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Effectiveness of Active Release Technique versus Muscle Energy Technique in Individuals with Non-Specific Low Back Pain: A Randomized Controlled Trial

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Abstract:

- ***Background of the Study:***

Low back pain is one of the most common musculoskeletal conditions affecting quality of life, and can have negative implications of disability and absence from work. 80%of people experience low back pain in their lifetime, and the prevalence of LBP is lowest in the youngest individuals, tends to increase between 30 and 60 years of age and then becomes more stable.

- ***Objective:***

To compare the effectiveness of Active Release Technique (ART) and Muscle Energy Technique (MET) in relieving pain intensity and functional disability in patients with non-specific low back pain.

- ***Subjects and Methods:***

Thirty patients with non -specific low back pain participated in the study. Patients were randomly allocated into two groups: group A, which received the Active Release Technique for active trigger points in target muscles; and group B, which received the Muscle Energy Technique for active trigger points in target muscles. Treatment sessions were given twice a week for 3 weeks duration. Patients were assessed before and after treatment using the Numerical Pain Rating Scale (NPRS) and the Oswestry Disability Index (ODI) to assess pain severity and functional disability.

- ***Results:***

Results demonstrated that Group B (MET) showed greater improvement in NPRS and ODI scores compared with Group A (ART).

- ***Conclusion:***

The Muscle Energy Technique group demonstrated greater improvement in pain and functional disability compared to the Active Release Technique group in individuals with non-specific low back pain.

Keywords: *Muscle Energy Technique, Active Release Technique, NSLP.*

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I. INTRODUCTION

Low back pain (LBP) represents a major musculoskeletal health concern and is one of the most frequently reported causes of pain and physical limitation in adults. It significantly affects daily activities, occupational performance, and overall quality of life, thereby placing a considerable burden on healthcare systems and society [1]. Epidemiological evidence indicates that nearly four out of five individuals experience at least one episode of low back pain during their lifetime [1,2]. Although its prevalence is comparatively lower in younger populations, it increases notably between the ages of 30 and 60 years and thereafter tends to stabilise, reflecting its strong association with the working-age population [2].

In addition to its high prevalence, low back pain is characterised by a substantial risk of recurrence. Following an initial episode, many individuals experience repeated episodes within the subsequent year, and recurrence rates reported in the literature vary widely. Moreover, population-based studies have demonstrated a marked rise in the prevalence of chronic low back pain over recent decades, emphasizing the growing clinical and socioeconomic impact of this condition and the need for effective conservative management strategies [1,2].

The majority of individuals presenting with low back pain are diagnosed with non-specific low back pain (NSLBP), a classification used when symptoms cannot be attributed to a specific pathological cause such as fracture, infection, inflammatory disease, or nerve root involvement [3]. NSLBP is multifactorial in nature and is commonly associated with muscular dysfunction, impaired neuromuscular control, postural stress, and soft tissue abnormalities rather than identifiable structural changes. Among these factors, myofascial trigger points within the lumbar and lumbopelvic musculature are frequently implicated in pain generation and functional limitation [4].

Trigger points may exist in either active or latent forms. Active trigger points are associated with spontaneous pain that may be present during rest or movement, whereas latent trigger points do not produce ongoing pain but can be elicited with manual pressure and may adversely influence muscle activation patterns and joint mobility. Trigger points may develop independently within a muscle or arise secondarily due to altered biomechanics, sustained postural stress, or compensatory muscle activity in adjacent regions [4].

Specific muscles of the lumbopelvic region, particularly the gluteus medius and iliocostalis muscle group, have been identified as common sites for trigger point formation in individuals with low back pain. Dysfunction of the gluteus medius may compromise pelvic stability during weight-bearing activities, leading to altered spinal loading and increased mechanical stress on the lumbar spine. Similarly, trigger points within the iliocostalis muscles may contribute to localized lumbar pain, restricted spinal movement, and impaired functional performance [4,5].

