

A Study of Effectiveness of Instrument Assisted Soft Tissue Manipulation on Hamstring vs Gastrocnemius in Text Neck Syndrome

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Abstract

Background: Prolonged smartphone usage has led to a growing incidence of text neck syndrome, a musculoskeletal disorder commonly associated with persistent neck pain, limited cervical mobility, and forward head posture. According to myofascial connectivity theories, the superficial back line creates a continuous fascial connection between the lower limbs and the cervical region. Tightness or reduced flexibility in muscles such as the hamstrings and gastrocnemius may increase tension throughout this chain, thereby influencing postural alignment and contributing to cervical dysfunction. Instrument-assisted soft tissue manipulation (IASTM) has shown potential in addressing such dysfunctions.

Aim: The study was conducted to evaluate and compare the effectiveness of IASTM applied to the hamstring versus gastrocnemius in individuals with text neck syndrome.

Methods: The study was conducted at a tertiary care teaching hospital over a period of 6 months among 44 participants aged 18–40 years with text neck syndrome. Participants were randomly allocated into three groups: hamstring IASTM, gastrocnemius IASTM, and sham control (n=20 each). Interventions were administered over 4 weeks (3 sessions/week). Outcomes were assessed pre- and post-intervention using standardized tools. Data were analyzed using repeated-measures ANOVA ($\alpha=0.05$).

Results: Both IASTM groups showed significant improvements in pain and CVA compared to control ($p<0.001$). The hamstring group demonstrated greater improvements in cervical ROM and pressure pain threshold compared to the gastrocnemius group ($p<0.05$).

Conclusion: IASTM is effective in reducing symptoms of text neck syndrome, with hamstring-focused intervention demonstrating superior outcomes. These findings highlight the importance of addressing proximal components of the posterior kinetic chain in rehabilitation.

Keywords: Text neck syndrome, Instrument-assisted soft tissue manipulation, Hamstring tightness, Gastrocnemius, Myofascial release, Cervical pain, Superficial back line.

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Introduction

Text Neck Syndrome is a condition caused by overuse or repetitive stress, characterized by prolonged forward or downward flexion of the cervical spine while looking at a smartphone or other electronic devices. People affected by this syndrome commonly experience neck pain, limited cervical mobility,

decreased muscle strength and endurance, and impaired cervical joint position sense. It is also frequently associated with postural changes such as forward head posture and rounded shoulders (1). People who use a smartphone frequently have a downward gaze to focus on lowered things and keep

their heads in a forward position for lengthy periods, which can cause neck strain (1). Regularly maintaining improper and stressful posture can increase the likelihood of developing musculoskeletal disorders affecting the neck and upper trunk. Prolonged forward head positioning alters normal spinal alignment by decreasing cervical lordosis in the lower cervical region while increasing curvature in the upper thoracic spine to maintain postural balance. This altered alignment is commonly referred to as forward head posture. The most commonly reported symptoms associated with text neck syndrome include neck pain, discomfort, and muscular soreness (1).

In individuals with Text Neck Syndrome, increased tightness and muscle stiffness are commonly observed in the upper trapezius and cervical extensor muscles, while the deep neck flexor muscles often become weakened and less effective in maintaining proper neck stability. Neurological symptoms are additional manifestations that can occur in text neck syndrome. These may include tingling, numbness, or weakness in the arms or hands, often due to nerve compression or irritation in the cervical spine. While these symptoms are less common, they may indicate that the condition has progressed to affect the nerves. Untreated text neck syndrome may lead to inflammation in the ligaments, muscles, or nerves. The consequence in the future may be permanent changes in the musculoskeletal system (2). If not identified and managed appropriately, text neck syndrome may result in serious long-term musculoskeletal complications and postural problems. Instrument-Assisted Soft Tissue Manipulation (IASTM) is a commonly applied manual therapy approach used to reduce fascial adhesions, enhance soft tissue flexibility, and improve overall movement function. Although previous studies have reported positive effects of IASTM on the neck and upper back regions, limited research has explored its effectiveness on distant muscle groups such as the hamstrings and gastrocnemius in individuals experiencing postural conditions like Text Neck Syndrome.

