

Figure 1: Consort Diagram

To assess the erector spinae tightness, the participant was asked to drop the shoulders in the direction of the groin. Decreased flattening of the lumbar lordosis pointed to the tightness. (ICC 0.88–0.99).[9] To assess the quadratus lumborum tightness, the participant was asked to pushed up sideways as far as possible without movement of the pelvis. Restricted range of movement, lack of curve in the lumbar spine and unusual tension on palpation just beyond the iliac crest, adjacent to erector spinae indicating muscle tightness. (ICC 0.88–0.99).[9]

Group A (Experimental) was given the MET through Post Isometric relaxation (PIR) and Group B (control) was given the transverse touching technique of Myofascial mobilization. However, the TENS and progressive back strengthening exercises were given to both groups. Treatment sessions were given thrice weekly for four weeks.

Group A:

For erector spinae muscle, starting position was in prone, with a pillow beneath abdomen and physical therapist (PT) was standing on the right-hand side of the patient. The therapist placed his right and left hand was placed on the sacrum and lower thoracic spine (cross-hand position). Therapist instructed the patient to elevate shoulders from couch to contract lumbar muscles for 7 seconds; in relaxation, the therapist took the left hand in the cephalic position and the right hand into the caudal position.[10] Starting position for quadratus lumborum was side-lying. The PT stood at the back side of the patient. The patient was then asked to breathe in and then asked to perform the abduction of top leg, and then hold the same position. The patient was recommended to stay in this position generally for the duration of 7-10 seconds, which allows the gravity to affect resistance. The participant was then asked to hang the leg behind him over the table from the back side of it. Released breath slowly on ending contraction. The both hands of the PT provided the assistance to the pelvis to release all firmness during exhalation. Grasped stretch for 10 seconds. The relaxation time of the patient was approximately 20 seconds, and then maneuver was repeated for 05 times.[11]

Group B:

For myofascial mobilization of erector spinae muscle, the patient was in the prone lying position. The therapist was standing adjacent to the patient. The therapist used both hand fingers tips on the Erector spinae muscle. The technique was applied through the repeated oscillation of the muscle belly. The frequency and amplitude of the touching technique were large enough so that rest of the patient's body oscillates during the treatment, thus provided inherent relaxation qualities of oscillatory motions.[12] For myofascial mobilization of quadratus lumborum muscle, the patient was in side-lying with a roll placed under the waist. The starting position of the PT was in standing right in front of the patient and performed a generalized stretch of the Quadratus Lumborum with the starting position of the patient to a roll for maximum passive stretch. One hand of PT was placed on attachment of the pelvis while the other hand proximal to the attachment on the lower lumbar spine. The cross-arm technique of myofascial stretch was employed.[13] The treatment duration of Myofascial mobilization was10 minutes with 04 minutes release followed by 02 minutes rest. [14]

The transcutaneous electrical nerve stimulation (TENS) was given in both groups. The pulse frequency of TENS was from 0.7 to 108 Hz and pulse width of 100s. The intensity level according to patient tolerance. The duration of the TENS application was 20 minutes.[15]

For strengthening exercises, the abdominal isometric exercise was performed in the progression. The subject was in supine position, with the knees bent to 90 degrees. The participant was asked to tuck in the tummy and hold the maximum isometric contraction for 10 seconds. Fifteen repetitions with three sets were done for each exercise. [16] The bridging exercise was performed in progression to the abdominal isometric. Participant was lying on his back with his hands-on side, knees folded, and feet straight on the floor below his knees and tightened his abdominal muscles. The participant was instructed to lift the pelvis from ankle to shoulder in an aligned manner until a hip flexion angle of zero degrees is reached. The participant was further trained to simultaneously squeeze his central part and draw the belly back towards the spine for about 05-10 seconds. Three sets of 15 repetitions were done for each exercise. [17] Further progression was made by back strengthening exercise. The participant lies on his chest with elbows in extension, and then lift shoulders off the couch and hold the position for 10 seconds. Three sets of 15 repetitions are done for each exercise performed twice weekly.[18]

The data was analysed with SPSS version 23. Shapiro-wilk test was utilized to evaluate data normality, and it revealed that only baseline demographics had a normal distribution. For demographics of data, an independent sample t-test was applied. Outcome measures of pain and disability did not follow a normal distribution. Non-parametric measures described in the form of median and interquartile ranges. Wilcoxon signed-rank test was employed for intragroup analysis. Mann-Whitney test was employed to measure intergroup data. P-value $\leq$ 0.05 was set as significant.

RESULTS

Among all the participants, group one had 22 (51.2%) males, while group two had 21(48.8%) males. Most of the participants had pain lateral to the spine. However, table 1 shows the means and standard deviations of participants' demographics presented at baseline. There was insignificant difference that was found between the experimental and control groups at the initial assessment.

