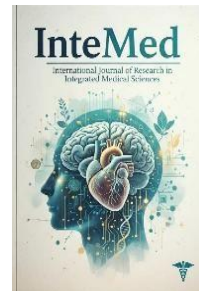




InteMed: International Journal of Research in Integrated Medical Sciences (IJ-RIMS)

Journal homepage: www.intemed.in

Vol.: 2 | Issue: 9 | Sep 2026



Article History: Received: 15-09-2026

Accepted: 18-09-2026

Published:30-09-2026

DOI: doi.org/10.68108/intemed.v2.i9.13

Research Article

Short Term Effects of Instrument Assisted Soft Tissue Mobilization versus Compressive Myofascial Release in Adults with Plantar Fasciitis.

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Abstract:

Background: Manual soft-tissue techniques are frequently used for plantar fasciitis, but direct comparative evidence for instrument-assisted and manual compressive approaches is limited.

Objective: To compare the short-term effects of instrument-assisted soft tissue mobilization (IASTM) and compressive myofascial release (CMR) on pain, ankle range of motion, and foot-related function in adults with plantar fasciitis.

Methods: Fifty adults aged 40-60 years with clinically diagnosed plantar fasciitis, a positive Windlass test, and a Numerical Pain Rating Scale (NPRS) score of at least 3 were allocated by odd/even OPD sequence to IASTM plus cryotherapy (Group A; n=25) or CMR plus cryotherapy (Group B; n=25). Each intervention was delivered in three sessions over one week. NPRS, ankle dorsiflexion and plantarflexion, and Foot Function Index (FFI) scores were recorded at baseline and after one week. Within-group changes were examined with paired t tests and between-group differences with independent t tests.

Results: Both groups improved significantly in pain, dorsiflexion, plantarflexion, and FFI scores. At one week, Group A had lower NPRS scores than Group B (3.44 $\pm$ 0.82 versus 5.20 $\pm$ 1.12; mean difference -1.76, 95% CI -2.32 to -1.20; $p<0.001$), greater dorsiflexion (18.88 $\pm$ 1.51 degrees versus 17.64 $\pm$ 2.02 degrees; mean difference 1.24 degrees, 95% CI 0.23 to 2.25; $p=0.018$), and lower FFI scores (51.96 $\pm$ 6.28 versus 58.32 $\pm$ 5.61; mean difference

-6.36, 95% CI -9.75 to -2.97; $p<0.001$). Post-treatment plantarflexion did not differ significantly between groups ($p=0.474$).

Conclusion: Both approaches produced short-term improvement. IASTM was associated with larger reductions in pain and foot-related disability and a modestly greater dorsiflexion gain. These preliminary findings require confirmation in adequately concealed, assessor-blinded trials with longer follow-up and exercise-based co-interventions.

Keywords: ankle dorsiflexion; compressive myofascial release; foot function; instrument-assisted soft tissue mobilization; plantar fasciitis; plantar heel pain

INTRODUCTION

Plantar fasciitis is a common source of plantar heel pain, particularly in middle-aged adults. The characteristic presentation is pain near the medial calcaneal tubercle that is most pronounced during the first steps after rest and may recur after prolonged standing or walking.^{1,2} Mechanical loading, reduced ankle dorsiflexion, obesity, prolonged weight-bearing, altered foot posture, and gastrocnemius-soleus tightness have been associated with the condition.^{3,4}

Although the traditional term emphasizes inflammation, histopathologic and clinical evidence supports a predominantly degenerative fasciopathy involving collagen disorganization, microtearing, and altered matrix repair.^{5,6} This distinction is clinically relevant because rehabilitation

is generally directed toward load management, restoration of calf and plantar fascial flexibility, progressive strengthening, and correction of modifiable movement impairments rather than inflammation alone.

The 2023 clinical practice guideline for heel pain recommends manual therapy directed at lower-limb joints and soft tissues when mobility or flexibility restrictions are present, together with plantar fascia-specific and gastrocnemius-soleus stretching and resistance exercise.¹ Instrument-assisted soft tissue mobilization uses a rigid tool to deliver controlled pressure and shear across soft tissues. Proposed effects include transient changes in pain sensitivity, tissue perfusion, and range of motion, while experimental explanations involving fibroblast activity and collagen remodeling remain mainly indirect.^{7,8} Compressive myofascial release applies sustained manual compression and stretch to restricted tissue and may influence pain through mechanical input, altered muscle tone, and neurophysiologic modulation.

