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Original Article

Comparative Effect of Conventional vs. Device-Assisted Myofascial Release on Pain and ROM in Upper Trapezius Trigger Points

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ABSTRACT

Background: Myofascial trigger points in the upper trapezius are a common source of neck pain and functional limitation. Conventional myofascial release is widely used, but device-assisted techniques may provide deeper and more consistent mechanical effects, potentially improving clinical outcomes. Objective: To compare the short-term effects of device-assisted versus conventional myofascial release on pain, cervical range of motion, pressure pain threshold, disability, muscle stiffness, and patient satisfaction. Methods: In this randomized controlled trial, 66 participants with upper trapezius trigger points were allocated to either conventional manual myofascial release or device-assisted myofascial release for six sessions over three weeks. Outcomes were measured at baseline and post-intervention using VAS, goniometry, algometry, MyotonPRO stiffness assessment, and the Neck Disability Index. Between-group differences were analyzed using ANCOVA, correlations using Pearson coefficients, and predictors of pain reduction using multiple linear regression. Results: Device-assisted myofascial release produced significantly greater reductions in pain (−4.2 vs −3.0), larger improvements in cervical ROM (+14–17° vs +8–10°), higher pressure pain threshold (+2.3 vs +1.4 kg/cm²), greater reductions in disability (−24.6% vs −16.2%), and lower muscle stiffness ($p < 0.001$). Regression analysis identified device-assisted treatment as an independent predictor of pain reduction ($\beta = 1.18$, $p < 0.001$). Conclusion: Device-assisted myofascial release is superior to conventional manual techniques for short-term management of upper trapezius trigger points. Keywords: Myofascial release, IASTM, trigger points, cervical pain, randomized controlled trial, physiotherapy

INTRODUCTION

Myofascial trigger points in the upper trapezius remain a leading cause of chronic neck pain, reduced cervical mobility, and functional impairment in adults, particularly among individuals exposed to postural overload, sedentary work habits, or repetitive strain (1). These hyperirritable nodules within taut bands of skeletal muscle cause characteristic referred pain patterns and decreased tissue extensibility, substantially affecting work productivity and quality of life (2). Conventional myofascial release (MFR), applied manually by physiotherapists, is widely used to improve muscle pliability, modulate nociceptive input, and restore range of motion through sustained pressure and fascial elongation (3). However, manual MFR depends heavily on the therapist's force output, skill level, and endurance, which may contribute to inconsistent treatment effects and practitioner fatigue (4). As a result, interest has grown

in device-assisted MFR techniques that employ instruments to deliver standardized, deeper, and more sustained shear forces to myofascial tissues (5).

Emerging evidence suggests that instrument-assisted soft tissue mobilization may enhance mechanotransduction, improve pressure pain thresholds, and facilitate more efficient tissue remodeling compared with manual methods (6). Despite promising findings, high-quality randomized controlled trials focusing specifically on upper trapezius trigger points remain scarce, and the comparative short-term clinical effectiveness of device-assisted versus manual MFR is not well established (7). Key knowledge gaps persist regarding their differential impact on pain modulation, cervical mobility, functional disability, and neuromechanical tissue properties, all of which are essential outcomes in musculoskeletal rehabilitation (8). Addressing these gaps is critical for guiding clinical decision-making and optimizing evidence-based practice in physiotherapy settings.

The present randomized controlled trial was designed to compare the short-term effects of conventional manual MFR and device-assisted MFR on pain intensity, cervical range of motion, pressure pain threshold, disability, muscle stiffness, and patient satisfaction among individuals with upper trapezius trigger points. Based on early mechanistic and clinical evidence, we hypothesized that device-assisted MFR would produce superior improvements in pain and functional outcomes compared with conventional MFR at three weeks.