Physiotherapy forms an essential component of conservative management for NSLBP, with interventions aimed at reducing pain, restoring movement, improving functional capacity, and preventing recurrence [3]. Manual therapy techniques are frequently incorporated into rehabilitation programs due to their effectiveness in addressing soft tissue restrictions and movement dysfunction. Among these techniques, Active Release Technique (ART) and Muscle Energy Technique (MET) are commonly used to manage myofascial trigger points and associated muscular dysfunction.

Active Release Technique is a hands-on soft tissue intervention that combines the application of targeted manual pressure with active movement performed by the patient [6,7]. The technique aims to identify and release abnormal tissue tension and adhesions that may develop following repetitive strain, prolonged postural stress, or acute injury, thereby restoring tissue mobility and reducing pain [7].

Muscle Energy Technique, in contrast, is a patient-active manual therapy approach that involves controlled isometric muscle contractions performed against a therapist-applied resistance, followed by relaxation and stretching [5]. Compared with passive stretching methods, MET has been reported to produce greater improvements in muscle extensibility and joint mobility through neurophysiological mechanisms such as post-isometric relaxation and reciprocal inhibition [8,9]. Due to its gentle nature and adaptability, MET has been widely applied in the management of lumbopelvic muscle imbalances and spinal mobility restrictions.[10]

Although both ART and MET have demonstrated benefits when applied independently, there remains limited evidence directly comparing their effectiveness in individuals with non-specific low back pain. [5,11]. Determining the relative efficacy of these commonly employed interventions may help clinicians select the most appropriate treatment strategy for patients with NSLBP.

Both ART and MET are intended to reduce pain, decrease muscle tightness, and improve range of motion; however, the therapeutic mechanisms differ between the two techniques. ART mainly focuses on releasing soft tissue adhesions and restoring tissue mobility through the application of directed tension combined with movement [12,13]. In contrast, MET involves voluntary muscle contractions performed against controlled resistance to lengthen shortened muscles, improve joint mobility, and restore musculoskeletal function [9]. Despite their

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widespread clinical use, direct evidence comparing the effectiveness of ART and MET in reducing symptoms associated with low back pain remains insufficient.

Therefore, the present study is important in providing evidence-based information regarding the comparative effectiveness of ART and MET in the management of NSLBP. Such analysis may assist clinicians in selecting suitable manual therapy interventions, support individualized rehabilitation planning, and improve patient outcomes. In addition, the findings may contribute to the existing literature and encourage further research related to manual therapy approaches for spinal disorders.

➢ *Aims and Objectives*

- *Aims*

To compare the effectiveness of Active Release Technique (ART) and Muscle Energy Technique (MET) in reducing pain intensity and improving functional disability in individuals with non-specific low back pain.

- *Objectives*

✓ To determine the effectiveness of ART in reducing pain intensity and functional disability in individuals with NSLBP.
✓ To determine the effectiveness of MET in reducing pain intensity and functional disability in individuals with NSLBP.
✓ To compare the effectiveness of ART and MET in reducing pain intensity and improving functional disability in individuals with NSLBP.

II. METHODS

➢ *Design and Source of Data*

This study was a single-blinded(participant-blinded) randomized controlled trial. The source of data was patients with non-specific low back pain, who were taken from the Outpatient Department (OPD) of the Department of Physiotherapy, University of Science and Technology, Meghalaya and PA Sangma Medical College and Hospital. Ethical clearance was obtained from the Institutional Ethics Committee of the University of Science and Technology Meghalaya (Ref No: USTM/PIMC/Ethics/2026-08). Written informed consent was obtained from all participants before participation.

➢ *Sample Selection*

Simple random sampling was used to select participants in the study. A total of 40 participants were screened for eligibility. Following exclusion and loss to follow-up, 30 eligible participants were included and randomly allocated into Group A (n = 15) and Group B (n = 15). The study population included both male and female patients diagnosed with non-specific low back pain.

➢ *Sampling Procedure:*

Patients with non-specific low back pain among individuals aged 18-45 years were selected using simple random sampling. Each patient was screened initially by using a simple selection proforma relevant to the inclusion and exclusion criteria. Those who fulfilled this symptomatic criterion underwent a detailed physical examination of the lumbar spine for baseline assessment.

