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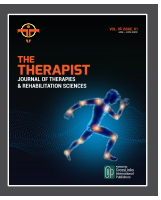

Original Article

Comparative Effectiveness of Muscle Energy Technique (MET) With or Without Proprioceptive Neuromuscular Facilitation (PNF) Pattern in Lumbosacral Dysfunction

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ABSTRACT

Lumbosacral dysfunction is a condition affecting the lumbar and sacral regions of the spine, causing back pain, limited range of motion, sensory deficits, and motor impairments. It can be caused by degenerative changes, traumatic injuries, congenital anomalies, or abnormal biomechanics. **Objective:** The objective of this study was to compare the effects Muscle Energy Technique (MET) alone and with combination of PNF in treating lumbosacral syndrome. **Methods:** The study was a quasi-experimental design over the duration of 8 weeks. Purposive sampling was employed with a sample size of 40 patients, divided equally into Group A (N= 20) who received MET combined with PNF and Group B (N= 20) that only received MET. We used Oswestry Disability Index (ODI), Numeric Pain Rate Scale (NPRS) and goniometer to assess disability, pain, and range of motion (ROM). We analyzed the data using IBM SPSS version 23.0. **Results:** Outcome measures including pain intensity, functional disability, and range of motion, were assessed at baseline and post-intervention (8 weeks). The group A showed significant improvements in all outcome measures compared to the group B at post-intervention assessments ($p < 0.05$), pain intensity decreased by 60-80%. Functional disability scores were reduced by 60-75% in the group A, while the group B showed only 40% significant change. Moreover, the group A exhibited a substantial increase in lumbosacral range of motion compared to the group B. **Conclusions:** The study reveals that both MET alone and MET combined with PNF effectively improve pain, functional disability, and lumbar range of motion in lumbosacral dysfunction patients.

INTRODUCTION

Lower back pain affects 80% of people at least once in their life with a significant percentage developing chronic conditions [1]. It significantly impacts daily tasks, work productivity, and quality of life making it a global disability cause [2]. LBP 4 are multifaceted, including pathological disorders, age, gender, genetics, sedentary behavior, obesity, smoking, and psychosocial factors like stress and depression [3]. Facet joint syndrome, a common cause of chronic low back pain can cause discomfort, limited mobility, and a lower quality of life due to its heterogeneity and lack of precise biomarkers [4]. Lumbosacral dysfunction is a condition affecting the lumbar and sacral regions of the spine causing back pain, limited range of motion, sensory deficits, and motor impairments [5, 6]. It

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can be caused by degenerative changes, traumatic injuries, congenital anomalies, or abnormal biomechanics. Diagnostic evaluation involves a comprehensive assessment, clinical history, and physical examination [7]. In some cases, facetogenic pain may resemble radiculopathy due to compressed spinal discs or nerves, leading to micro instability and synovial facet cysts [8]. PNF techniques were developed focusing on rhythmical stabilization (RS) and a combination of isotonic (COI) exercises for female patients [9]. However, there is limited evidence for their combined use with other therapeutic approaches. A clinical trial showed that MET supervised motor control and resistance exercises significantly improved ODI scores in 19 patients with acute low back pain [10]. The rationale of this study was to compare the effects of MET with combination of PNF in treating lumbosacral facet syndrome.

The aim is to determine the most effective treatment approach, either a combination of PNF and MET or MET alone, that potentially improving symptoms.

