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EFFECTIVENESS OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON CERVICOGENIC HEADACHE

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ABSTRACT

Background: Cervicogenic headache (CGH) is a secondary headache that originates from dysfunction or pathology in the cervical spine and its associated bony, disc, or soft tissue structures, particularly the upper cervical segments (C1-C3). Investigation into PNF for cervicogenic headache management has demonstrated diverse outcomes concerning pain relief, cervical mobility assessed the flexion-rotation test, and functional improvement.

Objective: To study the Effectiveness of Proprioceptive Neuromuscular Facilitation (PNF) on cervicogenic headache.

Method: In this experimental study, 40 participants diagnosed with cervicogenic headache received PNF treatment over a 4 week duration, with treatment sessions conducted three times weekly. The outcomes assessed were pain intensity using verbal analog scale, cervical mobility via the cervical flexion-rotation test, and functional disability using the neck disability index.

Result: Analysis revealed mean difference scores of 5.45 ± 2.05 for VAS, 0.19 ± 0.09 for NDI, and 29.03 ± 38.08 for CFRT. The observed changes in all three parameters were statistically significant with p value <0.0001 .

Conclusion: Based on the results, it can be concluded that proprioceptive neuromuscular facilitation (PNF) is an effective approach for reducing symptoms associated with cervicogenic headache.

Keywords: PNF, Cervicogenic headache, NDI, Cervical flexion rotation test (CFRT)

INTRODUCTION:

Cervicogenic headache (CEH) is a prevalent form of headache characterized by unilateral pain that has the potential to develop into a chronic condition.¹ Cervicogenic headache are defined by the International Classification of Headache Disorders (ICHD BETA 3) as "headache that are caused by disorders of the cervical spine and its component such as disc and soft tissue elements, but that is not usually accompanied by neck pain."² According to Ottar Sjaastad, the term "cervicogenic headache (CeH) was first introduced in 1983." To explain a type of headache that was thought to be caused by the cervical spine.³

The International Cervicogenic Headache Study Group (CHISG) was established in 1998. CEH was formally recognized as separate entity in 2004 when it was added to the second edition of the International Headache Society's classification of headaches.⁴ Additionally, it's a referred pain that can be felt anywhere on the head and is primarily nociceptive in musculoskeletal tissues innervated by cervical nerves.⁵

A chronic unilateral headache and symptoms indicators of neck involvement are hallmarks of cervicogenic headache (CEH), as a symptomatic headache. External pressure over the occipital or upper cervical region on the symptomatic side, prolonged awkward head positions, and neck movements can all exacerbate CEH.⁶ Any structure innervated by the spinal nerves C1-C3 may be the source of cervicogenic headache, which is believed to be referred pain resulting from irritation caused by cervical structures innervated by spinal nerves C1, C2, and C3. From the neck to the back of the head, this type of secondary cervicogenic headache can radiate via the scalp to the forehead, temple, and the region surrounding the ear and/or eye.⁷

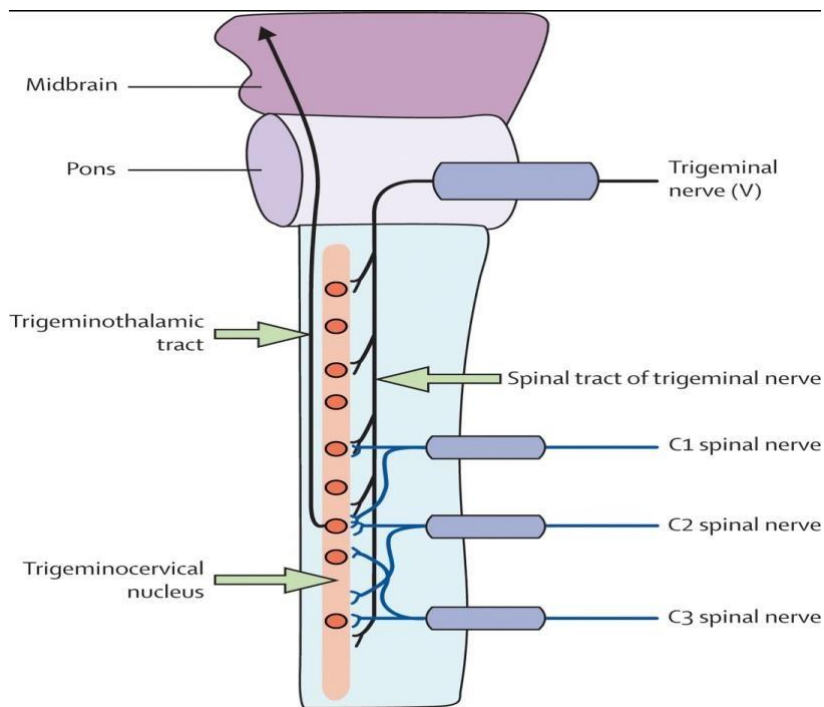
The most common signs of a cervicogenic headache are neck pain and cervical tenderness. Usually unilateral, the symptoms start in the neck and move to the head without changing sides. The most prevalent symptoms include pain, stiffness, tenderness, reduced range of motion, etc.⁵ Patients with cervicogenic headaches may experience either nociceptive, neuropathic, or a combination of these types of pain. According to some theories, neuropathic pain associated with cervicogenic headaches can lead to a lower quality of life for those who experience it by causing disabilities like anxiety, depression, and sleep disturbances.⁸