The selected patients who were willing to participate were then randomly divided into two groups of 15 each in Group A and Group B. The details and the purpose of the study were explained to all the patients and informed consent was obtained and demographic data were collected from each patient. Before group allocation for ART or MET interventions, all participants received standard conventional treatment. This included modalities such as hot packs and transcutaneous electrical nerve stimulation (TENS).

The participants were assigned to two groups randomly:

- Group A: 15 participants received Active Release Technique for active trigger points for target muscles, twice a week for a duration of 3 weeks.
- Group B: 15 participants received the Muscle Energy technique for active trigger points for target muscles twice a week for a duration of 3 weeks.

Outcome assessment was performed by an independent, blinded assessor.

➢ *Eligibility Criteria*

Patients for the study were selected based on the following criteria.

➢ *Inclusion Criteria*

- Participants older than 18 years with non-specific low back pain (that is pain between the lumbo-pelvic region and the 12th rib).
- Participants who have at least one active trigger point in each of Iliocostalis Lumborum, Gluteus Medius muscle, local twitch response, and pain lasting from 2 weeks were included in the study.
- Participants with subacute and chronic non-specific low back pain were included in the study
- Willingness to participate in the study as a volunteer.

➢ *Exclusion Criteria*

- Pregnant women
- Participants suffering from neurological or musculoskeletal disorders, motor weakness, tumours, infections or skin lesions and metastasis, or compression fracture.
- Participants who had undergone a back spinal injury
- Participants with psychiatric disorders
- Participants with sensory disorders
- Participants who had received treatment from another healthcare provider

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➢ *Outcome Measures*

- Numeric Pain Rating Scale (NPRS)- Numeric Pain Rating Scale (NPRS) is a simple, widely used tool for measuring a person's pain intensity. It is commonly used in clinical settings and research to monitor pain over time. The patient is usually asked:"On a scale of 0 to 10, with 0 being no pain and 10 being the worst pain imaginable, how would you rate your pain right now?"
- The Oswestry Disability Index (also known as the Oswestry Low Back Pain Disability Questionnaire)-This is an essential tool that researchers and disability evaluators use to measure a patient's permanent functional disability. The test is considered the 'gold standard' of low back functional outcome tools.[10]

➢ *Intervention*

- *Group A (Active Release Technique)*

Active release technique for Iliocostalis Lumborum and Gluteus Medius muscles:

✓ Active release technique for Iliocostalis lumborum: Participant was in sitting position while hands crossing the chest and the therapist were standing behind the patient. Therapist detected the active triggerpoints of Iliocostalis muscle and perform firm pressure on it then ask participant leaning forward with rotation to the otherside then return to starting position while the muscle is shortened for two sessions per week for three weeks.

✓ Active release technique for Gluteus Medius: Throughout ART therapy, the clinician utilizes deep digital tension (with the thumb or fingers) on the involved area while actively as well as passively moving the tissue from either a shortened to a lengthened position, or vice versa. The typical treatment session lasts between five and eight minutes per area. The most effective position for the patient is to lie in side-lying position. The trigger points within Gluteus Medius muscle are located and treated with direct, firm pressure from the top to the bottom by the therapist. The next step is to have the patient flex his or her lower leg from a neutral position to the fully flexed hip range and back again while the therapist maintains pressure on the trigger point.

- *Group B (Muscle Energy Technique)*

Muscle Energy Technique was performed in the form of post –isometric relaxation techniques for gluteus medius and iliocostalis lumborum muscles. The contraction was held for 7-10 seconds and relaxed for 2-3 seconds. Appropriate breathing instructions were given. After that, on exhalation trunk was taken very slightly beyond the restriction barrier and was held there for 10-30 seconds.

✓ Muscle Energy Technique for Gluteus Medius: Patient was positioned on the opposite side (non-affected side down). The therapist stands behind the patient. The pelvis is stabilised with one hand, and the other hand supports the top leg at the ankle or distal thigh. The leg is taken into abduction until we feel the tissue resistance (barrier), and the patient is instructed to resist a controlled movement against the therapist's resistance, typically for a short duration 7-10 seconds) at about 20–30% strength. This isometric contraction helps to activate and strengthen the gluteus medius. After the isometric contraction, the patient is encouraged to relax and breathe out, and the procedure was repeated for 3 -5 times.

