Manual Therapy Approaches in Quadratus Lumborum Syndrome: Comparing Muscle Energy Technique (MET) versus Myofascial Release (MFR) with Transcutaneous Electrical Nerve Stimulation

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Abstract: ***Background**: Quadratus Lumborum Syndrome (QLS) is one of the most widely seen yet underdiagnosed causes of low back pain in clinical practice. It arises from myofascial trigger points within the quadratus lumborum muscle, producing deep lumbar aching, restricted spinal movement, and considerable difficulty in performing routine daily activities. Manual therapy techniques such as Muscle Energy Technique (MET) and Myofascial Release (MFR) are increasingly applied in clinical management of this condition, yet direct comparative evidence remains limited. **Objective**: This study set out to evaluate and compare the clinical outcomes of MET and MFR, each administered alongside Transcutaneous Electrical Nerve Stimulation (TENS), in patients diagnosed with QLS. **Methods**: Sixty patients between 30 and 50 years of age, all diagnosed with QLS, were enrolled and randomly divided into two treatment groups of thirty each. Patients in Group A underwent MET sessions combined with TENS, while those in Group B received MFR combined with TENS. Both groups attended four treatment sessions every week over a period of two weeks. Pain sensitivity was evaluated using the Pressure Pain Threshold (PPT) measured with a digital algometer. Lumbar mobility was assessed through the Modified Schober's Test for flexion and extension, and the Finger-to-Floor Distance (FFD) test for lateral flexion. Functional disability was quantified using the Roland-Morris Disability Questionnaire (RMQ). Paired t-tests were used for within-group comparisons, independent t-tests for between-group analysis, and Chi-square tests for nominal data, with statistical significance set at $p < 0.05$. **Results**: At the end of the intervention period, both groups recorded statistically significant improvements across all outcome parameters ($p < 0.001$). When the two groups were compared against each other, Group B consistently outperformed Group A on every measure. Lumbar flexion improved by 30.00% in Group B versus 14.69% in Group A ($p = 0.00001$). Extension improved by 29.08% versus 16.06% ($p = 0.000237$). Lateral flexion showed gains of 31.65% in Group B compared to 15.32% in Group A ($p = 0.047$). PPT increased by 48% in Group B and 33% in Group A ($p = 0.0001$). Disability scores on the RMQ reduced by 39.40% in Group B and 24.95% in Group A ($p = 0.0007$). **Conclusion**: Both treatment approaches produced meaningful clinical benefits when delivered over a two-week period. However, the combination of Myofascial Release with TENS resulted in greater reductions in pain, superior restoration of lumbar mobility across all planes, and more substantial improvement in functional ability. MFR combined with TENS is therefore recommended as the more effective physiotherapy strategy for managing Quadratus Lumborum Syndrome.*

Keywords: Quadratus Lumborum Syndrome; Myofascial Pain Syndrome; Myofascial Release; Muscle Energy Technique; TENS; Pressure Pain Threshold; Lumbar Range of Motion; Roland-Morris Disability Questionnaire.

1. Introduction

Low back pain ranks among the most prevalent musculoskeletal conditions encountered in both primary care and physiotherapy settings, with studies reporting that nearly four out of five individuals experience at least one significant episode during their lifetime.[1] While structural causes such as disc prolapse and vertebral fractures receive considerable clinical attention, a substantial proportion of low back pain cases originate from myofascial sources that are frequently missed or misattributed. Among these, Quadratus Lumborum Syndrome (QLS) occupies a prominent yet underappreciated position.[2]

The quadratus lumborum is a paired, deep muscle situated within the posterior abdominal wall. Anatomically, it spans from the posterior iliac crest and iliolumbar ligament inferiorly to the twelfth rib and the transverse processes of the upper five lumbar vertebrae superiorly.[7] Functionally, it contributes to lateral trunk flexion when acting unilaterally, assists in lumbar extension during bilateral contraction, and serves as a stabilising anchor for the twelfth rib during diaphragmatic excursion.[8,9] Because of its central role in lumbopelvic stability, the QL muscle is highly susceptible to overload, particularly in individuals with weak core musculature or poor postural habits.[3]

