

A Comparative Study of Proprioceptive Neuromuscular Facilitation and Conventional Therapy Combined with Ergonomics Advice in Reducing Neck Disability in Patients with Text Neck Syndrome

Nidharsana. K. S.¹, Dr. Sugasri Sureshkumar^{1*} and Dr. R. Parthasarathy¹

¹Meenakshi College of Physiotherapy, Meenakshi Academy of Higher Education and Research, Chennai

*Corresponding Author
Dr. Sugasri
Sureshkumar

Article History

Received: 18.02.2025

Revised: 21.03.2025

Accepted: 05.04.2025

Published: 10.04.2025

Abstract: *Background:* Text neck syndrome is an overuse condition that has become a global problem for all ages who use smartphones and people with computer-based works for years. *AIM:* This study aimed to evaluate the effectiveness of Proprioceptive Neuromuscular Facilitation (PNF) and conventional therapy with ergonomic advice in reducing neck disability in patients with text neck syndrome. *Methods:* Thirty participants with text neck syndrome were allocated randomly to either the experimental or control group. Group A (Experimental group) Each patient in experimental group received PNF program of Contract-Relax technique and Rhythmic stabilization technique for 6 weeks, 3days a week, once a day for 10 repetitions along with ergonomic advice. Group B (control group) Each patient in control group received the conventional physiotherapy program as Full neck range of motion (ROM) exercise, Neck retractions, Upper trapezius & Levator scapulae stretch and Bruegger's pose for 6 weeks, 3 days a week, twice a day for 10 repetitions along with ergonomic advice. Outcome measures as pain and neck disability were assessed at baseline and end of 6 weeks. *Results:* Pain intensity and neck disability scores significantly improved in both groups ($P < .05$). The improvements in pain intensity and disability scores were greater in the experimental group compared with the control group. *Conclusion:* PNF could be used effectively to reduce neck pain and disability level and enhance cervical range of motion and posture in individuals with text neck syndrome.

Keywords: Pain, neck disability, proprioceptive neuromuscular facilitation, text neck syndrome..

INTRODUCTION

"Text neck" is the term used to describe the neck pain and damage caused by looking down at a cell phone, tablet, or other wireless device too often and for too long. According to a recent study, 79% of people between the ages of 18 and 44 carry their cell phones with them almost constantly, spending only two hours of their working day without their phones. The neck, also known as the cervical spine, is a coordinated network of nerves, bones, joints and muscles that are directed by the brain and the spinal cord. Irritation along the nerve pathways can also cause pain in the shoulder, arm, and hand [1]. A repetitive stress injury or overuse syndrome known as "Text neck" occurs when a person's head is hung or curved forward while they are hunched over, staring at their phone or other electronic device for extended periods of time [2].

While flexing the head forward at different degrees, text neck directly affects the spine. The forces on the neck increase to 27 pounds when the head tilts forward at 15 degrees, 40 pounds at 30 degrees, 49 pounds at 45 degrees, and 60 pounds at 60 degrees. The model prediction was unreliable at 90 degrees. If left untreated, text neck can cause serious, irreversible damage and resemble repetitive stress/strain injuries or occupational overuse syndrome [4]. Text neck may cause major, long-term harm if treatment is not received, including the spinal curve flattens and early arthritis onset, text neck can lead to spinal misalignment, Degeneration of the

Spine, Compression of discs, Herniation of the disc, Damage to the nerves, Damage to the muscles, GI issues, Lung volume capacity loss [6,7]. The term "tech neck hump," which is sometimes referred to as "Dowager's hump" or "kyphosis," is a condition in which the upper spine curves excessively, usually at the base of the neck, creating prominence. A common cause of this is posture, such as prolonged period of forward leaning when using electronic gadgets [8]. 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.[9] The PNF is recommended in general guidelines for managing chronic neck pain.[10] 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 neck pain.[11] Ira Fiebert et.al (2020) in the study of "Text neck: An Adverse postural phenomenon" has described multiple aspects of the text neck position that results when an individual uses a prolonged usage of gadgets. There are many more issues to be investigated regarding the effects of short term and long-term gadgets use on pain, cervical, thoracic, scapula and jaw posture and strength, cervical position sense, vision, gait, and more. Future research should examine these during sitting, standing, and movement in both children and adults. Well-designed, high-quality laboratories, epidemiological and

longitudinal studies are needed to strengthen the body of evidence [12] and hence this is the research gap to be addressed.

