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Original Article

Physiotherapy Section

Role of Instrument-assisted Soft Tissue Mobilisation in Text Neck Syndrome: A Quasi-experimental Study

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ABSTRACT

Introduction: Text Neck Syndrome occurs due to sustained Forward Head Posture (FHP) when smartphones are used constantly without any breaks for more than five hours and with improper posture. Long-term untreated text neck can cause inflammation of the neck's ligaments, muscles, and nerves, leading to chronic arthritic changes. Literature provides studies evaluating the effects of physical or manual therapy, but there is a lack of studies investigating the effects of Instrument-assisted Soft Tissue Mobilisation (IASTM) treatment in individuals with text neck syndrome.

Aim: To determine the added effect of IASTM on text neck syndrome.

Materials and Methods: This quasi-experimental study was conducted at Department of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Pune, Maharashtra, India, from August 2022 to December 2022. A total of 22 subjects, with a mean age of 21.58±1.18 years, participated in the study. The subjects were then divided into two treatment groups (n=11 each). The experimental group (Group-A) received stretching, strengthening exercises with IASTM, while the control group (Group-B) received only conventional physical therapy (stretching and strengthening). The treatment was delivered for a two-week period. The data were analysed using MedCalc statistical software version 20.210. Significance was set at a p-value less than 0.05. For within-group analysis, Wilcoxon's signed-rank or paired t-test was used depending on the normality distribution, and for between-group comparisons, Mann-Whitney tests were used for skewed variables.

Results: The pain severity (p-value=0.0063) and neck disability (p-value=0.0008) were significantly lower in the IASTM group than the control group. Additionally, the Craniovertebral Angle (CVA) (p-value=0.0001) significantly increased with IASTM (Group-A) compared to the control group.

Conclusion: The study concluded that IASTM and conventional therapy are individually effective in improving pain, disability, and FHP in text neck syndrome. However, adding IASTM to routine physical therapy showed statistically more significant results compared to physical therapy alone in reducing neck pain, disability, and FHP.

Keywords: Forward head posture, Neck pain, Repetitive stress, Turtle neck posture

INTRODUCTION

Text neck syndrome is considered "Pain of the Modern Era" since it can cause acute to chronic pain in the neck and upper back [1]. It is a term used to describe neck pain from using a mobile phone, tablet, or other wireless device excessively and for an extended period of time [2]. Smartphone use commonly requires excessive neck flexion angle [1]. This position, if maintained for a longer duration, can decrease the lordosis in the lower cervical vertebrae. As a result, posterior curvature increases in the upper thoracic vertebrae [3].

Forward Head Posture (FHP) affects a large percentage of the population and can result in significant neck pain [3]. Studies suggest that individuals who used mobile/smartphones for Internet browsing and chatting had the greatest prevalence of neck discomfort complaints than those who used them for fewer than two hours each day [4]. In a study by Kumari S et al., 62% of college students reported positive for neck disability with a greater propensity among female responders [1]. Constant use of a smartphone at home without any breaks and with improper posture leads to musculoskeletal pain with greater discomfort in the neck and shoulder region [5]. Also, head and neck flexion angles are higher while using smartphones than desktop or notebook computers. In the normal position, an adult head weighs between 4.5 and 5.5 kg (10 and 12 pounds). Different angles of forward head flexion directly impact the cervical spine. At 15° head flexion, around 12 kg of force is placed on the neck. This force rises to 18 kg at 30°, 22 kg at 45°, and 27 kg at 60° [6].

The functional ability and mobility of the neck are maintained by muscles including the scalene, rhomboids, and trapezius. The upper trapezius is the most affected by text neck syndrome [4]. The levator scapulae muscle is also crucial in maintaining proper head and neck posture. To counteract the predisposition for forward flexion, the muscle stays continuously active. With neck pain and postural issues, the levator scapulae becomes hyperactive and tender over the superior-medial border of the scapula [7].

Long-term untreated text neck can cause inflammation of the neck's ligaments, muscles, and nerves, which can result in chronic arthritic changes [8]. For its conservative care, a variety of procedures are available, including posture correction, stretching, soft tissue therapy [9], and exercise routines. Manual therapy is a combination of hands-on therapy methods, such as soft tissue mobilisation and massage, and methods utilising therapeutic instruments, like stainless-steel tools, that enable clinical therapists to recognise and address soft tissue dysfunctions [10]. IASTM helps mobilise scar tissue and myofascial adhesions as its deeper penetration stimulates connective tissue remodelling [11].

