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Original Article

Effects of Instrument-Assisted Soft Tissue Mobilization Versus Active Release Technique for Tight Upper Trapezius Among Bikers of Gujranwala

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ABSTRACT

Background: Upper trapezius tightness is a frequent musculoskeletal problem among bike riders because prolonged riding posture, vibration exposure, and sustained shoulder-neck loading may contribute to pain, restricted cervical mobility, and functional disability. Objective: This study aimed to compare the effects of Instrument-Assisted Soft Tissue Mobilization and Active Release Technique on pain intensity, cervical range of motion, and neck-related disability among bike riders with upper trapezius tightness. Methods: A randomized clinical trial was conducted in Gujranwala district over six months. A total of 126 individuals were screened, and 110 eligible bike riders aged 18–45 years were randomized into two equal groups. Group A received IASTM and Group B received ART; both groups also received standard physical therapy consisting of TENS, moist heat, and stretching. Treatment was delivered twice weekly for four weeks. Outcomes were assessed at baseline and after four weeks using the Numeric Pain Rating Scale, goniometric cervical range of motion, and Neck Disability Index. Results: Both groups showed significant within-group improvement after treatment. NPRS decreased from 6.71 ± 0.874 to 2.09 ± 1.191 in the IASTM group and from 6.94 ± 0.943 to 3.65 ± 1.493 in the ART group. IASTM showed greater post-treatment benefit for NPRS, flexion, extension, right side bending, and bilateral rotation, while NDI improved substantially in both groups without a statistically significant post-treatment between-group difference. Conclusion: IASTM was more effective than ART for reducing pain and improving most cervical mobility outcomes, while both interventions improved neck-related disability. Keywords: Active Release Technique; Bike Riders; Cervical Range of Motion; Instrument-Assisted Soft Tissue Mobilization; Neck Disability Index; Numeric Pain Rating Scale; Upper Trapezius Tightness.

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INTRODUCTION

Upper trapezius tightness is a common musculoskeletal presentation associated with neck pain, restricted cervical mobility, headache, shoulder discomfort, and activity limitation. The upper trapezius contributes to scapular elevation, upward rotation, and cervical extension, and sustained overload of this muscle can alter cervical and shoulder mechanics, provoke myofascial tenderness, and reduce functional tolerance during daily and occupational activities (1,2). Neck pain is particularly relevant in populations exposed to static or repetitive postures, as prolonged maintenance of the head and shoulder complex in a fixed position increases mechanical demand on cervical and scapular stabilizers and may contribute to muscle stiffness, local ischemia, pain sensitization, and reduced range of motion (3,4).

Motorcycle riders represent a clinically important population for upper trapezius-related dysfunction because riding commonly involves sustained forward head posture, prolonged gripping, shoulder elevation, exposure to whole-body vibration, and repeated postural adjustments during traffic navigation. These biomechanical and environmental demands can increase cumulative loading across the cervical and upper thoracic regions, particularly when riding is performed for occupational or prolonged daily transportation purposes. Previous work on bike drivers and occupational motorcyclists has shown that neck pain, impaired cervical range of motion, and reduced quality of life are relevant concerns in this population, supporting the need for context-specific preventive and rehabilitative strategies (5,6). In urban settings such as Gujranwala, where motorcycles are widely used for commuting and work-related travel, localized evidence is needed to guide physiotherapy management for riders presenting with upper trapezius tightness.

Several conservative interventions are used to manage upper trapezius tightness and mechanical neck pain, including heat therapy, electrotherapy, stretching, exercise, myofascial release, soft tissue mobilization, and manual therapy techniques. Instrument-Assisted Soft Tissue Mobilization (IASTM) is a myofascial intervention in which specifically designed tools are applied over soft tissues to detect and treat restrictions, reduce adhesions, modulate pain, and improve tissue mobility. Proposed mechanisms include mechanical stimulation of soft tissues, increased local circulation, improved fascial mobility, collagen realignment, and neuromodulation through stimulation of cutaneous and deep mechanoreceptors (7,8). Evidence suggests that IASTM may improve pain, function, and range of motion in several musculoskeletal conditions, including chronic neck pain and soft tissue restrictions, although results vary according to treatment site, dosage, co-interventions, and study design (8–11).

Active Release Technique (ART) is another soft tissue intervention used to address myofascial tightness, adhesions, and movement restriction. ART combines therapist-applied pressure or tension with active patient movement from a shortened to a lengthened position, with the aim of restoring soft tissue mobility and reducing pain associated with scar tissue, repetitive strain, and overuse-related dysfunction (12,13). Previous studies have reported improvements in pain, disability, and cervical mobility following ART in patients with chronic neck pain and upper trapezius trigger points, suggesting that this technique may be clinically useful for mechanical neck dysfunction (13,14). However, available evidence has primarily focused on general neck pain populations, students, office workers, athletes, or mixed musculoskeletal samples rather than motorcycle riders exposed to prolonged riding-related postural strain.

