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Effectiveness of Instrument-Assisted Soft Tissue Mobilization (IASTM) Versus Muscle Energy Technique (MET) on Pain, Range of Motion, and Functional Disability Among Individuals with Chronic Non-Specific Neck Pain

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ABSTRACT

Objectives: To compare the effects of IASTM and MET on pain intensity, active cervical range of motion (ACROM), and functional disability in individuals with NSNP, and to determine which intervention achieves superior clinical outcomes. Methodology: The ethical clearance was obtained from AUHEC (AUHEC/MPT-FT-004/17/02/2025). 52 participants with chronic non-specific neck pain were included in this study, and they were allocated into IASTM group and MET group with 26 participants each. Each participant underwent 12 treatment sessions over six weeks (two sessions per week, one hour per session). Pain was measured using the Numerical Pain Rating Scale (NPRS), cervical mobility with a universal goniometer, and functional disability with the Neck Disability Index (NDI). Results: Both groups demonstrated significant within-group improvements in pain reduction, ACROM, and functional disability ($p<0.05$). Between-group analysis showed that the MET group achieved significantly lower NPRS scores compared to IASTM ($p<0.05$) and significantly lower NDI scores ($p<0.05$). No significant between-group differences were observed in ACROM across all movement directions (all $p>0.05$).Conclusion: Both IASTM and MET are effective in managing NSNP. However, MET demonstrated superior benefits in reducing pain intensity and functional disability, whereas both interventions comparably improved cervical mobility

KEYWORDS: Non-specific neck pain, Instrument-Assisted Soft Tissue Mobilization, Muscle Energy Technique, cervical range of motion, functional disability, manual therapy, pain management.

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INTRODUCTION

Neck pain is a prevalent musculoskeletal disorder affecting a large proportion of the adult population worldwide. Epidemiological data indicate that approximately 30%–50% of adults experience neck pain annually, with lifetime prevalence exceeding 70% in some populations (Dieleman et al., 2020; Cohen, 2015). It ranks as the fourth leading cause of global disability and imposes substantial socioeconomic and occupational burdens due to productivity loss, healthcare utilization, and chronic pain-related disability (Genebra et al., 2017). Among various classifications, non-specific neck pain (NSNP)—defined as neck pain without identifiable structural, neurological, or systemic pathology—represents the majority of clinical presentations encountered in physiotherapy practice. Individuals with chronic NSNP commonly exhibit decreased cervical mobility, impaired sensorimotor control, and muscle weakness—particularly of the deep neck flexors—leading to functional limitations and reduced quality of life (Iqbal et al., 2021; Sun et al., 2024). Given its complex pathophysiology, the management of NSNP requires a multimodal and individualized approach. Clinical practice guidelines advocate the use of non-pharmacological interventions such as patient education, therapeutic exercise, ergonomic modification, and manual therapy (Corp et al., 2021). Among these, manual therapy is widely recognized for its ability to reduce pain, enhance mobility, and improve function through mechanical and neurophysiological mechanisms. Techniques such as joint mobilization, myofascial release, Muscle Energy Technique (MET), and Instrument-Assisted Soft Tissue Mobilization (IASTM) are frequently employed within physiotherapy practice. IASTM is a contemporary soft tissue mobilization approach that utilizes specially designed tools to apply controlled mechanical stress to the skin and underlying fascia. The technique aims to release myofascial restrictions, stimulate fibroblast activity, enhance blood flow, and promote collagen remodeling (Cheatham et al., 2016; Hamdy et al., 2023). By inducing localized microtrauma, IASTM triggers a reparative inflammatory response that facilitates tissue healing and restoration of mobility. Clinically, IASTM has been shown to reduce pain and improve range of motion in various musculoskeletal conditions, including chronic neck pain and upper trapezius myofascial tightness (Bostan & Kaya, 2024; El-hafez et al., 2020). It also offers practical advantages, such as deeper tissue penetration and reduced therapist fatigue, making it a valuable adjunct to conventional manual therapy. Conversely, the MET is an active manual therapy approach that engages the patient's voluntary muscle contractions against a controlled counterforce applied by the therapist. Rooted in osteopathic principles, MET functions through post-isometric relaxation and reciprocal inhibition mechanisms, which facilitate muscle elongation, reduce hypertonicity, and restore joint mobility (Mahajan