Adhesions and cross-linkages can be broken using the IASTM approach. In comparison to manual methods, moving the instrument puts more mechanical stress on the skin as it is compressed and then stretched. The activity of the compressed and stretched mechanosensitive neurons is anticipated to change due to increased skin deformation. There are various IASTM tools, such as Garston, hawk grips, functional and kinetic treatment, adhesion breakers, and facial abrasion techniques that have their own approach to treatment and instrument design, like material and shape of instruments [12].

Additionally, previous studies suggest that IASTM reduces local pain intensity, improves the pressure pain threshold, enhances

muscle tissue flexibility, and increases the Range of Motion (ROM) of the mobilised muscle and alters neural activities [13,14]. The postural adaptations following connective tissue involvement can cause chronicity of neck pain and promote a vicious cycle of pain. The limitation of functional activities further compromises the quality of life. IASTM works on releasing connective tissue and promotes muscle lengthening. The study hypothesised that adding IASTM to conventional exercise can have an effect on pain, disability, and FHP in text neck syndrome. The aim of the study was to determine the added effect of IASTM on text neck syndrome. In particular, the primary objective of the present study was to find the effect of the combined application of IASTM with a therapeutic exercise program on neck pain as determined using CVA for text neck syndrome. The secondary objective was to find the effect on neck disability and forward head in text neck syndrome.

MATERIALS AND METHODS

This quasi-experimental study was conducted at Department of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Pune, Maharashtra, India, from August 2022 to December 2022. Ethical clearance was obtained from the Institutional Sub-ethics Committee (DYPCPT/ISEC/45/2022).

Inclusion criteria: Both males and females, subjects using a smartphone for atleast two hours a day for more than six months, complaining of neck pain during and after the use of a smartphone. Age group: 18-24 years, with a minimum Neck Disability Index (NDI) score of 10%-48%, indicating mild to moderate disability [15,16], upper cross syndrome, and subjects with smartphone addiction (SAS-SV Score ≥34) were included in the study [17].

Exclusion criteria: Participants who were not willing to participate, had undergone recent surgery, had spinal pathology or ankylosing spondylitis, had any open wound around the neck, had a history of cervical fracture or torticollis, or had any other condition that contraindicated the use of IASTM tools, such as skin sensitivity were excluded from the study.

Sample size calculation: Patients with text neck syndrome who met the above inclusion criteria and provided written informed consent were included. A total of 22 subjects were recruited, with a mean age of 21.58±1.18 years. Assuming the mean and standard deviation of the numerical pain rating scale from a study conducted by Mahmood T et al., with a power of 80, a significant difference of 5, and a confidence interval of 95%, the sample size was calculated as 22 using WinPePi (version 11.65) [12].

Study Procedure

The subjects were allocated into the Experimental (Group-A) and Control (Group-B) groups. Group-A received IASTM (two times a week for two weeks, 4 sessions, with 90 to 120 seconds of IASTM on each muscle until hyperaemia occurred for each side, totalling nine minutes per session including one minute of rest after each muscle IASTM treatment) [18], along with conventional treatment. Group-B received only the conventional treatment protocol. Both groups received treatment for two weeks, with a total of 14 sessions. Pre and postintervention assessments of the Numerical Pain Rating Scale, Neck Disability Index, and Craniovertebral Angle parameters were performed.

Conventional treatment: The conventional treatment involved the use of a Hydrocollator pack for 20 minutes. Stretching exercises were performed for the levator scapulae, upper trapezius, suboccipital musculature, and scalene muscles [18]. Each stretch was repeated three times, holding for 30 seconds per muscle, totaling 6 minutes [19]. Neck isometric exercises were performed for flexion, side bending, and rotations [19]. Each exercise was repeated 15 times, holding for 7 seconds per day [20], totaling approximately 10 minutes.