Although both IASTM and ART are used in physiotherapy practice for soft tissue dysfunction, direct comparative evidence between these two techniques for upper trapezius tightness remains limited. Existing literature has compared IASTM with stretching, massage, integrated neuromuscular inhibition techniques, myofascial release, therapeutic cupping, and other interventions, while ART has been studied in relation to chronic neck pain and trigger point management. However, few studies have directly compared IASTM and ART in an activity-specific population such as bike riders, where vibration exposure, sustained cervical posture, and prolonged shoulder loading may influence treatment response. This gap limits evidence-based decision-making for physiotherapists managing rider-related upper trapezius tightness in local clinical settings.

Therefore, this randomized clinical trial was conducted to compare the effects of IASTM and ART on pain intensity, cervical range of motion, and neck-related disability among bike riders with upper trapezius tightness in Gujranwala. The PICO framework of the study comprised bike riders aged 18–45 years with clinically relevant pain, disability, and restricted cervical mobility as the population; IASTM combined with standard physical therapy as the intervention; ART combined with the same standard physical therapy as the comparator; and changes in Numeric Pain Rating Scale, cervical goniometric range of motion, and Neck Disability Index scores after four weeks as the primary clinical outcomes.

The study hypothesized that IASTM would produce greater improvement than ART in reducing pain and disability and improving cervical range of motion among bike riders with tight upper trapezius.

MATERIALS AND METHODS

This randomized clinical trial was conducted in Gujranwala district over a six-month period after approval from the ethical committee of Gujranwala Institute of Medical and Emerging Sciences. The study compared two active physiotherapy interventions, Instrument-Assisted Soft Tissue Mobilization and Active Release Technique, in bike riders with upper trapezius tightness. Participants were recruited through non-probability convenience sampling from the local community using social media platforms, including Facebook and WhatsApp, and word-of-mouth invitations. A total of 126 individuals were invited and screened for eligibility, and 110 eligible participants were enrolled, randomized, treated, and included in the final analysis, with 55 participants allocated to each intervention group.

Eligible participants were male or female bike riders aged 18–45 years who reported upper trapezius tightness with neck pain, had a Numeric Pain Rating Scale score of at least 3, had a Neck Disability Index score of 10 or above out of 50, and demonstrated restricted cervical mobility attributed to trapezius tightness. Participants were excluded if they had undergone cervical spine surgery within the previous six to twelve months, had recent traumatic cervical injury, had significant pathology such as infection or malignancy, or had a history of cervical radiculopathy, disc prolapse, fibromyalgia, myopathy, myelopathy, systemic disease, vascular syndrome, or other diagnosed conditions that could independently explain neck pain or restrict safe participation in manual therapy. Written informed consent was obtained from all enrolled participants after explanation of the study purpose, procedures, potential benefits, possible discomfort, voluntary nature of participation, and right to withdraw without penalty.

After consent and baseline assessment, participants were randomly allocated into two equal groups by concealed intervention assignment. Group A received IASTM, and Group B received ART. Both groups received the same standard physical therapy before the allocated intervention to reduce performance differences attributable to co-intervention. Standard treatment included Transcutaneous Electrical Nerve Stimulation, moist heat application, and static stretching of the upper trapezius. TENS was applied with the participant seated comfortably, arms relaxed, and back supported. Surface electrodes were placed bilaterally over the most tender regions of the upper trapezius, using a digital dual-channel TENS unit in acupuncture mode at a frequency of 2–4 Hz. Intensity was increased until the participant experienced a strong but comfortable tingling sensation, and stimulation was delivered for approximately 10 minutes. Moist heat was applied over the upper trapezius for 10 minutes at mild-to-moderate intensity to facilitate muscle relaxation and local circulation. Static stretching was performed in short sitting, with the participant's hand placed under the thigh to depress the shoulder while the therapist gently moved the head toward the opposite side with slight flexion and rotation toward the axilla. Each stretch was maintained for 30 seconds and repeated two to three times on each side with a 15–20 second rest interval.

In Group A, IASTM was applied to the upper trapezius region using a handheld instrument with gel as a lubricant to reduce skin friction. Participants were positioned in comfortable sitting, and the instrument was applied along the direction of the upper trapezius fibers using longitudinal strokes from superior to inferior and inferior to superior directions. Application was focused on the posterior neck and upper trapezius region according to the shape and orientation of the muscle fibers. The intervention was delivered twice weekly for four weeks, with each treatment session lasting approximately 15 minutes, in addition to the standardized baseline treatment. Treatment pressure was maintained within participant tolerance, and the therapist monitored discomfort, skin irritation, and adverse responses during and after application.

