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IMMEDIATE EFFECT OF MUSCLE ENERGY TECHNIQUE IN PATIENTS WITH MECHANICAL NECK PAIN: AN EXPERIMENTAL STUDY

Physiotherapy

Tanvi Devendra Pawar

Dr. Ravindra Karbhari Aher* Head of Department, Musculoskeletal Physiotherapy Motiwala College of Physiotherapy, Maharashtra University of Health Sciences, Nashik, India. *Corresponding Author

ABSTRACT

Background: Neck pain is a prevalent musculoskeletal disorder associated with reduced mobility, functional limitations, and decreased quality of life. Risk factors include any pathological conditions or bad posture. Muscle Energy Technique (MET) is a widely used manual therapy intervention aimed at improving joint mobility and reducing pain. This study was undertaken with aim to study the immediate effect of Muscle energy Technique in patients with neck pain. **Objective:** To evaluate the immediate effect of Muscle Energy Technique on pain intensity, functional disability, and cervical range of motion in patients with acute mechanical neck pain. **Methods:** An experimental study with purposive sampling was conducted over a period of 6 months in the outpatient department of Motiwala College of Physiotherapy and Civil Hospital, Nashik. A total of 60 participants aged 18–45 years diagnosed with acute neck pain were included. Outcome measures included Visual Analogue Scale (VAS), Neck Disability Index (NDI), and cervical Range of Motion (ROM). Statistical analysis was performed using SPSS software. The Wilcoxon signed-rank test was used due to non-normal data distribution. **Results:** Significant improvements were observed in all outcome measures. Mean VAS scores decreased from 6.15 ± 1.69 to 4.07 ± 1.53, while NDI scores improved from 15.92 ± 6.79 to 10.70 ± 5.48 ($p < 0.001$). Cervical ROM showed statistically significant improvements across all planes ($p < 0.001$), with median gains ranging from 10° to 17°. **Conclusions:** Muscle Energy Technique demonstrates an immediate, statistically significant effect in reducing pain, improving cervical mobility, and decreasing disability in patients with mechanical neck pain. It can be effectively incorporated into early-phase physiotherapy rehabilitation programs.

KEYWORDS

Muscle Energy Technique, Neck Pain, Visual Analogue Scale, Neck Disability Index, Cervical Range of Motion, Physiotherapy.

INTRODUCTION

Neck pain is one of the most common musculoskeletal problems affecting individuals across different age groups. It is associated with reduced cervical mobility, functional limitations, and decreased quality of life. Muscle energy technique (MET) is a manual therapy technique commonly used in physiotherapy practice to improve joint mobility, reduce pain, and restore functional movement patterns.

Point prevalence ranges from 6% to 22% and up to 38% of the elderly population, while lifetime prevalence ranges from 14, 2% to 71% (Fejer et al. 2006). For most of the neck disorders there is an absence of an identifiable underlying disease or abnormal anatomical structure. The natural course of NS-NP remains unclear. The area of the body between the mandible and the collarbone is called the neck. Anteriorly, the neck's midline between the chin and the sternal notch. Laterally, the sternocleidomastoid muscle's anterior border. Superiorly, the inferior margin of the mandible.[1]

According to the research that is currently available, the projected 1-year incidence of neck pain ranges from 10.4% to 21.3%, with office and computer workers experiencing a greater prevalence. Relapses are frequent because most cases of neck pain follow an episodic course across a person's lifetime, despite some studies showing that between 33% and 65% of persons had healed from an episode at one year.