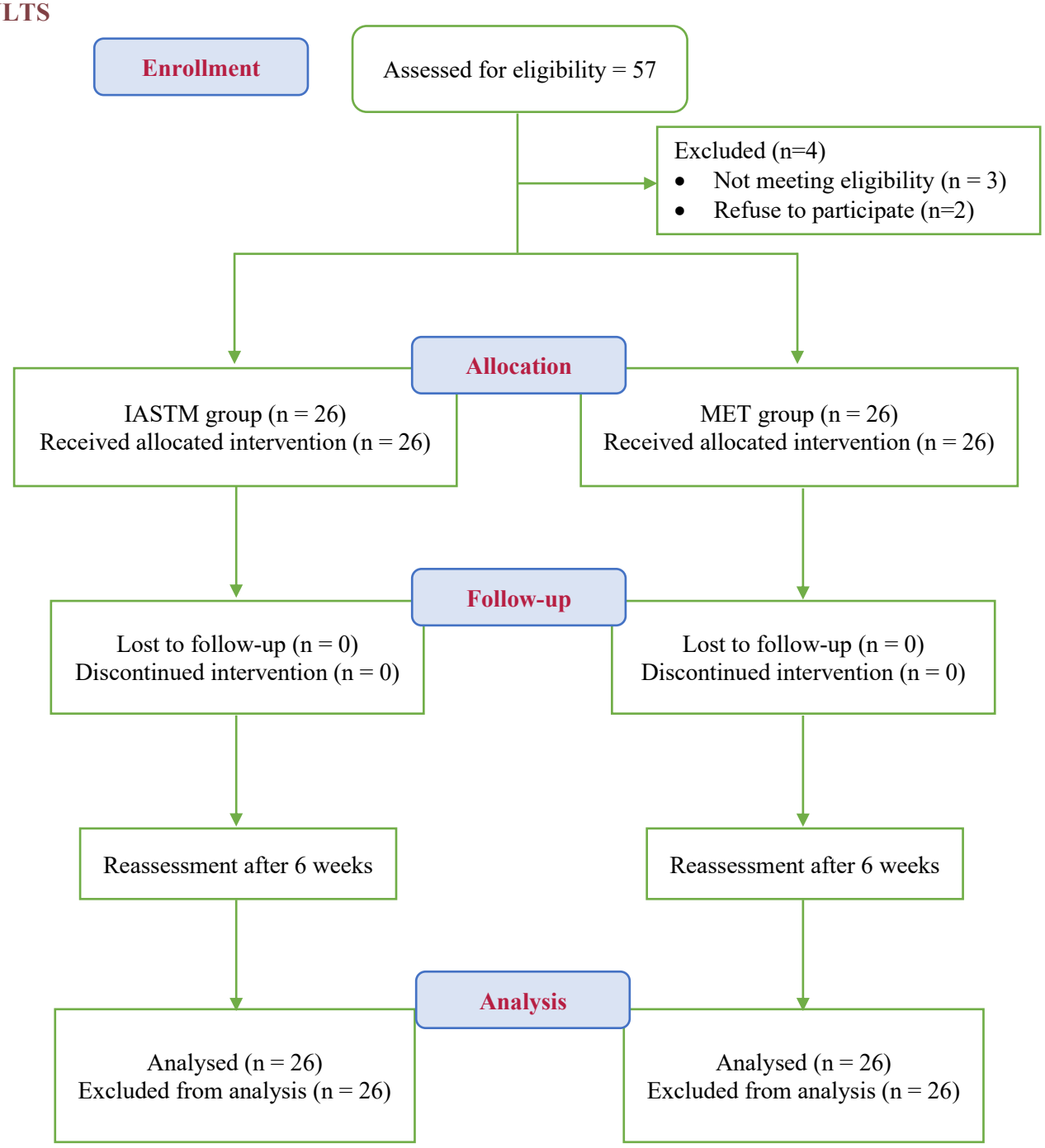
et al., 2012; Sbardella et al., 2021). Beyond its mechanical effects, MET also promotes neuromuscular re-education and proprioceptive control, making it particularly suitable for conditions such as NSNP that involve motor control dysfunction (Phadke et al., 2016). Furthermore, its active nature encourages patient participation and self-efficacy, which are the key factors in long-term functional recovery. Considering the high global prevalence of NSNP and its impact on daily function, it is essential to establish evidence-based guidelines for manual therapy interventions. Both IASTM and MET target soft tissue dysfunction and mobility impairments but differ fundamentally in application—IASTM being a passive, tool-assisted technique, and MET an active, muscle contraction-based technique. Comparing their relative effectiveness can provide valuable insights into which approach yields superior outcomes in pain reduction, mobility enhancement, and functional restoration. Therefore, this study aimed to compare the effectiveness of IASTM and MET on pain intensity, cervical range of motion, and functional disability among individuals with chronic non-specific neck pain.

