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Original Research Article

Effectiveness of Upper Thoracic Thrust Manipulation Along with Ergonomic Advice to Reduce Neck Pain and Improve Muscular Strength in School Teachers: A Quasi-Experimental Study

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ABSTRACT

Background: School teachers demonstrate a relatively high prevalence of musculoskeletal disorders, ranging from 40% to 95%. They are particularly at risk of experiencing neck pain due to the nature of their daily tasks. Ergonomics varies by individual based on their needs and physical traits. It includes techniques, body positioning, and tool adjustability to reduce strain. Work ergonomics focuses on the interaction between humans, tasks, tools, and the work environment, ensuring these elements adapt to human physical and mental characteristics. Cervical-thoracic and upper thoracic mobility restrictions have been associated with neck pain. Thrust joint manipulation techniques involve the application of high-velocity low-amplitude forces directed to spinal joints.

Objectives: The aim of this study is to analyze the Effectiveness of Upper Thoracic Thrust Manipulation and Ergonomic advice in reducing pain and improving muscular strength in teachers with neck pain.

Study design: A quasi-experimental study.

Methods: In a 4-week study, 30 teachers were studied, divided into two groups using convenient sampling. Group A (UTTM, Ergonomics, Conventional Exercise program) and Group B (Conventional Exercise Program). Pre and post-data were collected and analyzed by SPSS 29. Paired and unpaired t-tests were used to find out the significance of the treatment.

Results: Significant difference was found in the NDI score, MMT score, and RULA score in both groups, but Group A showed greater improvement in the outcomes.

Conclusion: The study concluded that a UTTM and Ergonomic advice, along with a conventional program, are effective in reducing neck pain and improving muscular strength in school teachers.

KEYWORDS: School teachers, Neck pain, Thrust, Ergonomics, Muscular strength.

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INTRODUCTION

Neck pain is a major problem in modern society. Neck pain is commonly defined as "pain located between the occiput and the third thoracic vertebra [1]. The prevalence of neck pain in the general population has been reported to be 15% for men and 23% for women. Certain groups of workers, due to their

occupational characteristics, are more susceptible to work-related musculoskeletal pain [2]. Teaching is often associated with stress, which impacts both physical and mental well-being and affects professional performance [3].

School teachers, compared to other occupational groups, demonstrate a relatively high prevalence of musculoskeletal disorders, ranging from 40% to 95% [4,5]. They are particularly at risk of experiencing neck pain due to the nature of their daily tasks, which often involve prolonged head-down postures such as preparing lessons, frequent reading, assessing students, and writing on blackboards, often in unfavourable conditions [6,7,8]. While performing such daily tasks repeatedly for a long period of time using abnormal posture, they might develop pain or discomfort around the shoulder/neck [9,10]. With the advancement of technologies, teaching has been transformed into modern methods, including the use of the internet, computers, and projectors. Therefore, prolonged static posture can lead to pain and weakness in the neck. Although various studies have demonstrated a high prevalence of NP in teachers, there are no interventional studies that have demonstrated improvements in pain and associated disabilities in this population [11].

The primary objective of ergonomics is to minimize the risk of on-the-job injuries and enhance productivity, ultimately benefiting the organization [12].

The principles of Ergonomics are: 1) Maintain neutral posture. 2) Work in a power or comfort zone. 3) Allow movement and stretching. 4) Reduce excessive force and motion. 5) Minimize contact stress. 6) Reduce excessive vibration. 7) Provide adequate lightning [13].

Thrust manipulation involves a high-velocity, low-amplitude technique. Before its application, the joint is moved to the limit of its motion to eliminate any slack in the tissue, following which a quick thrust is applied to the restricting tissue. Maintaining a small amplitude of thrust is crucial to prevent damage to unrelated tissues or loss of control over the manoeuvre. The thrust is executed at the end of the pathological limit of the joint, aiming to alter positional relationships, release adhesions, or stimulate joint receptors. The pathological limit refers to the end of the available range of motion when a restriction is present [14,15]. Cervical-thoracic and upper thoracic mobility restrictions have been associated with neck pain.

According to Norlander et al., reduced mobility at the cervical-thoracic junction has been shown to be a risk factor for neck pain [16, 17]. Teachers often adopt a head-down posture while reading, grading, and using computers, which can lead to occupational neck pain. While studies on teacher-specific neck pain are limited, research on other professions highlights the effectiveness of ergonomics in managing such issues. Improving posture and lifestyle habits can also alleviate neck pain and enhance muscle strength. The study aims to investigate the effectiveness of UTTM and Ergonomics in reducing neck pain among school teachers, with the goal of achieving optimal results & greater benefits.