METHODS

The study utilized a quasi-experimental design over the duration of 8 weeks from January 2023 till March 2023, and took place in both public and private sectors. Purposive sampling was employed with a sample size of 40 patients, divided equally into Group A (N= 20) and Group B (N= 20). For this quasi-experimental study, the sample size calculation was conducted using Raosoft software, ensuring that the study had sufficient statistical power to detect meaningful effects. The study population comprised regular outpatient department (OPD) patients meeting the inclusion criteria: male and female individuals aged between 25 and 50, diagnosed with lumbosacral dysfunction, limited ROMs of > 40%, NPRS score > 4 and ODI score >20. Exclusion criteria encompassed acute trauma, fractures, bony deformity, spine surgery, metabolic disorder like osteoporosis, and osteomyelitis. The study focused on variables including pain, disability, and lumber range of motion (ROMs), with an alpha value of 0.05 and a confidence interval of 95%. Experimental group received combination therapy of PNF techniques and Muscle Energy Technique. The intervention was structured into four sequential steps with a total period of 15 minutes. The initial step, Step 1, focused on preparing participants for subsequent interventions through PNF hold-relax techniques, aiming to induce relaxation and enhance blood flow in the affected lumbar area. Moving to Step 2, the focus shifted to addressing muscle stiffness frequently associated with lumbosacral facet syndrome, utilizing pulsed MET to enhance tissue flexibility and alleviate discomfort by targeting muscle tension reduction. Step 3 aimed at enhancing participants' range of motion through PNF contract-relax techniques, combining controlled contractions with passive stretches to improve joint flexibility and mitigate the limitations posed by the syndrome. The final step, Step 4, aimed at simultaneous strength and range of motion improvement, employing rapid and slow isotonic eccentric stretches. Participants engaged in 5 repetitions of each stretch type, effectively promoting muscle strength development and further augmenting joint mobility. Overall, this comprehensive four-step intervention seeks to address various aspects of lumbosacral facet syndrome, ultimately aiming to improve participants' functional mobility and participation and to reduce pain. Control group received only Muscle Energy Technique intervention. MET involves the use of isometric contractions to enhance joint mobility and restore balance to musculature around the joint. Patient placed in a comfortable position on a treatment table and is ensured relaxation and communication with the patient to maintain their comfort throughout the procedure. The practitioner uses one hand to feel the specific parts of the lower spine (L4–L5). The patient is sitting down and is gently moved into a slightly bent and tilted position, which puts the problem area at the point where it doesn't want to move further. At this moment, the patient is told to try to straighten up again. This action uses the muscles that are preventing the spine from moving as it should. At the same time, the practitioner applies a little resistance to prevent any actual movement. This effort to move without actually moving is held for about 3 to 5 seconds (as suggested by Stiles), using only about 20% of the patient's strength. This effort is coordinated with breathing. Once this isometric contraction is done and the patient stops trying to move, the problematic point should have shifted a bit, allowing for a bit more bending and tilting without effort. The process is repeated a few times until the maximum possible movement is achieved without discomfort. So, in simpler terms, the practitioner gently guides the patient's spine to a tricky point, and then the patient tries to move as if pushing against a gentle resistance, holding it briefly. When they stop, the difficult point usually becomes a bit easier to move, and this is repeated until the movement improves as much as possible. The data analysis was performed using SPSS version 23.0. A paired t-test was used to assess within-group comparisons from baseline to the post-treatment session for VAS, ODI, and lumbar ROM. An independent sample t-test was used to see the mean difference between the two groups for all the outcome measures at baseline, immediately after the first treatment session, and then after the final treatment session.

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RESULTS

Figure 1 shows frequency distribution of gender 28 (70%) male and 12(30%) female included in the study.

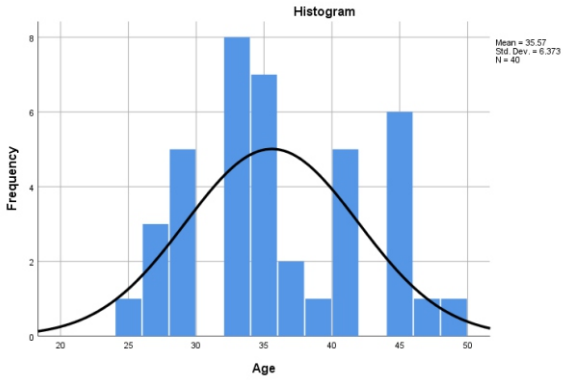

Figure 1: Gender distribution.