Characteristics of cervicogenic headaches :

- 1) Pain on one side only, without side shift.
- 2) Neck pain that radiates to the frontal, orbital, temporal, or occipital areas.
- 3) Mild to severe severity.
- 4) Pain that is neither throbbing nor lancinating.
- 5) The episodes duration varies from hours to months.
- 6) Pain may be continuous or sporadic.
- 7) Neck motions or outside pressure on the cervico-occipital area of the afflicted side typically cause or exacerbated pain.
- 8) Usually accompanied by limited range of motion in the neck and nebulous shoulder pain.
- 9) Less frequent than migraines, but potentially accompanied by phonophobia, photophobia, nausea, and vomiting.⁹

PATHOPHYSIOLOGY OF CERVICOGENIC HEADACHE:

The trigeminocervical nucleus transmit the pain associated with CGH. Pain signals are more easily transferred from the neck to the head due to the anatomical link between the cervical spine and the head. Neck pain may be mistaken for headache pain due to the merging of sensory impulses from the upper three cervical nerve roots.



Mechanism of pain referral from the cervical spine to head

Nociceptive afferents of the trigeminal and upper three cervical spinal nerves converge onto second-order neuron in the trigeminocervical nucleus in the upper cervical spinal cord. This convergence mediates the referral of pain signals from neck to regions of the head innervated by cervical nerves or the trigeminal nerve.¹⁰

Diagnostic criteria for cervicogenic headache:

International Headache Society (IHS) and Cervicogenic Headache International Study Group (CHISG) have proposed diagnostic criteria for cervicogenic headache.

IHS classifies CEH in section 11 that includes 'Headache or facial pain attributed to disorder of the cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cervical structure'. CEH is described under a subsection 11.2 Headache attributed to a disorder of the neck.

IHS recommends three diagnostic criteria for CEH as follows (adapted from IHS classification, 3rd edition)

1) IHS Cervicogenic Headache Criteria

Any headache that meets the requirements and Evidence of a condition or lesion in the cervical spine or soft tissues of the neck that can cause headaches, either clinically or imagingly.

Proof of causality shown by a minimum of two of the following:

1. The occurrence of the headache coincided with the onset of the cervical disorder or the lesion's appearance.
2. The cervical condition or lesion has improved or resolved in tandem with a notable improvement or resolution of the headache.
3. Provocative maneuvers cause headaches to worsen and cervical range of motion to decrease.
4. After the diagnostic blockade of a cervical structure or its nerve supply, the headache goes away.

2) CHISG Cervicogenic Headache Criteria

CHISG has also recommended certain diagnostic criteria for cervicogenic headache that are more specific.

I) Signs and symptoms of involvement of the neck

A. Head pain precipitation is occur by.

- i) Through prolonged awkward head positioning, neck movement
- ii). By applying pressure from outside the occipital or upper cervical region.

B. Limitation of neck range of motion on the symptomatic side.

C. Ipsilateral neck, shoulder, or arm pain of a rather vague nonradicular nature or, occasionally, arm pain of a radicular nature.