METHODOLOGY

This study was designed as a two-arm experimental study with pre- and post-intervention assessments. Ethical clearance was obtained from the AIMST University Human Ethical Council (AUHEC) (application reference number: AUHEC/MPT-FT-004/17/02/2025). A total of 52 participants was recruited and allocated into two equal groups: the IASTM group and the MET group, with 26 participants in each group. Allocation was performed sequentially as participants were enrolled, aiming to ensure balanced group sizes. All participants were provided with detailed information regarding the purpose, procedures, risks, and benefits of the study. Written informed consent was obtained from each participant prior to their enrolment. This study was conducted at the Physiotherapy Clinic of AIMST University, located in Bedong, Kedah, Malaysia. The duration of this study was six months, conducted from December 2024 to June 2025. The treatment duration for this study was six weeks. Participants in both the IASTM group and the MET group received their respective interventions twice per week, resulting in a total of 12 treatment sessions over the six-week period. Pre-intervention assessments were conducted prior to the beginning of the first treatment session, and post-intervention assessments were carried out after completion of the twelfth session at the end of week six. The sample size was calculated using G*Power software (version 3.1.9.7.) for an independent samples t-test, with an effect size of 0.80 and 80% of power (Gupta et al., 2012; Cunha et al., 2008; Mahajan et al., 2012. Participants were included in this study if they meet the following criteria: individuals of both genders aged between 30 and 50 years old; individuals diagnosed with non-specific neck pain with a referral by a medical doctor; individuals reporting a current neck pain intensity ranging between 2/10 and 6/10 on the Numerical Pain Rating Scale (NPRS); and individuals experiencing neck pain for a duration of at least three months. Meanwhile, participants were excluded from the study if they meet any of the following conditions: individuals with a history of neck or cervical spine surgery; individuals diagnosed with specific neck pathologies such as cervical radiculopathy, cervical myelopathy, or herniated cervical disc; individuals with a history of neck trauma or injury within the past six months; individuals with neurological disorders affecting the upper extremities or cervical spine; individuals currently receiving concurrent physical therapy or other manual therapy interventions for neck pain; individuals with cognitive impairments or communication difficulties that would limit their ability to understand instructions or participate effectively; and individuals who have received cervical spine injections or other invasive procedures for neck pain within the past six months. The outcome measures for this study included Numerical Pain Rating Scale (NPRS), Active Cervical Range of Motion (ACROM), and Neck Disability Index (NDI). Measurements were taken at baseline (pre-intervention) and after six weeks of intervention (post-intervention). The tools chosen for assessment were reliable, validated, and widely used in clinical and research settings. All participants enrolled in this study received a structured therapeutic intervention program over a six-week period, with sessions conducted twice weekly, resulting in a total of 12 supervised clinical sessions. The structure of each session included three core components: pre-treatment thermotherapy, the assigned manual therapy intervention (either IASTM or MET), and post-treatment passive stretching and home exercise reinforcement. At the beginning of each session, thermotherapy was applied to the cervical region using hydrocollator moist heat packs. Following thermotherapy, all participants received either IASTM or MET, depending on their group allocation for around 20 minutes. After the manual intervention, participants in both groups underwent 15-20 minutes of passive stretching for all major cervical movements: flexion, extension, lateral flexion (left and right), and rotation (left and right). Each stretch was sustained for 30 seconds and repeated three times, following evidence-based stretching protocols. A home-based neck stretching program was also prescribed, with instructions to perform the exercises five times per week. Home exercise programs (HEPs) are recognized as critical components of effective physiotherapy, promoting long-term neuromuscular adaptations, self-efficacy, and patient engagement in care (Baker et al., 2013). Participants in Group A received IASTM using the M2T blade, a stainless-steel tool designed to conform to various anatomical contours. Participants were seated leaning slightly forward with support under the arms and forehead. Following skin disinfection and application of a hypoallergenic lubricant to reduce friction, the therapist performed longitudinal and cross-fiber sweeping strokes using the instrument on the upper trapezius, levator scapulae, splenius cervicis, and splenius capitis muscles bilaterally. Each muscle was treated for approximately 3 minutes, and the therapist adjusted pressure based on patient feedback and tissue response. The treatment typically elicited mild erythema or petechiae, which are understood as markers of increased local perfusion and therapeutic tissue microtrauma. Participants in Group B underwent Muscle Energy Technique (MET) intervention once weekly for a total of six sessions. Each MET session followed a structured approach comprising three key phases: contraction, relaxation, and stretching. The therapist positioned the target muscle near the edge of its available range of motion (e.g., lateral neck flexion for the upper trapezius). The participant then performed a gentle isometric contraction against a controlled counterforce provided by the therapist. This contraction was held for 5 to 10 seconds at approximately 20% of the participant's maximum effort. Upon relaxation, the therapist guided the muscle into a deeper stretch, which was held for 15 to 30 seconds to facilitate muscle elongation. The contraction-relaxation-stretch cycle was repeated three to five times per muscle group, depending on the participant's tolerance and therapeutic response. The session concluded with passive neck stretching exercises targeting all directions of motion, and participants were provided with a home-based stretching program to perform five times per week to reinforce the clinical benefits. The statistical analysis for this study was conducted using IBM SPSS Statistics version 29.0.

