

# Comparative study between the effect of passive stretching exercises and post isometric relaxation technique in chronic mechanical neck pain patients

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## **Abstract**

*Aim of the study: Mechanical neck pain is a type of pain that affects the entire neck or shoulder area, that is characterized by mechanical symptoms such as symptoms triggered by maintained neck postures, neck movements, or palpation of the cervical muscles. Around two-thirds of people in their forties and fifties suffer from neck pain. Stretching exercises have many advantages, including enhanced muscle performance and endurance, injury prevention, improved muscle or athletic performance, healing promotion, and a reduced onset of muscle soreness. The hyperactive muscle relaxes well after using the post isometric relaxation procedure. We aimed to compare between the efficacy of passive stretching exercises and post isometric relaxation technique on neck pain severity and functional disability as well as neck sagittal, coronal and transverse mobility in treatment of patients with chronic mechanical neck pain.*

*Methods: Forty male and female patients diagnosed as chronic mechanical neck pain, whose age ranged between 20 to 40 years with duration of illness ranged between 3 and 24 months participated in this study. They were randomly distributed into two equal experimental groups. The first group received passive stretching exercises for upper fibers of trapezius, levator scapulae and sternocleidomastoid muscles and the second group received post isometric relaxation technique for upper fibers of trapezius, levator scapulae and sternocleidomastoid muscles. In addition to that both groups received infrared radiation before each treatment session for warming up. All patients were treated for 12 sessions (3sessions/week) every other day for four weeks.*

*Results: Both groups had significant improvement in all measured variables. Post isometric relaxation technique was significantly more effective than passive stretching exercises in*

*reduction of neck pain severity and functional disability as well as improving neck coronal mobility. However, there was no significant difference between both groups in improving neck sagittal and transverse mobility.*

*Key words: mechanical neck pain, passive stretching, post isometric relaxation, muscle energy technique.*

## **Introduction**

Neck pain is a pathological disorder linked to a rise in impairment in the general population [1]. Neck pain is a leading cause of injury, and neck pain dysfunction is becoming more common in clinical practice [2]. Neck pain was identified by Guzman et al. (2009) [3] as symptoms originating in the anatomical region of the neck and radiating to the head, trunk, and upper limbs. When mechanical neck pain lasts for more than 12 weeks, it is considered chronic [4].

According to Blanpied et al. (2017) [5] 30 percent of patients with neck pain experience chronic symptoms, with neck pain lasting longer than 6 months affecting 14 percent of all people who have a neck pain episode. They also found that 37% of people with neck pain had experienced it for at least a year. The majority of people who suffer from chronic neck pain are middle-aged women.

Patient education and physical activities are common treatments for mechanical neck pain. Cervical collars, manipulation, mobilization, and exercise therapy are only a few of the non-invasive methods available for treating neck pain [6].

Stretching exercises are one of the manual physical therapy methods that can be used in the treatment of mechanical neck pain. Stretching exercises require the use of manual or mechanical force to lengthen structures that are tight and lack mobility [7]. Stretching is a useful rehabilitation and exercise preparation method for increasing joint range of motion. There has been a lot of studies done on the effects of different stretching programs, and it has been shown that these exercises are clinically successful in modifying flexibility [8].

Muscle energy technique is a form of soft tissue manipulation that uses patient-initiated, precisely guided and regulated isometric and/or isotonic contractions to enhance musculoskeletal function and pain. One form of muscle energy technique is the post isometric relaxation technique. Within manual therapy classes, it is widely held that isometric contraction and relaxation of a long muscle under stretch improves the stretch [9].

Few studies [10-13] compared the effects of stretching exercises and post isometric relaxation techniques in the treatment of neck pain. Because of the scarcity of research comparing the two methods in the treatment of mechanical neck pain and the discrepancy between their results, the current study was conducted to determine which method is superior to the other in the treatment of patients with chronic mechanical neck pain.

## **Patients and methods**

This study was carried out in the outpatient clinic, faculty of physical therapy, Delta university for science and technology, Egypt. The clinical work of this study started on the 1st of April

2019 and ended at the end of July 2019. Forty male and female patients diagnosed as chronic mechanical neck pain whose age ranged between 20 to 40 years with duration of illness ranged between 3 and 24 months participated in this study. All patients were referred by an orthopedic surgeon who was assigned to the study and responsible for the diagnosis based on the clinical and radiological examinations. Patients were randomly distributed through simple randomization using closed envelopes into two equal experimental groups. The first experimental group consisted of 20 patients (7 males and 13 females), their mean age was 26.40 ( $\pm 3.62$ ) years and mean duration of illness was 4.95 ( $\pm 2.09$ ) months. The second experimental group consisted of 20 patients (6 males and 14 females), their mean age was 26.40 ( $\pm 3.25$ ) years and mean duration of illness was 5.45 ( $\pm 2.60$ ) months.

Each patient was assessed pretreatment within 24 to 48 hours before the first treatment session and posttreatment within 24 to 48 hours after the 12th treatment session by measuring neck pain severity, neck functional disability and neck motions in the sagittal, coronal and transverse planes.