- II) Verifying proof through diagnostic anesthetic blockades.
- III) Head pain that is unilateral and does not shift to one side.⁴

PNF is a widely used rehabilitation approach in physiotherapy education and postgraduate training. It places a strong emphasis on using motor learning principles, a positive approach, and a functional approach. The fundamental ideas and practices of PNF include the use of resistance, approximation and traction techniques, and a variety of stimuli to improve motor learning and muscle strength.¹¹

Proprioceptive: It concerns any of the sensory receptors that provide information about the body's position and movement.

Neuromuscular: Including both muscles and nerves.

Facilitation: Making things simpler.

By facilitating, inhibiting, strengthening, and relaxing muscle groups PNF works efficiently.

The aim of the PNF techniques is to enhance functional movement.

Static, eccentric, and concentric muscle contraction are all used in the techniques. Each patient's needs are taken into consideration when combining these appropriately graded muscle contractions with appropriate facilitation techniques.¹²

Prevalence of cervicogenic headache : Estimates of the prevalence of cervicogenic headache differ according to the populations studied and the criteria used to make the diagnosis. When clinical criteria have been used, the prevalence of cervicogenic headache has been estimated to be 1%, 2.5%,¹⁷ or 4.1%¹⁸ in the general population and as high as 17.5% among patients with severe headaches. The prevalence is as high as 53% in patients with headache after whiplash injury.¹³

OBJECTIVES:

- 1) To evaluate the impact of PNF techniques on the level of pain experienced by patients with cervicogenic headaches using the Verbal Analogue Scale (VAS).
- 2) To determine whether there has been an improvement in cervical range of motion (ROM) by using cervical flexion rotation test.
- 3) To study the changes in neck-related functional impairment and daily life disability after PNF treatment by using the standardized Neck Disability Index assessment.
- 4) To analyze the differences in pain, disability, and cervical range of motion after the pre and Post PNF treatment to determine its overall therapeutic efficacy for cervicogenic headache patients.

MATERIALS AND METHOD:

METHOD

Study design: Experimental-single Group study

Target population: Individuals with cervicogenic headache.

Age: 25-55 years

Duration of the study: 4 weeks

Sampling technique: simple random sampling

Sample size of data : 40

Source of data collection: Data was collected in and around the Belagavi city

MATERIALS:

Measurement tools:

- 1) Pain assessment scale (VAS scale)
- 2) Neck disability index
- 3) Cervical flexion rotation test
- 4) Data collection sheet
- 5) Informed consent form

Inclusion criteria –

- 1) Neck movement combined with prolonged awkward head posture.
- 2) Head pain, that is unilateral and which shift to one side.
- 3) Cervical flexion rotation test.
- 4) A combination of both men and women.

Exclusion criteria –

- 1) Broken bones.
 - 2) A history of surgery.
 - 3) Prolapsed disc
 - 4) The dysfunction of temporomandibular joint.
 - 5) Congenital conditions of the, including scoliosis, spina bifida, and torticollis
- The above mentioned inclusion and exclusion criteria were developed based on the International Headache Society's established standards for cervicogenic headaches.⁵

INTERVENTION:

This experimental study used a pre-test and post-test design. Before starting the procedure, Written inform consent was obtained from all the participants. Individuals who agreed to participate in daily intervention for four weeks were enrolled in the study. The neck PNF treatment was administered, with the total duration being 45 minutes.

Cervical flexion rotation test procedure:

The patient is positioned in supine lying, with the therapist standing at the head side. The therapist passively flexes the cervical spine. The the head is gently rotated to each side .The firm resistance or reproduction of pain indicates a positive test.

Neck isometrics exercises:

It involve contraction of neck muscles against resistance without moving the neck.

1. Flexion- Push the forehead into hands , resisting movement.
2. Extension- Push back of hand into hands.
3. Lateral flexion- Push side of head into hands sideways.
4. Rotation- Push side of head against hand resistance while attempting to rotate.
5. Hold each contraction for 5-8sec, repeat 3times per direction.

Hold-relax technique:

1. Sitting up right, gently stretching the neck in a desired direction.
2. Isometrically contracting the neck muscles against the resisting for 5sec without moving.
3. Relaxing the muscles and increasing the stretch for 10sec.
4. Repeating this cycle for 3 times per side.
5. This protocol should be applied for side flexion, rotation, extension stretches of the neck.

