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Effect of Deep Cervical Flexors Training Versus Specific Neck Muscles Training in Subjects with Chronic Neck Pain

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ABSTRACT

BACKGROUND AND OBJECTIVES: Chronic Neck Pain is a common condition and one of the leading causes of disability that results in pain, functional impairments, and loss in proprioception. The objective of the study was to compare the Effect of Deep cervical flexors training with Specific neck muscles training on reducing pain and improving function and proprioception in subjects with Chronic neck pain.
METHODS: Quasi Experimental Study Design. This study includes 80 subjects clinically diagnosed with Chronic neck pain were randomly allocated into 2 groups. In group A (n=40) subjects were treated with Deep cervical flexors training whereas Group B (n=40) received Specific neck muscles training. Participants were treated for 8 weeks.
RESULTS: Baseline comparisons showed no significant differences between groups (p>0.05). Following 8 weeks of intervention both groups demonstrated improvement; however, Group A showed significantly greater post-test improvements. Post test VAS scores were lower in Group A (1.56±0.64) compared to Group B (2.29±0.74)(p=0.0001). NDI scores improved more in Group A (8.6±2.5) than in Group B (11.5±2.8) (p=0.0001). JPE-FLEXION scores improved more in Group A (1.96±0.34) compared to Group B (5.09±0.94)(p=0.001). JPE-EXTENSION scores improved more in Group A (1.71±0.34) compared to Group B (3.67±1.46) (p=0.001)
CONCLUSION: After 8 weeks of training both the groups showed significant improvement. Deep Cervical Flexors Training Group was found to be more effective when compared to Specific Neck Muscles Training Group.

Keywords: *chronic neck pain, deep cervical flexors training, specific neck muscles training, visual analogue scale, neck disability index, joint position error test*

INTRODUCTION

Chronic neck pain is among the most common musculoskeletal condition with high prevalence that can impact an individual physical, social and psychological wellbeing of an individual. Chronic neck pain ranked the 4th greatest contributor to global disability and 21st in terms of overall burden. The prevalence of chronic neck pain in India is 7.6% and globally prevalence is 37%. Most neck pains have no discernible cause and it is considered to be idiopathic. [1]

It is the second most prevalent musculoskeletal condition. Global age standardized point prevalence of 3551.1 per 100,000 individuals and an incident rate of 806.6 per 100,000, with the largest increases in point prevalence over the past three decades. The prevalence of neck pain is higher among females which is 28.15% and prevalence in males is 12.1%. Some 70% of adults may experience neck pain during there lifetime, while nonspecific neck pain often resolves within a few months, approximately 50% of cases develop into chronic neck pain. [2]

Chronic neck pain (NP) is described as pain located in the posterior and lateral regions of the neck, spanning from the superior nuchal line to the spinous process of the first thoracic vertebra, without evidence of significant structural pathology. It may cause mild to severe interference with daily activities but occurs in the absence of neurological deficits or specific conditions such as traumatic sprains, fractures, tumors, infections, or inflammatory cervical spondylosis. [3]

When the duration of symptoms is greater than 12 weeks of evolution, it acquires the value of chronicity and it referred as chronic neck pain. It is a common condition that has a significant impact and imposes considerable socio-economic costs. [4]

Non-modifiable risk factors related to patho-anatomical features (e.g. history of trauma, age, gender and genetics) and adjustable risk factors, which are more related to psychosocial features (e.g. smoking, physical activity and sedentary life style, beliefs, coping style, expectations, and work satisfaction). These factors may also contribute to the transition from acute to chronic pain status. [5] The main symptoms of persons with chronic neck pain include decreased range of motion, muscle weakness and dysfunction and errors in joint position sense. [6] Usually chronic neck pain occurs insidiously, and is typically of multi factorial origin involving one or more of the following causes such as pressure of the neck, poor posture, anxiety, depression and occupational activities. [7]

Deep cervical flexors are responsible for stability of the cervical spine by coordinating with the superficial neck muscles like sternocleidomastoid and anterior scalene and play a key role in conveying spatial information about the body's position and the relative orientation of its different parts.[8] When neck pain occurs, the deep cervical flexor muscles tend to become underactive. As a result, the cervical joints may lose stability and control, leading to compensatory hyperactivity in superficial muscles like the sternocleidomastoid. Pain and impaired proprioception can consequently cause notable functional limitations and altered postural patterns. [9]

It has been theorized that when cervical muscle performance is impaired, the balance between the stabilizers on the back of the neck and deep cervical flexor muscles will be disrupted, resulting in loss of proper alignment and posture, which is then likely to contribute to cervical impairment and neck pain. [10]

Previous research has frequently reported changes in the cross-sectional area, thickness, size, and activity of deep neck muscles. These structural and functional alterations are believed to contribute to the persistence and recurrence of neck pain. Therapeutic exercise is commonly used to counteract and compensate for these negative effects and is considered an effective treatment approach.