METHODOLOGY

Participants and sampling

It is an experimental study conducted in Fusion private limited, Chennai. Participants voluntarily participated in this study and written informed consent was obtained from all participants. All subjects were included according to inclusion and exclusion criteria. Young adults (male and female, 25 to 40 years of age), subjects with limited neck range of motion, prolonged use of digital devices (smartphones, gadgets, tablets, computer, gaming), neck pain for at least 3 months, people with desk work minimum for 3 years, working with a computer daily at least 5 hours were included. Subjects with spinal infections or inflammatory disorders, history of structural scoliosis, cervical trauma, tumor, pregnancy, rheumatic disorder affecting the neck, torticollis, observable changes in scapula, surgical history of neck, herniation, diagnosed disc prolapse, stenosis, spondylolisthesis, osteoporosis, history of temporomandibular joint dysfunction, sensory deficit in cervical region, patient under analgesics or physical therapy treatment were excluded. Totally thirty participants who met the inclusion criteria were included. After the initial assessments, participants were randomized into two groups; either experimental group (n=15) or control group (n=15) using a convenience sampling method. After the allocation of groups, Group A (Experimental group) received PNF program of Contract-Relax technique and Rhythmic stabilization technique along with ergonomic advice for 6 weeks, 3 days/week. Group B (control group) received the conventional physiotherapy program as Full neck range of motion (ROM) exercise, Neck retractions, Upper trapezius & Levator scapulae stretch and Bruegger's pose along with ergonomic advice for 6 weeks, 3 days/week.

Interventions

Group A (Experimental group)

Group A (Experimental group) received PNF program of Contract-Relax technique and Rhythmic stabilization technique along with ergonomic advice for 6 weeks, 3 days/week.

Contract-relax technique: [9,10]

The Contract-Relax technique is used to improve range of motion, reduce muscle spasm and alleviate pain in the cervical spine.

Instructions:

- The participant was seated while the PNF contract-relax technique was performed which involves neck extension patterns on both sides.
- The participant's head was lowered, and the physiotherapist gently moved the chin to one

side, stopping at a point when the participant reached a painless position in the range of motion.

- During the extension, rotation, and lateral flexion to the opposite side, the physiotherapist applied resistance for six seconds while keeping one hand on the participant's chin and the other on the top of their head.
- The participant was then given instructions to rest for six seconds, and the therapist put the joint back in its starting position until the new range of motion was achieved.
- The procedure was performed 3 repetitions with breaks of 30 seconds-1 minute between each session according to patient's comfort.
- Duration: 6 weeks, 3days a week, twice a day for 10 repetitions

Rhythmic stabilization technique: [13,30]

The cervical rhythmic stabilization technique is used to improve stability, strength and control in spine.

Instructions:

- The therapist resisted an isometric contraction of cervical extension. The patient is asked to maintain the position of head without trying to move. Held for 5 seconds.
- The resistance was gently applied by the therapist and the patient responds with isometric contractions.
- When the patient was responding fully, the therapist began to change the resistance so that antagonistic motion was restricted.
- The procedure was repeated for 3 repetitions with breaks for 30 seconds to 1 minute according to patient's comfort.

Group B (Control group)

Group B (control group) received the conventional physiotherapy program as Full neck range of motion (ROM) exercise, Neck retractions, Upper trapezius & Levator scapulae stretch and Bruegger's pose along with ergonomic advice for 6 weeks, 3 days/week.

Conventional therapy:

Group B (control group) received the conventional physiotherapy program for 6 weeks, 3 days a week, twice a day for 10 repetitions along with ergonomic advice.

- Full neck range of motion (ROM) exercise
 - Flexion – Extension
 - Lateral flexion
 - Rotations
- Neck retractions
- Upper trapezius & Levator scapulae stretch [12,13]
- Bruegger's pose [14]

ERGONOMIC ADVICE: [15]

Ergonomic advice focuses on individual workspace and posture to minimize strain and discomfort during work. Recommendations are

- Workstation setup (chair, desk, monitor, lighting, breaks)
- Posture (sitting, standing, stretching)

Outcome measure and tools used:

Numerical Pain Rating Scale was used to calculate the severity of neck pain. The NPRS can be administered verbally (therefore also by telephone) or graphically for self-completion. Participants were asked to indicate the numeric value on the

segmented scale that best describes their pain intensity. Neck Disability Index was used to evaluate the level of disability or impairment in individuals with neck pain. NDI is a questionnaire which consists of 10 items was given to the participants. Instructions were given to the participants and asked them to self-report their level of disability for each item.