Contract-relax technique:

1. Passively stretch neck muscles to its limits.
2. Isometrically contract the stretched muscle (push against resistance without moving) for 4-6 sec at about 50-60% max effort.
3. Relax the muscle for 2-3 sec.
4. Passively stretch the muscle further into the increased range.
5. Hold the final stretch for 10-15sec.
6. Repeat the cycle for 3 times, allowing rest between repetition.

Rhythmic stabilization technique:

This is a PNF technique used to improve joint stability, increase range of motion (ROM), and reduce pain through alternating isometric contractions.

Procedure:

- 1.Position the patient sitting or standing with the neck in neutral or slightly extended position.
- 2.Place hands on the patient's head to apply manual isometric resistance.
- 3.Instruct the patient to resist movement as you apply gentle forces pushing in different direction(forward, backward, side-to-side, rotation).
- 4.Alternate resistance direction rhythmically between opposing neck muscles without allowing actual neck movement.
- 5.Maintain isometric contractions for 4-6sec per direction.
- 6.Use verbal cues like "hold," "don't let me move your head" to encourage effort.
- 7.Repeat for 2-3 cycles focusing on stability and muscle coordination around the neck.

OUTCOME MEASURES:

Verbal analog scale -The verbal scale is easy to use, quick to administer, and well to understood by most of the patients.¹⁴

Neck disability index – The NDI is 5- score scale that is comparable to the verbal rating scale every statement is given a number between 0 and 5, where 5 represents the highest level of intensity and 0 represents no symptoms. Score ranges from 0 to 50. If the patient misses one task, usually driving, the NDI is calculated as a percentage.¹⁵

RESULT:

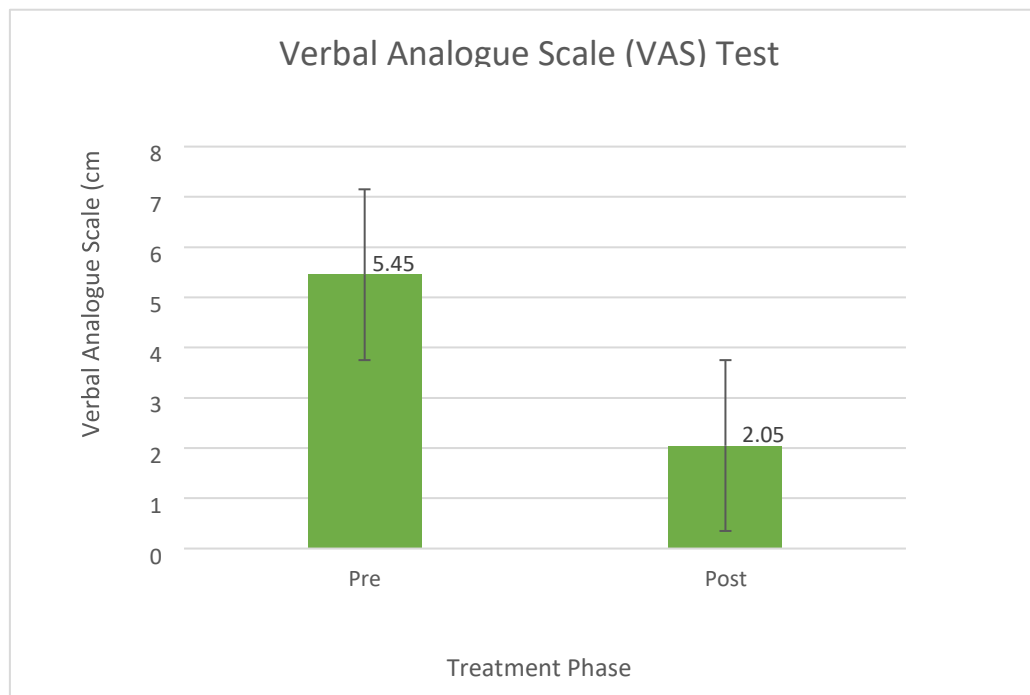
The study analyzed the effect of PNF on participants of cervicogenic headache using three outcome measures- VAS, NDI, and CRFT.

Data were systematically categorized through the computation of means and standard deviations using the Microsoft excel version for all outcome measures, both prior to and following the intervention. To determine the significance of change between pre and post treatment values, a paired t-test was applied for each variable. The level of significance was set at $p < 0.0001$.