Descriptive statistics, including mean, standard deviation, minimum, and maximum values, were calculated for demographic variables such as age, gender, and group distribution. Baseline homogeneity between the IASTM and MET groups was assessed using independent (unpaired) t-tests for age to confirm comparability between groups prior to the intervention. To evaluate the effectiveness of each intervention within groups, paired t-tests were performed separately for the IASTM and MET groups, comparing the pre-intervention and post-intervention scores for each outcome measure. For between-group comparisons (IASTM group versus MET group), independent (unpaired) t-tests were conducted to analyze differences in the mean change scores of NPRS, ACROM, and NDI from pre- to post-intervention. An intention-to-treat (ITT) analysis principle was adopted in this study to ensure that all participants initially allocated to each intervention group were included in the final analysis, regardless of their adherence to the treatment protocol or any deviations during the intervention period. A p-value of less than 0.05 was considered statistically significant for all analyses. In addition to p-values, 95% confidence intervals (CIs) were reported to quantify the precision of the estimated effects. The alpha level was set at 0.05 to maintain a balance between Type I and Type II error risks and to detect clinically meaningful differences between groups.

RESULTS



There was total of 52 sample size, with 26 participants in IASTM group and another 26 participants in MET group. The parameters for this study included Numerical Pain Rating Scale (NPRS), Active Cervical Range of Motion (ACROM), Neck Disability Index (NDI). All the parameters were taken before the first session and after the final session of 6 weeks intervention for both groups. All the participants were aged between 30 to 50 years old, with the mean age of 39.50 and standard deviation of 6.23. The mean