IASTM technique: Prior to treatment, the skin around the neck is lubricated with a friction-free oil or gel, and the IASTM instrument, M2T blade, is cleansed with an alcohol pad. The tool is used to determine the precise points of restriction in the upper trapezius [21], levator scapulae [22], and suboccipital muscles [22]. Then, while holding the instrument at a 45-degree angle, slow strokes were applied to the muscles. When the instrument slides across areas of irregular fibrosis of the underlying connective tissue, the clinician is able to identify changes in soft tissue consistency through vibrations of the instrument. After locating an adhesion, strokes were repeated for five minutes. The M2T blade is an ergonomically designed stainless steel tool made of 0.316 surgical grade steel [22] [Table/Fig-1].

[Table/Fig-1]: M2T Blade.

Outcomes: Pre and post values for neck pain, disability, and Craniovertebral Angle (CVA), which measures Forward Head Posture (FHP), were assessed using the numerical pain rating scale, Neck Disability Index (NDI), and Markus Bader ruler (MB ruler) software. The reliability of photographic postural analysis done using the MB ruler was >0.972 [23]. In the NDI, a total of 10 sections were scored from 0 to 5, with 0 indicating no pain and 5 indicating the worst imaginable pain. The minimum and maximum score range from 0 to 50, where 0 points or 0% represents no activity limitations and 50 points or 100% represents complete activity limitation. To calculate the NDI percentage, the total score of the 10 sections was divided by 50 and converted to a percentage. Scoring was categorised as follows: 0-4 points (0-8%) for no disability, 5 to 14 points (10-28%) for mild disability, 15-24 points (30-48%) for moderate disability, 25-34 points (50-64%), and 35-50 points (70-100%) for complete disability [15,16].

STATISTICAL ANALYSIS

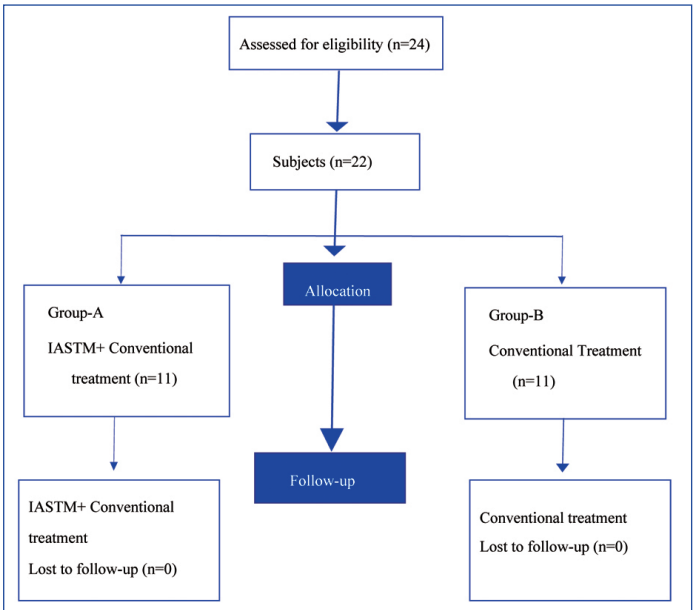
After entering the data into Microsoft excel, the mean and Standard Deviation (SD) were calculated for each parameter. The normality of the data was analysed using the Shapiro-Wilk Test in MedCalc statistical software version 20.210. The data was determined to have a normal distribution if the p-value was greater than 0.05, and not normally distributed if the p-value was less than 0.05. Intragroup (within-group) comparisons were conducted using the paired sample t-test for the Numeric Pain Rating Scale (NPRS) and CVA, as these parameters were normally distributed. The Wilcoxon Signed Rank Test (Z-test) was used for the Neck Disability Index (NDI), as the data was not normally distributed.

Inter-group (between-group) comparisons were performed using the Mann-Whitney test (U-test) for the NPRS, NDI, and CVA, which were not normally distributed. The level of significance was determined as $p<0.05$ at a 95% Confidence Interval (CI).

RESULTS

Out of the 24 volunteers assessed for eligibility in the study, two samples were excluded due to having less than 10% neck disability. Finally, 22 volunteers who met the inclusion criteria participated in the study, with 11 subjects in each group [Table/Fig-2]. The participants had a moderate disability score, calculated as 30.18%

on the Neck Disability Index. The demographic characteristics of the participants, including age, duration of pain, and smartphone addiction scale scores, were approximately similar [Table/Fig-3].



[Table/Fig-2]: Flow diagram of sampling and allocation.