Figure 2 the age distribution of the patients N=40 with mean of 35.57 and standard deviation 6.37

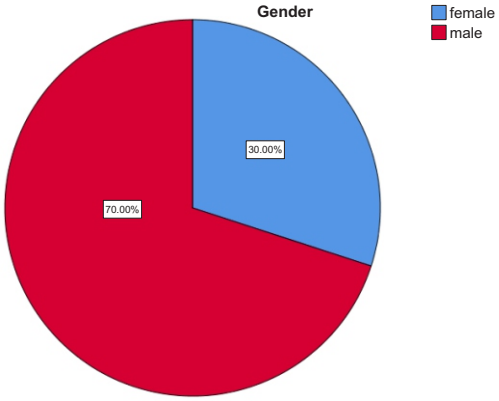

Figure 2: Age distribution of patients

For Group A, the NPRS scores showed a paired difference of 3.100 with a standard deviation difference of 1.03, yielding a significant p-value of < 0.001. For ODI the paired difference was 1.30 ± 0.510 with significant p-value <0.001, for Lumbar flexion it was 4.75 (SD = 1.631), for Right side flexion it was 3.50 (SD = 1.361), for Left side flexion it was 2.45 (SD = 2.637), and for Extension it was 2.95 (SD = 1.667) with significant two tailed p-values of <0.001. For Group B, the mean of paired differences for NPRS was 2.750 (SD = 1.050) and for Left side flexion it was 1.75 (SD = 1.959) with p < 0.001. Paired difference of ODI, Lumbar flexion, Right side flexion, and for Extension were 0.35 (SD = 0.657), 1.90 (SD = 1.694), 1.60 (SD = 1.791), 1.35 (SD = 1.465) and with significant two tailed values were 0.015, 0.006, 0.004 and 0.004 respectively (Table 1).

Table 1: Paired sample t-test within group comparison.

Variables	Group A			Group B		
	Pre-Treatment (Mean ± SD)	Post-Treatment (Mean ± SD)	p – value	Pre-Treatment (Mean ± SD)	Post-Treatment (Mean ± SD)	p – value
NPRS	5.850 ± 1.0399	2.750 ± 0.638	<.001	5.950 ± 1.050	3.20 ± 0.6615	<.001
ODI	3.55 ± 0.510	2.25 ± 1.07	<.001	3.3 ± 0.657	2.95 ± 0.605	0.015
Lumber Flexion	36.65 ± 1.631	41.4 ± 1.875	0.001	37.85 ± 1.694	39.75 ± 2.845	.006
Right Side Flexion	16.2 ± 1.361	19.70 ± 2.43	.0001	16.55 ± 1.791	18.15 ± 2.109	.004
Left Side Flexion	16.7 ± 2.637	19.150 ± 2.277	<.001	16.95 ± 1.959	18.7 ± 2.202	<.001
Extension	9.6 ± 1.667	12.55 ± 1.7	<.001	9.6 ± 1.465	10.95 ± 2.012	.004

Table 2 illustrated the comparison between groups by using independent sample t-test. Table 2 shows there is no statically significant difference between both groups at baseline.

Table 2: Independent sample t-test for dependent variables at baseline

Outcome Measure at Baseline	Treatment Groups		Independent t test	
	Group A (Mean ± SD)	Group B (Mean ± SD)	t – value	p – value
NPRS	5.85 ± 1.040	5.95 ± 1.05	0.303	0.764
ODI	3.55 ± 0.510	3.3 ± 0.657	1.344	0.373
Lumber flexion	36.65 ± 1.631	37.85 ± 1.694	2.282	0.28
Right side flexion	16.2 ± 1.361	16.55 ± 1.791	0.696	0.491
Left side flexion	16.7 ± 2.638	16.95 ± 1.959	0.340	0.736
Extension	9.6 ± 1.667	9.6 ± 1.465	0.00	1.00

P: probability SD: standard deviation

In table 3, ODI index, lumber flexion and extension some degree of significance as p-value<0.05 at post treatment sessions

Table 3: Independent sample t-test for dependent variables after treatment.

Outcome Measure after treatment	Treatment Groups		Independent t test	
	Group A (Mean ± SD)	Group B (Mean ± SD)	t – value	p – value
NPRS	2.75 ± 0.639	3.2 ± 0.616	.269	0.29
ODI	2.25 ± 1.070	2.95 ± 0.605	2.547	0.002
Lumber flexion	41.4 ± 1.875	39.75 ± 2.845	2.166	0.037
Right side flexion	19.70 ± 2.43	18.15 ± 2.11	2.154	0.38
Left side flexion	19.15 ± 2.277	18.7 ± 2.203	.635	.527
Extension	12.55 ± 1.701	10.95 ± 2.012	2.716	0.010

