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Effectiveness of neck exercises comparative with scapulothoracic & shoulder exercises with therabands on cervicogenic headache

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Abstract
Overview: Headache is the most prevalent pain disorder, affecting 47% of the global population, representing a major health problem, disturbing quality of life and work productivity. Cervicogenic Headache prevalence is estimated at 0.4% to 4% but may be high as 20% of the patients presenting with chronic cervicogenic headaches.
Materials and Methodology: Two group studies involved 15 patients in each group. NPR Scale was used to measure the pain quantity and Headache Impact Scale (HIS) was used to measure the impact that headaches have on your ability to function daily. Neck exercises were given to group A and Shoulder and Scapulothoracic exercises were given to group B using therabands for 5 days a week for 3 weeks.
Result: The patients in group A showed better and significant decrease in NPRS and HIS Score post treatment than the group B.
Conclusion: Neck Exercises are more effective in treatment of Cervicogenic Headache.

Keywords: cervicogenic headache, neck exercises, shoulder exercises, scapulothoracic exercises, headache impact scale and NPR scale

Introduction

Headache is the most prevalent pain disorder, affecting 47% of the global population[1], and thereby it represents a major health problem, disturbing both quality of life and work productivity. Cervicogenic Headache prevalence is estimated at 0.4% to 4% but may be high as 20% of the patients presenting with chronic cervicogenic headaches [1].

Headache is a common clinical phenomenon and has been classified into numerous types based on their signs, symptoms, and etiology. Headaches which are believed to originate from structures in the neck have been given various names, ranging from broad terms such as "cervical", "occipital" and "cervicogenic" to specific terms such as third nerve occipital headache [2]. Headaches arising from musculoskeletal disorders of the cervical spine, termed cervicogenic headaches are a common form of chronic and recurrent headache. Physical therapies are recommended as a first line of management [3]. Degenerative changes in the cervical vertebrae and discs are familiar even in asymptomatic people. These degenerative changes also increase with advanced age and have not shown a clear correlation with chronic pain [4].

Cervicogenic headache has been described as a syndrome that is a final common pathway—not an entity. Thus, CH is a syndrome that can have many contributing factors. The World Cervicogenic Headache Society has delineated Cervicogenic Headache as referred pain perceived in any part of the head and caused by a primary nociceptive source in the musculoskeletal tissues that are innervated by the cervical nerves [5]. Cervical headache is a symptom that potentially can arise from dysfunction of the joints, muscles, ligaments, and other soft tissues of the neck.

Impairments in muscle strength and endurance of the deep neck flexors appear to be one of the delineating features of Cervicogenic headache [6]. Individuals with chronic cervicogenic headache experience considerable restriction in daily function, limitation of social participation, and emotional distress. In addition, these individuals report a lower quality of life than healthy individuals [7].

Cervicogenic headache is referred pain from the cervical spine. Physiologically, this pain is cognate to pain felt in the shoulders, chest wall, buttocks, or lower limbs that is referred from the spinal sources, hence its familiarity to pain specialists. The mechanism underlying the pain includes convergence between cervical and trigeminal afferents in the trigeminocervical nucleus [8] in this nucleus, nociceptive afferents from the C1, C2, and C3 spinal nerves converge onto second-order neurons that as well receives afferents from adjacent cervical nerves and from the first division of the trigeminal nerve (V), through the trigeminal nerve spinal tract. This convergence has been unveiled anatomically and physiologically in laboratory animals [9]. Convergence between cervical afferents allows for upper cervical pain to be referred to the regions of the head innervated by the cervical nerves (occipital and auricular regions). The Convergence with trigeminal afferents allows for referral of pain into the parietal, frontal, and orbital regions [10].

Such patterns of referral have been educed in healthy volunteers by experimental, noxious stimulation of cervical structures. Early studies targeted the sub occipital and posterior cervical muscles [10] and investigators have shown that deleterious stimulation of more rostral structures in the cervical spine incited referred pain in the occipital region and more distant regions, such as the frontal region and orbit [11]. By contrast, stimulation of more caudal structures elicited the pain in the neck, which could be referred to the occipital regions, although not too distant regions of the head. Results from later studies have unveiled that deleterious stimulation of the atlanto-occipital and lateral atlanto-axial joints, the C2-3

