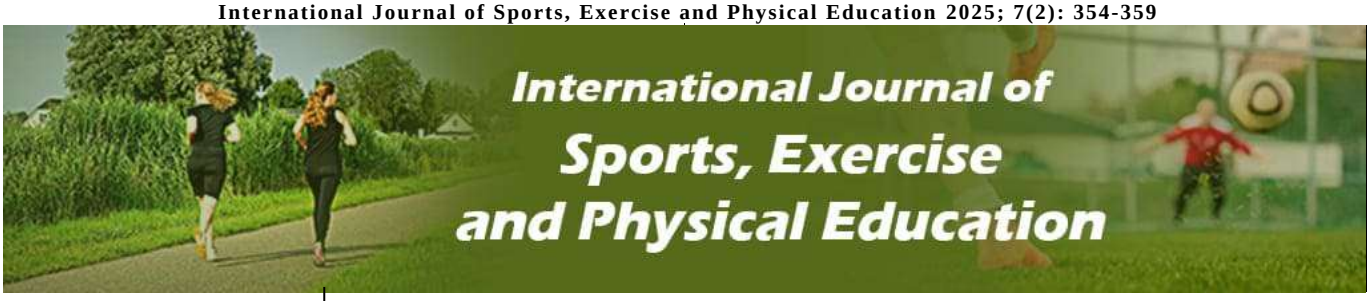

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Evaluating the therapeutic potential of PNF combined with mobilization techniques to mitigate the digital - related strain in text neck syndrome with SMS thumb

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Abstract
This study investigated the effectiveness of combining proprioceptive neuromuscular facilitation (PNF) with mobilization techniques in treating text neck syndrome and SMS thumb, two conditions increasingly common due to prolonged use of handheld digital devices. These conditions are characterized by symptoms such as neck pain, reduced cervical range of motion, abnormal head posture, and thumb pain due to repetitive strain on muscles and joints. A total of 15 online gamers aged between 18 and 25 years, all presenting with both text neck syndrome and SMS thumb, were selected for this quasi-experimental study. Participants underwent a structured intervention involving PNF and mobilization techniques three times a week for four weeks. The study used pre- and post-intervention assessments to measure the effects of the treatment. Tools used for evaluation included the Visual Analog Scale (VAS) to assess neck pain, an inclinometer to measure cervical range of motion (ROM), and the Cornell Hand Discomfort Questionnaire (CHDQ) to evaluate thumb discomfort and pain. After four weeks of treatment, significant improvements were observed in all outcome measures. Participants reported a notable decrease in neck and thumb pain, increased cervical ROM, and reduced discomfort in the thumb area. The combination of PNF and mobilization techniques appeared to provide both immediate and functional relief by addressing muscle tightness, joint mobility, and neuromuscular control. These findings suggest that this integrated approach is effective in managing symptoms associated with repetitive stress injuries caused by excessive device usage. In conclusion, the study demonstrates that the combined use of PNF and mobilization techniques offers a safe and effective therapeutic option for young adults suffering from text neck syndrome and SMS thumb. It highlights the importance of addressing modern postural and overuse conditions with targeted physical interventions that improve both pain and functional movement.

Keywords: Text neck syndrome, PNF, mobilization technique, SMS thumb

Introduction
A 21st century text neck syndrome was introduced by a US Chiropractor Dr.Dean L.Fisherman [1].
Text neck syndrome [TNS] or Text neck or Turtle neck posture refers to Repeated stress injury & pain as a consequence of frequent Forward & downward flexion of head while watching or texting on smartphone over long periods of time [2]. Which can leads to certain complications like headache, neck pain, shoulder & arm pain, reduced cervical range of motion, abnormal head posture, thumb pain, stiff neck, general soreness [3], SMS THUMB-Loading and end range motion of thumb leads to overuse of ligaments and muscles which likely results in MCP joints degenerative changes [2].
Globally, smartphone users reached 3.6 Billions in 2020 & Expected to reach 4.5 Billions by 2024 [4]. In Asian, 72% adults age 18-34 years old reports using a smartphone for 5 hours /day. 19-25 years old reports using a smartphone for 8.5 hours/ day. Teenagers 13-18 years reports more than 6-5 hours / day of screen time.8-12 years reports more than 4-5 hours /day [5]. TNS affects both males & females. However, studies suggest that females are more likely to experience text neck syndrome due to various factors [5].
Main factors of this condition is when using the smartphone for prolonged periods of time with the cervical spine in flexion it induces Forward head posture, incorrect body alignment is being associated with dysfunctional movement pattern and weak balance ability [6].