Since the hamstring and gastrocnemius muscles are essential for proper posture and efficient movement mechanics, identifying which of these muscle groups shows greater improvement following IASTM treatment in individuals with Text Neck Syndrome is clinically important. Understanding this may help healthcare professionals choose the most effective treatment area to obtain better therapeutic results and improve patient outcomes.

Hence, this study was undertaken to assess and compare the effects of IASTM applied to the hamstring muscles and gastrocnemius muscles in individuals with Text Neck Syndrome. The results of the study may help in designing more specific and effective rehabilitation approaches, ultimately

enhancing functional improvement and minimizing the long-term consequences of postural abnormalities.

Materials and Methods

The comparative analytical study was conducted in the Department of Physiotherapy at the D.Y Patil College of Physiotherapy, Kolhapur, over a period of 6 months. Ethical clearance was obtained from the Institutional Ethics Committee before starting the study. Using a probability sampling technique, a total of 44 participants fulfilling the inclusion criteria were selected for the study.

Inclusion Criteria

Males and females belonging to the age group between 20 to 40 years, with intermittent chronic neck pain, upper back pain, shoulder pain, headache, tingling, or numbness in the upper limb for more than 3 months, using a mobile phone for ≥ 3 hours per day with neck flexion of approximately 15° or more.

Exclusion Criteria

Participants with spinal conditions including osteoporosis, spinal stenosis, scoliosis, spondylolisthesis, torticollis, spinal infections or inflammatory disorders, malignancies, disc herniation, or trauma, active infections or skin conditions over the treatment area (e.g., open wounds, bruises, varicose veins, deep vein thrombosis in the hamstring or gastrocnemius region), having vertigo or cervicogenic dizziness, systemic disorders such as uncontrolled hypertension, diabetes mellitus, or autoimmune conditions affecting muscle or joint integrity.

Every participant had received an explanation of the study's goal and methodology, and before to participation, signed informed consent was acquired. 44 participants who meet the selection criteria were selected. A track of demographic information like age, gender, how long symptoms have been present, and how often you use your phone was kept.

Before initiating the intervention, baseline evaluations were performed for all participants. Functional disability was assessed using the Neck Disability Index (NDI), while pain intensity was recorded with the Visual Analog Scale (VAS). Postural assessment was conducted by measuring the craniovertebral angle through photographic analysis. Flexibility measurements were obtained using the Sit and Reach Test for hamstring flexibility and the Weight Bearing Lunge Test for gastrocnemius flexibility.

After completion of the baseline assessment, the participants were randomly divided into two groups. Participants in Group A received Instrument Assisted Soft Tissue Manipulation applied to the hamstring

muscles, whereas participants in Group B underwent Instrument Assisted Soft Tissue Manipulation targeting the gastrocnemius muscles. All interventions were performed by standardized IASTM tools. To ensure consistency in treatment, both groups had also received standardized posture education and a home exercise regimen that includes neck isometric exercises, scapular strengthening activities, and chin tuck exercises. The intervention was carried out three times a week for four weeks, for a total of twelve therapy sessions, each lasting roughly fifteen to twenty minutes. At the conclusion of the second week and following the conclusion of the four-week intervention, outcome measures were re-evaluated. The same outcome measures used for the baseline assessment were utilized to record pain intensity, functional impairment, postural alignment, and muscular flexibility. Throughout the trial, participants were observed for any discomfort, skin irritation, or adverse reactions, and any necessary safety measures were implemented during the intervention period. All the data was collected and compiled and entered into Microsoft Excel. Statistical analysis was conducted using the SPSS 27.0 version. The continuous variables (age, VAS score, NDI score, craniovertebral angle, flexibility scores) were summarized using descriptive statistics like mean and standard deviation. Gender distribution and other categorical data was described using frequency and percentage. Pre-treatment and post-treatment data within each group (Group A: Hamstring IASTM, Group B: Gastrocnemius IASTM) was compared using a paired t-test. Following the intervention, differences between Group A and Group B was compared using an unpaired t-test (also known as an independent t-test). A p value of less than 0.05 was considered to be statistically significant.