zygapophysial joint, and the C2-3 intervertebral disc can spawn pain in the occipital region [12]. Complementary studies have mapped the distribution of pain that could have be relieved in patients by controlled diagnostic blocks of the lateral atlanto-axial joint otherwise the C2-3 or C3-4 zygapophysial joints [13]. Patients with pain from a particular joint do not have exactly same distribution of pain, but there is resemblance in the distribution. Pain from the lateral atlanto-axial joint (Cl-2) tends to be focused on the occipital and sub occipital regions, and tends to be referred to the vertex, orbit, and ear [12]. Pain from the C2-3 zygapophysial joint also occurs in the occipital region and spreads across the parietal region towards the frontal region and orbit. Pain from the C3-4 joint can be referred to the head, but is more ubiquitously focused in the upper and lateral cervical region these data show that the structures capable of producing referred pain to the head are those which are innervated by Cl, C2, and C3 nerves. No experimental studies have unveiled that structures innervated by lower cervical nerves are capable of directly causing headache [14].

Major signs and symptoms of cervicogenic headache usually entail unilateral head pain without side-shift, combined with neck pain and restriction of neck movement. Despite the IHS classification, diagnosis of cervicogenic headache is arduous because up to 70% of individuals with frequent intermittent headache report accompanying neck pain. To assist in the diagnosis of cervicogenic headache and particularly C1-C2 segmental dysfunction Hall and Robinson have suggested using the cervical flexion-rotation test (FRT), as described by Dvorak et al [5].

Passive examination procedure includes fully flexing the cervical spine so that vertebral movement is theoretically constrained to C1-C2 segment, then assessing cervical rotation range of motion in this position. Normal range of movement is 44° towards each side. Hall and Robinson have found that subjects with cervicogenic headache have an average of 17° less rotation towards the headache side in the FRT, in contrast to those with no headache or migraine with aura [5].

In this project we are using Thera bands in order to give Neck, Shoulder and Scapulothoracic Exercises to find and compare the effectiveness of these exercises on Cervicogenic Headache.

Thera bands resistance bands are widely used for rehabilitation from muscles and joint injuries and for aerobics and general conditioning. Thera bands are the sole resistive exercise bands endorsed by the American Physical Therapy Association (APTA).

These 6" wide latex bands come in different, color coded resistance levels, distinguished by the thickness of the band [15]. The progressive resistive system makes it fast to measure progress in achieving fitness or therapy goals. Thera bands use can improve the cooperation of muscle groups. It also works on strength and range of motion [15].

Materials and Methodology

Materials

Data was collected from patients suffering from Cervicogenic Headache. It was a Prospective and Comparative Study sample size of 30 on the basis of Simple Random Sampling. Intervention was given for 4 Months with intervention of 3 weeks. The participants were selected on the basis of Inclusion criteria and Exclusion criteria.

Inclusion criteria

Major Criteria

Point I- Symptoms and Signs of Neck Involvement

- Precipitation of head pain, similar to the usually occurring by neck movement and/or sustained awkward head positioning.
- By external pressure over the upper cervical or over occipital region on the symptomatic side.
- Restriction of the range of motion (ROM) in the neck.
- Ipsilateral neck, shoulder, or arm pain of a rather vague non radicular nature or, occasionally, arm pain of a radicular nature.

Point II- Confirmatory Evidence by Diagnostic Anesthetic Blockades

Point III- Unilaterality of the Head Pain, Without Side shift

Head Pain Characteristics

Point IV

- Moderate to severe, non-throbbing, and non-lancinating pain, usually starting in the neck.
- -Episodes of varying duration, or Fluctuating, continuous pain.

Other characteristics of some importance

Point V

- Only marginal effect or lack of effect of indomethacin.
- Only marginal effect or lack of effect of ergotamine and sumatriptan succinate
- Female sex
- Not infrequent occurrence of head or indirect neck trauma by history, usually of more than only medium severity

Other features of lesser importance

Point VI

Various attack-related phenomena, only occasionally present:

- Nausea
- Phonophobia and photophobia
- Dizziness
- Ipsilateral "blurred vision"
- Difficulties on swallowing
- Ipsilateral edema, mostly in the periocular area

Exclusion criteria

1. Headache not of cervical origin.
2. Physiotherapy treatment in the past 3 months.
3. Headache with autonomic involvement, dizziness, or visual disturbance.
4. Congenital conditions of the cervical spine.
5. Inability to tolerate the flexion-rotation test

