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Effect of Muscle Energy Technique Over Hip Flexors on Pain, Lumbar Range of Motion and Disability in Subjects with Mechanical Low Back Pain

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Abstract: ***Background**: Mechanical low back pain (MLBP) is a common musculoskeletal condition associated with pain, restricted spinal mobility, and functional disability. Hip flexor tightness, particularly involving the iliopsoas, may alter lumbopelvic mechanics and contribute to anterior pelvic tilt and increased lumbar loading. Muscle Energy Technique (MET) uses controlled voluntary muscle contraction followed by relaxation and stretching, and may help improve muscle extensibility and movement. **Aim**: To determine the effect of MET over the hip flexors on pain, lumbar range of motion, and disability among subjects with mechanical low back pain. **Methodology**: An experimental study was conducted among 40 male subjects aged 25–45 years with non-specific mechanical low back pain and BMI of 25–30. Participants received MET over the hip flexors along with conventional physiotherapy for four weeks, five sessions per week. Pain was assessed using the Numeric Pain Rating Scale (NPRS) at rest and during activity, lumbar range of motion using the Modified Schober's test with an inch tape, and disability using the Oswestry Disability Index (ODI). Pre- and post-intervention scores were analysed using a paired-samples t-test. **Results**: Following four weeks, mean NPRS-rest decreased from 4.18 ± 1.06 to 2.53 ± 0.64 ($t = -13.56$, $p = 0.001$), and NPRS-activity decreased from 6.60 ± 1.01 to 4.05 ± 0.88 ($t = -29.20$, $p = 0.001$). Lumbar flexion scores increased from 4.62 ± 0.49 to 6.09 ± 0.45 ($t = 20.28$, $p = 0.001$), while extension scores increased from 2.07 ± 0.29 to 3.17 ± 0.27 ($t = 28.65$, $p = 0.001$). ODI scores decreased from 37.50 ± 5.78 to 22.15 ± 5.96 ($t = -20.04$, $p = 0.001$). **Conclusion**: MET applied to the hip flexors in combination with conventional physiotherapy was associated with significant improvement in pain, lumbar range of motion, and functional disability in the studied subjects.*

Keywords: Mechanical low back pain; Muscle Energy Technique; Hip flexors; Iliopsoas; Lumbar range of motion; Numeric Pain Rating Scale; Oswestry Disability Index.

1. Introduction

Low back pain is a major cause of activity limitation and disability. Mechanical low back pain generally refers to symptoms associated with loading or movement of spinal and surrounding musculoskeletal structures. It may present with pain, stiffness, and difficulty performing routine activities.

The lumbar spine and hip function as an integrated lumbopelvic complex. The iliopsoas, formed by the psoas major and iliacus, is a primary hip flexor. The psoas major arises from the T12–L5 region and attaches with the iliacus to the lesser trochanter. Because of its direct relationship with the lumbar spine, changes in iliopsoas length and tension may influence pelvic position and lumbar mechanics.

Prolonged sitting, reduced physical activity, and altered movement patterns may be associated with hip flexor tightness. Restricted hip extension can be accompanied by compensatory pelvic and lumbar movement. Anterior pelvic tilt and increased lumbar lordosis may increase mechanical demand on posterior lumbar structures and contribute to symptoms in some individuals.

Muscle Energy Technique is a manual therapy approach in which the patient performs a controlled voluntary contraction against therapist-applied resistance. The contraction is followed by relaxation and movement towards

the available range. MET is commonly used to address muscle tightness and restricted mobility. Applying MET to the hip flexors may improve their extensibility and hip extension, potentially supporting more efficient lumbopelvic movement.

Conventional physiotherapy for mechanical low back pain commonly includes thermal therapy, mobility exercises, trunk muscle activation, strengthening, and postural or activity advice. The present study evaluated changes in pain, lumbar mobility, and disability following a four-week programme combining MET over the hip flexors with conventional physiotherapy.

Aim

To determine the effect of Muscle Energy Technique over hip flexors on pain, lumbar range of motion, and disability among subjects with mechanical low back pain.

Objectives

- To assess changes in pain at rest and during activity using the NPRS.
- To assess changes in lumbar flexion and extension using the Modified Schober's test.
- To assess changes in functional disability using the Oswestry Disability Index.

2. Methodology

Study design and setting

Experimental study design conducted at the College of Physiotherapy, SVIMS, and BIRRD Hospital, Tirupati. The study period was six months and the intervention period was four weeks.

Participants

Forty male subjects with non-specific mechanical low back pain were included. Eligibility criteria were age 25–45 years and BMI 25–30. Exclusion criteria included osteoporosis; back pain due to other abnormalities; postural deformities; disc or spinal pathologies; lumbar or pelvic fractures; previous low back surgery; limb-length discrepancy; and hip or sacroiliac joint pathology.