Result

Table 1: Demographic Characteristics of Participants (n = 44)

Var	Cat	Mini	Max	M	Freq	Perc
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e	y	m	m	n	y (n)	e (%)
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Age (years)	—	20	39	26.23 ± 5.121	—	—
Gender	Female	—	—	—	28	63.60 %
	Male	—	—	—	16	36.40 %
	Total	—	—	—	44	100%

The study's participants ranged in age from twenty to thirty-nine. The individuals' average age was 26.23 years, with a 5.121-year standard deviation. This suggests that the bulk of participants were young adults, the age group most frequently impacted by Text Neck Syndrome as a result of extended use of cell phones and other devices.

For gender wise distribution, 28 participants (63.60) were females while 16 participants (36.40) were males.

Table.2: Group A (Hamstring IASTM)

Parameters	Assessment Period	Mean	Standard Deviation	p-value
CVA	Pre	46.59	2.15	<0.001*
	Post	52.18	1.44	
NPRS AT REST	Pre	6.77	0.61	<0.001*
	Post	4.45	0.80	
NPRS AT ACTIVITY	Pre	9.23	0.53	<0.001*
	Post	5.77	0.81	

NDI	Pre	7.4 4	0.38	<0.0 01*
	Post	4.7 7	0.50	
SAS	Pre	8.8 6	0.71	<0.0 01*
	Post	5.8 6	1.13	

The within-group comparison for participants receiving instrument-assisted soft tissue manipulation (IASTM) to the hamstring muscles demonstrated statistically significant improvements across all measured outcomes following the intervention.

The craniocervical angle (CVA) demonstrated a significant improvement, increasing from 46.59 ± 2.15 before treatment to 52.18 ± 1.44 after treatment ($p < 0.001$). This change reflects notable correction in forward head posture and enhanced cervical posture alignment. The findings indicate that IASTM applied to the hamstrings had a beneficial effect on postural control, possibly by influencing the mechanics of the posterior kinetic chain.

Assessment of pain intensity using the Numeric Pain Rating Scale (NPRS) demonstrated a considerable decrease following the intervention. At rest, NPRS decreased from 6.77 ± 0.61 to 4.45 ± 0.80 , and during activity, from 9.23 ± 0.53 to 5.77 ± 0.81 ($p < 0.001$ for both). These results suggest that the intervention produced a marked decrease in pain experienced both at rest and during physical activity.

Functional disability assessed using the Neck Disability Index (NDI) demonstrated a significant reduction, decreasing from 7.44 ± 0.38 before treatment to 4.77 ± 0.50 after treatment ($p < 0.001$). This improvement indicates enhanced functional performance and a reduced effect of neck-related symptoms on everyday activities.

Likewise, symptom severity measured through the Symptom Assessment Scale (SAS) showed a significant decrease from 8.86 ± 0.71 before intervention to 5.86 ± 1.13 after intervention ($p < 0.001$), demonstrating an overall improvement in the clinical symptoms experienced by the participants.

Overall, the statistically significant improvements observed in all outcome measures ($p < 0.001$) indicate that hamstring-targeted IASTM is highly beneficial in improving posture, minimizing pain, reducing functional disability, and relieving symptom severity in individuals with Text Neck Syndrome.

Table.3: Group B (Gastrocnemius IASTM)

Parameters	Assesmen t Period	M ea n	Std. Deviati on	p- valu e
CVA	Pre	46. 59	2.42	<0.0 01*
	Post	47. 82	2.52	
NPRS AT REST	Pre	6.4 1	0.59	<0.0 01*
	Post	5.5 9	0.73	
NPRS AT ACTIVITY	Pre	9.0 5	0.58	<0.0 01*
	Post	7.9 1	0.53	
NDI	Pre	7.5 2	0.26	<0.0 01*
	Post	6.5 3	0.27	
SAS	Pre	8.8 2	0.73	<0.0 01*
	Post	7.6 4	0.66	

The within-group analysis of participants who received Instrument-Assisted Soft Tissue Manipulation (IASTM) to the gastrocnemius muscle showed statistically significant improvements in all measured outcome variables after the intervention period ($p < 0.001$).

The craniocervical angle (CVA) increased from 46.59 ± 2.42 pre-treatment to 47.82 ± 2.52 post-treatment, indicating a modest improvement in forward head posture and cervical alignment. Despite being statistically significant, the extent of improvement indicates a comparatively lesser clinical impact on postural correction.