In general, the prevalence is higher among women, higher in high-income nations than in low- and middle-income nations, and higher in urban regions than in rural ones. The start and progression of neck discomfort is influenced by numerous environmental and personal variables. According to most research, women are more likely than males to experience neck pain, and their chance of doing so increases until they are between the ages of 35 and 49, at which point it starts to decrease.[2]

Neck pain is one of the most common and painful musculoskeletal substantial medical consumption and result in prolonged sick leave and disability.[3] Poor neck posture is defined as a forward head posture, which is a combination of lower cervical flexion and upper cervical extension. The two main muscles that contribute to forward head posture are the levator scapulae and upper trapezius.[4] Both muscles when shortened result in trigger points, pain, soreness, and decreased cervical joint range of motion.[5,6] Classification system that categorizes neck pain into four grades:

- Grade I and II: Non-specific neck pain with varying levels of interference in daily activities.
- Grade III: Cervical radiculopathy, characterized by objective neurological signs such as reduced reflexes, muscle weakness, or sensory deficits.
- Grade IV: Neck pain due to major pathology, considered specific neck pain.[7]

Various physiotherapy treatment techniques are used to treat acute neck pain like electrotherapy modalities, isometrics and strengthening exercise, manual therapy techniques, muscle energy technique, stretching, soft tissue mobilization, etc.

Muscle Energy Technique (MET) is an active manual process, MET are a form of soft tissue or joint manipulation or mobilization derived from osteopathic medicine and employed in a treatment of musculoskeletal dysfunction.[8] The simplest form of MET is the precise placement of a bodily part, followed by an isometric (and occasionally isotonic) contraction. In acute situations or joint treatment, this repositioning may need some stretching or may take advantage of a decrease in resistance to movement after the contraction, enabling movement to a new barrier without straining.[8] MET regimen may be effective in training deep cervical muscle to decrease neck pain.[9] MET appears to be effective in the treatment of neck pain in both the acute and chronic phases.[10] MET effective in alleviating the mechanical neck pain in terms of decreasing pain intensity and increasing active cervical range of motion.[11]

Anatomy

Muscle of cervical region are posterior muscles are superficial to deep the trapezius is superficial, levator scapula is deep to trapezius; splenius capitis, cervicis these are prime mover of head and neck they produce extension of head and neck; semispinalis capitis, cervicis are deeper to splenius they give optical alignment to cervical spine. Longissimus capitis, cervices are lateral to semispinalis they produce ipsilateral lateral flexion; scalene are located to lateral aspect of cervical spine act as frontal plane stabilizer, posterior scalene laterally flex the neck, anterior muscle contains longus capitis it work with trapezius to stabilize head and neck. Cervical muscle work synergistically to produce lateral flexion, flexion and extension of neck.[12]

Muscles of the Neck.

1. The Platysma

Originating from the fascia across the pectoralis and deltoid below the collarbone, the platysma is a thin muscle that resembles a sheet. It inserts superiorly at the angle of the mouth, orbicularis, and base of the jaw. The blood supply is made up of a minor pedicle, which branches off the suprascapular artery, and a dominant pedicle, which branches off of the submental artery. The cervical branch of the facial nerve innervates the platysma. Its purpose is to descend the lower lip and bring the corners of the mouth inferiorly.[1]

2. The Sternocleidomastoid

The medial part of the sternal manubrium and the sternocleidomastoid muscle are the origins of the clavicle and join the superior nuchal line and temporal bone's mastoid process. The superior thyroid artery and occipital artery supply it. Its functions include extending the head, rotating the head, and flexing the neck (when both sides are engaged). Additionally, it is an inspiration accessory muscle. The accessory nerve supplies the muscle's motor component, whereas the cervical plexus provides sensory innervation.[1]

3. The Trapezius

The occipital protuberance and medial superior nuchal line are the origins of the big muscle known as the trapezius, which attaches at the lateral third of the C7-T12 spinous processes, clavicle, and acromion process. It serves to rotate, compress, and retract the scapulae in addition to shrugging the shoulders (raising the scapulae). It plays a key role in maintaining posture and uses a variety of muscle groups to enable varied scapular movements (such as those with the serratus and rhomboids) and throwing (with the deltoid). The cervical spinal nerves C3 and C4 supply minor motor and sensory components, whereas the spinal accessory nerve (cranial nerve XI) supplies the primary motor component. The main artery supplying the trapezius is the superficial branch of the transverse cervical artery, or the superficial cervical artery, and in 20% the subclavian artery.[1]

4. The muscles that raise the hyoid are called suprahyoid muscles.

Digastric, Mylohyoid, and Geniohyoid are among them.