Many individuals experience eye discomfort & vision problem when viewing digital screens for extended periods. Three major mechanisms that lead to this syndrome are the extraocular, accommodative & ocular mechanism [6], This syndrome is exacerbated by improper sleeping posture & Forward head posture it lead to cervical spatial changes, respiratory dysfunction, reduced cervical range of motion, Temporomandibular joint issues, improper proprioception [7]. Forward head posture affect cervical sensorimotor control and respiratory function and is associated with reduced proprioception [7].

In FHP the mastication muscles pull the mandible so to maintain the mouth closed, while the infrahyoid muscles contract in order to depress the mandible and retract it towards a posterior direction. The muscles of the thoracic wall (the intercostal muscles, pectoralis major and minor, serratus anterior) will present impaired mobility, as well as the muscles of the cervical spine and head (ie. the levator scapulae, sternocleidomastoid, upper trapezius, the scalene and suboccipital muscles, the rectus capitis posterior major and minor, as well as the obliquus capitis inferior and superior). As for the rhomboids, middle trapezius, and supra- and infrahyoid muscles, they will appear stretched and will become weak in prolonged FHP. Generally, the muscular imbalances associated with FHP result from the combination of the elongation and weakening of the anterior neck muscles, and the contraction and stiffness of the posterior neck muscles [6].

Higher flexion degrees apply additional stress to the spine, increasing the weight-bearing load and producing a weight increase from 18.14 kg at 30° to 27.22 kg at 60 degree. The cervical spine is elevated in cases of Forward head posture [FHP], causing changes in cervical muscles and disrupting balance mechanisms. This leads to a shift in the centre of gravity (COG), affecting the entire body's COG and postural control [7].

Text Neck Syndrome

The Proprioceptive neuromuscular facilitation (PNF) technique is mainly based on the neurophysiology principles that facilitate the brain's ability to recognize by stimulating the proprioceptive sense through muscles and nerves to treat neuromuscular and structural dysfunction. The technique's patterns are characterized by 3-dimensional and diagonal movements resulting from synergistic muscle activation. The PNF is recommended in general guidelines for managing chronic neck pain. Recent evidence suggests that the use of different PNF techniques may enhance clinical and physiological outcomes, and improve the quality of life, and well-being of patients with chronic nonspecific neck pain [4].

SMS Thumb

Mobilization techniques to improve joint flexibility and reduce stiffness in the metacarpophalangeal joint in SMS Thumb. Use graded oscillatory movements or sustained stretches under the guidance of a trained therapist [7].

Materials

The following tools and instruments were utilized for intervention and assessment are consent form, assessment chart, goniometer (to measure range of motion) and chair.

Methodology

Study Design

Quasi Experimental pre & post study design.

Study setting

The study was conducted at Sri Ramakrishnan Hospital, outpatient department of physiotherapy, Coimbatore.

Sampling Method

Convenient sampling method

Criteria for Sampling

Inclusion criteria

- Age group 18-25 years
- Both males & females
- Smartphone Addiction Scale [score >33 to 198] included
- Smartphone users for more than 5 hours/ day
- Neck Disability Index [score >15 -24] included.
- A person who reads & writes for a prolonged time.

Exclusion criteria

- Patients who undergone previous neck surgery around past 3 years.
- Patients diagnosed disc prolapse, stenosis & herniation
- Recent trauma treated by conservative or surgical around past 1 year
- Patients with cardiovascular impairment
- Spinal infections & inflammatory disorders were excluded
- Patients with deformities like scoliosis & torticollis
- Pregnancy women

Study duration

The duration of the study was 6 months.

Study Size

15 online gamer participants were assigned in a group.

Duration of Intervention

- The intervention was carried for a duration of 4 weeks.
- 3 days/week.
- 45 minutes per each session,

Variables

Independent variables

- PNF technique [Contract - relax technique, Replication technique].
- Mobilization technique [Maitland].

Dependent variables

- Visual Analog Scale [VAS]-- for pain
- Goniometer - for cervical ROM
- Cornell Hand Discomfort Questionnarise [CHDQ] - for thumb pain/discomfort.

Measurements Tools

- Visual Analog Scale [VAS]-- for pain
- Goniometer - for cervical ROM
- Cornell Hand Discomfort Questionnarise [CHDQ] - for thumb pain/discomfort.

Treatment Techniques

A total of 15 online gamer participants were selected as a sample by using convenient Sampling method and assigned in a group.

Experimental group - received PNF combined with Mobilization techniques.

Procedure

15 online gamer participants were selected from the physiotherapy department Sri Ramakrishna college, who were diagnosed as TNS with SMS Thumb as informed consent was obtained from all the patient and parent before starting the treatment session and they are treated for the period of 4 weeks and a general assessment about health status of the patient was taken, Pre- test measurement of VAS- for pain, Goniometer- cervical range of motion, CHDQ- thumb pain/discomfort were assessed before commencement of treatment.

Intervention

45 minutes for 3 days per week.