Outcome measures

Pain was assessed using the Numeric Pain Rating Scale (NPRS) at rest and during activity. Lumbar flexion and extension were assessed using an inch tape/Modified Schober's method. Functional disability was assessed using the Oswestry Disability Index (ODI). Measurements were recorded before and after the intervention.

Study procedure

Subjects attending the outpatient departments were screened against the eligibility criteria. The study procedure was explained and written informed consent was obtained. Demographic and clinical details were recorded, followed by baseline assessment of NPRS, lumbar range of motion, and ODI. The intervention was delivered for four consecutive weeks, after which the same outcome measures were reassessed.

MET over hip flexors

The participant was positioned prone with a pillow under the abdomen, or the opposite leg was positioned to reduce lumbar lordosis. The therapist stabilized the pelvis at the sacrum and assessed hip extension by gently flexing the knee and lifting the thigh. At the restrictive barrier, the participant performed a gentle isometric contraction by pushing the thigh towards the table for 7–10 seconds at approximately 15–25% effort. After relaxation, the therapist moved the limb to the new barrier and applied a gentle stretch for approximately 20–30 seconds. The procedure was repeated for 3–5 repetitions per side, avoiding lumbar hyperextension.

Conventional physiotherapy

Both components of the intervention programme were delivered five days per week for four weeks (20 sessions). Conventional physiotherapy included a hot moist pack to the lumbar region for 10–15 minutes; pelvic tilts and cat–camel mobility exercises; abdominal draw-in/core activation; and progressive exercises such as bridges, prone press-ups when tolerated, planks/side bridges, flexibility exercises, graded walking, functional practice, and posture/activity education. Session duration was approximately 30–40 minutes.

Statistical analysis

Continuous variables were summarized using mean and standard deviation. Within-subject pre- and post-intervention differences were examined using a paired-samples t-test. Statistical significance was set at $p < 0.05$.

Study Algorithm

Screening of subjects → eligibility assessment → informed consent → baseline NPRS, lumbar ROM and ODI → four-week MET over hip flexors plus conventional physiotherapy (5 sessions/week) → post-intervention assessment → statistical analysis.

3. Results

Forty participants were included. The mean age was 36.28 ± 5.77 years (range: 26–45 years). Pre- and post-intervention values for the outcome measures are presented below.

Outcome	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
NPRS – Rest	4.18 ± 1.06	2.53 ± 0.64	−13.56	0.001
NPRS – Activity	6.60 ± 1.01	4.05 ± 0.88	−29.20	0.001
Lumbar flexion*	4.62 ± 0.49	6.09 ± 0.45	20.28	0.001
Lumbar extension*	2.07 ± 0.29	3.17 ± 0.27	28.65	0.001
ODI	37.50 ± 5.78	22.15 ± 5.96	−20.04	0.001

*Lumbar flexion and extension values are reproduced as reported in the dissertation; the measurement unit was not specified in the results table.

All five paired comparisons were reported as statistically significant ($p = 0.001$). NPRS and ODI scores decreased, while lumbar flexion and extension measurements increased.

Statistical Report and Graphs

Descriptive statistics were expressed as mean ± standard deviation. Paired-samples t-tests were used to compare pre- and post-intervention scores in the 40 participants (df = 39),

with statistical significance set at $p < 0.05$. Significant pre–post differences were reported for NPRS at rest ($t = -13.56$, $p = 0.001$), NPRS during activity ($t = -29.20$, $p = 0.001$), lumbar flexion ($t = 20.28$, $p = 0.001$), lumbar extension ($t = 28.65$, $p = 0.001$), and ODI ($t = -20.04$, $p = 0.001$). Mean NPRS-rest decreased by 1.65 points, NPRS-activity by 2.55 points, and ODI by 15.35 points. Lumbar flexion increased by 1.47 and extension by 1.10 in the units reported in the dissertation (unit not specified). These findings represent within-group changes after the combined MET and conventional physiotherapy programme.