✓ Muscle Energy Technique for Iliocostalis Lumborum: Patient in a seated position sits upright on the edge of a plinth or table. The patient is asked to cross their arms over their chest. The therapist stands behind and slightly to the side. Patient's trunk is side bent toward the non-affected side (to stretch the affected iliocostalis). Ask the patient to gently side-bend toward the affected side against resistance. Hold 7–10 seconds, relax, then reposition deeper into the stretch. After the isometric contraction, the patient is encouraged to relax and breathe out and the process is repeated for 3 -5 times.

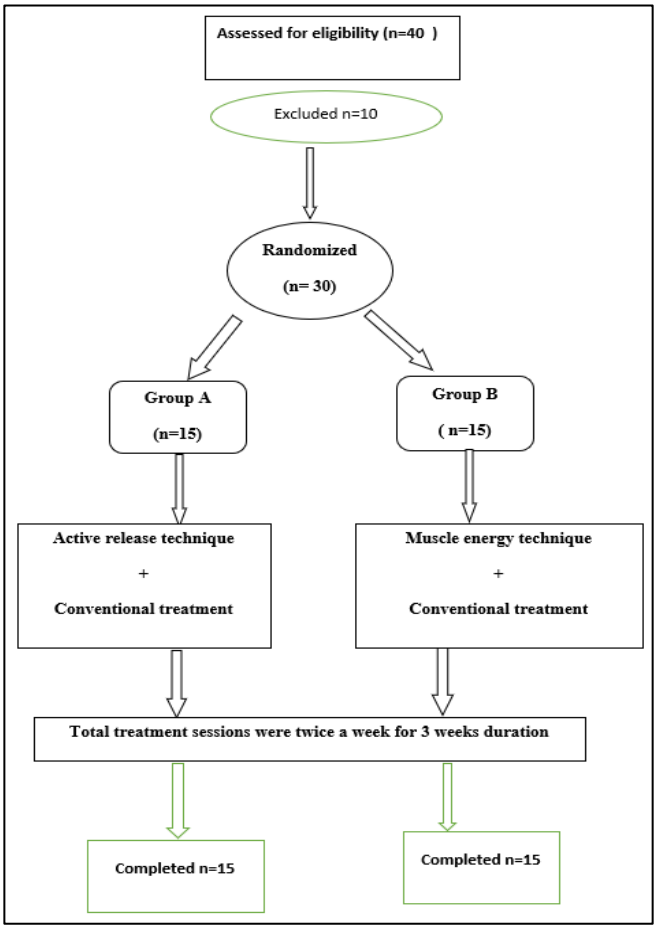

Fig 1 Flowchart of Study Design

III. DATA ANALYSIS AND RESULTS

Data were analysed using IBM SPSS Statistics version 26.0. Descriptive statistics including mean and standard deviation were calculated for demographic and outcome variables. Paired t-tests were used to compare pre- and post-treatment outcomes within groups, while independent samples t-tests were performed to compare differences between the ART and MET groups. Statistical significance was set at $p < 0.05$.

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Table 1 Comparison of NPRS Scores within Groups

Group	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	t-value	p-value
ART	6.60 ± 1.45	4.47 ± 1.60	11.12	<0.001
MET	6.80 ± 1.21	2.60 ± 0.63	18.87	<0.001