Methodology

The study received ethical approval from the Institutional Ethical Committee. The participants were screened from Pravara Institute of Medical Sciences, Loni and after finding their suitability according to the inclusion and exclusion criteria, they were requested to participate in the study. The participants were concisely informed about the nature of study, the duration of intervention and the intervention being used in the language best understood by the participants. They were encouraged to clarify queries regarding the study, if any. An informed written consent form was then obtained from the

participants. The demographic data was obtained and a detailed assessment of 30 participants was done on the basis of Name, Age, Flexion Rotation Test. Headache Impact Scale and Pain quantity by Numerical Rating Scale. Participants were divided into group A (given Neck exercises for 3 weeks) and group B (Shoulder and Scapulothoracic exercises for 3 weeks). The Headache Impact Scale and Pain Quantity of the participants from both groups was assessed before and after 3 weeks of study and then compared for conclusion.

Neck Exercises

Cervical side bending isometric exercise using thera-band

Fig 1

Place the middle of the band around the back of your head. Grasp the ends of the band in front of your head. Keep your neck in a neutral position with the chin slightly tucked. Extend your elbows, stretching the band in front of you. Slowly return, and keep your neck stable

Cervical Rotation Isometric Exercise using Thera-Band

Fig 2

Place the middle of the band around the back of your head. Cross the ends of the band over your forehead and grasp the ends of the band at eye level near your head. Keep your neck in a neutral position with the chin slightly tucked. Extend your elbows outward to the side, stretching the band away from your head. Slowly return, and keep your neck stable. Repeat with the other hand.

Cervical Flexion Isometric Exercise using Thera-Band

Fig 3

Place the middle of the band around the front of your head, holding each end of the band at the side of your head, near eye level. Keep your neck in a neutral position with the chin slightly tucked. Pull the ends of the band backward. Slowly return, and keep your neck stable.

Cervical Extension Isometric Exercise using Thera-Band

Fig 4

Place the middle of the band around the back of your head. Grasp the ends of the band in front of your head. Keep your neck in a neutral position with the chin slightly tucked. Extend your elbows, stretching the band in front of you. Slowly return, and keep your neck stable

Shoulder Exercises

Shoulder Adduction Exercise using Thera-Band

Fig 5

Begin with one end of the band or tubing securely attached. Grasp the other end with slight tension in the band or tubing, and pull toward your side. Keep your elbow straight and avoid leaning over. Hold and slowly return.

Shoulder Extension Exercise using Thera-Band

Fig 6

Begin with one end of the band securely attached. Grasp the other end of the band with slight tension. Extend your arm backward, keeping your elbow straight. Hold and slowly return.

Shoulder Internal Rotation at 0 degrees using Thera-Band

Fig 7

Begin with one end of the band securely attached at waist-height. (You may place a towel roll under your arm as well.) Grasp the other end of the band with tension. Pull the band away from the wall, rotating your forearm inward. Hold and slowly return.

TIP: Be sure to keep your forearm parallel to the ground, your elbow by your side, and your wrist straight.

Shoulder External Rotation at 0 degrees using Thera-Band

Fig 8

Begin with one end of the band securely attached at waist-height. (You may place a towel roll under your arm as well.) Grasp the other end of the band with tension. Pull the band away from the wall, rotating your forearm outward. Hold and slowly return.

TIP: Be sure to keep your forearm parallel to the ground, your elbow by your side, and your wrist straight.

Shoulder Flexion to 90 degrees using Thera-Band

Fig 9

Begin with a slightly stretched band or tubing anchored under your foot. Lift the band in front of our body. Keep your thumb pointing upward and your elbow straight. Avoid arching your back

Shoulder Abduction to 90 degrees using Thera-Band

Fig 10

Begin with one end of the band or tubing stabilized under your foot. Grasp the band with tension at your side. Keeping your elbow straight, lift the arm upward to shoulder level. Hold and slowly return. Avoid arching your back.

Scapular strengthening exercises
Shoulder Shrug using Thera-Band

Fig 11

Origin: Lower Vertical
Attachment: 2 Handles
Movement: Begin with hands near waist. Shrug shoulders and pull upward, keeping elbows straight.