The visual analogue scale was used to estimate the intensity of neck pain, based on the work of Gundersen et al. (2004) [14] and Suri et al. (2011) [15]. Pain was expressed by a 10-centimeter horizontal line, with 0 denoting no pain and 10 denoting the most serious pain. The patient was asked to choose a point on the scale that better described the magnitude of his neck pain.

The neck disability index, based on work of Vernon (2008) [16], was used to determine functional disability in the neck. It's a ten-item (section) survey that assesses the patient's self-reported neck pain-related impairment. Each section was scored on a scale of 0 to 5 (no disability) and a total score of 50 was determined. The patient was informed to answer each section and mark only one box in each section that best described his condition; if he felt two or more statements in any one section applied to him, he was told to mark the box that best described his problem. In this study, the Arabic version of this index was used [16].

Neck motions in the sagittal, coronal and transverse planes were assessed by using single bubble inclinometer. Its model was Baseline Bubble Inclinometer made by Fabrication Enterprises Inc., White Plains, New York, USA. Measurement was based on the work of Piva et al. (2006) [17] by placing the inclinometer on a specific point for each plane and then asking the patient to make the movement that will be measured. Prior to each single measurement, the inclinometer was recalibrated by setting it to zero.

Patients in the first group received infrared radiation as source of heat in the supine lying position for 15 minutes/session for warming up. The infrared lamp was positioned at a perpendicular distance that ranged between (50-75) cm from the neck and both shoulders according to the patient comfort. In addition to infrared radiation, the patients of this group received passive stretching exercises for upper fibers of trapezius, levator scapulae and sternocleidomastoid muscles according to the work of Ylinen (2008) [18] and Kisner et al. (2017) [19]. Stretching was held for 30 seconds followed by 30 seconds of relaxation. Each stretching exercise was applied for 4 repetitions on each side.

Patients in the second group also received infrared radiation as source of heat in the supine lying position for 15 minutes/session for warming up. The infrared lamp was positioned at a perpendicular distance that ranged between (50-75) cm from the neck and both shoulders according to the patient comfort. In addition to infrared radiation, the patients of this group received post isometric relaxation technique for upper fibers of trapezius, levator scapulae and sternocleidomastoid muscles. The post isometric relaxation technique was applied according to the work of Chaitow (2013) [9], in which the contraction was 20% of maximal isometric contraction. The patient was instructed to make maximum isometric contraction against the dynamometer and then 20% was determined. The contraction was sustained for 7 seconds followed by 7 seconds of relaxation then passive stretching was held beyond resistance barrier and was sustained for 30 seconds followed by 30 seconds of relaxation. Post isometric relaxation technique was applied for 3 repetitions one each side for each muscle.

**Results**

Pre-treatment comparison for the demographic data (age and duration of illness) of both groups was done by using unpaired t-test showed that there was no significant difference between groups (P > 0.05). Pre-treatment comparison between groups for neck pain severity, functional disability and neck sagittal, coronal and transverse mobility was done by using unpaired t-test showed also that there was no significant difference between groups (P > 0.05).

Post-treatment within groups difference: Paired t-test showed that there was significant difference between the pretreatment means and the post-treatment means of neck pain severity, functional disability and neck sagittal, coronal and transverse mobility in the both groups as shown in table (1) and table (2).

**Table 1: Within the first group (passive stretching exercises group) difference**

Variables	Pre-treatment Mean (±SD)	Post-treatment Mean (±SD)	t-value	P-value
Pain severity	5.13 (±1.40)	2.59 (±1.45)	27.82	0.001
Functional disability	17.75 (±6.39)	9.00 (±5.29)	17.25	0.001
Sagittal mobility	91.25° (±8.56)°	106.75° (±11.39)°	16.27	0.001
Coronal mobility	63.25° (±7.99)°	74.75° (±8.66)°	21.88	0.001
Transverse mobility	120.00° (±9.87)°	132.25° (±10.45)°	18.12	0.001

**Table 2: Within the first group (post isometric relaxation technique group) difference**

Variables	Pre-treatment Mean (±SD)	Post-treatment Mean (±SD)	t-value	P-value
Pain severity	5.17 (±1.07)	1.00 (±1.17)	24.79	0.001
Functional disability	17.55 (±4.16)	3.75 (±3.48)	24.43	0.001
Sagittal mobility	92.75° (±5.95)°	112.75° (±15.43)°	7.96	0.001
Coronal mobility	63.25° (±5.68)°	83.00° (±9.23)°	15.41	0.001
Transverse mobility	114.25° (±12.59)°	139.00° (±16.27)°	17.93	0.001

Post-treatment between groups difference: Unpaired t-test showed that there was significant difference between the post-treatment means of neck pain severity, functional disability and neck coronal mobility in favor of the second group (post isometric relaxation technique group). However, there was no significant difference between post-treatment means of neck sagittal and transverse mobility as shown in table (3).