Cervical spine has a very delicate proprioceptive system that plays a crucial role in controlling posture and balance. Most of the current studies have indicated that one of the main problems in patients with chronic neck pain is the cervical proprioception impairment which leads to cervical sensory motor control disturbances[11],which involves central integration and processing of all the afferent information (i.e.; visual vestibular and cervical proprioceptive inputs) and execution of motor program through the cervical muscles contributing to the maintainace of head posture and balance as well as the stability of cervical joints. [9]

Chronic neck pain can alter the biomechanics of the cervical region, leading to impaired joint position sense due to muscle imbalances and changes in head and neck posture. [12]

Cervical muscles are densely populated with muscle spindles, which are sensory receptors that detect changes in muscle length, requiring a high proprioceptive capacity. [13]

Neck proprioceptors are crucial for sensing the position and movement of the head and neck relative to the trunk. They also contribute to maintaining head posture through their links with the vestibular system. [14]

Since proprioceptive deficits are commonly observed in individuals with chronic neck pain, clinical guidelines recommend assessing and addressing proprioceptive dysfunction, making the restoration of proprioception an important aspect of treatment. [15]

Proprioceptive receptors, found in the skin, joints, and muscles, gather sensory information about body position. Muscle spindles, which are low-threshold receptors within the muscles, play a key role in receiving this proprioceptive input. [16]

Several treatments are offered, including pharmacological and non- pharmacological treatments such as electrotherapy, manual therapy, massage, acupuncture, but evidence for the effectiveness of these treatments varies. Guideline endorsed treatments for chronic neck pain include advise, education and manual therapy as well as recommendations for physical exercise programs.

Exercise is considered a low-risk intervention and appears to be a cost-effective approach for managing chronic neck pain when compared to other treatments like manual therapy or massage.[11] Evidence from randomized control trials suggest that proprioceptive targeted exercises improve joint position sense (JPS) at the neck and results in pain reduction. [9]

Deep cervical flexor muscles have been found to have a significant role in supporting and strengthening of the cervical spine. Studies also suggested that in case of cervical disorders, a rehabilitation approach will be more effective if deep cervical flexors are used properly before strengthening of global cervical muscles.

The use of pressure biofeedback unit is also suggested as a more effective way of deep cervical flexors strengthening than conventional exercises. [17]

The deep cervical flexors are considered the primary receptors in the cervical spine responsible for sensing position. [18] When neck pain occurs, these muscles can become underactive, leading to reduced support and control of the cervical joints, while superficial muscles may become overactive to compensate. [19] Deep cervical flexor training including the muscle longus colli and captis have large number of muscle spindles which contain proprioceptors.

Deep cervical flexors training includes exercises which are to be done with pressure bio feedback which helps the therapist to use visual feedback for the activation of muscles [20,21].

Specific neck exercises involve strengthening the deep neck muscles through movements of the eyes and neck, including chin tucks, typically performed in a crook-lying position without a fixed sequence [16]. Such training can enhance proprioceptive acuity by activating muscle spindles within the deep neck muscles. Additionally, targeting both the intrinsic eye and neck muscles contributes to improved proprioception [22,11], highlighting the important role these muscles play in maintaining normal neck proprioceptive function [23].

From the available data no studies have shown the effects of deep cervical flexors training and specific neck muscles training in subjects with chronic neck pain. Therefore, the need of this study is to identify the most effective program between deep cervical flexors training and specific neck muscle training to improve pain, function and proprioception in subjects with chronic neck pain.

MATERIALS & METHODS

This is a quasi-experimental study approved by the Ethical Committee of GSL Medical College & General Hospital. The study was conducted at Department of Physiotherapy OPD, Tertiary Care Teaching Hospital, Rajahmahendravaram, affiliated to Dr. NTRUHS for a period of one year. (From August 2024 to May 2025). A total of 120 subjects were screened for eligibility through Agility T-test out of which 80 subjects were recruited according to inclusion and exclusion criteria. All the subjects were consecutively randomized through Systematic Random Sampling to either Deep Cervical Flexors Training (Group A) or Specific Neck Muscles Training (Group B) groups with 40 subjects in each group. Both the groups received intervention 3 days in a week for 8 weeks.