In Group B, ART was applied to the affected upper trapezius muscle while participants remained in short sitting. The therapist applied localized thumb or finger pressure over the restricted or tender region of

the upper trapezius while the participant actively moved the cervical spine from a shortened to a lengthened position. The movement sequence included ipsilateral rotation, flexion, and contralateral side flexion to stretch the involved upper trapezius while therapist-applied tension was maintained over the restricted tissue. The intervention was delivered twice weekly for four weeks, with each session lasting approximately 15 minutes, in addition to the same standardized baseline treatment used in Group A. Treatment intensity was adjusted according to participant tolerance, and any discomfort or adverse response was monitored throughout the sessions.

Baseline outcome assessment was performed before initiation of treatment, and post-intervention assessment was conducted after completion of the fourth week of treatment. Pain intensity was measured using the 11-point Numeric Pain Rating Scale, where 0 indicated no pain and 10 indicated the worst imaginable pain. Neck-related disability was measured using the Neck Disability Index, which includes 10 items scored from 0 to 5, producing a total score ranging from 0 to 50, with higher scores indicating greater disability. Cervical range of motion was measured using a goniometer for flexion, extension, right and left side bending, and right and left rotation. For flexion and extension, the goniometer axis was positioned at the seventh cervical vertebra, with the fixed arm perpendicular to the ground and the movable arm aligned with the earlobe at the end of movement. For right and left side bending, the axis was positioned over the C7 spinous process, the fixed arm remained perpendicular to the ground, and the movable arm followed the midline of the cervical spine. For right and left rotation, the axis was positioned at the center of the head, the fixed arm was aligned with the midline of the head, and the movable arm followed the tip of the nose at the end of movement.

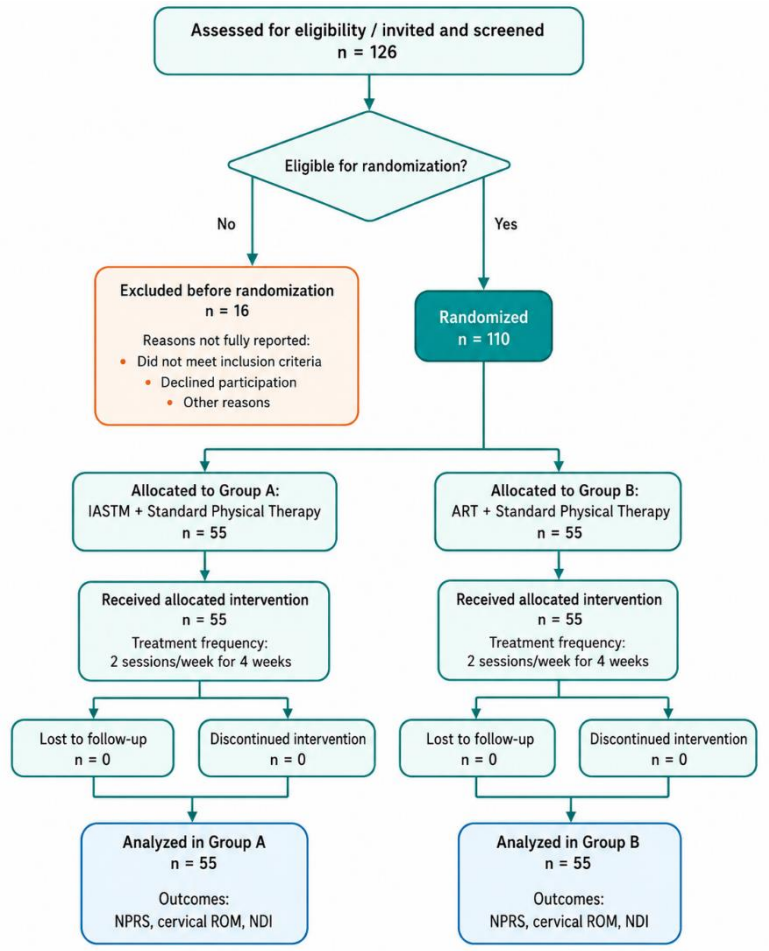

Figure 1 CONSORT Flowchart

The primary outcomes were changes in pain intensity, cervical range of motion, and neck-related disability from baseline to four weeks. Pain was operationalized as the NPRS score, disability as the NDI total score, and cervical mobility as goniometric range of motion in degrees for flexion, extension,

bilateral side bending, and bilateral rotation. To reduce measurement variability, the same assessment procedures, participant positions, anatomical landmarks, and timing of measurements were used at baseline and follow-up. Both groups received equal treatment frequency, treatment duration, and baseline co-interventions to minimize differential treatment exposure. Data were checked for completeness before analysis, and participant records were coded to maintain confidentiality.