The aim of the study is to analyze the Effectiveness of UTTM and Ergonomic advice in reducing pain and improving muscular strength in teachers with neck pain.

Hypothesis: Null hypothesis [H_0] – There is no significant effect of UTTM, Ergonomics to reduce neck pain and improve muscular strength. Alternative hypothesis [H_1] –There is a significant effect of UTTM, Ergonomics to reduce neck pain and improve muscular strength.

MATERIALS AND METHODS

Research design: A quasi-experimental study.
Sample design: convenient sampling.

Study population: Primary School teachers.

Sample size: 30 Participants. Group A: 15 subjects (UTTM, Ergonomic advice, Conventional Exercise program). Group B: 15subjects (Conventional Exercises). Study setting: Sarvajanik School of Mehsana, Nootan College of Physiotherapy, Orthopaedics department OPD, Visnagar, Gujarat.

Study duration: 1 year

Treatment duration: 4 Weeks

Inclusion Criteria: Both Male and Female gender between 35 and 50 years old with mechanical neck pain in the last 3 months, having an NDI score >=20 and a RULA score >3 [18].

Exclusion Criteria: Neurological defect; Recent Shoulder, Neck, or Arm Injury; history of Cervical or Head Trauma; surgical intervention in the Neck, Upper thoracic area; cervical disc disease with Radiculopathy; Inflammatory or Malignancy; Angina pectoris; Rheumatic disease; Osteoporosis; or Spinal cord tumor, Meningitis, Had evidence of central nervous system involvement [19].

Material required: Data collection Form, Consent Form, Plinth, Pillow, Pen, Paper, Chair, Ultrasound, TENS

Outcome Measures: [1] Neck pain disability index [2] Manual Muscle Testing of sternocleido mastoid muscle, Upper trepazius and Anterior scelene muscle [3] Rapid Upper Limb Assessment.

Sampling procedure: This research was accepted by Ethical Committee of Nootan College of Physiotherapy, Sankalchand University Visnagar, Participants were selected based on inclusion and exclusion criterias. They were divided in 2 groups i.e. Group A and Group B by convenient sampling. Group A was treated with UTTM, Ergonomics and conventional exercise and Group B was given only conventional exercise program.

Data Collection: Participants underwent pre-evaluation which obtained information about demographic details, medical history, personal history, surgical history, pain assessment, muscle strength of the subjects. Pain was assessed by Neck Disability Index (NDI) and Muscle Strength by Oxford Grade.

Intervention:

The treatment protocol consisted of 5 sessions of conventional program/week, ergonomics and 2 sessions/week for thrust manipulation for 2 weeks. Total treatment duration is 4 weeks (4 days/week).

Conventional program includes Stretching of Neck flexors, extensors, sterrnocleiodo mastoid, trapezius, leavator scapulae, Active ROM exercises of neck, isometrics, chin tuck, lateral bending with chin tuck in, neck curl with chin tuck in.

Along with that Theraputic Ultrasoud for 5 min with 1 MHz is also given on Neck Pain Area And Transcutaneous electrical nerve stimulation (TENS) is also given to the patients on continuous mode for the 15 minutes to the painful area of Neck.

Ergonomic advices:

1. Teaching/working with students - Be aware of your posture - good posture maintains the natural curve of your spine. “Do not slouch - stand up straight!”

2. Alternate between sitting and standing when possible. Lean when and where you can on a solid support to reduce fatigue when standing for prolonged periods.

3. **Use a podium or standing height desk** for reading books/documents to class.

4. **Distribute your weight equally on feet**, keep your feet apart to shoulder width [20].

For using writing board:

1. By using longer period of writing on black board can strain over your neck and shoulder musculature. So, to avoid that you should try to write on board by your eye level. If your height is short than use small stool or stepper to maintain eye level.

2. Avoid bending due to writing.

3. The height and the distance of the computer monitor, chair, and desk has a direct impact on neck pain

4. The chair influences the pressure distribution and the curvature of the spine, which may lead to increased pressure through the vertebral bodies, compensation, muscle fatigue and asymmetry.

5. When the arms aren’t supported on the armrests or the desk it provides an excess load on the neck and scapula stabilizers leading to muscle fatigue and strain.