Randomized studies have reported benefits from trigger-point manual therapy and myofascial release in plantar heel pain, while smaller trials of IASTM have shown promising but heterogeneous effects.⁹⁻¹³ Evidence remains limited regarding whether one approach offers a clinically meaningful short-term advantage over the other when treatment dose and co-interventions are similar. Therefore, this study compared one week of IASTM and CMR, each followed by cryotherapy, on pain, ankle range of motion, and foot function in adults aged 40-60 years.

MATERIALS AND METHODS

Study design and setting

This was a two-arm, parallel-group, quasi-randomized comparative clinical study conducted in the musculoskeletal physiotherapy outpatient department of a tertiary care hospital. The overall study period was April 2021 to June 2022, and each participant received one week of intervention. The quasi-randomized designation reflects allocation by odd/even OPD visit sequence rather than generation of an unpredictable random sequence.

Participants

Adults of either sex were eligible if they were 40-60 years old, had a clinical diagnosis of plantar fasciitis, had a positive Windlass test, reported an NPRS score of at least 3, and provided written informed consent. Exclusion criteria were recent foot or ankle surgery, ankle sprain or strain, recent fracture, skin lesions around the treatment area, hypersensitive skin, and inflammatory edema around the foot or ankle.

Ethical considerations and registration

Institutional ethics approval was obtained before recruitment. All participants received an explanation of the study and provided written informed consent. The study synopsis states that the trial was registered with the Clinical Trials Registry-India after ethical approval.

Sample size and allocation

The planned sample was 50 participants, with 25 in each group. Eligible participants were indexed according to their OPD visit order; odd-numbered participants entered Group A and even-numbered participants entered Group B. Because this sequence was predictable, allocation concealment was not achieved.

Interventions

Group A received IASTM using an M2T blade over the calf soft tissues and plantar fascia. Each session comprised 15 strokes for three sets. Group B received CMR to the corresponding soft-tissue regions using manual compression with the therapist's knuckles, also delivered as 15 strokes for three sets. Both groups received three treatment sessions during one week, and every session was followed by a cold pack for 15 minutes. No exercise programme was provided during the intervention week.

Outcome measures

Pain intensity was measured on the 11-point NPRS, where 0 indicates no pain and 10 indicates the worst imaginable pain.¹⁴ Active ankle dorsiflexion and plantarflexion were measured in degrees with a universal goniometer. Foot-related pain and disability were evaluated using the Foot Function Index; higher scores indicate greater impairment.¹⁵ All outcomes were recorded before the first session and after completion of the one-week intervention.

Statistical analysis

Data were entered in Microsoft Excel and analyzed with InStat version 3. Continuous outcomes are presented as mean and standard deviation. Within-group pre-post differences were examined with paired *t* tests, and post-treatment group means were compared with independent-samples *t* tests. For this manuscript, mean differences and 95% confidence intervals were calculated from the reported summary statistics. Tests were two-sided and statistical significance was set at $p < 0.05$.

RESULTS

Participant flow and baseline profile

Fifty participants were included, with 25 allocated to each group and 25 analyzed per group. Women comprised 72% of Group A and 64% of Group B. The age-category and sex distributions were similar across groups (Table 1). Baseline values for NPRS, plantarflexion, and FFI were broadly comparable; Group B had a slightly higher mean dorsiflexion value at baseline.

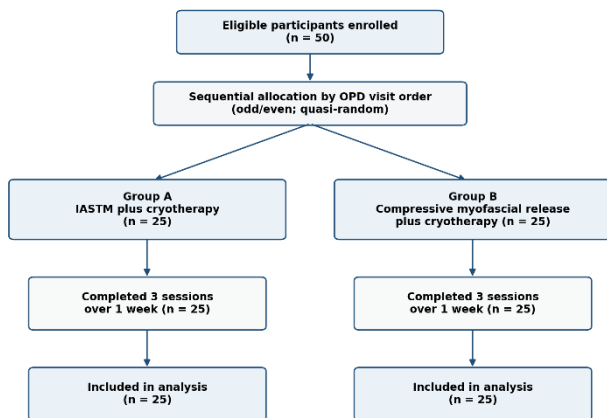


Figure 1. Participant allocation, treatment, and analysis flow.