age of the 26 participants in IASTM group was 39.65 with standard deviation of 6.03, whereas the mean age of the other 26 participants in MET group was 39.35 with standard deviation of 6.54. In this study, 52 participants were all successfully completed the study and no subjects absent or lose to follow-up within the 6 weeks of study. IASTM group did show significant improvements in the outcomes. The mean NPRS score for IASTM group at baseline was 3.96 ± 1.37, which decreased to 2.12 ± 1.21 after the intervention. The t-test result ($t = 12.14$, $p < 0.05$) indicates a statistically significant reduction in pain following the IASTM treatment. For cervical flexion range of motion in IASTM group, the mean value was 29.38 ± 5.62 before the intervention and increased to 37.42 ± 3.43 post-intervention. The t-test ($t = -3.89$, $p < 0.05$) confirms a significant improvement in flexion. Similarly, cervical extension range of motion showed a substantial increase from 19.04 ± 6.38 before the intervention to 37.81 ± 5.06 after the intervention, with a t-value of -12.74 and a p-value < 0.05. For cervical lateral flexion, the left-side mean value was 23.77 ± 6.26 pre-intervention and improved to 32.73 ± 6.70 post-intervention. The t-test ($t = -7.42$, $p < 0.05$) indicates a significant increase in left-side lateral flexion. Similarly, the right-side lateral flexion improved from 24.96 ± 7.37 before the intervention to 33.35 ± 7.49 after the intervention, with a t-value of -8.28 and a p-value < 0.05, indicating a statistically significant improvement in right-side lateral flexion as well. Regarding cervical rotation, the left-side rotation mean value was 37.85 ± 5.95 before the intervention and increased to 53.15 ± 5.07 after the intervention. The statistical analysis ($t = -8.88$, $p < 0.05$) confirms a significant improvement in left-side rotation. For right-side rotation, the pre-intervention mean was 42.38 ± 5.99, which increased to 53.08 ± 4.69 post-intervention. The t-test ($t = -8.95$, $p < 0.05$) shows that this improvement is also statistically significant. Additionally, the Neck Disability Index (NDI) in IASTM group showed a substantial reduction from 22.08 ± 6.61 before the intervention to 12.96 ± 5.94 after the intervention. The t-test ($t = 15.83$, $p < 0.05$) indicates a highly significant improvement in functional ability, with a marked reduction in disability scores. For MET group, the mean NPRS score at baseline was 4.27 ± 1.37, which decreased to 1.42 ± 1.10 after the intervention. The t-test result ($t = 15.55$, $p < 0.05$) indicates a statistically significant reduction in pain, demonstrating the effectiveness of the MET intervention in alleviating discomfort. For cervical flexion range of motion, the mean value was 30.85 ± 5.84 before the intervention and increased to 37.46 ± 4.04 post-intervention. The t-test ($t = -4.70$, $p < 0.05$) confirms a significant improvement in cervical flexion following the MET treatment. Similarly, cervical extension range of motion increased from 19.08 ± 5.73 at baseline to 38.42 ± 3.65 after the intervention. The t-test ($t = -9.77$, $p < 0.05$) demonstrates a highly significant improvement in cervical extension. For cervical lateral flexion, the left-side mean was 26.12 ± 4.84 before the intervention and improved to 35.12 ± 5.89 after the intervention. The t-test ($t = -8.69$, $p < 0.05$) indicates a statistically significant increase in left lateral flexion. Similarly, the right-side lateral flexion improved from 26.08 ± 5.82 at baseline to 36.73 ± 6.71 post-intervention. The statistical analysis ($t = -8.07$, $p < 0.05$) confirms a significant improvement in right lateral flexion as well. Regarding cervical rotation, the left-side mean value was 38.85 ± 6.17 before the intervention and increased to 52.88 ± 4.68 after the intervention. The t-test ($t = -6.56$, $p < 0.05$) confirms a significant increase in left-side rotation. For right-side rotation, the pre-intervention mean was 40.65 ± 6.89, which improved to 50.58 ± 4.72 after the intervention. The t-test ($t = -6.22$, $p < 0.05$) suggests a statistically significant improvement in right-side rotation. Additionally, the NDI mean score was 23.65 ± 7.42 before the intervention and decreased to 6.15 ± 5.30 post-intervention. The t-test ($t = 19.72$, $p < 0.05$) indicates a highly significant reduction in disability, highlighting the effectiveness of MET in improving functional abilities. For the between-group comparison, the mean NPRS score after the intervention was 2.12 ± 1.21 for the IASTM group and 1.42 ± 1.10 for the MET group. The t-test result ($t = 2.96$, $p < 0.05$) indicates a statistically significant reduction in pain, favoring the MET intervention. For cervical flexion range of motion, the mean post-intervention value was 37.42 ± 3.43 in the IASTM group and 37.46 ± 4.04 in the MET group. The t-test ($t = 0.88$, $p = 0.971$) suggests no significant difference in flexion between the groups. Similarly, cervical extension range of motion was 37.81 ± 5.06 in the IASTM group and 38.42 ± 3.65 in the MET group, with a t-value of 0.98 and a p-value of 0.856, confirming no significant difference between the interventions for extension improvements. For cervical lateral flexion, the left-side mean was 32.73 ± 6.70 for the IASTM group and 35.12 ± 5.89 for the MET group. The t-test ($t = -0.81$, $p = 0.179$) suggests no significant difference in left lateral flexion improvements. Likewise, right-side lateral flexion had mean values of 33.35 ± 7.49 in the IASTM group and 36.73 ± 6.71 in the MET group, with a t-value of -0.68 and a p-value of 0.092, indicating no significant difference between groups. Regarding cervical rotation, the left-side mean value was 53.15 ± 5.07 for the IASTM group and 52.88 ± 4.68 for the MET group. The t-test ($t = 0.95$, $p = 0.843$) confirms that both interventions yielded similar improvements in left-side rotation. For right-side rotation, the mean post-intervention value was 53.08 ± 4.69 in the IASTM group and 50.58 ± 4.72 in the MET group. Although the t-test ($t = 2.53$, $p = 0.069$) suggests a trend toward greater improvement in right-side rotation in the IASTM group, the result does not reach statistical significance. Additionally, the mean post-intervention NDI score was 12.96 ± 5.94 for the IASTM group and 6.15 ± 5.30 for the MET group. The t-test ($t = 3.43$, $p < 0.05$) indicates a statistically significant reduction in disability, with the MET intervention demonstrating a greater improvement in functional outcomes compared to IASTM. Overall, when comparing the two groups at post-intervention, the statistical analysis reveals that MET produced significantly greater improvements in NPRS and NDI scores compared to IASTM ($p < 0.05$), suggesting that MET was more effective in reducing pain and disability. However, no significant differences were found between the two groups for ACROM ($p > 0.05$), indicating that both interventions were equally effective in improving cervical mobility.