PNF Technique

Table 1: 45 minutes for 3 days per week. PNF Technique

PNF Technique	Duration - 30 minutes
Contract - Relax Technique [For Neck extension pattern] • Extension • Lateral flexion • Rotation **Total Duration** • Replication technique [For scapular posterior elevation pattern] **Total Duration** • 15 minutes	6 sec [Resistance] - 6 sec [Relax]. 6 sec [Resistance] - 6 sec [Relax]. 6 sec [Resistance] - 6 sec [Relax] • Total - 12 sec for 1 repetition • 3 sets - 5 repetitions • 5 reps x 12 sec = 60 sec [1 min] • 3 sets x 1 min = 3 minutes • 3 [Ext] + 3 [Lat flexion] +3 [Rotation] = 9 minutes. **15 minutes** 15 sec [Resistance] - 30 sec interval. • 3 sets - 5 repetitions • 5 rep x 45 sec = 4 minutes • 3 sets x 4 minutes = 12 mins.

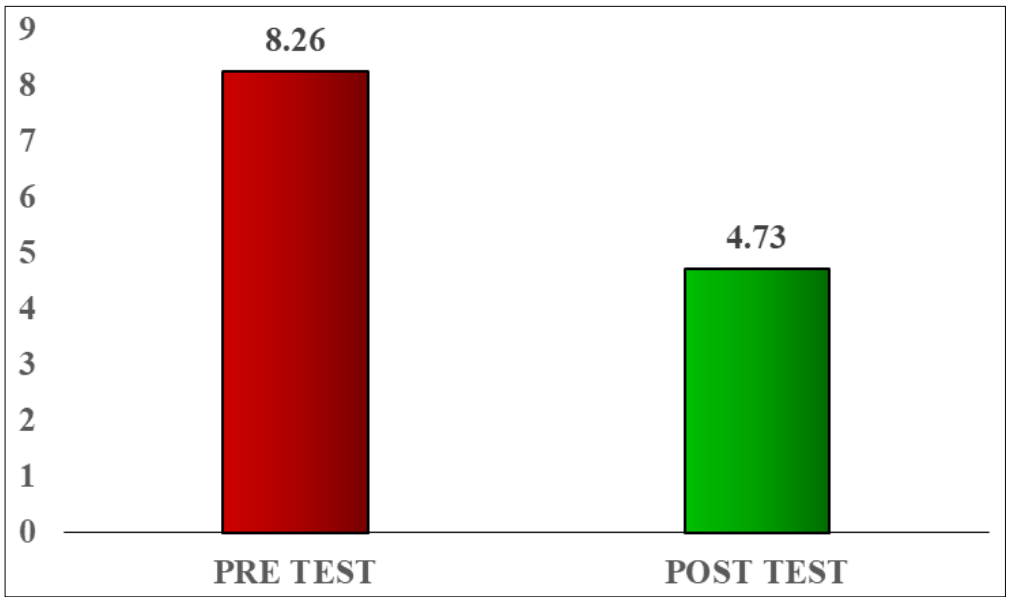
Total duration of PNF technique - 30 minutes

- **Mobilization Technique**

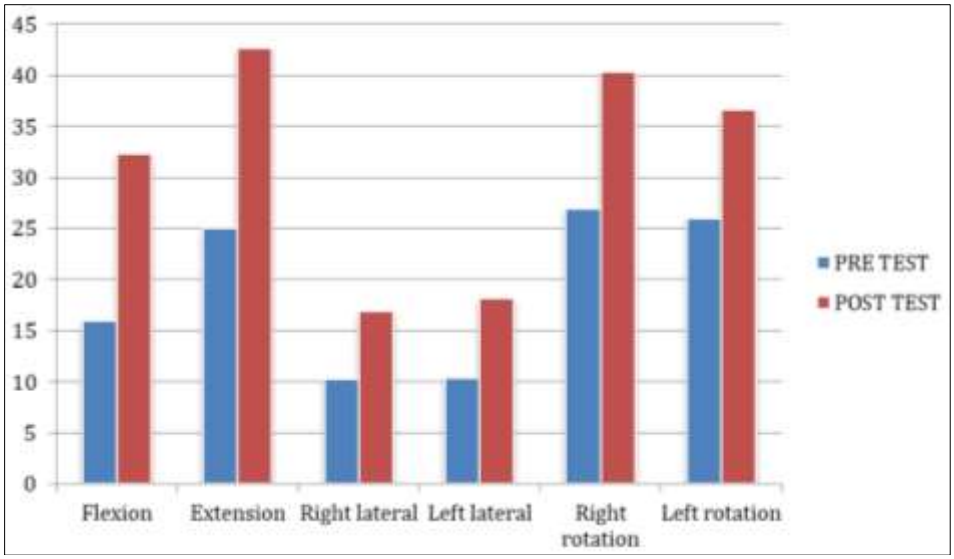
Table 2: Mobilization Technique

Mobilization technique	Duration - 15 minutes
Maitland mobilization	3 sets x 5 minutes =15 minutes