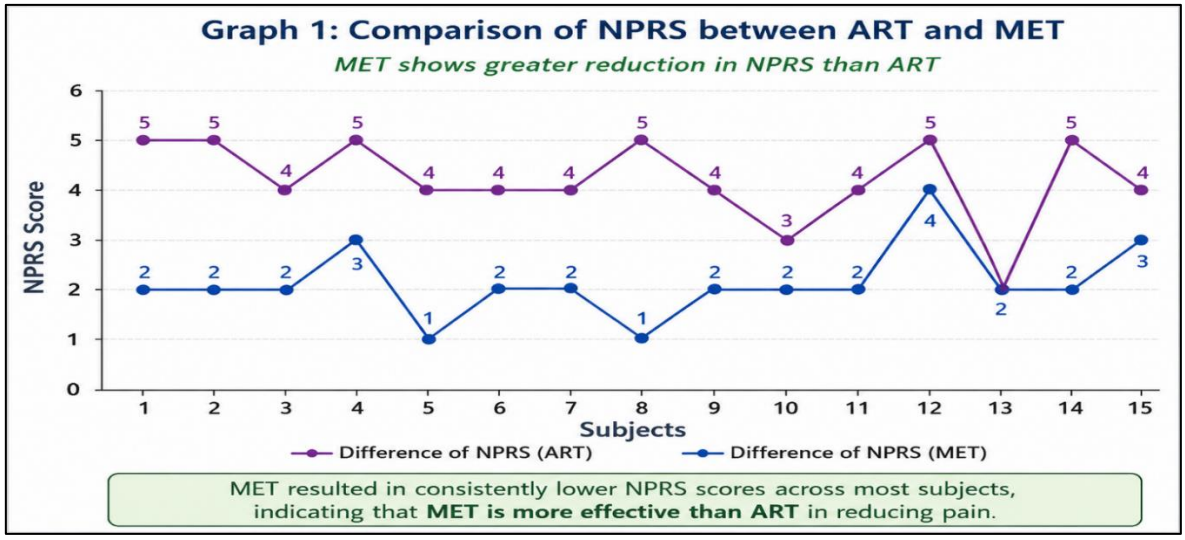
Table 2 Comparison of ODI Scores within Groups

Group	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	t-value	p-value
ART	**0.391 ± 0.141**	**0.315 ± 0.114**	**5.32**	**<0.001**
MET	**0.549 ± 0.202**	**0.144 ± 0.069**	**9.19**	**<0.001**

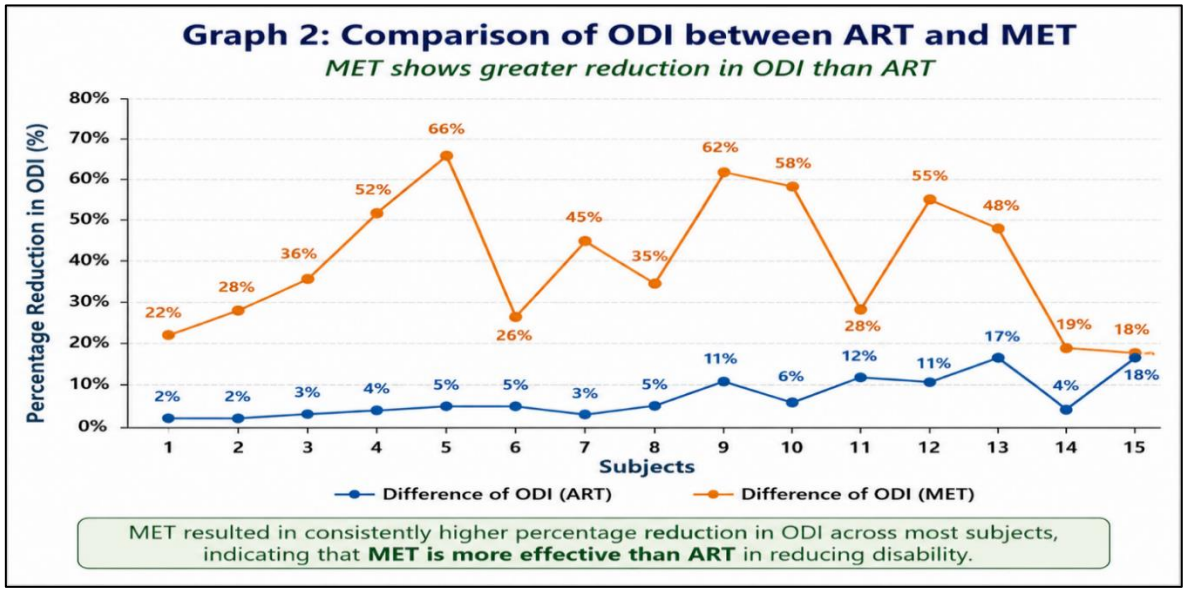
Table 3 Between Groups Comparison (ART and MET)