Table 1: Comparisons between the groups

Test Name	Mean (pre)	Mean (post)	t- statistic	p- value
Verbal analogue scale (VAS)	5.45 ± 1.43	2.05 ± 1.22	13.82	<0.0001
Neck disability index (NDI)	0.19 ± 9.97	0.09 ± 6.46	9.27	<0.0001
Cervical flexion rotation Test	29.03 ± 2.64	38.08 ± 4.26	-12.01	<0.0001

Graph 1: Comparing pre-test and post-test scores of VAS



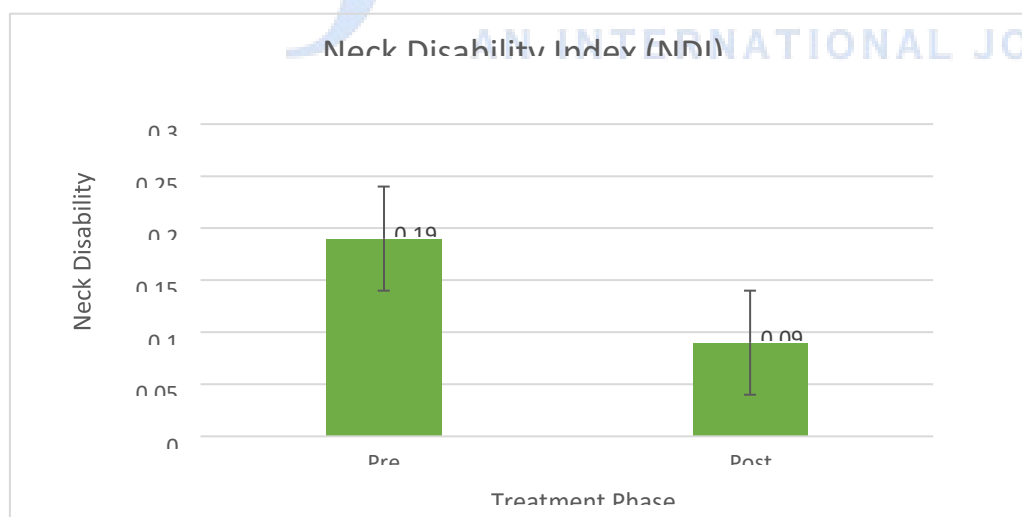
Graph 1: The above bar graph represents the Verbal Analogue Scale (VAS) Test, which measures pain intensity pre – treatment and post treatment .

Axis:

- 1)The X – axis shows the treatment phases Pre and Post.
- 2)The Y- axis represents the VAS score in centimetres.

The Pre-treatment bar shows a mean pain score of 5.45 cm and post- treatment bar shows a mean pain score of 2.05 cm. As there is a difference between pre and post values of VAS, the graph suggests that pain level decreased after intervention.

Graph 2:Comparing pre-test and post-test of NDI

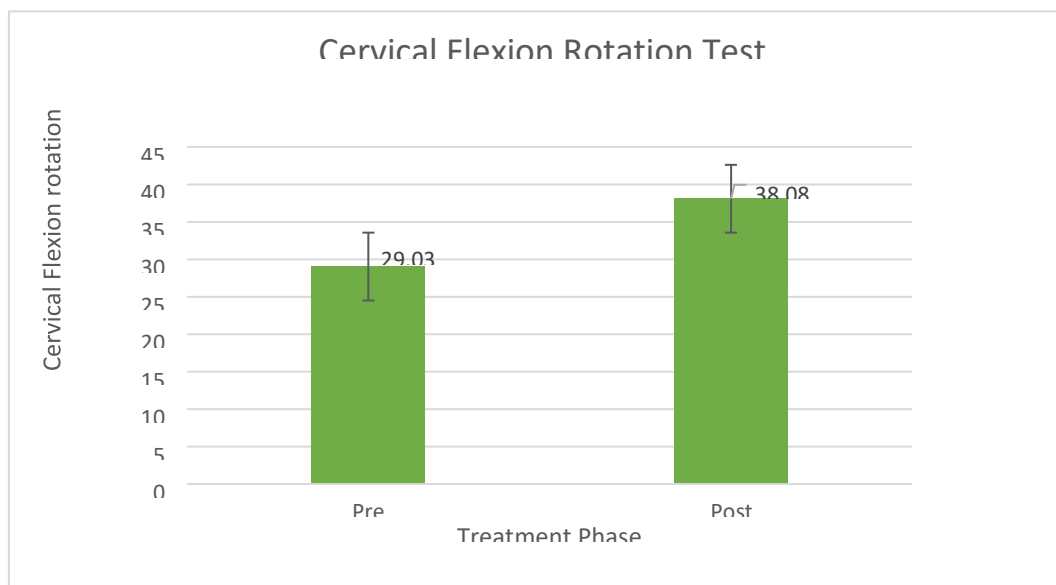


Graph -2 The above bar graph represents the Neck Disability Index (NDI), which measures the level of neck-related disability pre treatment and the post treatment intervention.