**Table 3: Post-treatment between groups difference**

Variables	Passive stretching exercises group Mean ( $\pm$ SD)	Post isometric relaxation technique group Mean ( $\pm$ SD)	t-value	P-value
Pain severity	2.59 ( $\pm$ 1.45)	1.00 ( $\pm$ 1.17)	3.801	0.001**
Functional disability	9.00 ( $\pm$ 5.29)	3.75 ( $\pm$ 3.48)	3.708	0.001**
Sagittal mobility	106.75 ( $\pm$ 11.39)	112.75 ( $\pm$ 15.43)	1.399	0.170
Coronal mobility	74.75 ( $\pm$ 8.66)	83.00 ( $\pm$ 9.23)	2.915	0.006**
Transverse mobility	132.25 ( $\pm$ 10.45)	139.00 ( $\pm$ 16.27)	1.561	0.127

\*\*Significant difference

## Discussion

Our results revealed that post isometric relaxation technique was more effective than passive stretching exercises in reduction of neck pain severity and functional disability and increase in neck coronal mobility. However, both treatments were equally effective in increasing neck sagittal and transverse mobility.

Our findings regarding reduction of neck pain severity and functional disability are consistent with those reported by Haritha et al. [12], Phadke et al. [13] and Osama & Rehman [20]. All these studies [12,13,20] reported that post isometric relaxation technique was more effective than passive stretching exercises in reduction of neck pain severity and functional disability in the treatment of mechanical neck pain.

According to Frontera (2003) [21], the reduction in pain intensity following static stretching is due to inhibition of the golgi tendon organ, which results in a decrease in motor neuronal discharges, inducing relaxation of the musculo-tendinous unit by regaining its resting duration and pancinian corpuscle adjustment. These reflexes allow for musculotendinous unit stress to be reduced and pain perception to be reduced. Because post isometric relaxation technique includes central and peripheral modulatory processes, such as stimulation of muscle and joint mechanoreceptors that include centrally regulated pathways, such as the periaqueductal grey in the midbrain, or non opioid serotonergic and noradrenergic descending inhibitory pathways, it was believed that the post isometric relaxation technique decreases neck pain intensity [22].

We attribute that post isometric relaxation technique showed more significant reduction in neck pain severity to that passive stretching exercises do not include isometric contraction of the muscle as in post isometric relaxation technique and according to Zakaria et al. (2018) [23], when isometric contraction and stretching the muscle are performed together, the

mechanoreceptors in the muscles and proprioceptors in joints are stimulated and this stimulation reduces pain sensations, allowing for greater ease and tolerance in stretching.

Phadke et al. (2016) [13] reported that the decrease in functional disability could be due to the fact that the neck disability index, which assesses neck functional disability, evaluates various aspects of neck pain, including pain severity and everyday activities, implying that an increase in the score could be due to a decrease in pain. We also attribute this finding to pain relief and enhanced muscle endurance in both groups, which resulted in improved neck range of motion and, as a result, a decline in neck functional disability.

On the contrary to our results, Shenouda [10], Mahajan et al. [11] and Gillani et al. [24] found no significant difference between passive stretching exercises and post isometric relaxation technique in reduction of neck pain severity and functional disability in treatment of patients with mechanical neck pain.

Our findings that post isometric relaxation technique was more effective than passive stretching exercises in improvement of neck coronal mobility was in agreement with the findings of Haritha et al. [12], Phadke et al. [13] and Osama & Rehman, [20]. While our results that there was no significant difference between both treatments in improvement of neck sagittal and transverse mobility is in agreement with the findings of Mahajan et al. [10] and Gillani et al. [24].

We attribute our results as post isometric relaxation technique showed more significant improvement than passive stretching exercises in improvement of neck coronal mobility because of the selected muscles in our study (upper fibers of trapezius, levator scapula and sternocleidomastoid) are synergists in side-bending. These muscles were affected dramatically and physiologically by the post isometric relaxation technique and showed more increase in the extensibility of muscle fibers.

The physiological mechanisms underlying changes in muscle extensibility - reflex relaxation, viscoelastic adjustment, and changes in stretch tolerance - can be used to explain the effects of the post isometric relaxation technique component for increased range of motion post intervention. The stimulation of the golgi tendon organs and their inhibitory effect on the alpha-motor neuron pool is thought to induce reflex muscle relaxation after contraction. Because the greater forces could produce increased viscoelastic change and passive extensibility, the combination of contractions and stretches used in the post isometric relaxation technique may be more efficient for producing viscoelastic change than passive stretching alone [9].

Post isometric relaxation technique increases muscle length by reducing both active and passive stress in the targeted muscle, making it superior to passive stretching exercises. The post isometric relaxation technique inhibits the muscle through agonist (autogenic inhibition) pre-contraction, resulting in the activation of the golgi tendon organ, lowering active tension and reducing passive tension by stretching the targeted muscle after the contraction [9].

## **Conclusion**

The use of passive stretching exercises or post isometric relaxation technique is a safe and effective method for treatment of chronic mechanical neck pain patients between the ages of 20-

40 years. Either type of treatment can possibly be used to reduce neck pain severity and functional disability as well as to increase neck sagittal, coronal and transverse mobility. However, the post isometric relaxation technique is more effective than the passive stretching exercises for reduction of neck pain severity and functional disability as well as in increasing neck coronal mobility.

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