When the QL is repeatedly overloaded or subjected to prolonged mechanical strain, microscopic tissue damage accumulates over time. This triggers a cascade of local inflammation, taut band formation, and the eventual development of myofascial trigger points (MTrPs)-hyperirritable nodules within the muscle that produce pain both locally and in distant referral zones.[4] The referred pain from QL trigger points is particularly deceptive, as it can radiate to the iliac crest, sacroiliac joint, greater trochanter, and lateral thigh, mimicking conditions such as sacroiliac joint dysfunction, hip pathology, and even renal pain.[5] This characteristic pattern contributes significantly to diagnostic delay.[6]

From a pathophysiological standpoint, MTrP formation is explained through the Integrated Hypothesis, which attributes trigger point development to excessive acetylcholine release at dysfunctional neuromuscular junctions. This causes sustained sarcomere shortening, impaired local circulation, and accumulation of pain-sensitising substances including bradykinin, substance P, and prostaglandins, ultimately resulting in peripheral and central sensitisation. [10,12]

Management of QLS draws from both electrotherapy and manual therapy traditions. TENS is one of the most widely applied electrotherapeutic modalities in musculoskeletal physiotherapy. It reduces pain through activation of the gate control mechanism and by stimulating the release of endogenous opioids within the central nervous system.[13,14] Among manual therapy approaches, MET involves the patient performing a low-intensity isometric contraction from a precisely controlled position, enabling post-isometric relaxation and facilitating tissue lengthening.[44,45] MFR, by contrast, is a passive hands-on technique in which the therapist applies sustained, directional pressure into fascial restrictions until a tissue release is perceived, thereby restoring normal myofascial length and reducing nociceptive input.[15,16]

While both MET and MFR have demonstrated individual effectiveness for low back pain in previous studies, their relative efficacy when combined with TENS in patients specifically diagnosed with QLS has not been adequately examined in a controlled trial setting. The present study was designed to address this clinical question directly.

2. Methods

2.1 Study Design and Setting

A prospective, two-group randomized comparative trial was carried out at the Outpatient Physiotherapy Department of Kempegowda Institute of Physiotherapy and the Orthopaedic and Rehabilitation units of KIMS Hospital, Bengaluru, Karnataka, between 2023 and 2025. Ethical approval was secured from the Institutional Ethics Committee prior to commencement, and all procedures adhered to the ethical principles outlined in the Declaration of Helsinki. Every participant provided written informed consent before enrolment.

2.2 Participant Selection

Patients presenting with clinical features consistent with QLS — defined as reproducible deep lumbar pain, identifiable taut bands on palpation, and active MTrPs within the QL muscle, in accordance with the diagnostic criteria of Simons, Travell and Simons [4]- were screened for eligibility.

Inclusion criteria: Age between 30 and 50 years; clinical diagnosis of QLS; symptom duration between 6 and 12 weeks; both male and female participants; capacity to understand and comply with the study protocol.

Exclusion criteria: Known structural spinal pathology including intervertebral disc prolapse, lumbar canal stenosis, spondylolisthesis, ankylosing spondylitis, spinal tuberculosis, or malignancy; previous spinal surgical intervention; presence of systemic, inflammatory, metabolic, or psychiatric illness; any contraindication to TENS application such as cardiac pacemaker, pregnancy, active haemorrhage, or open skin wounds.

2.3 Sample Size and Randomization

A prior power calculation performed using G*Power 3.1 determined that 30 participants per group would be sufficient to detect a clinically meaningful difference with effect size $d = 0.8$, type I error $\alpha = 0.05$, and statistical power of 0.85 (achieved power = 0.861). A total of sixty chits- thirty labelled for each group — were placed in an opaque container. Each patient drew one chit upon enrolment, and allocation was finalised accordingly without replacement.