Inclusion Criteria: Subjects with age less than 50 years, subjects who with persisting neck pain for a minimum of 3 months, neck pain diagnosed by orthopaedician, subjects with grade1 and 2 according to neck pain task force grading.

Exclusion Criteria: Subjects with history of neoplasm, vertigo, vestibular disorders,
Cervical neoplasm, whiplash injury, inflammatory disease, cervical radiculopathy. Subjects who received physiotherapy in past 6 months due to neck pain.

Outcome Measures: Visual Analogue Scale (VAS): It is used to measure the severity of the pain. It is a 10 cm line which is shown to the subjects where one end is marked 0 and the other end is marked 10. It will be explained to subjects that o represents no pain and 10 represents the maximum pain. The subjects will mark the scale based on severity [24].

Neck Disability Index (NDI): Patient-perceived disability will be assessed using the Neck Disability Index (NDI), which is widely recognized as a standard tool for measuring self-reported disability in individuals with neck pain. The questionnaire includes five main domains, such as pain intensity, performance of daily activities, and headache severity. Each item offers six possible responses, scored from 0 (no disability) to 5 (complete disability) [25].

Joint Repositioning Error Test (JPE): It is used to measure neck proprioception. Joint position error is measured in centimeters which is between the starting center point and the point which subject reached will be measured using a ruler by therapist. The normal relocation is within 7 cm from the starting point, and abnormal error is considered more than 7 cm [26].

INTERVENTION: This is an 8 weeks study which includes deep cervical flexors training for Group -A and specific neck muscles training for Group- B. The outcomes were measured by visual analouge scale (VAS), neck disability index (NDI), joint proprioception error (JPE). All the subjects who are eligible for criteria were allocated randomly into Group- A and Group-B.

Group A:
DEEP CERVICAL FLEXORS TRAINING:

This program consisted of three exercises aimed at retraining the deep cervical flexor muscles from different positions. Crook-lying position: [1 set × 10 repetitions per exercise]. An inflatable, air-filled pressure biofeedback sensor was positioned under the suboccipital region at the back of the participant's neck, starting at 20 mmHg and gradually increasing by 2 mmHg at each stage until reaching 30 mmHg in the final stage. Shifting the eye towards the flexion direction made the movement easier,3 sets were performed (each set consisted of 10 repetitions and held for 10 sec for with between each motion and 30 sec among each set)

Fig: 1 CROOK LYING

Quadruped: [3setsx10 repetitions/exercise] The subject will perform a chin tuck and head retraction, lowering the cervical vertebrae until a stretch is felt across the posterior cervical muscles. The exercise was repeated three times with 30 sec hold and 30 sec rest in between

Fig: 2 QUADRUPEDS

Standing: [5 setsx10 repetitions/exercise] The participant stood against the wall, keeping the natural curvature of the waist and pelvis, while performing a chin tuck and holding a 5 mm thick book at the back of the head. There was a total of five sets of training, with a 1-min rest in each set.

Fig: 3 STANDING

Group B:
SPECIFIC NECK MUSCLES TRAINING:

Specific neck muscle training involved deep neck muscle strengthening exercises performed in a crook-lying position:

i. Upward and backward eye movement: Participants moved their eyes upward and backward without moving the head or neck, holding the position for 5 seconds at the end range.

ii. Forward and downward eye movement: Participants moved their eyes forward and downward without moving the head or neck, maintaining the position for 5 seconds at the end range. They will perform a gentle chin tuck holding the position for 5 seconds at the end range.

Fig: 4 CHIN TUCK

Fig: 5 RESISTED CHIN TUCK

They will perform a gentle resistive chin tuck, to their chins with their hands and holding the position for 5 seconds at the end range. They press the back of their head (occiput) into the bed with submaximal force and held the position for 5 seconds.

Fig: 6 SUB - OCCIPITAL MUSCLES CONTRACTION

Each exercise was initially performed 5 times and increased to 20 times by the end of the eight-week program

CONVENTIONAL PHYSIOTHERAPY:
The conventional physiotherapy program consisted of stretching exercises for the upper trapezius, levator scapulae, and pectoralis major muscles, along with strengthening exercises for the rhomboids, lower trapezius, and serratus anterior muscles. This program was provided to both Group A and Group B in addition to their respective interventions. All participants received three sessions per week over a period of eight weeks.