The minimum sample size was estimated using G*Power software through an a priori calculation for two independent groups, using a two-tailed test, effect size d = 0.65, alpha = 0.05, and power = 0.95, which indicated a required sample size of 63 participants per group and 126 participants in total. Although 126 individuals were invited and screened, 110 eligible participants completed enrollment and were included in the final analysis, with 55 participants in each group. Statistical analysis was performed using IBM SPSS Statistics version 30. Continuous variables were summarized as mean and standard deviation, while categorical variables were summarized as frequency and percentage. The Kolmogorov–Smirnov test was used to assess normality of continuous variables. Within-group pre-post changes were analyzed using paired-samples t-tests, and between-group comparisons were analyzed using independent-samples t-tests. Statistical significance was set at $p < 0.05$. For publication reporting, between-group treatment effects should be presented using mean differences with 95% confidence intervals and effect sizes alongside p-values to support clinical interpretation.

The study was conducted according to ethical principles for human participant research. Approval was obtained from the ethical committee of Gujranwala Institute of Medical and Emerging Sciences before data collection. All participants provided written informed consent before enrollment. Participation was voluntary, and participants were informed that they could withdraw at any stage without penalty. Confidentiality and anonymity were maintained by using coded records, securely storing study data, and limiting access to research personnel. All interventions were administered by qualified physiotherapy personnel, and participant comfort and safety were monitored during each treatment session.

RESULTS

A total of 126 bike riders were invited and screened for eligibility, of whom 110 eligible participants were enrolled, randomized, treated, and included in the final analysis. Participants were equally allocated to the Instrument-Assisted Soft Tissue Mobilization group and the Active Release Technique group, with 55 participants in each group. The analyzed sample included participants aged 18–45 years, with the largest age category being 26–30 years, followed by 31–35 years. Group distribution and age distribution are presented in Table 1.

Table 1. Participant Distribution and Age Categories of the Analyzed Sample

Variable	Category	Frequency (n)	Percentage (%)
Treatment group	IASTM	55	50.0
	ART	55	50.0
	Total	110	100.0
Age group	15–20 years	9	8.2
	21–25 years	23	20.9
	26–30 years	37	33.6
	31–35 years	31	28.2
	36–40 years	8	7.3
	41–45 years	2	1.8
	Total	110	100.0

Table 1 shows that both intervention arms were equally represented, with 55 participants in the IASTM group and 55 in the ART group. The most frequent age category was 26–30 years, representing 37 participants (33.6%), followed by 31–35 years with 31 participants (28.2%) and 21–25 years with 23 participants (20.9%). Only 8 participants (7.3%) were aged 36–40 years, and 2 participants (1.8%) were aged 41–45 years, indicating that the study sample predominantly consisted of young adult bike riders. Normality was assessed using the Kolmogorov–Smirnov test for baseline continuous variables. All

baseline variables had p-values greater than 0.05, indicating that the distributional assumptions for parametric testing were acceptable. The normality statistics are presented in Table 2.

Table 2. Kolmogorov–Smirnov Test for Normality of Baseline Outcome Variables

Baseline Variable	Kolmogorov–Smirnov Statistic	df	p-value
Pre NPRS score	0.082	110	0.063
Pre cervical flexion	0.067	110	0.200
Pre cervical extension	0.077	110	0.120
Pre right side bending	0.072	110	0.200
Pre left side bending	0.075	110	0.161
Pre right rotation	0.083	110	0.061
Pre left rotation	0.084	110	0.052
Pre NDI score	0.084	110	0.052

As shown in Table 2, the p-values for all baseline measures exceeded the 0.05 threshold. Pre-flexion and pre-right side bending showed the strongest evidence of normal distribution, each with p = 0.200. Pre-left rotation and pre-NDI score were borderline but remained above the significance threshold, with p = 0.052 for both variables. Therefore, paired-samples and independent-samples t-tests were used for within-group and between-group comparisons.

Baseline comparability between groups is shown in Table 3. Most baseline variables were statistically comparable between the IASTM and ART groups, including NPRS, cervical flexion, extension, bilateral side bending, and NDI. However, baseline right and left rotation were higher in the IASTM group than in the ART group, indicating that rotation outcomes should be interpreted with caution and ideally adjusted for baseline values in the final statistical model.