MATERIALS AND METHODS

This randomized controlled trial was conducted in physiotherapy outpatient departments in Islamabad over a three-week intervention period, designed to evaluate the comparative effectiveness of device-assisted versus conventional myofascial release for upper trapezius trigger points. Adults presenting with clinically diagnosed upper trapezius trigger points characterised by palpable taut bands, tender nodules, and reproduction of the patient's typical referred pain were eligible for inclusion (9). Additional inclusion criteria comprised unilateral or bilateral upper trapezius pain persisting for more than four weeks, baseline pain intensity of at least 4 on the 10-point Visual Analogue Scale (VAS), and preserved neurological function. Individuals with cervical radiculopathy, prior cervical spine surgery, fibromyalgia, systemic inflammatory disorders, fracture history, or ongoing analgesic injection therapy were excluded to minimize confounding and ensure the homogeneity of musculoskeletal pain mechanisms (10).

Participants were recruited consecutively from outpatient clinics and screened by licensed physiotherapists. After receiving verbal and written information, all eligible individuals provided informed consent prior to randomization. Allocation was performed using a concealed, computer-generated random sequence assigning participants in a 1:1 ratio to conventional or device-assisted MFR, with assessors blinded to group assignment to minimize detection bias. Both groups received six treatment sessions over three weeks, matched for therapist contact time to ensure treatment dose equivalence.

Data were collected at baseline and immediately after the three-week intervention period. Pain intensity was measured using the VAS, while cervical range of motion (flexion, extension, lateral flexion, rotation) was quantified using a universal goniometer according to standardised procedures (11). Pressure pain threshold was assessed using a calibrated algometer, and muscle stiffness was measured using the MyotonPRO device, which provides objective tissue mechanical parameters. Functional disability was evaluated with the Neck Disability Index (NDI), and patient satisfaction with a 10-point Likert scale. All measurements were taken by trained assessors at the same time of day to minimize diurnal variation.

Primary and secondary variables were defined operationally before analysis. Steps to reduce bias included standardized instructions, consistent testing order, identical environmental conditions, and rigorous calibration of measuring instruments. Sample size was predetermined at 66 participants (33 per

group) to provide adequate power to detect clinically meaningful between-group differences in pain reduction, assuming moderate effect sizes derived from prior literature (12).

Statistical analysis was performed using SPSS software 26. Continuous variables were inspected for normality and summarized as means and standard deviations. Between-group comparisons of change scores were analyzed using ANCOVA adjusting for baseline values. Correlation matrices were constructed using Pearson's coefficients for post-treatment variables. Multiple linear regression was performed to identify independent predictors of pain reduction, with entry of clinically relevant covariates including group allocation, baseline pain, pressure pain threshold, cervical ROM, symptom duration, BMI, age, sex, and occupation. Model fit was evaluated using R^2 and adjusted R^2. Missing data were handled with complete-case analysis due to minimal loss to follow-up. Ethical approval was obtained from the institutional review board, and all procedures adhered to the Declaration of Helsinki and established standards for research reproducibility, including secure data storage, audit trails, and standardized protocols for measurement consistency (13).

RESULTS

Baseline characteristics between the conventional and device-assisted MFR groups were statistically comparable across all demographic and clinical parameters, demonstrating successful randomization. Age, sex distribution, BMI, occupation, symptom duration, pain intensity, cervical ROM, pressure pain threshold, and disability scores did not differ significantly ($p > 0.05$), indicating equivalent starting points for assessing treatment effects.

Table 1. Baseline Characteristics of Participants (n = 66)

Variable	Conventional MFR (n=33)	Device-Assisted MFR (n=33)	Total (n=66)	p-value
Age (years), mean ± SD	34.6 ± 8.2	35.2 ± 8.8	34.9 ± 8.5	0.756
Sex, n (%)				0.818
Male	14 (42.4%)	16 (48.5%)	30 (45.5%)	
Female	19 (57.6%)	17 (51.5%)	36 (54.5%)	
BMI (kg/m²), mean ± SD	25.8 ± 3.9	26.4 ± 4.2	26.1 ± 4.0	0.578
Occupation (Sedentary/Standing/Manual), n (%)	18/10/5	16/12/5	34/22/10	0.856
Duration of symptoms (weeks), mean ± SD	12.4 ± 6.8	11.8 ± 7.2	12.1 ± 7.0	0.712
Baseline pain (VAS), mean ± SD	6.8 ± 1.4	6.6 ± 1.6	6.7 ± 1.5	0.612
Cervical ROM, mean ± SD				
Flexion (°)	42 ± 8	41 ± 9	42 ± 8	0.678
Extension (°)	48 ± 10	47 ± 11	48 ± 10	0.756
Lateral flexion (°)	38 ± 7	37 ± 8	38 ± 7	0.612
Rotation (°)	62 ± 12	60 ± 14	61 ± 13	0.578
Baseline PPT (kg/cm²), mean ± SD	2.4 ± 0.6	2.3 ± 0.7	2.4 ± 0.6	0.512
Baseline NDI (%), mean ± SD	38.6 ± 10.2	39.4 ± 11.4	39.0 ± 10.8	0.756