Scapular Retraction using Thera-Band

Fig 12

Origin: Upper Vertical
Attachment: Handle
Movement: Pull arm backward, keeping elbow straight

Scapular Protraction using Thera-Band

Fig 13

Origin: Upper Vertical
Attachment: Handle
Movement: Push arm forward, keeping elbow straight.

Scapular Depression using Thera-Band

Fig 14

Origin: Upper horizontal
Attachment: Handle
Movement: Pull arm downwards, keeping elbow straight

Results

Table 1: Shows the Pre and Post effect of Neck Exercises on NPRS in Cervicogenic Headache.

NPRS Score	P Value	T Value	Mean +-Sd
Pre NPRS score	<0.0001 Extremely statistically significant	7.856	5.6+-1.549
Post NPRS score			3.2+-1.699

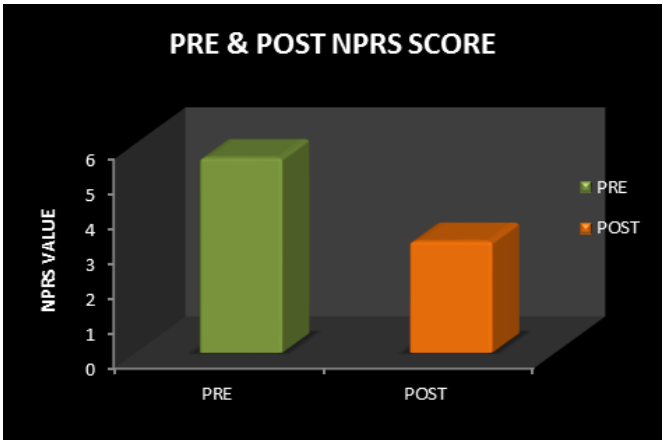

Fig 15: The above graph shows the Pre and Post Neck Exercise NPRS score.

Result: The NPRS score post the Neck Exercises is decreased. The pre NPRS score is 5.6 and Post NPRS score is 3.2, t score is 7.856 and p<0.0001 which is extremely statistically significant.

Table 2: Shows the Pre and Post effect of Shoulder and Scapulothoracic Exercises on NPRS in Cervicogenic Headache.

NPRS Score	P value	T value	Mean +-Sd
Pre NPRS score	<0.0001 Extremely statistically significant	5.137	5.93+-1.387
Post NPRS score			5+-1.732

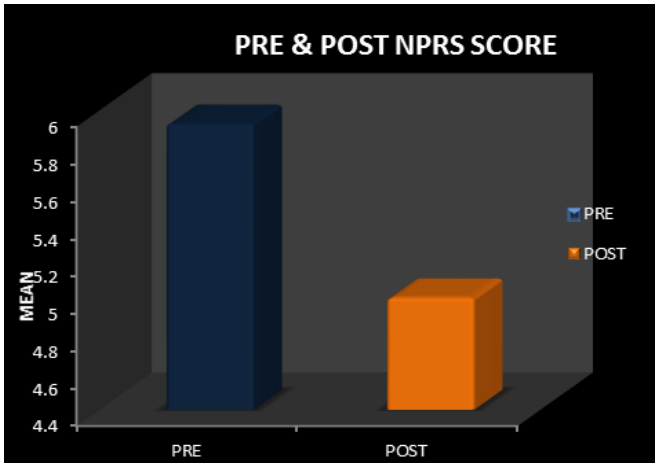

Fig 16: The above graph shows the Pre and Post Shoulder and Scapulothoracic Exercise NPRS score.

Result: The NPRS score post the Shoulder & Scapulothoracic Exercise is decreased. The pre NPRS score is 5.93 and post NPRS score is 5, t value is 5.137 and p<0.0001 which is extremely statistically significant.

Table 3: Shows the Post Neck (Group A) & Shoulder and Scapulothoracic Exercises (Group B) NPRS score on Cervicogenic Headache.