2.4 Treatment Protocols

Both groups received treatment four days per week for two consecutive weeks. A standardised home exercise programme was prescribed to all participants, comprising QL self-stretching, knee-to-chest mobilisation, lateral trunk bending, cat-camel spinal mobility exercise, pelvic bridging, and quadruped arm-leg raise. Each exercise was performed for ten repetitions with a progressive hold duration of five to ten seconds based on individual tolerance.

TENS Application (Both Groups): Patients were positioned in prone lying. Self-adhesive electrodes were placed paravertebrally between the T12 and L5 spinal levels using aquasonic conductive gel. A conventional TENS protocol was delivered at a frequency of 2 Hz, pulse duration of 200 microseconds, for a total duration of 20 minutes per session. [13,32]

Group A – Muscle Energy Technique: The patient was placed in supine lying with the trunk positioned in left lateral flexion, commonly referred to as the 'banana position', to engage and lengthen the right QL. The treating physiotherapist cradled the patient's right axilla with one hand while the opposite hand stabilised the left side of the pelvis. The patient was then instructed to push gently toward right lateral flexion against the therapist's unyielding resistance for a duration of ten seconds. Following this isometric contraction phase, the patient was asked to relax completely, after which the therapist guided the trunk into further left lateral flexion and maintained this stretched position for thirty seconds. This sequence was completed five times within each treatment session. [15,26,29]

Group B- Myofascial Release: The patient was positioned in side-lying with both hips and knees bent to approximately seventy degrees. The physiotherapist stood perpendicular to the patient and applied the ulnar aspect of the forearm into the soft tissue corridor between the twelfth rib and the iliac crest, targeting the QL directly. A sustained, light-to-moderate compressive force was applied until a palpable softening or release of myofascial tone was detected. This was combined with a slow, deliberate anteroposterior gliding motion of the forearm. Three applications of ninety seconds each were performed on the affected side per session. [23, 25, 27, 31]

2.5 Outcome Measures

- Pressure Pain Threshold (PPT): A digital pressure algometer was applied perpendicularly over a point located 5 cm lateral to the L3 spinous process. Three successive readings were recorded at 30-second intervals and averaged. Values were expressed in kg/cm². This method carries high test-retest reliability with an ICC of 0.91 (95% CI: 0.82–0.97).[20]
- Modified Schober's Test: Spinal landmarks were identified at 10 cm above and 5 cm below the lumbosacral junction. The change in distance between these marks during active forward flexion and backward extension was recorded in centimetres. ICC = 0.942 (95% CI: 0.875–0.976).[21,22]
- Finger-to-Floor Distance (FFD): The patient stood upright and performed maximal active lateral flexion to each side. The perpendicular distance between the tip of the middle finger and the floor was recorded in centimetres. ICC: Right 0.791, Left 0.844.[21,22]
- Roland-Morris Disability Questionnaire (RMQ): A validated 24-item self-report tool measuring the impact of low back pain on activities of daily living. Scores range from 0 (no disability) to 24 (maximum disability). ICC = 0.87 (95% CI: 0.75–0.94).[19]

2.6 Statistical Analysis

All data were analysed using IBM SPSS Statistics version 26.0. Descriptive statistics including mean and standard deviation were computed for continuous variables. The paired t-test was applied to examine within-group changes from baseline to post-intervention. Between-group differences in continuous outcomes were assessed using the independent t-test. The Chi-square test was used to compare nominal variables including gender distribution and side of involvement. A p-value below 0.05 was considered statistically significant throughout.

3. Results

3.1 Participant Demographics

Sixty patients completed the full intervention period with no dropouts recorded. Baseline demographic data confirmed that the two groups were well matched with respect to age, gender distribution, and the side of QL involvement, with no statistically significant differences observed on any variable (Table 1, Figure 1).