Change your position every 30 minutes to one hour. Shift your weight from one foot to another. Pursed-lip breathing is another technique to help you feel calmer.

Table 1: Treatment for Group A,

WEEK 1	WEEK 2	WEEK 3	WEEK 4
1.Stretching: [10seconds hold for3 repetitions]	1.Stretching: [10 seconds hold for 3 repetitions]	1.Stretching: [10 seconds hold for 3 repetitions]	1.Stretching: [10 seconds hold for 3 repetitions]
2.Active range of motion exercise: [5repetitions each]	2.Active range of motion exercise: [5 repetitions each]	2.Cervical isometrics : [3-5 repetitions each]	2.Cervical isometrics : [3-5 repetitions each]
3.Cervical Isometrics: [3-5 repetitions each]	3.Cervical Isometrics: [3-5 repetitions each]	3.Lateral bending with chin tucked in [5 repetitions each]	3.Lateral bending with chin tucked in [5 repetitions each]
4.Ultasound[5 min]	4.Chin tuck-in : [5 repetitions with 10 seconds hold]	4.Neck curl with chin tuck in [5 repetitions each]	4.Neck curl with chin tuck in [5 repetitions each]
5.TENS[15min,Cont mode]	5.ultrasound[5 min]	5.ultrasound[5 min]	5.ultrasound[5 min]
6.ergonomic advice	6.TENS[15min, Cont mode]	6.TENS[15min, Cont mode]	6.TENS[15min, Cont mode]
	7.Ergonomic advice	7. Ergonomic advice	7. Ergonomic advice
		8. UTTM (2 (2 thrust per week)	8. UTTM (2 thrust per week)

A single HVLA thrust manipulation directed bilaterally to the upper thoracic (T1-2) spine, with the patient supine, will perform. For this technique the patient held her/his arms and forearms across the chest, with the elbows aligned in a superioinferior direction.

The therapist contacted the transverse processes of the lower vertebrae of the target motion segment with the thenar eminence and middle phalanx of the third digit. The upper lever was localized to the target motion segment by adding the secondary levers of rotation away and side bending towards the therapist; and the lower lever, or underside hand, used pronation and radial deviation to achieve rotation toward and side bending away moments, respectively. The space inferior to the xiphoid process and costochondral margin of the therapist was used as the contact point against the patients elbows to deliver a HVLA thrust manipulation in an anterior-to-posterior direction, targeting T1-2 bilaterally [21].

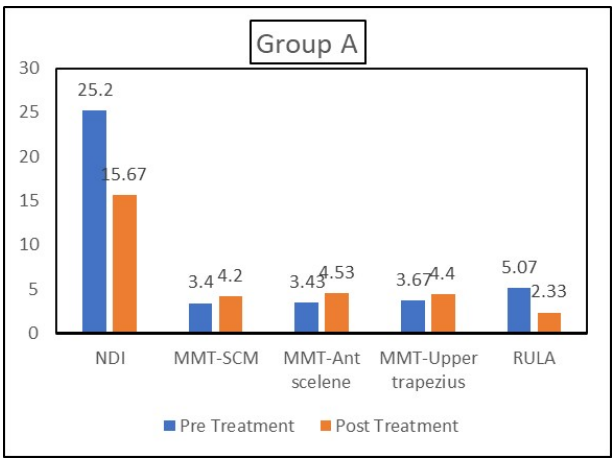
RESULT AND INTERPRETATION

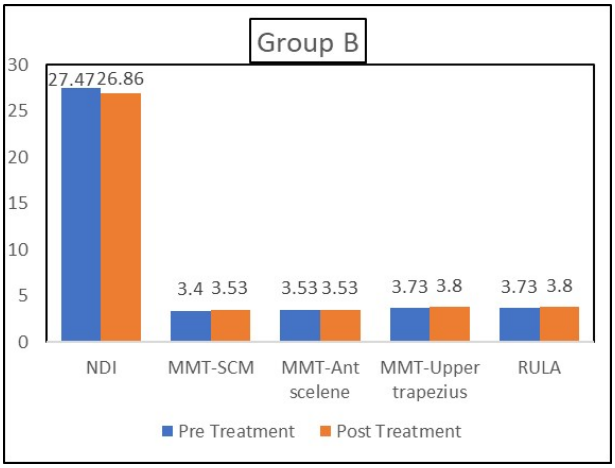
Table 2: Treatment for Group B: Conventional program as Group A.