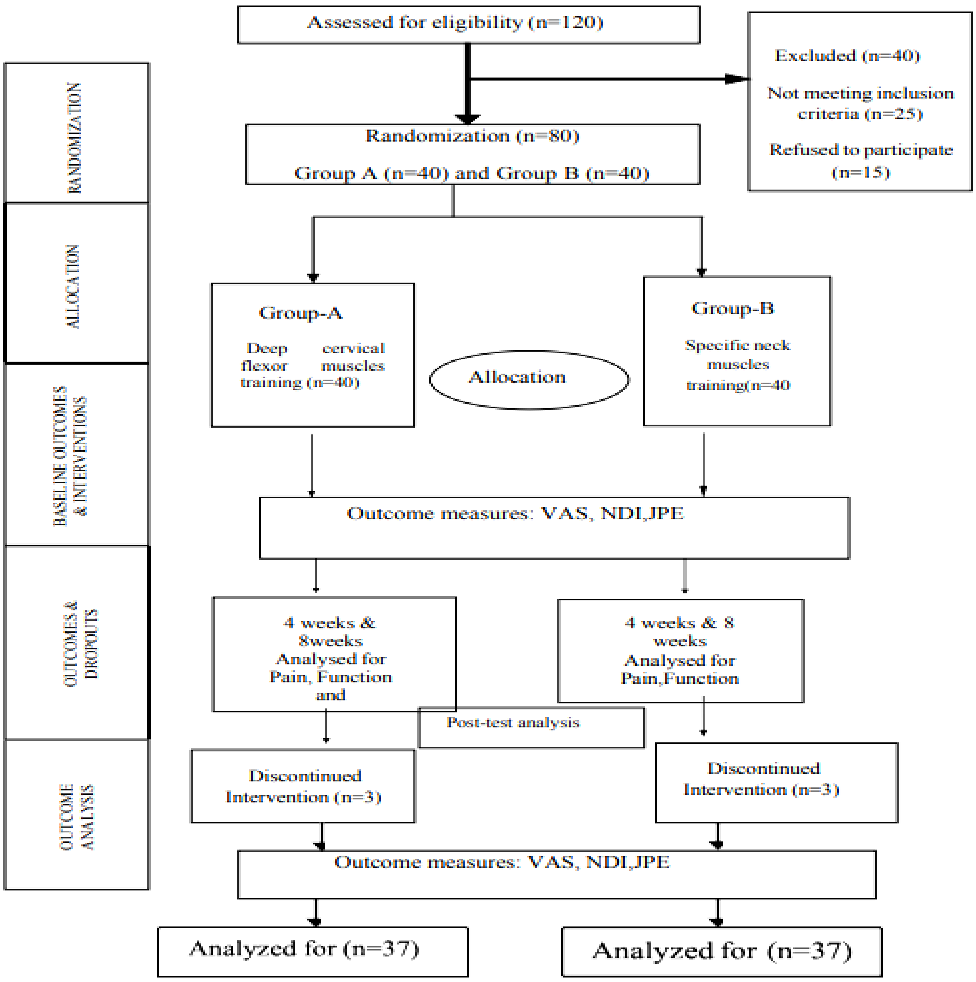

Fig: 7 CONSORT FLOW CHART

Statistical Analysis

Statistical analysis was done by using SPSS software version 20.0 and Microsoft excel 2019.All descriptive data was presented in the form of mean ± standard deviation and mean difference percentages will be calculated and presented. Within the groups: ANOVA was performed to assess the statistical difference within the groups for chronic neck pain, function and proprioception from pre-test, after 4th week and post-test values. Between the groups: independent student 't' test was performed to assess the statistically significant difference in mean value between the groups for the Visual Analogue scale for pain, Neck Disability Index for function, Joint position error for proprioception. Data was tabulated and graphically represented. For all statistical analyses, p<0.05 was considered as statistically significant.