Table 1: Baseline Demographic Characteristics of Both Groups

Variable	Group A (MET+TENS) n = 30	Group B (MFR+TENS) n = 30	Test Statistic	p-value
Age (years) Mean ± SD	38.66 ± 6.47	39.23 ± 6.20	t = 0.35	0.73
Female: Male	18 (60%): 12 (40%)	11 (36.6%): 19 (63.3%)	$\chi^2 = 3.27$	0.7
Right: Left Side	16 (53.3%): 14 (46.7%)	17 (56.7%): 13 (43.3%)	$\chi^2 = 0.06$	0.79

Independent t-test used for age comparison; Chi-square test used for gender and side of involvement. p > 0.05 for all variables confirms baseline homogeneity.

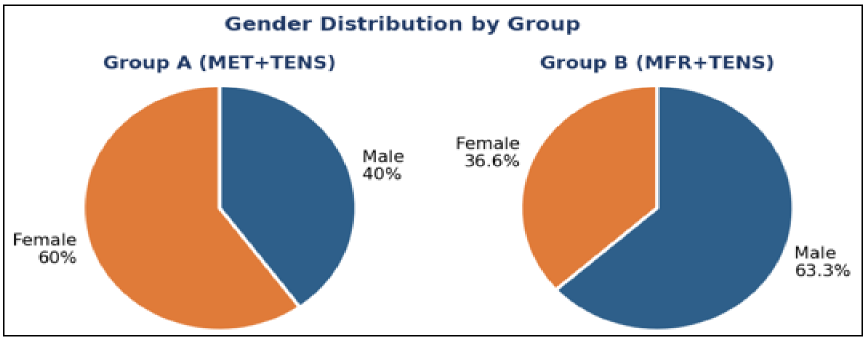

Figure 1: Gender Distribution Across Both Treatment Groups

3.2 Lumbar Range of Motion

Active lumbar mobility improved significantly in both groups following the two-week intervention. Table 2 presents a comprehensive summary of all outcome data. Group B demonstrated gains that were approximately twice those of Group A across all three planes of movement (Figure 2).

Table 2: Pre- and Post-Intervention Outcome Measures with Statistical Comparisons

Outcome Measure	Group A Pre	Group A Post	Group B Pre	Group B Post	Between-Group p	% Change Group A	% Change Group B
Schober's Flexion (cm)	5.26±0.15	6.03±0.29	5.23±0.17	6.80±0.58	0.00001*	14.69%	30.00%
Schober's Extension (cm)	1.93±0.24	2.24±0.29	1.96±0.20	2.53±0.27	0.000237*	16.06%	29.08%
FFD Lateral Flexion (cm)	12.40±2.99	14.36±2.98	12.13±2.88	15.97±3.11	0.047*	15.32%	31.65%
PPT (kg/cm²)	2.66±0.22	3.54±0.28	2.71±0.18	4.02±0.19	0.0001*	33.00%	48.00%
RMQ Score	14.47±1.22	10.86±1.16	14.57±1.10	8.83±0.98	0.0007*	−24.95%	−39.40%

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** $p < 0.05$, statistically significant. Within-group improvements were significant ($p < 0.001$) for both groups across all measures (paired t-test). Negative percentage for RMQ denotes reduction in disability score. FFD = Finger-to-Floor Distance; PPT = Pressure Pain Threshold; RMQ = Roland-Morris Disability Questionnaire.*