Table 1. Baseline demographic profile of the study groups

Characteristic	Group A IASTM n=25	Group B CMR n=25	Total n=50
Age 40-50 years, n (%)	16 (64)	15 (60)	31 (62)
Age >50-60 years, n (%)	9 (36)	10 (40)	19 (38)
Male, n (%)	7 (28)	9 (36)	16 (32)
Female, n (%)	18 (72)	16 (64)	34 (68)

Outcome	Group	Baseline mean +/- SD	Week 1 mean +/- SD	Mean change (95% CI)	p value
NPRS	B	7.44 +/- 1.23	5.20 +/- 1.12	-2.24 (-2.56 to -1.92)	<0.001
Dorsiflexion (degrees)	A	14.36 +/- 3.39	18.88 +/- 1.51	+4.52 (2.99 to 6.05)	<0.001
Dorsiflexion (degrees)	B	15.76 +/- 2.63	17.64 +/- 2.02	+1.88 (1.01 to 2.75)	<0.001
Plantar flexion (degrees)	A	45.92 +/- 2.93	47.20 +/- 2.27	+1.28 (0.46 to 2.10)	0.004
Plantar flexion (degrees)	B	45.72 +/- 2.88	46.72 +/- 2.42	+1.00 (0.48 to 1.52)	<0.001
FFI score	A	65.88 +/- 8.64	51.96 +/- 6.28	-13.92 (-17.01 to -10.83)	<0.001
FFI score	B	63.52 +/- 6.55	58.32 +/- 5.61	-5.20 (-6.06 to -4.34)	<0.001

Within-group changes

Both interventions produced statistically significant improvements in all measured outcomes (Table 2). Group A showed a mean NPRS reduction of 4.04 points (95% CI 3.62 to 4.46), compared with 2.24 points (95% CI 1.92 to 2.56) in Group B. Dorsiflexion increased by 4.52 degrees in Group A and 1.88 degrees in Group B. FFI scores decreased by 13.92 points in Group A and 5.20 points in Group B.

Table 2. Within-group changes after one week of intervention

Outcome	Group	Baseline mean +/- SD	Week 1 mean +/- SD	Mean change (95% CI)	p value
NPRS	A	7.48 +/- 1.12	3.44 +/- 0.82	-4.04 (-4.46 to -3.62)	<0.001

Note: Values are mean +/- standard deviation. Negative changes in NPRS and FFI indicate improvement; positive changes in ankle range of motion indicate improvement. Confidence intervals were reconstructed from the reported paired t statistics.

Between-group comparisons

At the one-week assessment, Group A had significantly lower pain and FFI scores and greater dorsiflexion than Group B. The between-group difference in plantarflexion was small and not statistically significant (Table 3).

Table 3. Between-group comparison at one week

Outcome	Group A mean +/- SD	Group B mean +/- SD	Mean difference A-B (95% CI)	t (df=48)	p value
NPRS	3.44 +/- 0.82	5.20 +/- 1.12	-1.76 (-2.32 to -1.20)	- 6.35	<0. 001
Dorsiflexion (degrees)	18.88 +/- 1.51	17.64 +/- 2.02	1.24 (0.23 to 2.25)	2.46	0.0 18
Plantarflexion (degrees)	47.20 +/- 2.27	46.72 +/- 2.42	0.48 (-0.86 to 1.82)	0.72	0.4 74
FFI score	51.96 +/- 6.28	58.32 +/- 5.61	-6.36 (-9.75 to -2.97)	- 3.78	<0. 001

Interpretation: For NPRS and FFI, a negative mean difference favors Group A. For range of motion, a positive mean difference favors Group A.

DISCUSSION

Principal findings

Both IASTM and CMR, when followed by cryotherapy, were associated with meaningful short-term improvements in pain, ankle mobility, and foot-related function. The improvement was larger with IASTM for pain and FFI, and dorsiflexion was modestly greater after IASTM. Plantarflexion improved within each group but did not differ between groups. The findings therefore suggest a selective short-term advantage rather than uniform superiority across all outcomes.

Pain and function

The 4.04-point reduction in NPRS in Group A exceeded commonly used thresholds for clinically important change in chronic pain scales, whereas Group B also showed a substantial 2.24-point reduction.¹⁴ The post-treatment difference of 1.76 points favored IASTM. Because both groups received cryotherapy and there was no untreated or exercise-only group, the observed improvement cannot be attributed exclusively to either soft-tissue technique.