NPRS SCORE	P value	T value	Mean+-Sd
Group A Post NPRS score	<0.0001 Extremely Statistically Significant	2.874	3.2+-1.699
Group B Post NPRS score			5+-1.732

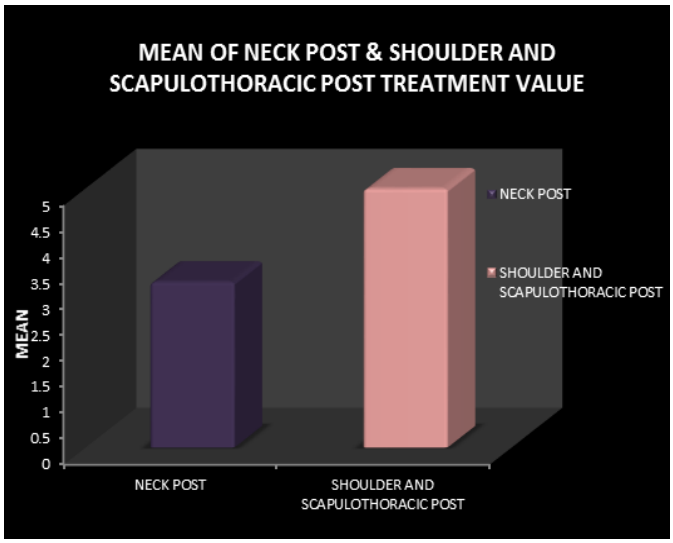

Fig 17: The above graph shows the comparison of post Neck Exercise NPRS score and post Shoulder & Scapulothoracic Exercise NPRS score.

Result: The post Neck Exercise NPRS score is more decreased in comparison to post Shoulder & Scapulothoracic Exercise NPRS score. The post Neck Exercise NPRS score is 3.2 and post Shoulder & Scapulothoracic Exercise NPRS score is 5, t value is 2.874 and p<0.0001 which is extremely statistically significant.

Table 4: Shows the Pre and Post Neck Exercise Headache Impact Scale score

Headache Impact Scale Score	P value	T value	Mean+-Sd
Pre HIS score	<0.0001 Extremely Statistically Significant	16.412	48.13+-1.598
Post HIS score			34+-2.928

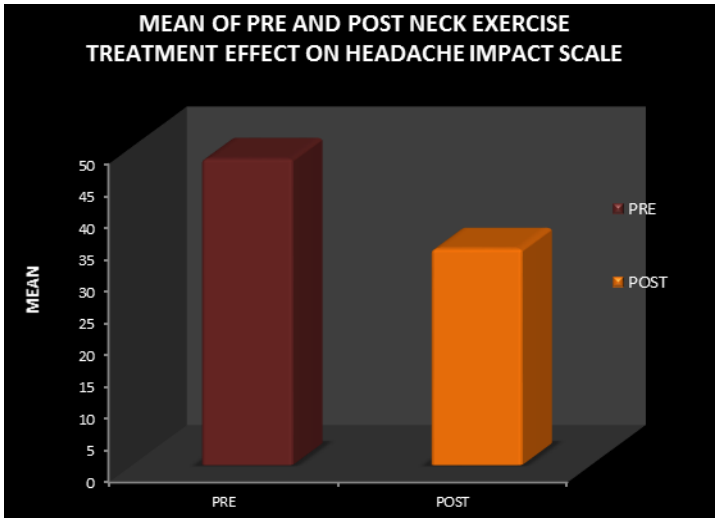

Fig 18: The above graph shows the Pre and Post Neck Exercise Headache Impact Scale score.

Result: The Headache Impact Scale score post the Neck Exercise treatment is decreased. The pre HIS score is 48.13 and post HIS score is 34, t value is 16.412 and p<0.0001 which is extremely statistically significant

Table 5: Shows the Pre and Post Shoulder and Scapulothoracic Exercise Headache Impact Scale score

Headache Impact Scale Score	P value	T value	Mean+-Sd
Pre HIS score	<0.0001 Extremely Statistically Significant	5.401	48.8+-1.014
Post HIS score			46.8+-1.014

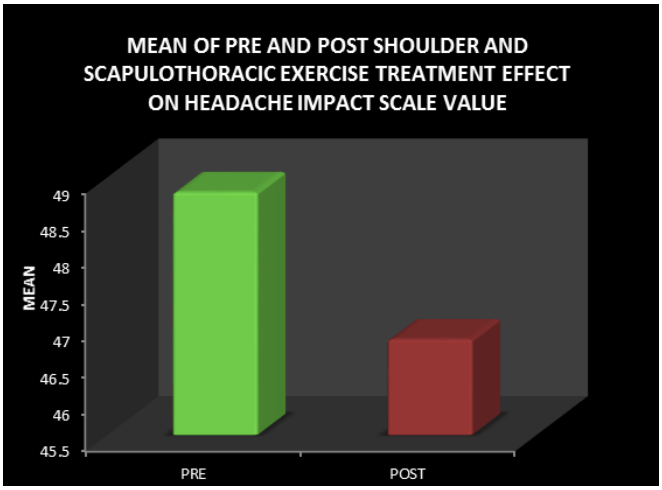

Fig 19: The above graph shows the Pre and Post Shoulder and Scapulothoracic Exercise Headache Impact Scale score.