RESULT

The study compared the effect of Deep Cervical Flexors Training and Specific Neck Muscles training program on pain, function, and proprioception in chronic neck pain subjects. After eligibility evaluation, 80 subjects in total were recruited based on the inclusion and exclusion criteria. Each subject was randomly allocated to one of two groups, each consisting of 40 subjects, after completing baseline assessments. Training was given three times a week for eight weeks. Due to dropouts in the middle of the study at the end of the intervention, 74 subjects—37 in Group A and 37 in Group B—completed the training. At a significance level set at p ≤ 0.05, both the groups demonstrated statistically significant improvements in pain and function, but Group-B demonstrated statistically less significant in proprioception.

TABLE 1: COMPARISION OF MEAN SCORE OF VAS BETWEEN GROUPS FOR PRE VALUES

PRE VALUES		MEAN	SD	P VALUE	INFERENCE
VAS	GROUP-A	6.37	0.92	0.616	INSIGNIFICANT
	GROUP-B	6.48	0.96		

The above table1 and shows that the pre test mean scores of VAS in between the group A and group B were found to be statistically insignificant (p<0.05). Group A had a pretest mean score of 6.37, while Group B had a pre- test mean score of 6.48 indicating an insignificant difference of pre-test values between the groups A & B.

TABLE 2: COMPARISION OF MEAN SCORE OF VAS BETWEEN GROUPS FOR 4TH WEEK

4th WEEK		MEAN	SD	P VALUE	INFERENCE
VAS	GROUP-A	3.86	0.88	0.01	SIGNIFICANT
	GROUP-B	4.40	0.89		

The above table2 shows that the 4TH week mean scores of VAS between group A and group B were found to be statistically significant (p<0.05). Group A had a post-test mean score of 3.86, while Group B had a post-test mean score of 4.4 indicating a significant difference of post-test values between the groups A&B.

TABLE 3: COMPARISION OF MEAN SCORE OF VAS BETWEEN GROUPS FOR 8TH WEEK

8th WEEK		MEAN	SD	P VALUE	INFERENCE
VAS	GROUP-A	1.56	0.64	0.0001	HIGHLY SIGNIFICANT
	GROUP-B	2.29	0.74		

The above table3 shows that the 8TH week mean scores of VAS in between the group A and group B were found statistically highly significant(P<0.05). Group A had a post- test mean score of 1.56 and, while Group B had a post - test mean score of 2.29 indicating an significant difference of post -test values between the groups A&B.

TABLE 4: COMPARISION OF MEAN SCORE OF NDI BETWEEN GROUPS FOR PRE VALUES

PRE VALUES		MEAN	SD	P VALUE	INFERENCE
NDI	GROUP-A	21.8	4.44	0.1919	INSIGNIFICANT
	GROUP-B	23.1	4.04		

The above table4 shows that the pre-test mean scores of NDI in between group A and group B were found statistically insignificant(p<0.05). Group A had a pretest mean score of 21.8, while Group B had a pre- test mean score of 23.1 indicating an insignificant difference of pre-test values between the groups A&B.

TABLE 5: COMPARISION OF MEAN SCORE OF NDI BETWEEN GROUPS FOR 4TH WEEK

4th WEEK		MEAN	SD	P VALUE	INFERENCE
NDI	GROUP-A	14.8	3.6	0.0003	HIGHLY SIGNIFICANT
	GROUP-B	17.1	3.2		

The above table5 shows that the 4TH week mean scores of NDI in between group A and group B were found to be statistically significant($p<0.05$). Group A had a post-test mean score of 14.8, while Group B had a post-test mean score of 17.1 indicating a significant difference of post-test values between the groups A&B.

TABLE 6: COMPARISION OF MEAN SCORE OF NDI BETWEEN GROUPS FOR 8TH WEEK

8th WEEK		MEAN	SD	P VALUE	INFERENCE
NDI	GROUP-A	8.6	2.5	0.0001	HIGHLY SIGNIFICANT
	GROUP-B	11.5	2.8		

The above table6 shows that the 8TH week mean scores of NDI in between the group A and group B were found to be statistically highly significant($p<0.05$). Group A had a post-test mean score of 8.6, while Group B had a post-test mean score of 11.5 indicating a significant difference of post-test values between the groups A&B.

TABLE 7: COMPARISION OF MEAN SCORE OF JPE-FLEXION BETWEEN GROUPS FOR PRE VALUES

PRE VALUES		MEAN	SD	P VALUE	INFERENCE
JPE- FLEXION	GROUP-A	2.26	0.35	0.008	INSIGNIFICANT
	GROUP-B	4.62	1.06		

The above table7 shows that the pre -test mean scores of JPE- FLEXION in between group A and group B were found statistically not significant($p<0.05$). Group A had a pretest mean score of 2.26, while Group B had a pre-test mean score of 4.62 indicating an insignificant difference of pre-test values between the groups A&B.