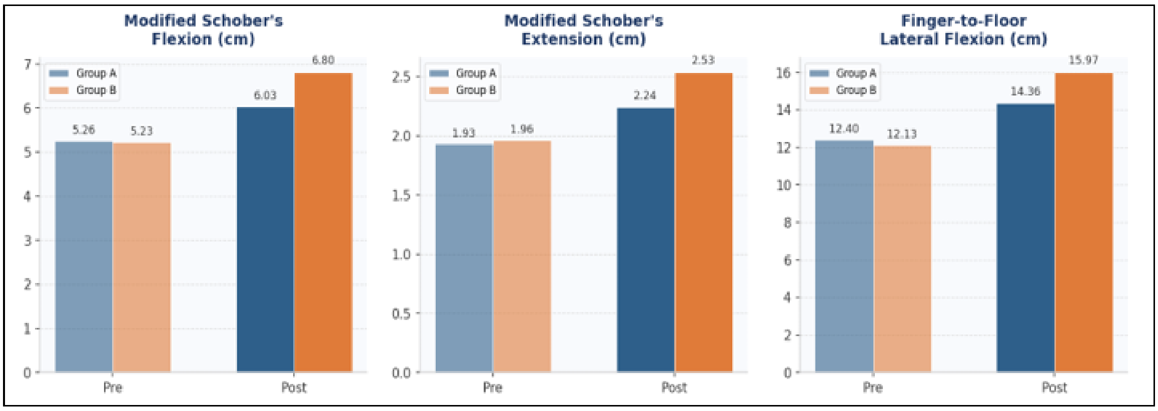

Figure 2: Pre- and Post-Intervention Lumbar Range of Motion: Flexion, Extension, and Lateral Flexion

Lumbar flexion as measured by the Modified Schober's Test rose from 5.26 cm to 6.03 cm in Group A, representing an improvement of 14.69%. In Group B, the corresponding values moved from 5.23 cm to 6.80 cm, a gain of 30.00%. The post-intervention difference between groups was highly significant ($p = 0.00001$). For lumbar extension, Group A improved by 16.06% while Group B achieved 29.08% improvement ($p = 0.000237$). Lateral flexion assessed via FFD showed gains of 15.32% in Group A and 31.65% in Group B ($p = 0.047$).

3.3 Pain Pressure Threshold

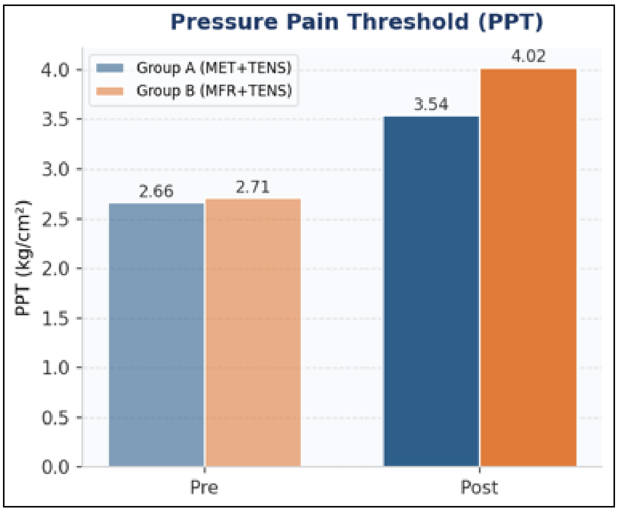

Figure 3: Pre- and Post-Intervention Pressure Pain Threshold (PPT) Values

At baseline, PPT values were similar in both groups-2.66±0.22 kg/cm² in Group A and 2.71±0.18 kg/cm² in Group B ($p = 0.37$). Following treatment, Group A recorded a post-intervention value of 3.54±0.28 kg/cm² (+33%), while Group B reached 4.02±0.19 kg/cm² (+48%). The between-group difference at post-intervention was highly significant ($t = 7.56$, $p = 0.0001$), indicating that MFR produced a substantially greater reduction in MTrP sensitivity than MET over the same treatment period.

3.4 Functional Disability

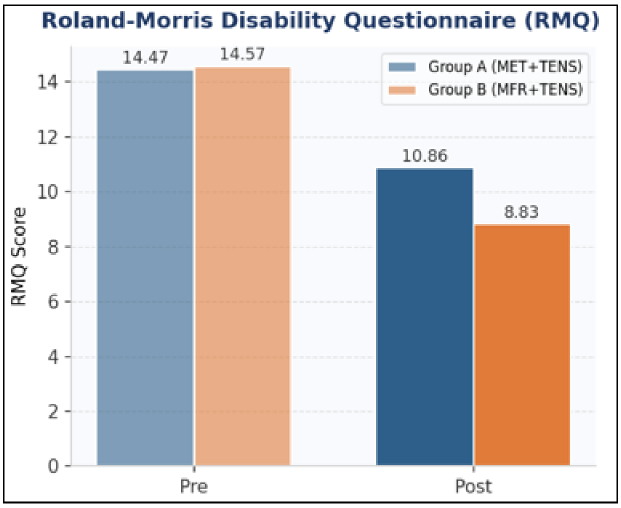

Figure 4: Pre- and Post-Intervention Roland-Morris Disability Questionnaire (RMQ) Scores