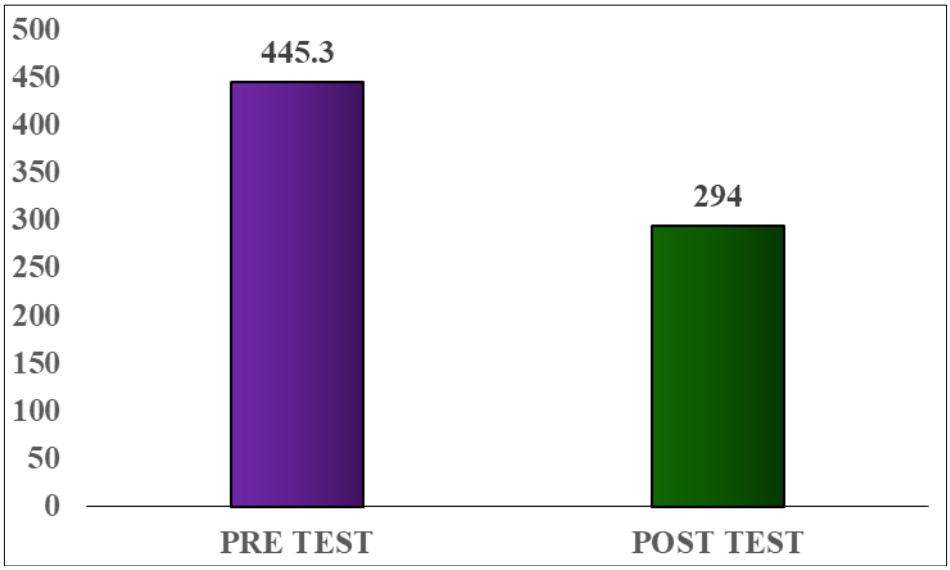
Total duration of mobilization technique - 15 minutes



Graph 1: Pre and Post-test value graph for vas - pain intensity



Graph 2: Pre and Post-test value graph for cervical rom



Graph 3: Pre and Post-Test value graph for CHDQ Thumb Pain/Discomfort

Discussion

The Objectives of the study was to find out evaluating the therapeutic potential of PNF Combined with Mobilization Techniques to mitigate the digital - related strain in Text neck Syndrome with SMS thumb which were analysed on the basis of the result obtained by Pain Intensity, Cervical Range of Motion, Cornell Hand Discomfort Questionnarise. The outcome data of treatment was statistically analysed. In order to Compare the Pre and Post test data of dependent Variables within the Groups.

In this study, 15 online gamers participants were assigned in a group were included, As per The Sampling criteria the patients were randomly allocated in the group. In dependent 't' test, Pre & Post mean value for Pain intensity is 8.26 & 4.73. Mean Difference and Standard Deviation between pre and post test for Pain Intensity were 3.53 & 1.12. 't' value for pain intensity was 12.9 respectively. In cervical Range of Motion [flexion, Extension, Right & Left lateral Flexion, Right & Left Rotation.].

	Pre- test value	Post - test value	Mean Difference	Standard Deviation	T - value
Flexion	16	32.3	16.3	23.09	13.1
Extension	25	42.7	17.7	31.7	12.1
Right Lateral Flexion	10.3	16.9	8.53	12.6	9.3
Left Lateral Flexion	10.4	18.2	7.8	10.1	9.4
Right side Rotation	27	40.3	13.3	30.7	9.2
Left side Roation	26	36.7	10.7	13.8	11.1

In Cornell Hand Discomfort Questionnarise [CHDQ], Pre & Post test mean value was 445.3 & 294. The mean Difference and Standard Deviation were 151.3 & 2783.8. 't' value was 14.1 respectively.

In Dependent 't' value for Pain Intensity, Cervical Range of motion, Cornell Hand Discomfort Questionnarise [CHDQ] value was 12.9, 13.1,12.1, 9.3, 9.4, 9.2, 11.1 and 14.1 respectively in which these values are greater than table

value 1.761 at 18 degree of freedom at the level of 0.05 significance.

The results indicated that the effectiveness of PNF combined with Mobilization technique shows the significant effect for online gamers with Text Neck Syndrome with SMS thumb.

Conclusion

The results of the study concluded that PNF combined with Mobilization technique were found to be effective in reducing neck pain, improving cervical ROM and alleviating thumb pain/discomfort associated with Text neck syndrome with SMS thumb.

However, Statistical analysis shows improvement on treatment of PNF combined with Mobilization technique. Hence rejecting the null hypothesis and accepting the alternate hypothesis. Therefore, Alternate hypothesis concluded that "there is a significant improvement in PNF combined with Mobilization technique".

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