The direction of the present findings agrees with small clinical studies of IASTM for plantar heel pain. Jones and colleagues reported clinically important changes in a pilot trial of Graston-based treatment, and Pisirici and colleagues found sustained functional improvement when Graston treatment was combined with stretching in chronic plantar heel pain.^{11,12} A recent immediate-effect study also reported reduced pain and improved weight-bearing ankle

mobility after IASTM, although its symptomatic cohort did not include an alternative-treatment control.¹³

The improvement with CMR is also consistent with trials showing benefits from trigger-point manual therapy plus stretching, myofascial release, and manual therapy combined with exercise.^{9,10,20} Akter and colleagues later found that both myofascial release and a structured multimodal approach improved plantar heel pain and disability, with the multimodal programme producing larger gains in several functional outcomes.¹⁶

Ankle range of motion

Restricted dorsiflexion can increase compensatory pronation and loading demands during gait. Group A gained 4.52 degrees of dorsiflexion compared with 1.88 degrees in Group B. Instrument-assisted pressure may transiently alter stretch tolerance, local tissue stiffness, or sensorimotor response, but the present study did not measure tissue stiffness or neuromuscular mechanisms. Experimental work has shown immediate dorsiflexion changes after IASTM without consistent changes in muscle stiffness, emphasizing that increased range should not automatically be interpreted as structural tissue remodeling.¹⁷

A direct comparison in participants with dorsiflexion restriction found that CMR increased dorsiflexion after a single session, whereas the Graston intervention did not clearly outperform the control condition.¹⁸ A separate trial found improvement after both IASTM and manual myofascial release in upper-trapezius myofascial pain.²¹ Differences in population, weight-bearing measurement, treatment dose, and the presence of pain may explain why those results differ from the current study. The absence of a between-group plantarflexion difference also suggests that treatment response may depend on the movement limitation targeted.

Possible mechanisms

IASTM is often described as promoting scar-tissue breakdown and collagen reorganization. Such explanations are biologically plausible but are supported mainly by animal or laboratory work rather than direct confirmation in human plantar fasciopathy.^{7,8,19} More defensible short-term explanations include altered nociceptive input, temporary changes in stretch tolerance, tissue perfusion, and reduced protective muscle tone. CMR may act through overlapping mechanisms, including sustained mechanical input and neurophysiologic modulation. Consequently, the present clinical outcomes do not establish that either technique permanently changed fascial structure.

Clinical implications

The findings support considering IASTM or CMR as short-term adjuncts when pain and calf or plantar soft-tissue restriction limit rehabilitation. They should not replace education, load modification, plantar fascia-specific and calf stretching, and progressive resistance exercise, which remain central components of evidence-based care.¹ Recent

evidence syntheses reach different conclusions about IASTM: an updated review judged the evidence very low in quality, whereas newer meta-analyses reported moderate improvement in pain but lower-certainty or heterogeneous effects on function.²²⁻²⁴ This uncertainty favors shared decision-making and outcome-guided use rather than routine application to every patient.

Strengths and limitations

A strength of the study is the matched treatment schedule and common cryotherapy co-intervention, which allowed a pragmatic comparison of two soft-tissue approaches. Multiple patient-centered and impairment-level outcomes were collected. However, the trial had important limitations: predictable odd/even allocation, no allocation concealment, no reported assessor blinding, a small single-center sample, only one week of treatment, no exercise comparator, no longer-term follow-up, and no reported adverse-event monitoring. Baseline-adjusted analysis was not possible without participant-level data. The FFI version and scoring procedure should also be reported explicitly in any journal submission.

CONCLUSION

Over one week, both IASTM and CMR combined with cryotherapy reduced pain and disability and improved ankle range of motion in adults with plantar fasciitis. IASTM produced larger short-term improvements in pain, dorsiflexion, and FFI score, while plantarflexion outcomes were comparable. Because of the quasi-random allocation, brief follow-up, and absence of an exercise-based control, the findings should be considered preliminary and should be confirmed in a fully randomized, concealed, assessor-blinded trial.

ETHICS AND CONSENT

The study received approval from the Institutional Ethical Committee of the Physiotherapy College before recruitment. Written informed consent was obtained from all participants.

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