Functional disability as captured by the RMQ showed marked improvement in both groups. Group A scores fell from 14.47±1.22 to 10.86±1.16, reflecting a 24.95% reduction. Group B scores declined more substantially from 14.57±1.10 to 8.83±0.98, a reduction of 39.40%. The between-group comparison confirmed that this difference was statistically significant ($t = 7.29$, $p = 0.0007$), indicating considerably greater functional recovery in patients who received MFR with TENS.

3.5 Overall Comparative Improvement

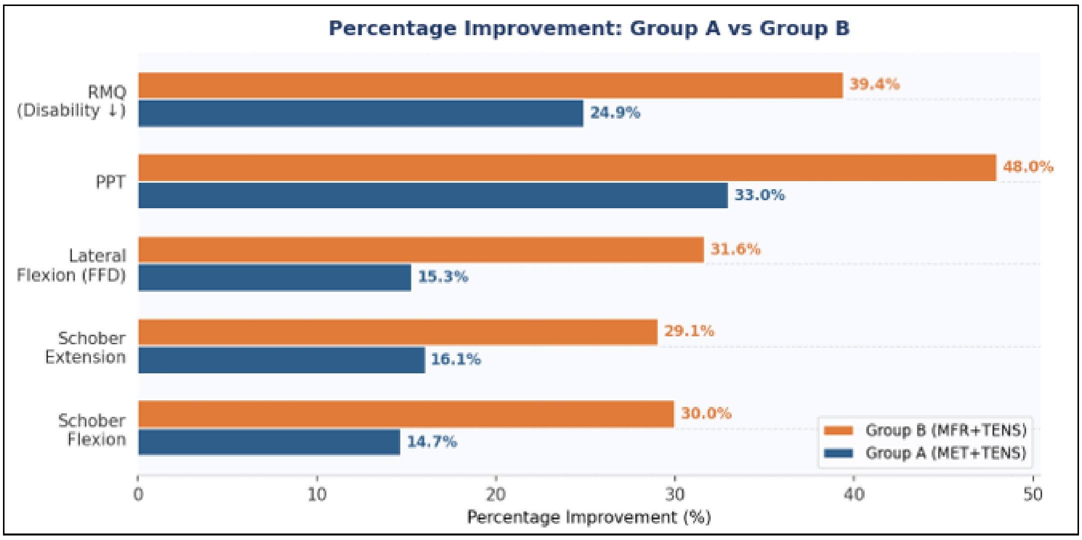

Figure 5: Comparative Percentage Improvement Across All Five Outcome Measures: Group A vs Group B

Figure 5 visually consolidates the performance difference between the two groups. Across every outcome domain, Group B achieved gains that were roughly double those recorded in Group A. The most pronounced disparity was observed for lateral flexion (+31.65% vs +15.32%) and functional disability reduction (−39.40% vs −24.95%), highlighting the clinical advantage of MFR with TENS in comprehensive QLS rehabilitation.

4. Discussion

This study presents a direct comparison of two widely practised manual therapy techniques- MET and MFR- in combination with TENS for the management of QLS. The consistent superiority of MFR with TENS across all five outcome measures is a clinically significant finding that merits detailed consideration.