Variables	Group-A (n=11)	Group-B (n=11)
Gender n (%)	Male- 4 (36.36%)	Male- 3 (27.2%)
	Female- 7 (63.6%)	Female- 8 (72.7%)
Age (Mean±SD) in years	21.36±0.75	21.81±1.50
Duration of pain (in months)	12.81±11.86	8.45±1.7
SAS-SV	40.09±3.67	40.62±5.53

[Table/Fig-3]: Baseline characteristics of the patients (n=22).
SD: Standard deviation

Within each group, the post-values showed statistically significant improvements. Neck pain, as reported by the Numeric Pain Rating Scale (NPRS), improved in the experimental group from 5.8 to 2.5, and in the control group from 5.1 to 3.4, with a p-value less than 0.0001 in both groups. Similar results were seen for neck disability, as reported using the NDI scale. In the experimental group, NDI showed a change from a mean of 16.54 to 8.72, while in the control group, the mean change was from 13.6 to 10.72, with a p-value less than 0.05 in both groups. An improvement in FHP was observed in both groups, as the CVA reported using the MB ruler increased [Table/Fig-4].

Variables	Groups	Pre comparison (Mean±SD)	Post comparison (Mean±SD)	95% CI of mean difference	T/Z value	p-value
NPRS	Group A	5.818±1.77	2.54±1.03	4.12 to 2.41	T=8.533	p<0.0001*
	Group B	5.18±1.53	3.45±1.63	2.25 to 1.191	T=7.286	p<0.0001*
NDI	Group A	16.54±5.4	8.72±3.1	10.50 to 5.50	Z=2.941	p=0.0033*
	Group B	13.6±3.5	10.72±3.1	4.50 to 1.50	Z=2.947	p=0.0032*
CVA	Group A	44.74±6.17	53.3±6.4	7.04 to 10.13	T=12.410	p<0.0001*
	Group B	48.79±6.79	50.30±6.72	0.87 to 2.15	T=5.265	p=0.0004*

[Table/Fig-4]: Within Group pre–and post-comparison of NPRS and CVA using paired t-test and NDI using Wilcoxon test based on normality.
*Statistically significant
SD: Standard deviation; NPRS: Numerical pain rating scale; NDI: Neck disability index; CVA: Craniovertebral angle; SD: Standard deviation; CI: Confidence interval; Z: Wilcoxon test; T: paired sample t-test

Between the groups, the experimental group showed statistically more significant results, with a p-value less than 0.05. There was an improvement in neck pain, as reported by the NPRS, with a change in mean score to 3.27 in the experimental group and 1.72 in the control group, with a median difference of 2 for Group A and B at a 95% confidence interval of 3 to 1. Neck disability, reported using the NDI, showed greater improvement in the experimental group (7.81) compared to the control group (2.90), with a median difference value of 4 at a 95% confidence interval of 6 to 3. An increase in CVA, signifying improvement in FHP, showed a greater mean difference in the experimental group (8.58) than the control group (1.51), with a median difference of 7.13 at a 95% confidence interval of 9.10 to 5.13 [Table/Fig-5].

Variables	Group A Mean±SD	Group B Mean±SD	Median Diff.	95% CI Median Diff.	U value	p-value
NPRS	3.27±1.3	1.72±0.8	2.00	3.00 to1.00	19.50	0.0063*
NDI	7.81±3.5	2.90±2.1	4.00	6.00 to3.00	9.50	0.0008*
CVA	8.58±2.3	1.51±0.95	7.13	9.10 to5.130	0.00	0.0001*

[Table/Fig-5]: Between groups mean comparison of NPRS, NDI and CVA using Mann Whitney test.
*Statistically significant
SD: Standard deviation; NPRS: Numerical pain rating scale; NDI: Neck disability index; CVA: Craniovertebral angle; CI: Confidence interval; U: Mann-Whitney test

DISCUSSION

The IASTM works by applying pressure to release tightened connective tissue structures and treat soft tissue dysfunctions. Previous studies have reported that IASTM can improve cervical joint position error in chronic neck pain [24]. In the present study, which was conducted on patients with text neck syndrome and a score of more than 34 on the smartphone addiction scale (short version), it was found that the additional use of IASTM along with conventional physical therapy resulted in a decrease in neck pain, improvement in disability, and FHP. FHP was reduced as a result of strengthening exercises, which also led to an increase in CVA, suggesting posture correction, and a reduction in the NDI.