Statistical Analysis:

Independent t-test is used to compare two different groups and Paired t-test is used to see changes inside the same group.

RESULT

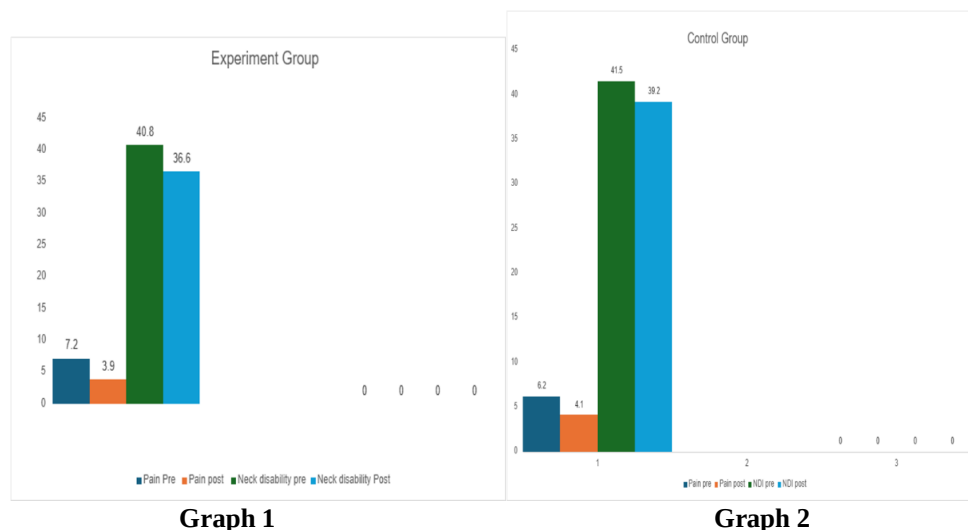
Comparison of pre and post test of Group A (Experimental group)

S. No	Variable	Days	Mean	t-value	Level of significance
1.	Pain	Day 1 Day 56	7.2 3.9	5.68	p<0.05
2.	Neck disability	Day 1 Day 56	40.8 36.6	36.06	p<0.05

Comparison of pre and posttest of Group B (Control group)

S. No	Variable	Days	Mean	t-value	Level of significance
1.	Pain	Day 1 Day 56	6.2 4.1	15.2	p<0.05
2.	Neck disability	Day 1 Day 56	41.5 39.2	39.25	p<0.05

- Group A (Experimental group) showed significant improvement in both pain and neck disability after intervention (p<0.05)
- Group B (Control group) showed slight improvement in both pain and neck disability after intervention. (p<0.05)



Graph 1: Comparison of pain and neck disability before and after intervention in experimental group

Graph 2: Comparison of pain and neck disability before and after intervention in control group

DISCUSSION:

This study reveals that **Proprioceptive Neuromuscular Facilitation (PNF)** and ergonomic advice in *Text Neck Syndrome* patients provide more benefits than

conventional therapy exercises. One of the main objectives of PNF techniques is to restore the functional range of motion, increase flexibility, reduce neck disability, and enhance muscle strength and neuromuscular control.

The theories of **reciprocal inhibition** and **autogenic inhibition** provide an explanation for the decrease in pain and the improvement in cervical extension range of motion. The **Golgi Tendon Organs (GTO)** self-regulatory systems are necessary for autogenic inhibition to preserve structures. With PNF stretching, the antagonist muscle contracts, utilizing this process to reduce muscular tension and enable muscle fiber elongation.

According to the theory of reciprocal inhibition, when one muscle contracts, the opposing muscle relaxes and is thereby suppressed to prevent mutual opposition. This response is triggered when the antagonist muscle contracts, inhibiting the **targeted muscle (TM)**. Because of this inhibition and the decreased contraction of the antagonist muscles, the TM's muscular fibers can elongate further, increasing the stretching force on the TM.