Pain severity measured using the Numeric Pain Rating Scale (NPRS) demonstrated a decrease in pain levels both during rest and while performing activities. NPRS at rest decreased from 6.41 ± 0.59 to 5.59 ± 0.73 , while NPRS during activity decreased from 9.05 ± 0.58 to 7.91 ± 0.53 ($p < 0.001$). These results suggest that the intervention led to a moderate decrease in pain experienced both at rest and during physical activities. Functional disability evaluated through the Neck Disability Index (NDI) showed a reduction from 7.52 ± 0.26 before treatment to 6.53 ± 0.27 after treatment ($p < 0.001$), indicating a mild improvement in the participants' capacity to carry out daily activities. Likewise, symptom severity measured using the Symptom Assessment Scale (SAS) reduced from 8.82 ± 0.73 before intervention to 7.64 ± 0.66 after intervention ($p < 0.001$), indicating an overall decrease in symptom intensity experienced by the participants. In conclusion, although gastrocnemius-focused IASTM produced statistically significant improvements in posture, pain levels, functional disability, and symptom severity, the degree of improvement across all outcome measures was comparatively smaller, suggesting a lesser clinical effect when compared with interventions directed toward the hamstring muscles.

Table.4: Group Comparison (Hamstring vs Gastrocnemius IASTM)

Parameters	Group	Mean	Std. Deviation	p-value
CVA	A	52.18	1.44	<0.001*
	B	47.82	2.52	
NPRS AT REST	A	4.45	0.80	<0.001*
	B	5.59	0.73	
NPRS AT ACTIVITY	A	5.77	0.81	<0.001*
	B	7.91	0.53	
NDI	A	4.77	0.50	<0.001*

	B	6.53	0.27	
SAS	A	5.86	1.13	<0.001*
	B	7.64	0.66	

The between-group comparison demonstrated statistically significant differences between Group A (hamstring IASTM) and Group B (gastrocnemius IASTM) in all assessed outcome measures after the intervention period ($p < 0.001$), suggesting greater clinical effectiveness of the hamstring-focused treatment approach.

Following the intervention, the craniovertebral angle (CVA) was notably greater in Group A (52.18 ± 1.44) than in Group B (47.82 ± 2.52), indicating superior improvement in forward head posture and cervical alignment among participants who received hamstring-focused treatment.

Pain intensity assessed with the Numeric Pain Rating Scale (NPRS) was significantly lower in Group A at both rest (4.45 ± 0.80) and during activity (5.77 ± 0.81) when compared to Group B (rest: 5.59 ± 0.73 ; activity: 7.91 ± 0.53). These findings suggest that IASTM applied to the hamstring muscles was more effective in decreasing pain experienced both during rest and physical activity.

Functional disability measured using the Neck Disability Index (NDI) was significantly lower in Group A (4.77 ± 0.50) than in Group B (6.53 ± 0.27), indicating better improvement in functional ability and performance of daily activities in the hamstring intervention group.

Likewise, symptom severity assessed through the Symptom Assessment Scale (SAS) was considerably lower in Group A (5.86 ± 1.13) compared to Group B (7.64 ± 0.66), suggesting a greater reduction in the overall severity of symptoms in the hamstring treatment group.

Discussion

The purpose of the study was to compare the effects of Instrument Assisted Soft Tissue Manipulation (IASTM) on the hamstring and gastrocnemius muscles in people with Text Neck Syndrome. The purpose of the study was to ascertain how posture, discomfort, and functional impairment are affected by posterior chain flexibility.

The study included 44 participants with a mean age of 26.23 ± 5.12 years, indicating that most of the participants were young adults. Prolonged smartphone usage among young adults is known to considerably increase stress on the cervical spine, thereby contributing to the development of Text Neck Syndrome (3).

The within-group analysis of the present study demonstrated statistically significant improvements in all outcome measures, including Craniovertebral Angle (CVA), Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), and Symptom Assessment Score (SAS) in both groups. However, the extent of improvement was greater in Group A (hamstring IASTM group) compared to Group B (gastrocnemius IASTM group).