Result: The Headache Impact Scale score post the Shoulder & Scapulothoracic Exercise is decreased. The pre HIS score is 48.8 and post HIS score is 46.8, t value is 5.401 and p<0.0001 which is extremely statistically significant.

Table 6: Shows the post Neck (Group A) & Shoulder and Scapulothoracic Exercise (Group B) Headache Impact Scale Score.

Headache Impact Scale Score	P value	T value	Mean+-Sd
Group A Post HIS score	<0.0001 Extremely Statistically Significant	16	34+-2.928
Group B Post HIIS score			46.8+-1.014

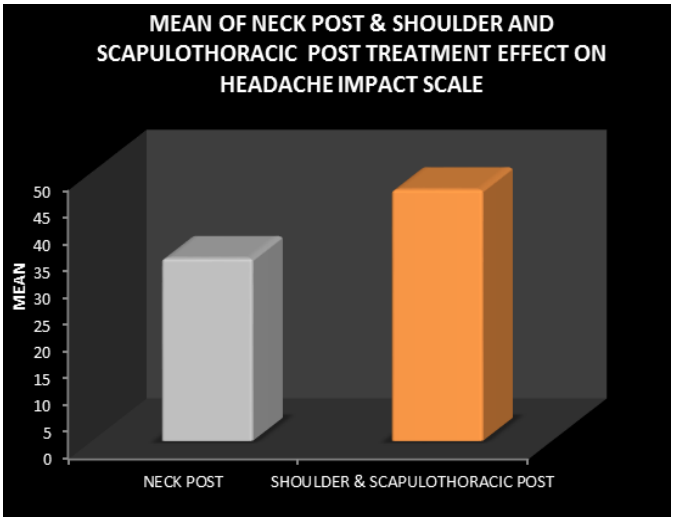

Fig 20: The above graph shows the comparison of post Neck Exercise HIS score and post Shoulder & Scapulothoracic Exercise HIS score.

Result: The Headache Impact Scale score post Neck Exercises (Group A) is more decreased in comparison to post Shoulder & Scapulothoracic Exercise (Group B) HIS score. The Group A post HIS score is 34 and Group B post HIS score is 46.8, t value is 16 and p<0.0001 which is extremely statistically significant.

Discussion

Cervicogenic Headache is a relatively common syndrome. The paroxysmal and rather intense head pain usually is unilateral, spreading from the back of head to the frontal and temporal regions, and triggered by certain movements or sustained provocative head positions.

In the study conducted on "Effect of Neck, Shoulder and Scapulothoracic Exercise on Cervicogenic Headache" the participants received strengthening exercise using Thera bands for 5 days a week for 3 weeks. The study shows that the Neck exercise as well as Shoulder and Scapulothoracic Exercise are effective in reducing neck pain in patients with Cervicogenic Headache, but Neck exercise gave a more significant reduction in the pain quantity measured by NPRS (from 5.6 to 3.2). Shoulder and Scapulothoracic Exercise also were beneficial in reducing the neck pain (from 5.93 to 5) but not as much as Neck Exercise. The Headache impact Scale Score was also seen to be reduced after Neck, Shoulder and Scapulothoracic Exercise but again Headache Impact Scale Score after Neck Exercise were found more significantly reduced (from 48.13 to 34) than Shoulder and Scapulothoracic Exercise (from 48.8 to 46.8). Thus it is found that Neck Exercise has a significant effect in reducing neck pain in patients with Cervicogenic Headache. Therefore Neck Exercise must be considered as the primary treatment for Cervicogenic Headache and Shoulder & Scapulothoracic Exercise can be given in addition to improves the prognosis.