5. The hyoid is depressed by the infrahyoid muscles.

Sternohyoid, Sternothyroid, Thyrohyoid, and Omohyoid are among them.[1]

Biomechanics

Cervical spine is designed for large amount of mobility, the motion occurring are flexion, extension, lateral flexion and rotation. In flexion occipital condyle roll forward and slide backward, in extension occipital condyle roll backward and slide forward, rotation and lateral flexion are coupled motion these motions are also combination of vertebral tilt and slide.

In kinetics, cervical region subjected to axial compression, tension, bending, torsion and shear stresses. The cervical spine is lordotic and therefore experiences ant shear forces even in the ideal upright position.[12] The complex interactions between the bones, joints, ligaments, and muscles that permit head movement, preserve posture, and safeguard the spinal cord are all part of the cervical spine's biomechanics. The cervical spine is structurally separated into two regions: the lower cervical area (C3–C7) and the upper cervical region (C0–C2). The atlantoaxial joint (C1–C2) allows axial rotation, which makes up over half of the neck's rotational capacity, while the atlanto-occipital joint (C0–C1) allows flexion and extension, enabling the head to nod. Because of the orientation of the facet joints, the lower cervical vertebrae aid in flexion, extension, lateral bending, and rotation. These motions frequently take place in linked patterns, such as lateral flexion followed by ipsilateral rotation.[12] A network of ligaments, including the anterior and posterior longitudinal ligaments throughout and the alar and transverse ligaments in the upper cervical spine, maintain stability. The head is supported and moved by the coordination of bigger superficial muscles. The facet joints direct and limit movement to avoid instability, whereas the intervertebral discs between C3 and C7 absorb shock and permit segmental motion. The biomechanics of the cervical spine as a whole exhibit a harmony between stability and fluidity, permitting a great range of motion while protecting neural structures.[12]

Pathophysiology

Cervical Spondylosis, the most prevalent progressive condition affecting the aging cervical spine is cervical spondylosis. It results from the process of degeneration of the intervertebral discs and facet joints of the cervical spine. Biomechanically, the disc and the facets are the connecting structures between the vertebrae for the transmission of external forces. They also facilitate cervical spine mobility. Symptoms related to myelopathy and radiculopathy are caused by the formation of osteophytes, which compromise the diameter of the spinal canal.[13] Cervical Radiculopathy, The most frequent causes of nerve root compression are facet joint spondylosis and intervertebral disc herniation. Radiculopathy's clinical manifestations include arm pain or paresthesia in the afflicted nerve's dermatomal distribution, which may or may not be linked to motor weakness and neck pain.[14] Cervical Disc Herniation, Natural history of disc herniation: loss of disc height, degenerative changes in the index level nucleus, and a change in spinal biomechanics that may result in adjacent segment degeneration are caused by the extrusion of large amounts of healthy nucleus pulposus tissue through a ruptured annulus. A relatively healthy nucleus tissue protruding through a mechanically damaged or degenerative annulus—more precisely, the annulus-endplate interface—causes a disc herniation.[15] Muscle Imbalance should be regarded as one of the main factors that negatively affects a joint's biomechanics and leads to the decline of joint function. When certain muscles become weak and inhibited while others become tight, lose their extensibility, and become overactive, this is referred to as muscle imbalance. The main issue with tight muscle is not so much the shortening of the contractile muscle fibers as it is the changed elastic characteristics of the connective tissue in the myofascial unit and the decreased tight muscle threshold for irritability.[16]

Anatomy of Cervical Spine and Neck Muscles

1. The cervical spine consists of seven vertebrae divided into two functional regions:
- Upper cervical spine (craniovertebral region): Occipital condyles, atlas (C1), axis (C2)
- Lower cervical spine (sub axial region): C3 to C7 vertebrae Vertebrae C3 to C6 are considered typical cervical vertebrae due to similar structural characteristics, while atlas and axis are atypical vertebrae because of their unique morphology.