DISCUSSION

This study compared the effects of IASTM and MET in individuals with chronic NSNP. Both interventions produced significant improvements in pain, cervical ROM, and functional disability. However, MET showed greater reductions in pain and disability, while both techniques were equally effective in improving ROM. The superior outcomes with MET align with previous studies emphasizing its neurophysiological mechanisms, particularly post-isometric relaxation and reciprocal inhibition, which decrease muscle hypertonicity and promote pain modulation (Sbardella et al., 2021). MET also enhances proprioceptive input and neuromuscular control, facilitating long-term functional recovery. The technique's active nature encourages patient participation and may contribute to better self-efficacy and adherence compared to passive modalities. IASTM, meanwhile, exerts its effects primarily through mechanical stimulation of soft tissues, improving blood flow, fibroblast activity, and collagen remodeling

(Cheatham et al., 2016; Hamdy et al., 2023). These processes reduce fascial restrictions and enhance tissue mobility, explaining the significant gains in ROM. However, because IASTM focuses more on peripheral tissue changes than neuromuscular retraining, its effects on functional disability were less pronounced than those of MET. Comparable improvements in cervical mobility between groups suggest that both interventions effectively enhance soft tissue extensibility and joint mechanics. The findings support earlier evidence that manual therapy techniques—whether tool-assisted or contraction-based—can restore mobility and reduce stiffness in NSNP (El-hafez et al., 2020). Clinically, this indicates that IASTM and MET can both be integrated into multimodal physiotherapy programs depending on individual presentation. MET may be preferred when the primary goal is to reduce pain and improve function through neuromuscular re-education, while IASTM is advantageous for patients with myofascial restrictions or connective tissue tightness. Combining both interventions could potentially provide synergistic benefits by addressing mechanical and neuromuscular components simultaneously. This study reinforces the clinical value of manual therapy in NSNP management and supports tailoring interventions to patient-specific needs. Limitations include the short treatment duration, lack of long-term follow-up, small sample size, and inability to blind participants or therapists. Future studies should include larger samples, long-term follow-up, and combine objective measures such as muscle activation or proprioception analysis to better understand underlying mechanisms and optimize treatment protocols.

CONCLUSION

Both IASTM and MET were effective in reducing pain, improving cervical range of motion, and decreasing functional disability among individuals with chronic non-specific neck pain. However, MET demonstrated greater improvements in pain reduction and functional outcomes, suggesting superior effects on neuromuscular control and patient function. In contrast, IASTM produced comparable gains in cervical mobility, indicating its value in addressing soft tissue restrictions. These findings highlight the importance of selecting manual therapy techniques based on patient presentation, which using MET for neuromuscular dysfunction and IASTM for soft tissue tightness. Both approaches can serve as effective components of a multimodal physiotherapy program. Future research with larger sample sizes, standardized treatment protocols, and long-term follow-up is recommended to further validate these results and explore the combined use of IASTM and MET for optimal rehabilitation outcomes.

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