Following intervention the severity of neck pain measured by NPRS and the Headache Impact Scale score (HIT is a tool used to measure the impact headaches have on your ability to function on the job, at school, at home and in social situations. The score shows you the effect that headaches have on normal daily life and your ability to function) was observed to be decreased. The improvement in muscle strength and pain is probably due to physiological effects of strengthening exercises on neural factors such as increase in activation of motor units and sensory units acting synchronously and reducing or counteracting inhibitory impulses. Any technique having contact with the skin and mobilizing tissues activates beta mechanoreceptors fibers, which are faster than C and A delta fibers, and interneurons of lamina IV in spinal cord dorsal horn, in the quotidian competitive inhibition. Skin touch may be powerful modulator, and proprioceptive stimuli speed may help the inhibition of painful stimuli in the central nervous system [17].

CGH arises primarily from musculoskeletal dysfunction in the upper three cervical segments. The condition's pathophysiology and source of pain have been debated, but the pain is probably referred from one or more muscular, neurogenic, osseous, articular, or vascular structures in the neck. The trigeminocervical nucleus is a region of the upper cervical spinal cord where sensory nerve fibers present in the descending tract of the trigeminal nerve (trigeminal nucleus caudalis) are believed to interact with sensory fibers from the upper cervical roots. This functional convergence of the upper cervical and trigeminal sensory pathways allows the bidirectional referral of painful sensations between the neck and trigeminal sensory receptive fields of the face and head. [16].

A study was previously done in year 2005 on effect of specific exercise program on cervicogenic headache by Mary Kate McDonnell et al. Placzek et al demonstrated that patients with Cervicogenic Headache had significantly less strength and endurance of the deep neck flexors. In the scapulothoracic region, he has noted that patients with CH usually display an alignment of scapular abduction and depression, indicating lengthened levator scapulae and trapezius muscles. Additionally, he observed that this scapular alignment is often consociated with concomitant weakness of some or all portions of the trapezius as well as the rhomboids and levator scapulae. The potential result of these impairments is compressive loading of the cervical spine, precipitating from a transfer of the weight of the upper extremity to the cervical region through the cervicoscapular muscle attachments. The patient reported an ease in headache frequency and intensity (1 headache in 3 weeks, intensity 1/10) and a decrease in his NDI score from 31 (severe disability) to 11 (mild disability). The patient also demonstrated enhancement in upper cervical joint mobility, cervical range of motion, scapular alignment, and scapulothoracic muscle strength. . Akron, Ohio carried out a study in March 5 2014 which showed a 40% decrease in neck and shoulder pain intensity and an increase in isometric muscle strength in participants. Simple elastic resistance exercise is shown to be effective in reducing pain and increasing strength in neck and shoulder muscles. We found similar results to the study done by Akron. The statistical

analysis of this study supports the beneficial effects of neck shoulder and scapulothoracic strengthening exercises on pain. [5].

Gwendolen Jull carried out a study on "A Randomized Controlled Trial of Exercise and Manipulative Therapy for Cervicogenic Headache" where participants were categorized into 4 groups, Controlled group, Manipulative therapy group, and Combined Therapy and Exercise Therapy group. A randomized controlled trial of 200 patients with cervicogenic headache tested the effectiveness of manipulative therapy and a new low-load exercise program emphasizing muscle control rather than strength. Interventions were used solitary and in combination. The intervention period was 6 weeks, and patients were followed up over 1 year. This study showed that the conservative treatments of manipulative therapy and a precise exercise program are effective for the management of cervicogenic headache, and that the effects are maintained in the long term. Although there was not statistical evidence of an additive effect from the treatments, there were certain differing effects of the interventions on some outcomes, and 10% more participants receiving the combined therapy obtained good and excellent outcomes. But from the following outcome it cannot be found that which of the two given exercise in the combined group was effective [3].

Hereby this study has been conducted to evaluated and compare the individual effect of both type of exercise on Cervicogenic Headache and it was found that Neck Exercise is more effective than Shoulder and Scapulothoracic exercise.

This would support the use of combined manipulative therapy and exercise in the management of cervicogenic headache. Significantly, all three treatments were equally effective in reducing the symptoms of headache and neck pain, and these outcomes were maintained over the 12-month period. Some differing effects of the interventions on both Patient-centered and physical outcomes support a recommendation for the use of combined therapies.

Conclusion

The present study concluded that there is more significant effect of Neck Exercises over shoulder and Scapulothoracic Exercises for pain relief in patients with cervicogenic headache. Neck Exercises have also proved to be beneficial over Shoulder and Scapulothoracic Exercises in reducing the patients discomfort while performing daily activities as measured by Headache Impact Scale.

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