Almost every desktop user gazes at their screens for extended periods, and most smartphone users hold their heads downward to use their mobile devices. This **prolonged poor head posture** causes undue strain on the neck muscles and cervical spine, leading to neck pain [29,30]. **Adaptive muscular shortening** caused by sustained forward head posture also contributes to excessive neck flexion. This loop of chronic bad posture and adaptive muscle fiber shortening continues, exacerbating symptoms.

By lengthening these shortened muscle fibers, PNF stretching techniques help address the excessively forward head position. Correcting bad posture reduces the load on the cervical spine, which in turn lessens neck pain [29,30].

Several studies support the conclusion that **PNF techniques increase functional range of motion and reduce neck disability** among *Text Neck Syndrome* patients. For instance:

- **Meltem Kaya et al. (2023)** concluded that the effect of PNF on individuals with text neck syndrome could be used effectively to reduce neck pain and disability levels, and enhance cervical range of motion, muscle endurance, and posture. The authors further explained that the PNF group showed positive effects on pain intensity due to impaired superior proprioception centers being reactivated. This was achieved by stimulating the **proprioceptive myoreceptors** in muscles and tendons, improving nerve control, regulating muscle tone, and promoting better blood and tissue fluid circulation [19].

- **Cho et al. [36]** employed the hold-relax approach, and **Ito et al. [37]** used the replication method in studies examining how the PNF methodology affected joint position perception. Both studies found considerable improvements.

The **replication approach**, which includes rotational components of joint movements, has been linked to increased activity in the **cerebellum and superior parietal cortex** [38]. Given these findings, the improvement in cervical joint position sense observed with PNF techniques may be due to these rotational aspects.

A study by **Kayla B. Hindle et al. (2012)** on *Proprioceptive Neuromuscular Facilitation: Its Mechanisms & Effects on Range of Motion and Muscular Function* reported that PNF stretching and its contraction techniques (contract-relax and contract-relax-antagonist) are useful for enhancing and preserving ROM and boosting athletic performance, particularly following exercise [39].

Another study by **T. Maicki et al. (2017)** on *PNF and Manual Therapy Treatment Results on Patients with Cervical OA* revealed that the PNF group experienced a higher reduction in pain than the manual therapy group. Both short-term (after two weeks) and long-term (after three months) outcomes favored the PNF approach [40].

By analyzing these studies, it is evident that PNF stretching methods are widely employed to improve rehabilitation and motor function. A novel intervention regimen for treating **Text Neck Syndrome** is presented in this study.

This research aligns with previous comparative studies on **PNF vs. conventional therapy combined with ergonomic advice** in reducing neck disability. The current study demonstrates that the experimental group showed notable improvement after six weeks of PNF intervention. A substantial body of research supports the effectiveness of **PNF techniques** in reducing neck disability in *Text Neck Syndrome* patients.

CONCLUSION:

Taking frequent pauses from using a mobile device, such as every 20 minutes or so, can help avoid or alleviate text neck, which is a repetitive stress injury. To return the neck to its initial neutral position, you should always gaze up. Other options include raising the mobile phones or other electronic gadgets so that they are in line with the eyes and lessen the strain on the neck muscles. By doing posture-focused workouts like yoga and Pilates, which focus on developing proper posture, you can lessen the strain on your shoulders and neck. These activities will raise awareness about how mobile devices are used and ought to be used. Before the issue develops, a few easy lifestyle adjustments can significantly assist in reducing the neck's muscle pain and stiffness. A

person can feel better by making a few easy adjustments to his or her everyday posture and way of life. The strain on the shoulders and neck can be reduced by taking regular pauses.

LIMITATIONS AND RECOMMENDATION:

- 30 samples were used in the study. Hence larger samples can be analyzed with a greater number of samples in the group.
- Age group selected between 25 - 40 hence age group below 25 and above 40 can be selected
- The duration of this study is 6 weeks; further study can be done with longer duration as 8 weeks or more.
- In the present study pain and neck disability are measured, a further study can be done with other outcome measures such as cervical muscle endurance.
- Other scales like Visual Analogue Scale or McGill pain questionnaire can be used to assess pain and Copenhagen Neck Functional Disability Scale can be used to assess neck disability in further study.

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