The greater PPT gains achieved in Group B reflect the distinctive biomechanical and neurophysiological effects of MFR on myofascial tissue. When sustained compressive force is applied to a fascial restriction, it induces viscoelastic deformation of the extracellular matrix, promotes thixotropic changes in ground substance, and mechanically disrupts dysfunctional actin-myosin cross-links within the trigger point.[17,18] Additionally, the pressure stimulates mechanoreceptors such as Ruffini endings and interstitial receptors within the fascia, which in turn modulate the autonomic nervous system and reduce sympathetic drive to the affected muscle.[17] These combined effects explain why MFR produced a 48% increase in PPT compared to 33% in the MET group. These findings are in agreement with Rajan and Gurudut (2023), who demonstrated that gross myofascial trunk release significantly elevated pressure pain thresholds in patients with lumbar radiculopathy.[34]

The substantially greater ROM gains in Group B across flexion, extension, and lateral flexion can be attributed to MFR's capacity to address deep fascial restrictions that limit spinal mobility. The thoracolumbar fascia, which envelops the QL and interconnects it with adjacent structures, undergoes mechanical densification in chronic myofascial conditions. MFR techniques directly engage this tissue, restoring its normal viscoelastic properties and sliding capacity.[17] These observations align with those reported by Tamartash and Bahrpeyma (2022), who found that lumbar MFR significantly improved both flexion angle and pelvic inclination in patients with non-specific chronic LBP.[25] Çetinyol et al. (2025) similarly demonstrated acute gains in Schober's test measurements following a single MFR session, attributing this to immediate fascial rehydration and lengthening.[32] In contrast, MET achieves its effects primarily through neurological pathways- post-isometric relaxation reduces Ia afferent firing and promotes golgi tendon organ activation, enabling muscle lengthening.[15] While this mechanism is effective for neuromuscular hypertonicity, it may be insufficient to resolve the denser connective tissue restrictions that develop in established QLS.

The superior functional outcomes in Group B (RMQ reduction of 39.40% versus 24.95%) reflect not just pain reduction but a broader restoration of movement quality and daily functional capacity. Sakabe et al. (2020) reported comparable findings in their controlled trial of myofascial techniques targeting the QL, thoracolumbar fascia, and iliopsoas, observing significant reductions in disability scores that were maintained at one-month follow-up.[28] Arguisuelas et al. (2017) also documented sustained RMQ improvements following MFR in chronic non-specific LBP.[30] The ability of MFR to address fascial restrictions across multiple tissue layers- rather than targeting a single muscle- likely explains the more comprehensive functional recovery observed in Group B.

It should be noted that Group A also produced clinically meaningful results. MET has strong evidence in QL-related LBP, as reported by Kashyap et al. (2023) and Subramanian et al. (2021).[24,26] It remains a valuable option particularly in acute presentations, in patients who respond well to active participation in treatment, and in settings where MFR expertise is limited.

5. Limitations

- The intervention period was limited to two weeks with no follow-up assessment to evaluate durability of outcomes.

- The study enrolled only subacute cases aged 30 to 50 years, which restricts generalisability to acute, chronic, or older and younger populations.
- Patient compliance with the home exercise programme was based on self-report without objective verification.

6. Conclusion

A structured two-week programme of either Muscle Energy Technique or Myofascial Release, when delivered alongside TENS, leads to significant and measurable reductions in pain, restoration of lumbar range of motion, and improvement in functional status among patients with Quadratus Lumborum Syndrome. However, the data from this trial consistently demonstrate that patients treated with MFR and TENS achieve superior outcomes across all measured parameters compared to those receiving MET and TENS. On the basis of these findings, MFR combined with TENS is recommended as the preferred manual therapy strategy for clinicians managing QLS in an outpatient physiotherapy setting. Larger multi-centre trials incorporating long-term follow-up and objective imaging confirmation are needed to further strengthen the evidence base for this recommendation.

Declarations

Ethical Approval: Granted by the Institutional Ethics Committee, KIMS, Bengaluru. All procedures followed the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from each participant prior to enrolment.

Funding: This study received no external funding.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

Data Availability: Study data are available from the corresponding author upon reasonable request.

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