In text neck syndrome, additional stress is placed on the postural muscles of the entire spine, particularly the cervical spine. The position of the skull anterior to the body's centre of gravity contributes to chronic neck pain [3]. Stretching and strengthening exercises are considered the most effective way to treat neck pain. Deep neck flexors are crucial for stabilising the correct alignment of the cervical spine, so most treatment regimens focus on strengthening these muscles. Previous studies on text neck suggest that to improve postural alignment and treat the condition, weak muscles should be strengthened, and shortened muscles should be stretched. Exercises like the chin tuck-in exercise work on the deep cervical flexors, while head bending exercises improve the endurance of the cervical flexor muscles [24-26]. In the present study, specific muscle stretching and neck isometrics resulted in a decrease in neck pain, as measured by the Numeric Pain Rating Scale (NPRS), in patients with text neck syndrome. Pain was reduced in both groups, with a greater mean pain reduction in the experimental group (3.27) compared to the control group (1.72). A recent study in 2022 found a decrease in chronic neck pain following IASTM applied to the trapezius and sternocleidomastoid muscles [24]. IASTM has also been reported to be beneficial in reducing pain and improving function for upper trapezius trigger points [21].

Adding IASTM can facilitate and improve blood perfusion. The generation of heat beneath the instrument decreases tissue viscosity, resulting in a softening effect. IASTM also promotes angiogenesis and speeds up the healing process, leading to reduced pain [10]. Motimath et al., found that the IASTM technique with the M2T blade was effective in reducing pain in individuals with upper trapezius spasm [27]. Another study on chronic low back pain found a significant reduction in pain using the Graston technique [28].

The significant reduction in disability observed in patients can be attributed to the biomechanical correction of FHP. IASTM can break adhesions and cross-linkages, leading to improved muscle flexibility. Treatment of trigger areas in the upper trapezius using IASTM tools has shown a significant reduction in pain and disability, as measured by the NPRS and Neck Disability Index (NDI) [13]. This improvement in disability level has a positive impact on performance during daily activities. Additionally, a reduction in pain can lead to an improvement in muscle activity levels [22]. In the present study, the experimental group showed a mean reduction in disability of 7.81 compared to 2.90 in the control group. These findings align with a study that reported a decrease in pain and disability using IASTM in combination with stretching exercises for the management of upper cross syndrome compared to routine physical therapy [12]. Another study demonstrated the positive effect of the M2T blade IASTM in reducing pain in trapezitis [27]. Similar results, with reductions in pain and disability, were also reported in a 2020 study on chronic neck pain [22].

The authors also found a statistically significant improvement in the CVA in both groups. Specifically, following two weeks of treatment, the CVA increased by 8.56 degrees in the IASTM group compared to only conventional treatment. In the control group, the increase in CVA was 1.51 degrees, which was also statistically significant. The use of IASTM leads to localised haemorrhage by micro-traumatising soft tissues. This, in turn, increases the number of fibroblasts and releases nutrients, ultimately resulting in the production and maturation of collagen protein. Additionally, the decreased myofascial stiffness allows for better sliding of the fascia, aiding in improved postural adjustments [19]. Mylonas et al., found that combining IASTM with neuromuscular exercises improves forward head posture and functionality in individuals with mechanical neck pain [10].

Stretching and strengthening exercises in text neck syndrome significantly reduce the NPRS, NDI, and increase the CVA. The addition of IASTM to the conventional protocol in text neck syndrome can help decrease pain, disability, and improve forward head posture. This can prevent the chronicity of the condition.

Limitation(s)

The study had its limitations. It was limited to a young adult population, so the findings may not be applicable to other age groups. Range of Motion (ROM) in the cervical region was not considered in the present study, which could have provided additional insights into the effectiveness of the interventions. Additionally, the study protocol only lasted for two weeks, and no further follow-up was conducted to assess the long-term effects of the interventions. Future studies should include longer-term follow-up periods and consider assessing additional outcome measures, particularly neck ROM, to provide a more comprehensive evaluation of the interventions.

CONCLUSION(S)

The study concluded that both conventional physical therapy and IASTM were individually effective in improving pain, disability, and FHP in text neck syndrome. However, the addition of IASTM to routine physical therapy resulted in statistically more significant results compared to routine physical therapy alone in reducing the NPRS, NDI, and CVA.

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