Table 3 indicates that both groups were similar at baseline for pain intensity and disability. NPRS scores were 6.71 ± 0.874 in the IASTM group and 6.94 ± 0.943 in the ART group, with no statistically significant difference (p = 0.187). NDI scores were almost identical between groups, with 29.93 ± 4.455 in the IASTM group and 29.95 ± 4.449 in the ART group (p = 0.981). Baseline cervical flexion, extension, and side bending were also statistically comparable. However, the IASTM group had significantly greater baseline right rotation than the ART group (51.96 ± 7.290 vs. 48.65 ± 7.645; p = 0.022) and greater baseline left rotation (51.60 ± 7.671 vs. 48.27 ± 7.600; p = 0.024). These baseline differences suggest that interpretation of post-treatment rotation superiority should consider the higher starting values in the IASTM group. Within-group pre-post changes are presented in Table 4. Both interventions produced statistically significant improvements in pain, cervical range of motion, and neck-related disability after four weeks of treatment.

Table 3. Baseline Between-Group Comparison of Outcome Variables

Outcome Variable	IASTM Mean ± SD (n = 55)	ART Mean ± SD (n = 55)	Mean Difference	95% CI for Difference	p-value
NPRS score	6.71 ± 0.874	6.94 ± 0.943	-0.23	-0.57 to 0.11	0.187
Cervical flexion (°)	39.45 ± 5.156	40.95 ± 4.874	-1.50	-3.40 to 0.40	0.120
Cervical extension (°)	45.02 ± 5.201	44.56 ± 5.766	0.46	-1.62 to 2.54	0.661
Right side bending (°)	41.58 ± 4.810	40.58 ± 5.560	1.00	-0.97 to 2.97	0.315
Left side bending (°)	40.05 ± 4.755	39.55 ± 5.305	0.50	-1.40 to 2.40	0.604
Right rotation (°)	51.96 ± 7.290	48.65 ± 7.645	3.31	0.49 to 6.13	0.022
Left rotation (°)	51.60 ± 7.671	48.27 ± 7.600	3.33	0.44 to 6.22	0.024
NDI score	29.93 ± 4.455	29.95 ± 4.449	-0.02	-1.70 to 1.66	0.981

Table 4. Within-Group Pre-Post Changes After Four Weeks of Intervention

Outcome Variable	Group	Pre-Treatment Mean ± SD	Post-Treatment Mean ± SD	Mean Change	t-value	p-value
NPRS score	IASTM	6.71 ± 0.874	2.09 ± 1.191	-4.62	38.627	<0.001
	ART	6.94 ± 0.943	3.65 ± 1.493	-3.29	23.887	<0.001
Cervical flexion (°)	IASTM	39.45 ± 5.156	44.87 ± 1.654	+5.42	-8.463	<0.001
	ART	40.95 ± 4.874	43.09 ± 2.128	+2.14	-3.203	0.002

Outcome Variable	Group	Pre-Treatment Mean ± SD	Post-Treatment Mean ± SD	Mean Change	t-value	p-value
Cervical extension (°)	IASTM	45.02 ± 5.201	49.82 ± 5.175	+4.80	-30.246	<0.001
	ART	44.56 ± 5.766	46.65 ± 5.885	+2.09	-14.408	<0.001
Right side bending (°)	IASTM	41.58 ± 4.810	44.58 ± 4.537	+3.00	-23.598	<0.001
	ART	40.58 ± 5.560	42.44 ± 5.163	+1.86	-15.816	<0.001
Left side bending (°)	IASTM	40.05 ± 4.755	42.56 ± 4.375	+2.51	-20.674	<0.001
	ART	39.55 ± 5.305	41.04 ± 5.084	+1.49	-12.575	<0.001
Right rotation (°)	IASTM	51.96 ± 7.290	59.85 ± 6.453	+7.89	-40.754	<0.001
	ART	48.65 ± 7.645	52.35 ± 7.499	+3.70	-14.602	<0.001
Left rotation (°)	IASTM	51.60 ± 7.671	59.87 ± 7.193	+8.27	-39.404	<0.001
	ART	48.27 ± 7.600	52.24 ± 7.535	+3.97	-51.017	<0.001
NDI score	IASTM	29.93 ± 4.455	13.65 ± 1.898	-16.28	29.223	<0.001
	ART	29.95 ± 4.449	14.27 ± 1.672	-15.68	27.768	<0.001

Table 4 demonstrates statistically significant within-group improvement in both treatment arms. In the IASTM group, NPRS decreased from 6.71 ± 0.874 to 2.09 ± 1.191, representing a mean reduction of 4.62 points. In the ART group, NPRS decreased from 6.94 ± 0.943 to 3.65 ± 1.493, representing a mean reduction of 3.29 points. Cervical flexion improved by 5.42° in the IASTM group compared with 2.14° in the ART group, while extension improved by 4.80° and 2.09°, respectively. Right rotation improved by 7.89° in the IASTM group and 3.70° in the ART group, whereas left rotation improved by 8.27° and 3.97°, respectively. NDI scores decreased substantially in both groups, with a 16.28-point reduction in the IASTM group and a 15.68-point reduction in the ART group. These findings indicate that both interventions were effective over four weeks, with numerically larger improvements observed in the IASTM group for pain and all cervical mobility outcomes.