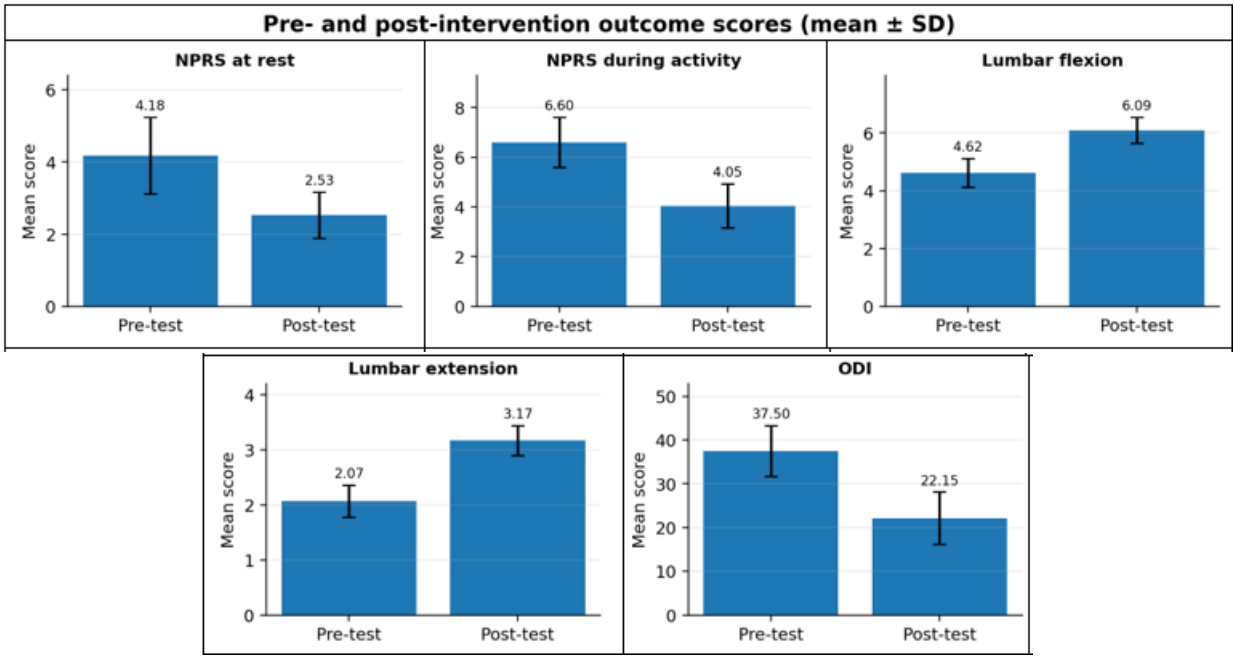


Figure 1: Pre- and post-intervention mean scores with standard deviation error bars.

4. Discussion

The present study evaluated the effect of MET over the hip flexors combined with conventional physiotherapy in 40 male subjects with mechanical low back pain. Following the four-week intervention, all measured outcomes showed statistically significant pre- to post-treatment changes.

Pain at rest decreased from 4.18 ± 1.06 to 2.53 ± 0.64, while pain during activity decreased from 6.60 ± 1.01 to 4.05 ± 0.88. These changes may be related to reduced hip flexor muscle tension, improved movement tolerance, and the combined effects of the conventional programme. MET uses a controlled contraction followed by relaxation and stretching, which may help improve muscle extensibility and reduce movement-related discomfort.

Lumbar flexion increased from 4.62 ± 0.49 to 6.09 ± 0.45, and extension increased from 2.07 ± 0.29 to 3.17 ± 0.27. Improvement in hip flexor extensibility may allow more efficient hip and pelvic movement and reduce compensatory lumbar movement. The accompanying mobility and core activation exercises may also have contributed to improved movement performance.

ODI decreased from 37.50 ± 5.78 to 22.15 ± 5.96, indicating reduced self-reported disability after the intervention. Improved pain and mobility may have enabled participants to perform daily activities with fewer limitations. The findings are broadly consistent with literature reporting beneficial effects of MET-based interventions on pain, mobility, and disability in non-specific or mechanical low back pain, including reports by Franke et al., Santos et al., Fahmy et al., and Szulc et al.

These results should be interpreted as changes observed after a combined intervention. Since MET was delivered together with conventional physiotherapy and the study used a single-group pre–post analysis, the independent contribution of MET cannot be determined and causal comparisons with other treatments cannot be made.

5. Conclusion

The present study found statistically significant improvements in pain at rest and during activity, lumbar flexion and extension, and functional disability following four weeks of MET over the hip flexors combined with conventional physiotherapy in 40 subjects with mechanical low back pain. MET may be considered an adjunct to a comprehensive physiotherapy programme. Because the study used a single-group pre–post design, the results do not establish the independent effect of MET.

6. Limitations

- Small sample size (40 participants) may limit generalizability.
- Intervention was limited to four weeks; long-term effects were not assessed.
- Only male participants aged 25–45 years with BMI 25–30 were included.
- Assessment was limited to NPRS, lumbar range of motion, and ODI; muscle strength, pelvic alignment, gait, and quality of life were not measured.

- Daily activity, occupational loading, and home-exercise adherence were not objectively monitored.

7. Future Recommendations

- Future studies should include larger samples and both sexes.
- Longer follow-up is recommended to assess maintenance of treatment effects.
- Comparative or randomized controlled studies should compare MET with other interventions and conventional physiotherapy alone.
- Additional outcomes may include hip flexor length, core strength, pelvic alignment, gait, quality of life, and electromyographic activity.

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