Outcome	ART Mean ± SD	MET Mean ± SD	t	p
NPRS (post)	4.47 ± 1.60	2.60 ± 0.63	4.21	0.0005
ODI (post)	0.315 ± 0.114	0.144 ± 0.069	4.97	0.00005

Table 3 interprets an independent samples *t*-test was conducted to compare post-treatment outcomes between Group A (ART) and Group B (MET). A statistically significant difference was observed in post-treatment NPRS scores (t = 4.21, p = 0.0005), with the MET group demonstrating greater reduction in pain compared to the ART group. Similarly, post-treatment ODI scores showed a statistically significant difference (t = 4.97, p = 0.00005), indicating superior improvement in functional disability in the MET group.



Graph 1 Demonstrates Greater Reduction in NPRS Scores in the MET Group Compared to the ART Group.



Graph 2 Demonstrates a Greater Reduction in ODI Scores in the MET Group Compared to the ART Group

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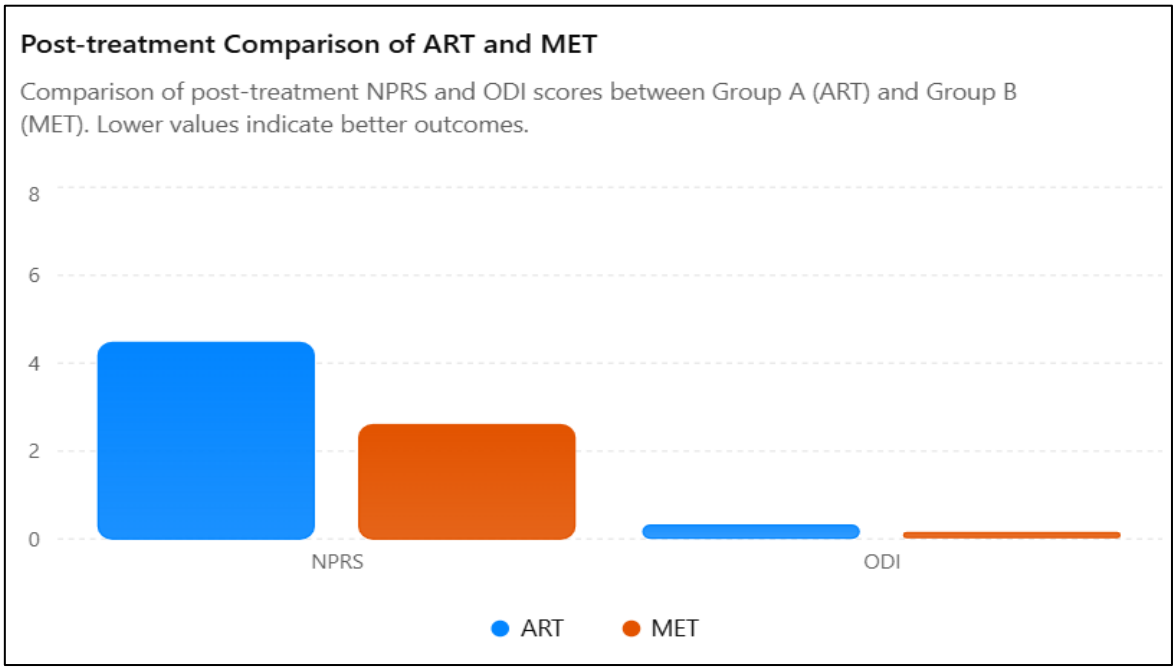
Graphs 1 and 2 demonstrate greater reduction in NPRS and ODI scores in the MET group compared with the ART group, indicating better improvement in pain and functional disability following MET intervention.



Graph 3 Post-Treatment Comparison of ART vs MET

Graph 3 demonstrates lower post-treatment NPRS and ODI scores in the MET group compared to the ART group, indicating greater improvement in pain intensity and functional disability following MET intervention.