Post-treatment between-group comparisons are presented in Table 5. These comparisons were calculated from the reported post-treatment means, standard deviations, and equal group sizes. Mean differences are expressed as IASTM minus ART; therefore, negative values favor IASTM for NPRS and NDI because lower scores indicate better outcomes, while positive values favor IASTM for range-of-motion outcomes because higher values indicate better cervical mobility.

Table 5. Post-Treatment Between-Group Comparison After Four Weeks

Outcome Variable	IASTM Mean ± SD (n = 55)	ART Mean ± SD (n = 55)	Mean Difference	95% CI for Difference	Hedges' g	p-value
NPRS score	2.09 ± 1.191	3.65 ± 1.493	-1.56	-2.07 to -1.05	-1.15	<0.001
Cervical flexion (°)	44.87 ± 1.654	43.09 ± 2.128	1.78	1.06 to 2.50	0.93	<0.001
Cervical extension (°)	49.82 ± 5.175	46.65 ± 5.885	3.17	1.08 to 5.26	0.57	0.003
Right side bending (°)	44.58 ± 4.537	42.44 ± 5.163	2.14	0.30 to 3.98	0.44	0.023
Left side bending (°)	42.56 ± 4.375	41.04 ± 5.084	1.52	-0.27 to 3.31	0.32	0.096
Right rotation (°)	59.85 ± 6.453	52.35 ± 7.499	7.50	4.86 to 10.14	1.06	<0.001
Left rotation (°)	59.87 ± 7.193	52.24 ± 7.535	7.63	4.85 to 10.41	1.03	<0.001
NDI score	13.65 ± 1.898	14.27 ± 1.672	-0.62	-1.30 to 0.06	-0.34	0.072

As shown in Table 5, the IASTM group had significantly lower post-treatment pain scores than the ART group, with NPRS values of 2.09 ± 1.191 versus 3.65 ± 1.493, respectively. The between-group mean difference was -1.56 points, with a 95% CI from -2.07 to -1.05 and a large standardized effect size (Hedges' $g = -1.15$; $p < 0.001$), indicating clinically meaningful superiority of IASTM for pain reduction. Cervical flexion was also significantly greater in the IASTM group than in the ART group, with a mean difference of 1.78° (95% CI: 1.06 to 2.50; $g = 0.93$; $p < 0.001$). Extension showed a significant between-group advantage for IASTM, with a mean difference of 3.17° (95% CI: 1.08 to 5.26; $g = 0.57$; $p = 0.003$).

For side bending, right side bending was significantly higher after IASTM than after ART, with post-treatment means of 44.58 ± 4.537° and 42.44 ± 5.163°, respectively. The mean difference was 2.14° (95% CI: 0.30 to 3.98; $g = 0.44$; $p = 0.023$). Left side bending was numerically higher in the IASTM group, with a mean difference of 1.52°, but the 95% CI crossed zero (-0.27 to 3.31), and the between-group difference was not statistically significant ($p = 0.096$). Therefore, while both groups improved in bilateral side bending, clear between-group superiority was demonstrated only for right side bending.

Post-treatment rotation outcomes showed the largest between-group differences in favor of IASTM. Right rotation was 59.85 ± 6.453° in the IASTM group and 52.35 ± 7.499° in the ART group, with a mean difference of 7.50° (95% CI: 4.86 to 10.14; g = 1.06; p < 0.001). Left rotation was 59.87 ± 7.193° in the IASTM group and 52.24 ± 7.535° in the ART group, with a mean difference of 7.63° (95% CI: 4.85 to 10.41; g = 1.03; p < 0.001). These findings suggest a large post-treatment advantage for IASTM in cervical rotation; however, because the IASTM group also had significantly higher baseline rotation values, these outcomes should be interpreted cautiously and confirmed using change-score comparison or baseline-adjusted analysis.

Post-treatment NDI scores were lower in the IASTM group than in the ART group, with scores of 13.65 ± 1.898 and 14.27 ± 1.672, respectively. The mean difference was -0.62 points, with a 95% CI from -1.30 to 0.06 and a small-to-moderate standardized effect size (Hedges' g = -0.34). This difference did not reach statistical significance (p = 0.072), indicating that although both groups achieved substantial within-group reductions in neck-related disability, the post-treatment disability difference between IASTM and ART was not statistically significant based on the available aggregate data.