2. Posterior cervical muscles from superficial to deep include:
- Trapezius (superficial)
- Levator scapulae (deep to trapezius)
- Splenius capitis and splenius cervicis

(primary extensors)
- Semispinalis capitis and cervicis (postural alignment)
- Longissimus capitis and cervicis

(ipsilateral lateral flexion)
- Scalene muscles act as frontal plane stabilizers and assist in lateral flexion. Deep cervical muscles such as longus capitis work with trapezius to stabilize the head and neck. Cervical muscles act synergistically to produce flexion, extension, and lateral flexion movements.

Important neck muscles include:

2.1 Platysma

The platysma originates from fascia covering the pectoralis and deltoid muscles and inserts into the mandible and lower facial structures. It depresses the lower lip and mouth corners and is innervated by the cervical branch of the facial nerve.

2.2 Sternocleidomastoid

The sternocleidomastoid originates from the sternum and clavicle and inserts into the mastoid process. It assists in neck flexion, head rotation, extension, and acts as an accessory inspiratory muscle.

2.3 Trapezius

The trapezius originates from the occipital protuberance and spinous processes of C7– T12 and inserts into the clavicle and scapula. It elevates, retracts, rotates, and stabilizes the scapula and contributes to posture maintenance.

2.4 Suprahyoid muscles these include:
- Digastric
- Mylohyoid
- Geniohyoid They elevate the hyoid bone.

2.5 Infrahyoid muscles these include:
- Sternohyoid
- Sternothyroid
- Thyrohyoid
- Omohyoid

They depress the hyoid bone.

3. Biomechanics of cervical spine The cervical spine allows large mobility including:
- Flexion
- Extension
- Lateral flexion
- Rotation

During flexion, the occipital condyles roll forward and slide backward. During extension, they roll backward and slide forward. Rotation and lateral flexion occur as coupled motions.

The cervical spine experiences several forces including:

- Axial compression
- Tension
- Bending
- Torsion
- Shear stress

The atlanto-occipital joint allows flexion and extension, while the atlanto-axial joint provides over half of cervical rotation. Lower cervical vertebrae assist in flexion, extension, lateral bending, and rotation. Ligaments contributing to cervical stability include:

- Anterior longitudinal ligament
- Posterior longitudinal ligament
- Alar ligament
- Transverse ligament

4. Muscle imbalance

Muscle imbalance significantly affects joint biomechanics and function. It occurs when some muscles become weak while others become tight and overactive. Tight muscles may initially appear stronger but excessive tightness reduces their functional strength and increases irritability thresholds within myofascial tissues. The present study focuses on evaluating the immediate impact of muscle energy technique in patients with neck pain using validated outcome measures including Visual Analogue Scale (VAS), Neck Disability Index (NDI), and cervical range of motion (ROM).

MATERIALS AND METHODS

1. Study Design

An experimental pre–post intervention study design was used.

2. Study setting

The study was conducted at:Motiwala College of Physiotherapy Civil Hospital, Nashik, Maharashtra, India

3. Participants

In the present study 60 patients diagnosed with acute neck pain with age group 18–45 years and there were 36 females and 24 males.

4. Inclusion Criteria

Age group: 18–45 years
Acute mechanical neck pain
Willingness to participate

5. Exclusion Criteria

Cervical radiculopathy
Recent trauma or surgery
Neurological deficits

6. Outcome Measures

The study's methodology guarantees reliability and therapeutic relevance by utilizing validated outcome measures like;

- Pain: Visual Analogue Scale (VAS)
- Functional Disability: Neck Disability
- Index (NDI)
- Cervical Range of Motion (ROM): Flexion, extension, lateral flexion, rotation

7. Intervention

Muscle Energy Technique was applied targeting:

- Upper trapezius
- Levator scapulae

8. Statistical Analysis

Data analyzed using SPSS software
Shapiro–Wilk test used for normality Non-parametric Wilcoxon signed-rank test applied.