Activity	Week 1	Week 2	Week 3	Week 4
Stretching	10 seconds hold for 3 repetitions	10 seconds hold for 3 repetitions	10 seconds hold for 3 repetitions	10 seconds hold for 3 repetitions
Active range of motion exercise	5 repetitions each	5 repetitions each		
Cervical Isometrics	3-5 repetitions each	3-5 repetitions each	3-5 repetitions each	3-5 repetitions each
Ultrasound	5 min	5 min	5 min	5 min
TENS	15 min, Cont mode	15 min, Cont mode	15 min, Cont mode	15 min, Cont mode
Ergonomic advice				
Chin tuck-in	5 repetitions with 10 seconds hold			
Lateral bending with chin tucked in			5 repetitions each	5 repetitions each
Neck curl with chin tuck in			5 repetitions each	5 repetitions each
UTTM			2 thrust per week	2 thrust per week

Data were tabulated and participated to statistical analysis using SPSS 29 software and analysed with paired t test and unpaired t test. After the treatment, the result showed a significant reduction in neck pain and improved muscle strength($p<0.05$)

Thus, the results interpret that significant difference was found in the NDI score, MMT score and RULA score in both the groups, but Group A showed greater improvement in the outcomes.





DISCUSSION

Mechanical Neck pain is gradual in onset and is multifactorial in origin, like faulty posture, forward head posture, crossed neck syndrome, anxiety, depression, sporting, and various occupational activities [22].

Patients with chronic neck pain often experience a reduction in neck mobility. Overall, the evidence of the effect of physiotherapy for chronic neck pain is strengthened. Physiotherapy interventions for chronic neck pain showing the strongest support for an effect on pain are strength and endurance training. Regarding manual therapy, thoracic manipulation appears to have an effect on pain, as supported by Lau et al. Within the area of Electrotherapy, Ultrasound therapy and TENS seem to have a beneficial effect on pain reduction [23].

Teachers typically engage in activities that require sustained periods of stooping, bending, and constant trunk flexion. Most studies investigating work-related MSDs among pecial education school teachers have focused on pain in a single specific body region, such as the lower back and its associated factors. Some studies have shown that an elevated arm is significantly associated with neck pain. Elevating the arm above the shoulder during writing on the board was 2.71 times more likely to result in a higher chance of neck pain compared to not elevating the arm above the shoulder. Possible reasons could be that working with raised arms above an unsupported shoulder for an extended period can cause friction, tension, and strain in the cervico-brachial regions [24,25].

By optimizing their workspace and teaching methods to promote better ergonomics, teachers can reduce the risk of such ailments and maintain their long-term health [26]. By implementing ergonomic principles, such as proper seating arrangements, adjustable furniture, and regular breaks to stretch and move around, schools can help teachers maintain their energy levels and prevent burnout [27]. A study by De la Llave-Rincon et al. (2012) reported immediate improvements in cervical range of motion following upper thoracic manipulation in individuals with mechanical neck pain. Upper thoracic thrust manipulation is often used as an adjunct to exercise therapy and other manual techniques in the management of musculoskeletal conditions.

Thrust involves applying a quick, controlled thrust to specific segments of the upper thoracic spine to restore normal joint function, increase range of motion, and reduce pain. A randomized controlled trial by Cleland et al. (2007) found that combining thoracic manipulation with exercise therapy resulted in greater improvements in pain and disability compared to exercise therapy alone in patients with neck pain. This study demonstrates a significant reduction in neck pain and an improvement in muscular strength in outcome measures during the post-treatment stage compared to the pre-treatment stage. Although a significant improvement was observed after treatment in both groups, Group A showed a greater improvement in the NDI Score, MMT Score, and RULA score (p value < 0.05). Thus, the alternative hypothesis is accepted.

Limitations: Long-term follow-up wasn't taken, the study duration was only 4 weeks, and other muscle groups of the neck were not included.

Suggestions and recommendations: A study could be conducted with a longer follow-up and treatment period, and revised to include a larger sample size. Further studies can be conducted using the same intervention procedures to improve shoulder muscle strength and alleviate pain in elderly subjects. Further studies can be taken up with different intervention parameters for improving cervical pain and muscle strength

CONCLUSION

In this study, both groups demonstrated significant improvements in reducing neck pain and enhancing muscular strength. Upper thoracic thrust manipulation and ergonomic advice, along with a conventional program (Group A), demonstrated a significant reduction in neck pain and improvement in muscular strength compared to the conventional program alone (Group B).

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Conflicts of interest: **None**

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