Overall, both IASTM and ART produced statistically significant improvements in pain, cervical mobility, and disability after four weeks of treatment. IASTM demonstrated stronger post-treatment outcomes for NPRS, cervical flexion, extension, right side bending, and bilateral rotation. The strongest between-group effects favored IASTM for NPRS reduction and cervical rotation. However, left side bending and NDI did not show statistically significant post-treatment between-group differences. Because baseline right and left rotation were significantly higher in the IASTM group, the rotation findings should be interpreted with caution, and a baseline-adjusted model or comparison of change scores should be used in the final analysis to confirm the robustness of treatment superiority.

Figure 1. Comparative Clinical Response to IASTM Versus ART in Upper Trapezius Tightness Among Bike Riders.

The panelled figure demonstrates a consistent post-treatment clinical gradient favoring IASTM over ART for pain and most cervical mobility outcomes. IASTM produced a larger reduction in NPRS than ART, with a post-treatment mean difference of -1.56 points and a large standardized effect (Hedges' g = -1.15). Cervical rotation showed the strongest mobility advantage, with post-treatment mean differences of 7.50° for right rotation and 7.63° for left rotation, corresponding to large standardized effects of 1.06 and 1.03, respectively. Flexion also favored IASTM with a 1.78° advantage and large standardized effect (g = 0.93), while extension and right side bending showed moderate advantages. Left side bending

showed only a small, statistically uncertain difference, and NDI demonstrated substantial within-group improvement in both groups but only a small post-treatment between-group difference. The baseline balance panel indicates that right and left rotation were already higher in the IASTM group before intervention, supporting cautious interpretation of rotation superiority and reinforcing the need for baseline-adjusted or change-score analysis in the final model.

DISCUSSION

This randomized clinical trial compared the effects of Instrument-Assisted Soft Tissue Mobilization and Active Release Technique on pain intensity, cervical range of motion, and neck-related disability among bike riders with upper trapezius tightness. The findings demonstrated that both interventions produced statistically significant within-group improvements after four weeks of treatment, indicating that both IASTM and ART may be clinically useful when combined with standard physical therapy consisting of TENS, moist heat, and stretching. Pain intensity decreased substantially in both groups, but the magnitude of post-treatment improvement was greater in the IASTM group, with NPRS scores declining from 6.71 ± 0.874 to 2.09 ± 1.191 compared with a reduction from 6.94 ± 0.943 to 3.65 ± 1.493 in the ART group. The post-treatment between-group comparison also favored IASTM, with a mean NPRS difference of -1.56 points and a large standardized effect, suggesting clinically meaningful superiority for pain reduction in this sample.

The greater pain reduction observed in the IASTM group may be explained by the proposed mechanical and neurophysiological effects of instrument-assisted soft tissue loading. IASTM applies controlled mechanical stimulation through specialized tools, which may improve local tissue mobility, reduce myofascial restriction, increase local circulation, and stimulate mechanoreceptors involved in pain modulation. The smaller contact surface of the instrument may also generate concentrated compressive and shear forces over restricted soft tissue, potentially enhancing sensory feedback and reducing nociceptive input. These mechanisms are consistent with previous literature reporting favorable effects of IASTM on pain and function in patients with chronic neck pain and other musculoskeletal conditions (7–11). Bostan et al. reported that IASTM combined with exercise therapy improved pain and muscle endurance in patients with chronic neck pain, while Hamdy et al. found that IASTM used with standard treatment improved pain intensity and neck function in nonspecific chronic neck pain (10,15). Similarly, Shewail et al. reported improvement in chronic neck pain following IASTM, although differences compared with myofascial release therapy were not statistically superior, suggesting that treatment effects may vary according to comparator, dosage, baseline severity, and population characteristics (16).

Cervical range of motion improved in both intervention arms, but the IASTM group showed larger improvements across flexion, extension, side bending, and rotation. Flexion improved by 5.42° in the IASTM group compared with 2.14° in the ART group, while extension improved by 4.80° and 2.09°, respectively. Right and left rotation showed the largest numerical improvements in the IASTM group, with gains of 7.89° and 8.27°, compared with 3.70° and 3.97° in the ART group. These findings suggest that IASTM may have a stronger effect on mobility-related outcomes, possibly through reduced fascial resistance, improved soft tissue extensibility, and decreased pain-related guarding. This interpretation is supported by studies showing improved range of motion after IASTM in neck pain, hamstring tightness, and other soft tissue restrictions (9,17,18). However, the present rotation findings require cautious interpretation because the IASTM group had significantly higher baseline right and left rotation values than the ART group. Therefore, although post-treatment rotation remained higher after IASTM, a baseline-adjusted analysis or change-score comparison should be prioritized in final statistical reporting to confirm whether the observed advantage is attributable to the intervention rather than baseline imbalance.