TABLE 8: COMPARISION OF MEAN SCORE OF JPE-FLEXION BETWEEN GROUPS FOR 4TH WEEK

4th WEEK		MEAN	SD	P VALUE	INFERENCE
JPE- FLEXION	GROUP-A	2.26	0.35	0.001	HIGHLY SIGNIFICANT
	GROUP-B	5.31	0.9		

The above table8 shows that the 4TH week mean scores of JPE- FLEXION between group A and group B were found to be statistically highly significant. Group A had a post-test mean score of 2.26, while Group B had a post-test mean score of 5.31 indicating a significant difference of post-test values between the groups A&B.

TABLE 9: COMPRARISION OF MEAN SCORE OF JPE-FLEXION BETWEEN GROUPS FOR 8TH WEEK

8th WEEK		MEAN	SD	P VALUE	INFERENCE
JPE- FLEXION	GROUP-A	1.96	0.34	0.001	HIGHLY SIGNIFICANT
	GROUP-B	5.09	0.94		

The above table9 shows that the 8TH week mean scores of JPE- FLEXION between the group A and group B were found to be statistically highly significant. Group A had a post-test mean score of 1.96, while Group B had a post-test mean score of 5.09 indicating a significant difference of post-test values between the groups A&B.

TABLE 10: COMPARISION OF MEAN SCORE OF JPE-EXTENSION BETWEEN GROUPS FOR PRE VALUES

PRE VALUES		MEAN	SD	P VALUE	INFERENCE
JPE- EXTENSION	GROUP-A	2.14	0.35	0.009	INSIGNIFICANT
	GROUP-B	3.64	1.44		

The above table10 shows that the pre-test mean scores of JPE- EXTENSION in between the group A and group B were found to be statistically not significant($p<0.05$). Group A had a pretest mean score of 2.14, while Group B had a pre- test mean score of 3.64 indicating an insignificant difference of pre-test values between the groups A&B.

TABLE 11: COMPARISION OF MEAN SCORE OF JPE-EXTENSION BETWEEN GROUPS FOR 4TH WEEK

4th WEEK		MEAN	SD	P VALUE	INFERENCE
JPE- EXTENSION	GROUP-A	2.14	0.35	0.001	HIGHLY SIGNIFICANT
	GROUP-B	4.21	1.46		

The above table11 shows that the 4TH week mean scores of JPE- EXTENSION in between the group A and group B were found to be statistically highly significant. Group A had a post-test mean score of 2.14, while Group B had a post-test mean score of 4.21 indicating a significant difference of post-test values between the groups A&B.

TABLE 12: COMPARISION OF MEAN SCORE OF JPE-EXTENSION BETWEEN GROUPS FOR 8TH WEEK

8th WEEK		MEAN	SD	P VALUE	INFERENCE
JPE- EXTENSION	GROUP-A	1.71	0.34	0.001	HIGHLY SIGNIFICANT
	GROUP-B	3.67	1.46		

The above table12 shows that the 8TH week mean scores of JPE- EXTENSION in between the group A and group B were found to be statistically highly significant. Group A had a post-test mean score of 1.71, while Group B had a post-test mean score of 3.67 indicating a significant difference of post-test values between the groups A&B.

DISCUSSION

The purpose of the current study was to assess the effectiveness of Deep Cervical Flexors Training and Specific Neck Muscle Training on pain, function, and proprioception in subjects with chronic neck pain. In this study, subjects were assessed for pain and function and proprioception. The following outcome measures are visual analogue scale (VAS), neck disability index (NDI) and joint position error test (JPE) were used to measure the intensity of pain, function, and proprioception

Subjects were evaluated for pain, function and proprioception at baseline, 4th week and at the end of the intervention using VAS for pain, NDI for function and JPE for proprioception. There were a total of 6 dropouts i.e, In Group-A(Deep cervical flexor muscle group) 3 dropouts i.e 2 subjects are due to lack of transportation and 1subject is due to other health issues with 37 subjects and in Group-B (Specific neck muscle training group) there are 3 dropouts i.e,2 subjects are due to spontaneous recovery and 1 subject is due to relocation with 37 subjects .