Table 1: Demographics of study participants

	Group	Mean	S. D	P-Value
Age	**group 1**	40.9	8.964	0.094
	group 2	44.9	9.358	
Weight	**group 1**	72.1	14.192	0.506
	group 2	69.9	10.597	
Height	**group 1**	167.8	5.858	0.469
	group 2	166.5	7.912	
BMI	**group 1**	25.7	5.470	0.896
	group 2	25.5	2.792	
Symptoms Duration (in weeks)	**group 1**	9.6	1.268	0.320
	group 2	8.7	1.235	

Table-2 represents the before and after treatment evaluation of symptoms and functional outcomes in group 1 and group 2. The both of the experimental and control groups showed statistical significance in terms of reducing pain and improving functional disability.

Table 2: Within Group analysis of VAS and RMDQ

Variable	Pre median (IQR)	Post median (IQR)	P-value
	GROUP A		
VAS	6 (1.25)	4 (1)	<0.001
RMDQ	12 (3.25)	7 (2.5)	<0.001
	GROUP B		
VAS	6 (2)	3 (1)	<0.001
RMDQ	11.5 (6.5)	6 (4)	<0.001

Table-3 represents the post-treatment readings to compare the difference between the experimental and control groups. When both groups compared with each other, statistically, no significant difference was observed between groups at the completion of trial. Therefore, both groups are equally effective in relieving pain and reducing disability.

Table 3: Between-group analysis of VAS and RMDQ

Variable	Pre median (IQR)	Post median (IQR)	P-value
VAS	4 (1)	3 (1)	0.272
RMDQ	7 (2.5)	6 (4)	0.102

DISCUSSION

The current research determined the effects of MET and conventional exercise versus MFR combined with conventional treatment on pain and disability. The results showed that both interventions positively alleviated the pain intensity and disability. According to the between-group analysis, MET and MFR are evenly beneficial in decreasing symptoms and improving outcomes.

The pain intensity and functional disability were measured by using two outcome measures; the VAS and RMDQ. Shafshak et al. demonstrated that the Visual analogue scale appears to be reliable in measuring pain severity and RMDQ can predict the disability of patients with LBP.[19] These explanations are following a summary of the review conducted by Cristiana Kahl et al. that the VAS is a clinically useful, valid outcome measure for diverse adult population, including rheumatic diseases.[20] The subjects who were treated in both groups showed reduction in the VAS and functional disability scores after treatment sessions in our study.

RMDQ was an outcome measure used to measure the level of disability in LBP patients. It consists of 24 questions with an overall score of 24. One study compared the movement command exercises with general exercises on sub-acute NSLBP, and RMDQ was used as the main outcome measure in that trial.[21]

Our study analyzed the intragroup median of the RMDQ. Both groups had statistically significant improvement, representing an improvement in functional activities. When the inter-group analysis was performed, both groups had no statistically significant difference stating muscle energy and myofascial mobilization techniques are equally effective in improving functional disability.

Our research findings are similar to an RCT conducted by Marzouk A. Ellythy et al. The study included 40 participants and 20 in each group with chronic NSLBP. Group A was given four weeks of a specific MET program in post-isometric relaxation (PIR). Meanwhile, Group B was treated with four weeks of a specific MFR program. The possible mechanism for the reduction of pain may be due to the activation of the joint mechanoreceptors and

proprioception that causes joint movement and stretching of the joint capsule during isometric contraction of low back muscles in the MET group. MFR may improve fluid circulation in the tissues that enhance the lymphatic system at the same time, thus producing decongestion of fluid stasis. The study concluded that MET (PIR) and MFR improved pain sensation and functional disability in experimental and control with chronic LBP.[22] The research was conducted on chronic LBP patients with a small sample size. Despite the above research, our study was done on sub-acute NSLBP with large sample size.

James w. on acute NSLBP described in an RCT that the MET increases adaptability and ROM of spine in LBP patients with reduced spinal mobility. The research also specified that there was low-quality evidence regarding MET combined with additional treatments for management of NSLBP.[23] However, our study has demonstrated that MET is an effective management for pain and functional disability in NSLBP patients. Erector spinae and quadratus lumborum muscles are mostly responsible for tightness and pain in the low back region.

However, the limitations of study includes that the findings will be limited to the population of sub-acute NSLBP.

CONCLUSION

It is concluded that both Muscle Energy Technique (MET) and myofascial mobilization are effective treatment approaches for managing sub-acute non-specific low back pain. Significant improvements were observed in pain intensity and functional outcomes following both interventions. However, no statistically significant difference was found between the two techniques. This indicates that neither MET nor myofascial mobilization is superior to the other. Both techniques may therefore be considered equally beneficial in clinical practice. The choice of intervention can be guided by patient needs and therapist expertise.

Conflict of Interest: None to declare.

Funding Source: None to declare

Author's Contribution

All authors (FA, SA, and AAMB) contributed to the conception and design of the study. Data collection was carried out by FA, data analysis, and interpretation was performed by AAMB. Manuscript drafting and critical revision were undertaken by all authors. All authors approved the final manuscript.

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