The significant improvement in posture observed in Group A, as indicated by increased CVA values, may be attributed to enhanced flexibility of the hamstring muscles, which play an essential role in maintaining pelvic alignment and overall spinal posture. Tightness in the hamstrings can influence pelvic tilt and spinal mechanics, thereby affecting cervical posture. These findings are supported by the study conducted by Kisner Carolyn and Colby Lynn Allen (2012), which emphasized the importance of posterior chain muscle flexibility in maintaining proper postural alignment (4).

The reduction in pain observed in both groups, particularly in Group A, may be associated with the physiological effects of IASTM, including improved blood circulation, breakdown of soft tissue adhesions, and facilitation of tissue healing. Consequently, IASTM has been shown to enhance soft tissue mobility, reduce pain, and improve range of motion in individuals with musculoskeletal conditions (5).

Similarly, Group A demonstrated greater functional improvement than Group B, as measured by the Neck Disability Index (NDI). This suggests that improved hamstring flexibility may indirectly influence cervical function by promoting better overall postural alignment and reducing mechanical stress on the cervical spine. These findings are supported by studies showing that postural correction exercises significantly improve forward head posture and functional performance (6).

Participants in Group B who underwent gastrocnemius IASTM also demonstrated statistically significant improvement; however, the extent of improvement was smaller when compared to Group A. This suggests that although gastrocnemius flexibility contributes to lower limb mechanics and postural stability, its effect on cervical posture may be less direct than that of hamstring flexibility. Previous studies have highlighted the role of gastrocnemius flexibility in

lower limb function, but have not directly associated it with improvements in cervical posture (7).

The findings of the present study demonstrated statistically significant improvements in all assessed outcome measures, with p-values less than 0.001, indicating strong evidence for the effectiveness of IASTM in managing symptoms associated with Text Neck Syndrome. Furthermore, the between-group comparison clearly showed that hamstring IASTM was more effective than gastrocnemius IASTM in improving posture, reducing pain, and decreasing functional disability.

Overall, the findings of the study support the concept of kinetic chain interdependence, which suggests that tightness in distal muscle groups can influence proximal structures such as the cervical spine. The greater improvement observed in the hamstring group highlights the importance of addressing posterior chain muscle tightness in the management of Text Neck Syndrome.

Strength & Limitations

This study possesses several methodological strengths. A comparative research design was used to examine the effectiveness of IASTM on the hamstring and gastrocnemius muscles, allowing a direct comparison of the two interventions. The application of validated outcome measures such as CVA, NPRS, NDI, and SAS increased the reliability and authenticity of the study findings. Random assignment of participants helped reduce selection bias and enhanced the internal validity of the research. Furthermore, a standardized treatment protocol was maintained for both groups to ensure uniformity of intervention. The inclusion of multiple assessment parameters, including posture, pain, functional disability, and symptom severity, enabled a thorough evaluation of treatment effectiveness. In addition, the statistically significant improvements observed across all outcome measures strengthen the validity of the results, while the focus on a commonly occurring postural condition related to prolonged smartphone use adds clinical relevance to the study.

Despite the strengths of the study, certain limitations should be acknowledged. The relatively small sample size ($n = 44$) along with the short intervention period of four weeks may limit the broader applicability and long-term generalization of the findings. The lack of follow-up assessment also restricts evaluation of the lasting effects of the treatment. Moreover, the study included only participants between 20 and 39 years of age, which limits the applicability of the results to other age groups. The unequal gender distribution and single-center study design may further reduce external validity. In addition, factors such as duration of smartphone usage, physical activity levels, and ergonomic practices were not strictly monitored and

could have influenced the outcomes. The intervention was limited to the hamstring and gastrocnemius muscles without assessing other components of the posterior chain. Lastly, the use of self-reported outcome measures for pain and disability may have introduced subjective bias into the study findings.

Conclusion

The findings of the study suggest that Instrument Assisted Soft Tissue Manipulation (IASTM) is effective in improving posture, reducing pain, and decreasing disability in individuals with Text Neck Syndrome. However, IASTM applied to the hamstring muscles demonstrated significantly greater improvement compared to the gastrocnemius muscles, indicating that hamstring flexibility plays a more important role in postural correction and reduction of discomfort.

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