Table 2. Pre- and Post-Intervention Outcomes

Outcome Variable	Conv Pre	Conv Post	Device Pre	Device Post	Mean Δ Difference (95% CI)	p-value*
Pain (VAS)	6.8 ± 1.4	3.8 ± 1.2	6.6 ± 1.6	2.4 ± 1.0	−1.2 (−1.8 to −0.6)	<0.001
Cervical ROM (°)						
Flexion	42 ± 8	52 ± 7	41 ± 9	58 ± 6	+7 (4–10)	<0.001
Extension	48 ± 10	58 ± 8	47 ± 11	64 ± 7	+7 (4–10)	<0.001
Lateral Flexion	38 ± 7	46 ± 6	37 ± 8	52 ± 5	+7 (5–9)	<0.001
Rotation	62 ± 12	72 ± 10	60 ± 14	80 ± 8	+10 (6–14)	<0.001
Pressure Pain Threshold (kg/cm²)	2.4 ± 0.6	3.8 ± 0.7	2.3 ± 0.7	4.6 ± 0.8	+0.9 (0.6–1.2)	<0.001
Neck Disability Index (%)	38.6 ± 10.2	22.4 ± 8.6	39.4 ± 11.4	14.8 ± 7.2	−8.4 (−12.6 to −4.2)	<0.001
Muscle stiffness (Hz)	18.6 ± 3.2	15.2 ± 2.6	19.1 ± 3.4	13.4 ± 2.2	−2.3 (−3.5 to −1.1)	<0.001
Patient satisfaction (0–10)	—	7.6 ± 1.4	—	9.2 ± 0.8	+1.6 (1.1–2.1)	<0.001

Table 3. Correlation Matrix of Post-Treatment Variables

Variables	Pain	Flex ROM	Ext ROM	Lat Flex ROM	Rotation ROM	PPT	NDI	Satisfaction
Pain	1	−0.74	−0.72	−0.70	−0.76	−0.78	0.82	−0.80
Flexion ROM	−0.74	1	0.88	0.86	0.84	0.76	−0.78	0.74
Extension ROM	−0.72	0.88	1	0.84	0.82	0.74	−0.76	0.72
Lateral Flexion ROM	−0.70	0.86	0.84	1	0.80	0.72	−0.74	0.70
Rotation ROM	−0.76	0.84	0.82	0.80	1	0.78	−0.80	0.76
PPT	−0.78	0.76	0.74	0.72	0.78	1	−0.82	0.80
NDI	0.82	−0.78	−0.76	−0.74	−0.80	−0.82	1	−0.84
Satisfaction	−0.80	0.74	0.72	0.70	0.76	0.80	−0.84	1

Both interventions produced clinically meaningful improvements across all outcomes; however, device-assisted MFR demonstrated substantially greater gains. Pain intensity decreased by −3.0 points in the conventional group and −4.2 points in the device-assisted group, with between-group differences favouring the device-assisted method ($p < 0.001$). Cervical ROM improved in all planes, with device-assisted therapy yielding 14–17° gains compared with 8–10° in the conventional group. Improvements in pressure pain threshold were markedly higher following device-assisted MFR (+2.3 vs +1.4 kg/cm²), and disability decreased more substantially in this group (−24.6% vs −16.2%). MyotonPRO stiffness values showed a larger reduction with device assistance, reflecting improved muscle mechanical properties. Patient satisfaction was significantly higher in the device-assisted group (9.2 vs 7.6).