P: probability SD: standard deviation

DISCUSSION

The present study investigated the efficacy of two treatment modalities in managing lumbosacral dysfunction. The findings suggest that both interventions, MET alone and MET combined with PNF, demonstrate significant improvements in various outcome measures compared to baseline, with some differences noted between the two groups post-treatment. In Group A, revealed the significant reductions in NPRS and ODI scores

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indicate a reduction in pain levels and functional disability, respectively, following MET intervention. Moreover, improvements in lumbar range of motion parameters suggest enhanced flexibility and mobility in the lumbosacral region, which are crucial for overall spinal health and function. Although Group B exhibited similar significant improvements, there was a slightly lower mean paired difference compared to Group A. A research has been conducted in which PNF Integrated Pattern (PIP) cross-training is used in the study [11]. The within group comparison using independent sample t-tests revealed no statistically significant differences between Group A and Group B at baseline, indicating that both groups were comparable before the intervention. However, we observed significant differences in ODI index, lumbar flexion, and extension at post-treatment sessions, suggesting that the effectiveness of the two interventions may vary in certain outcome measures. These findings corroborate the established benefits of MET in mobilizing restricted joints, improving muscle function, and alleviating pain, thus enhancing overall patient well-being [12]. A study on 44 chronic low back pain patients found proprioceptive neuromuscular facilitation training reduced pain intensity and improved functional disability [13]. An RCT study involving 30 patients aged 20-40 with chronic low back pain found that muscle energy technique (MET), (PNF) and static stretching significantly improved hamstring flexibility. The results showed that these techniques significantly decreased pain and increased the range of motion in the hamstring, making them an effective therapeutic maneuver for chronic lower back patients [14]. Another RCT was conducted to compare the effectiveness of MET versus PNF in reducing pain and improving strength and function in participants with low back pain (LBP) found significant improvement in pain, disability, and performance. The study divided participants into three groups: MET, PNF, and control. Results showed MET were more effective than PNF and control in treating LBP participants [15]. A study involving 30 chronic nonspecific low back pain patients found that MET, supervised exercises, hot pack, and TENS significantly improved the Oswestry Disability Index score, decreasing disability and improving function [16]. The systematic review of twelve trials involving 410 participants found that PNF Exercise effectively relieved pain, and improved waist function but did not significantly improve dynamic balance in chronic low back pain patients [17]. A study evaluated the effect of Proprioceptive neuromuscular facilitation (PNF) stretching combined with resistance training on non-athlete male students. Results showed significant improvements in strength, muscle volume, and flexibility in both groups after 8 weeks [18]. Some studies from literature give indications that there are same effects of MET when compared with other techniques and with PNF as well. A study compared the immediate effects of MET and lumber stabilizing exercises (LSE) on 21 patients with chronic low back pain with suspected facet joint origin. The study found no significant difference in pain, lumbar movements, or disabilities scores between 21 patients with chronic low back pain, suggesting that a single session of MET and LSE may not be enough [19]. A randomized clinical trial evaluated the effect of MET with or without strain counter-strain (SCS) on acute lower back pain (LBP) in 50 patients. Results showed significant improvement in pain, ROM, and disability after the second session, but no significant difference was found between groups. The immediate effect was only on pain intensity after the first session [20]. However, several limitations should be considered. Firstly, the sample size of the study may have limited statistical power to detect small differences between groups. Furthermore, the study design, while providing valuable insights, does not enable drawing causal inferences regarding the effectiveness of the interventions. Future research employing larger sample sizes and rigorous study designs, such as randomized controlled trials, is warranted to further elucidate the comparative effectiveness of MET with and without PNF in lumbosacral dysfunction.

CONCLUSIONS

In conclusion, the findings of this study suggest that both MET alone and MET combined with PNF are effective interventions for improving pain, functional disability, and lumbar range of motion in individuals with lumbosacral dysfunction. However, the addition of PNF to MET may not confer additional benefits in terms of improving lumbar flexibility. Practitioners should consider these findings when designing treatment plans for individuals with lumbosacral dysfunction, considering the specific needs and preferences of the patient.

Authors Contribution

Conceptualization: TU, AK
Methodology: RK, TA, AM
Formal analysis: SWR, AA
Writing-review and editing: SH, AH

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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