IV. DISCUSSION

Non-specific low back pain (NSLBP) is one of the leading causes of pain, disability, and reduced functional capacity worldwide. It is characterized by pain in the lumbar region without any identifiable specific pathology [14]. Manual therapy interventions such as Active Release Technique (ART) and Muscle Energy Technique (MET) are commonly used in physiotherapy management to address musculoskeletal dysfunctions, soft tissue tightness, and movement restrictions associated with NSLBP [12].

Active Release Technique is a soft tissue mobilization approach in which manual pressure applied by the therapist is combined with active patient movement to release adhesions, scar tissue, and myofascial restrictions [7]. In patients with NSLBP, ART is commonly applied to muscles such as the iliocostalis lumborum and gluteus medius to improve tissue extensibility and reduce muscular tightness. The technique may help restore normal movement patterns by decreasing stress on surrounding fascial and neural structures while improving lumbar mobility and functional performance [6]. Previous studies have reported that ART can produce short-term pain relief and improve soft tissue flexibility, especially in chronic musculoskeletal conditions [15].

Muscle Energy Technique is a manual therapy procedure involving voluntary isometric contraction of muscles against controlled therapist resistance followed by relaxation and stretching [5]. MET is frequently used to correct muscle imbalance, improve pelvic and lumbar alignment, and restore restricted joint mobility. The therapeutic effects of MET are believed to occur through mechanisms such as post-isometric relaxation and reciprocal inhibition, which reduce muscle hypertonicity and enhance flexibility [9]. In addition, active patient participation during MET may improve neuromuscular coordination and postural control. The findings of the present study are consistent with the study conducted by Wilson et al., who reported significant improvement in pain and lumbar mobility following MET intervention in patients with low back pain [8].

Although both ART and MET were effective in reducing pain and improving function, the findings of the present study demonstrated that MET produced superior outcomes compared to ART in individuals with NSLBP involving the gluteus medius and iliocostalis lumborum muscles. The greater improvement observed with MET may be attributed to its combined effect on muscular flexibility, joint mobility, and neuromuscular control. Since dysfunction of the gluteus medius and iliocostalis lumborum is often associated with pelvic asymmetry and altered lumbar biomechanics, MET may have been more effective in correcting these dysfunctions and restoring normal movement patterns.

ART mainly targets soft tissue adhesions and myofascial restrictions, making it beneficial for improving tissue mobility and providing symptomatic relief. In contrast, MET focuses on restoring muscle balance and joint alignment, which may contribute to longer-term biomechanical correction. Therefore, while ART may provide faster reduction in muscular tightness, MET appears

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to offer greater improvement in overall functional stability and pain reduction in NSLBP.

The findings of the present study suggest that both techniques are clinically useful; however, MET may be more effective in managing pain associated with NSLBP. The superior outcomes observed with MET may be associated with post-isometric relaxation, improved neuromuscular control, and restoration of lumbopelvic biomechanics. These findings suggest that MET may be particularly beneficial in patients presenting with muscular tightness and movement dysfunction associated with NSLBP. Combining ART and MET may provide additional therapeutic benefits by addressing both soft tissue restriction and biomechanical dysfunction. Further research with larger sample sizes and long-term follow-up is recommended to evaluate the combined effects of these interventions.

V. LIMITATIONS IN CURRENT EVIDENCE

The present study has certain limitations that should be considered while interpreting the findings. The study was conducted with a relatively small sample size and a short duration of intervention, which may limit the generalizability of the results. In addition, long-term follow-up was not performed; therefore, the sustained effects of the intervention could not be determined. The absence of therapist blinding may also have introduced the possibility of bias. Furthermore, as the study was carried out in a single centre, the findings may not be representative of a wider population.

VI. CONCLUSION

Both Active Release Technique and Muscle Energy Technique were effective in reducing pain and improving functional ability in individuals with non-specific low back pain. However, Muscle Energy Technique demonstrated significantly greater improvement in pain intensity and functional disability than Active Release Technique. Future studies with larger sample sizes, multicentre settings, and long-term follow-up are recommended to confirm these findings.

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