Table 4. Multiple Linear Regression Predicting Pain Reduction (Δ VAS)

Predictor Variable	β	SE	t-value	p-value	95% CI
Group (Device vs Conv)	1.18	0.22	5.36	<0.001	0.74 to 1.62
Baseline pain	0.68	0.09	7.56	<0.001	0.50 to 0.86
Baseline PPT	−0.42	0.14	−3.00	0.004	−0.70 to −0.14
Baseline ROM (Flexion)	0.04	0.02	2.00	0.050	0.00 to 0.08
Duration of symptoms	−0.02	0.01	−2.00	0.050	−0.04 to 0.00
BMI	0.06	0.04	1.50	0.139	−0.02 to 0.14
Age	−0.01	0.01	−1.00	0.321	−0.03 to 0.01
Sex (Female = 1)	0.28	0.24	1.17	0.246	−0.20 to 0.76
Occupation (Manual = 1)	0.32	0.28	1.14	0.258	−0.24 to 0.88
Constant	1.64	1.42	1.15	0.254	−1.20 to 4.48

Correlational analysis confirmed strong, clinically coherent relationships among post-treatment variables, including strong negative associations between pain and ROM, PPT, and satisfaction, and positive associations between pain and disability. Regression modeling identified device-assisted treatment, baseline pain, and baseline PPT as significant independent predictors of pain reduction, explaining 72% of the variance. This model further reinforced the superiority of device-assisted MFR as an independent contributor to therapeutic benefit.

DISCUSSION

This randomized controlled trial provides robust evidence that device-assisted myofascial release yields superior short-term clinical outcomes compared with conventional manual MFR in patients with upper trapezius trigger points. Both treatment approaches produced improvements consistent with previous reports describing the efficacy of manual myofascial release in reducing pain and improving fascial extensibility (14), yet the device-assisted modality resulted in significantly greater reductions in pain, larger improvements in cervical mobility, and more substantial gains in pressure pain threshold and muscle stiffness. These findings align with emerging literature suggesting that instrument-assisted techniques facilitate deeper mechanical loading, enhanced shear forces, and improved modulation of nociceptive pathways (15).

The greater improvements in cervical ROM and PPT in the device-assisted group likely reflect more efficient disruption of dysfunctional cross-links within the myofascial matrix and enhanced stimulation of mechanoreceptors responsible for neuromuscular inhibition and tissue remodeling (16). The consistent pattern of larger ROM gains across all cervical planes supports the hypothesis that device-assisted techniques exert global improvements in tissue extensibility rather than localized effects. The

improvement in muscle stiffness measured through MyotonPRO further corroborates structural modifications at the tissue level, which may not be achievable with manual pressure alone.

The strong correlations observed between pain reduction, functional improvement, and tissue mechanical properties reinforce the interconnected biomechanical–neurological basis of myofascial dysfunction. The regression model identified device-assisted treatment as an independent predictor of greater pain relief, even after adjusting for baseline characteristics. This finding suggests that the therapeutic superiority of device-assisted MFR is not simply attributable to higher baseline severity or other confounders, but rather reflects genuine method-related efficacy.

These findings contribute meaningfully to the limited high-quality literature comparing manual and device-assisted fascial interventions. The results suggest that device-assisted methods may be particularly advantageous in clinical settings requiring reproducible pressure application, reduced therapist fatigue, and enhanced treatment precision (17). Nonetheless, the study's short-term follow-up limits the evaluation of sustained effects, and future research should investigate long-term outcomes, cost-effectiveness, and potential applicability to other musculoskeletal pain conditions.

CONCLUSION

Device-assisted myofascial release demonstrated superior short-term effectiveness compared with conventional manual myofascial release in reducing pain, improving cervical range of motion, enhancing pressure pain threshold, decreasing neck disability, reducing muscle stiffness, and increasing patient satisfaction among individuals with upper trapezius trigger points. These findings support the integration of device-assisted methods into routine physiotherapy practice for myofascial trigger point management.

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