Significance level set at $p < 0.05$. Statistical analyses were performed on complete pre–post pairs (n=60) in SPSS. For each endpoint a change score (Δ) was defined so that positive values indicate improvement:
ΔVAS and ΔNDI = PRE − POST; ΔROM = POST − PRE. Distributional assumptions were assessed with the Shapiro–Wilk test applied to Δ; all outcomes showed non-normality ($p \leq .008$). Consequently, paired comparisons used the Wilcoxon signed-rank test (twotailed, $\alpha=0.05$) and effect magnitudes were expressed as the Hodges– Lehmann (HL) median difference with 95% confidence intervals.

RESULTS

Demographic Data

- Total participants: 60
- Mean age: 34 ± 9.2 years
- Females: 60% (n=36)
- Males: 40% (n=24)

Pain and Disability Outcomes

- VAS reduced from 6.15 to 4.07 ($p < 0.001$)
- NDI reduced from 15.92 to 10.70 ($p < 0.001$)
- Cervical Range of Motion

Significant improvements observed in all movements:

Movement	Pre	Post
Flexion	48.88 °	61.58° ↑
Extension	52.02°	64.90° ↑
Rt. Lat Flexion	47.95°	62.88°↑
Lt. Lat Flexion	50.03°	64.95°↑
Rt. Rotation	64.73°	79.03°↑
Lt. Rotation	70.25°	84.50°↑

All improvements were statistically significant ($p < 0.001$).
Effect Size
VAS ≈ 1 (large effect)
NDI ≈ 1 (large effect)
ROM ≈ very large effect

DISCUSSION

The present study demonstrates that Muscle Energy Technique has an immediate beneficial effect on patients with mechanical neck pain. Significant reductions in pain and disability, along with improvements in cervical ROM, were observed following a single session of MET.

These findings are consistent with previous studies that highlight the effectiveness of MET in reducing neuromuscular tightness and improving joint mobility. The mechanism of action includes post-isometric relaxation, which reduces muscle tone, and reciprocal inhibition, which enhances muscle extensibility.

Unlike passive treatments, MET involves active patient participation, improving proprioception and neuromuscular control. This is particularly beneficial in individuals with forward head posture, where muscle imbalance is a key contributing
factor.1,5,8,17,18,21,23

CONCLUSIONS

The present study provides strong evidence that Muscle Energy Technique (MET) is a safe, non-invasive, and effective manual therapy intervention for the immediate management of mechanical neck pain in individuals aged 18–45 years. The application of MET targeting key muscles such as the levator scapulae and upper trapezius resulted in significant reduction in pain intensity, improvement in cervical range of motion, and decrease in functional disability, as demonstrated through validated outcome measures including the Visual Analogue Scale (VAS) and Neck Disability Index (NDI). The observed improvements may be attributed to neuromuscular mechanisms such as postisometric relaxation and reciprocal inhibition, which facilitate muscle lengthening, joint mobility restoration, and early symptom relief. In addition, the active participation required during MET contributes to improved proprioceptive feedback and postural correction, particularly in individuals presenting with forward head posture associated with mechanical neck dysfunction. Overall, the findings support the clinical usefulness of Muscle Energy Technique as an effective component of early-phase rehabilitation programs and encourage its integration into multimodal physiotherapy management strategies for acute mechanical neck pain. Further research is recommended to evaluate the long-term effectiveness of MET and to investigate its outcomes across different occupational groups and functional demands.

Limitations

- Subjective pain measurement (VAS)
- No long-term follow-up
- Lack of occupational classification
- Absence of objective tools like EMG

Future Recommendations

- Conduct randomized controlled trials with long-term follow-up
- Compare MET with other techniques (Mulligan, taping, exercises)
- Use objective tools (EMG, imaging) Study different populations (occupational groups, chronic cases)

Conflict of Interest

- None declared.
- Funding
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