ART also produced statistically significant within-group improvements in pain, disability, and all cervical mobility outcomes. This supports the clinical value of ART as an active manual therapy approach for

upper trapezius tightness. ART combines therapist-applied pressure with active patient movement, which may reduce adhesions, improve tissue glide, increase circulation, and restore movement through repeated shortening-lengthening of the involved muscle. Previous studies have reported positive effects of ART on pain and range of motion in patients with chronic neck pain and latent upper trapezius trigger points (13,14). Kim et al. observed improvement in pain and cervical range of motion following ART in patients with chronic neck pain, while Sadria et al. reported beneficial effects of ART on latent trigger points of the upper trapezius (13,14). The present findings are consistent with this evidence, as the ART group showed meaningful reductions in NPRS and NDI and improved cervical mobility after treatment. Nevertheless, when compared with IASTM, ART produced smaller improvements in pain and most range-of-motion outcomes in the present sample.

Neck-related disability decreased substantially in both groups. The IASTM group improved from 29.93 ± 4.455 to 13.65 ± 1.898, while the ART group improved from 29.95 ± 4.449 to 14.27 ± 1.672. These reductions suggest that both interventions contributed to functional recovery and reduced activity limitation. However, the post-treatment between-group difference in NDI was small and did not reach statistical significance, indicating that although IASTM produced stronger effects for pain and several mobility outcomes, both interventions were similarly effective in reducing disability over four weeks. This distinction is clinically important because pain reduction and movement gains do not always translate proportionally into between-group differences in disability, particularly when both groups receive active manual therapy and identical standard physical therapy. It is also possible that the four-week intervention period was sufficient to produce rapid symptomatic improvement but not long enough to reveal larger between-group differences in functional disability.

The findings have practical relevance for physiotherapists managing upper trapezius tightness among motorcycle riders. Bike riders are exposed to prolonged static posture, vibration, traffic-related stress, and sustained shoulder-neck loading, all of which may contribute to upper trapezius overactivity and cervical movement restriction (5,6). In this context, IASTM may be considered a useful adjunct when the clinical goal is rapid reduction of pain and improvement in cervical mobility, particularly flexion, extension, and rotation. ART remains a viable option, especially where instrument-assisted tools are unavailable or where therapist-guided active movement is preferred. However, because both groups also received TENS, heat, and stretching, the observed effects should be interpreted as the added comparative effect of IASTM or ART within a multimodal physiotherapy program rather than as isolated effects of either intervention alone.

Several limitations should be considered when interpreting the findings. First, although 126 individuals were invited and screened, only 110 participants were included in the final analysis, and the reasons for non-enrollment should be clearly documented in the CONSORT flow diagram. Second, the study was conducted in a single geographic area and focused on bike riders from Gujranwala, which may limit generalizability to non-rider populations, different occupational groups, or riders from other regions. Third, the use of convenience sampling for recruitment may have introduced selection bias, even though participants were randomized after enrollment. Fourth, assessor blinding and allocation concealment were not described in sufficient detail, which may increase the risk of measurement or performance bias. Fifth, both groups received common co-interventions, including TENS, heat, and stretching, making it difficult to isolate the independent effect of IASTM or ART. Sixth, baseline cervical rotation differed significantly between groups, so rotation outcomes should be interpreted cautiously and preferably confirmed using baseline-adjusted analysis. Seventh, outcomes were assessed only after four weeks, and no long-term follow-up was conducted to determine whether improvements were sustained or whether symptoms recurred after treatment completion.

Overall, the results suggest that both IASTM and ART are effective interventions for reducing pain, improving cervical mobility, and decreasing disability among bike riders with upper trapezius tightness. IASTM demonstrated greater post-treatment benefit for pain and most range-of-motion outcomes, while

both interventions produced substantial and comparable improvements in neck-related disability. Future trials should use larger multicenter samples, concealed allocation, assessor blinding, baseline-adjusted statistical models, predefined primary endpoints, adverse event reporting, and follow-up assessments to determine the durability of treatment effects and to establish more definitive clinical recommendations for motorcycle riders with upper trapezius-related neck dysfunction.

CONCLUSION

Both Instrument-Assisted Soft Tissue Mobilization and Active Release Technique produced significant improvements in pain intensity, cervical range of motion, and neck-related disability among bike riders with upper trapezius tightness after four weeks of treatment. IASTM showed greater post-treatment benefit than ART for NPRS score and most cervical mobility outcomes, particularly flexion, extension, and bilateral rotation, while both interventions produced substantial reductions in NDI scores. However, because baseline cervical rotation was higher in the IASTM group, rotation-related superiority should be interpreted cautiously and confirmed through baseline-adjusted analysis. These findings support the clinical use of IASTM as an effective adjunct to standard physiotherapy for reducing pain and improving cervical mobility in bike riders with upper trapezius tightness, while ART remains a useful manual therapy option for improving symptoms and function.

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