Axis:

- 1) The X-axis shows the treatment phases Pre and Post.
- 2) The Y-axis represents the Neck Disability Index (NDI) score (%).

The Pre-treatment bar shows a mean NDI score of 0.19, while the Post-treatment bar shows a mean NDI score of 0.09. The reduction in the NDI score after treatment indicates an improvement in neck function and a decrease in disability level following the intervention Graph 3: Comparison pre-test and post-test of CRFT



Graph -3: The above bar graph represents the results of the Cervical Flexion Rotation Test, which measures the cervical rotation range of motion (in degrees) before and after the treatment intervention.

Axis:

- 1) X-axis: Represents the treatment phases — Pre and Post treatment.
- 2) Y-axis: Represents the Cervical Flexion Rotation (in degrees).

The Pre-treatment bar shows a mean cervical flexion rotation value of 29.03°, whereas the Post-treatment bar shows a mean value of 38.08°. There is an increase in cervical flexion rotation after post-treatment, indicating a significant improvement in cervical mobility following the intervention.

DISCUSSION

This study evaluated the impact of proprioceptive neuromuscular facilitation (PNF) technique on cervicogenic headache, neck disability index (NDI), and also on cervical flexion-rotation range. 40 participants were included in this study based on inclusion and exclusion criteria. Both pre and post examination was done by using VAS, NDI, and cervical flexion-rotation test. We delivered a treatment by using manual therapy such as PNF. Cervicogenic headache is the most prevalent and it impacts a large number of people. 90% of people had headaches at some point in their lives. According to this study, the most common signs of a cervicogenic headache are neck pain and cervical tenderness. Usually unilateral, the symptoms start in the neck and move to the head without changing sides. The most prevalent symptoms include pain, stiffness, tenderness, and reduced range of motion. Earlier, the International Headache Society (IHS) and Cervicogenic Headache International Study Group (CHISG) have proposed diagnostic criteria for cervicogenic headache, based on that it differs from the migraine and any other conditions. According to this study, patients with cervicogenic headache who received proprioceptive neuromuscular facilitation (PNF) experienced improvement in cervical flexion-rotation range of motion.

Kaya et al. concluded in his study that PNF technique gives significant results in increasing the ROM in cervical spine in the direction of flexion and rotation. This study stated that there is a significant reduction of the pain intensity as it was measured by verbal analog scale.¹⁶

V. Suresh et al. stated that PNF technique helped to decrease the pain and also enhanced functional mobility at the neck. This study proved that functional disability is lessened by using PNF, by using an outcome measure neck disability index. As there is improvement in scoring of NDI after post-treatment.¹⁷

Ana Yusuf's et.al. study offered important new information about PNF contribution to treat cervicogenic headaches. As their research suggested that ,while both PNF and MFR are useful therapies, as MFR typically produces better outcomes in terms of increasing cervical rotation and lowering the Neck Disability Index (NDI) scores. But they also concluded that PNF is still a useful treatment strategy for cervicogenic headaches because it successfully reduces disability and promotes functional recovery.¹

As this study showed that PNF had a superiority in terms of increasing range of motion by. reciprocal and autogenic inhibition, particularly through contract-relax and hold-relax techniques.

Tejasri Balaji et.al.conducted a comparative study on effect of post-isometric relaxation and hold-relax technique on cervicogenic headache. Results showed that hold-relax technique have a significant reduction than post-isometric relaxation on Cervicogenic headache. The current results of this study appear to be in line with other studies that investigated the effects of various

PNF techniques on cervical range of motion in patients suffering from cervicogenic headache¹⁸

CONCLUSION:

The studies demonstrate significant improvements in pain and neck functionality following PNF therapy in cervicogenic headache.

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