In Group-A (Deep cervical flexors training) there is statistically significant improvements at 4th week but statistically more significant improvements seen at the end of the study i.e at 8th week (p=0.001) in VAS and also statistically more significant improvements seen in NDI (p=0.001) and statistically high significant improvement at 4th week but more significannt at the end of the study i.e 8th week (p=0.001) in proprioception. Exercises in this group shown to be effectively involved in reducing the neck pain by activating the deep cervical muscles and reducing the activity of the sternocleidomastoid muscle. One possible explanation for reduction of pain is the restoration of normal alignment and posture which occurs when the deep cervical flexors muscles and the stabilizers on the back of neck work together more effectively [27].

According to Ashfaq and Riaz, the adults suffering from chronic mechanical neck pain showed better results with cranio-cervical flexion training by pressure bio feedback [28].

According to Mahto and Malla they compared the benefits of deep cervical flexors training utilizing pressure biofeedback with those of proprioceptive neuromuscular facilitation exercise. The results of the study demonstrated that both approaches can be utilized separately to alleviate pain while correcting joint position errors, and there was no significant variation in outcomes between the two groups [22].

Exercises in Group A resulted in a clear decrease in disability. This outcome may be attributed to how improved mobility helps counteract catabolic processes. When the body remains immobile, protein production drops and catabolic activity rises, which can irritate nociceptors. Deep cervical flexor training enhances neck mobility, likely promoting better protein turnover in the muscles, which in turn may have contributed to the larger reduction in disability seen in this group [29]. These results agree with the observations of Rolving, who reported improvements in pain and disability in patients with neck pain across both the general physical activity group and the neck- and shoulder-focused training group[30].

Exercises in this group seem to contribute to improved proprioception, as the deep cervical flexor muscles contain a large number of muscle spindles. Repeated contraction and training of these muscles may boost the activity of these spindles, which can lead to better cervical proprioception [31].

These findings reinforce the results of Mahto and Malla, who noted that both deep neck flexor strengthening and proprioceptive neuromuscular facilitation exercises helped reduce neck joint position error in patients with neck pain [22].

In Group-B (specific neck muscle training) of the current study, significant improvements were noted in VAS ($P = 0.001$) and NDI ($P = 0.001$). However, there was no significant improvement in proprioception (JPE) at the 4th week or at the end of the 8-week study.

Exercises in Group B were found to be effective in decreasing neck pain. These improvements may result from metabolic changes that take place in neck muscle cells after exercise therapy. Such exercises can increase the activity of the Na^+–K^+ pump and improve blood flow within the muscles, which might help explain the reduction in pain and disability observed following the therapy [32].

Exercise in Group B was effective in reducing disability, likely because these exercises support the removal of catabolic byproducts and enhance the supply of oxygen-rich blood. This can lower nociceptor activity, reduce pain, and ultimately improve overall function.

Additionally, these results align with those of Dedering et al., who reported that both structured physical activity and targeted neck-specific exercises helped decrease pain and disability in patients diagnosed with cervical radiculopathy [33].

Aside from the reductions in pain and disability, Group B showed no notable improvement in proprioception. This may be because the specific neck exercises—such as eye–head coordination drills—are not sufficient to activate the deep neck muscle spindles. In contrast, the ROM-based exercises used in the deep cervical flexor training group can stimulate Golgi tendon organs, muscle spindles, and joint mechanoreceptors. Therefore, it appears that the deep cervical flexor group engaged a greater number of proprioceptors, resulting in a more stable and enhanced improvement in proprioceptive acuity compared with the specific neck muscle training group [34].

In Group-A the application of pressure biofeedback mainly targets the deep cervical flexor muscles which are the primary muscles where the proprioceptors are mainly located, so activation of deep cervical flexors may be activates the proprioceptors and in turn increases the proprioception.

After eight weeks of intervention, the outcomes revealed notable improvements in all assessed measures—Visual Analogue Scale (VAS), Neck Disability Index (NDI), and Joint Position Error (JPE)—in the deep cervical flexor muscle training group when compared with the specific neck muscle training group.

Therefore, the study findings indicate that Deep cervical flexors training was effective for reducing pain, improving function and proprioception in the sample studied.

CONCLUSION

In conclusion, the present study compared the effects of Deep cervical flexors Training and the Specific neck muscles training on pain, function, and proprioception in subjects with chronic neck pain, where both interventions produced significant improvements in reducing pain, improving pain and proprioception. However, more percentage of improvement was found in subjects received Deep cervical flexors training when compared to Specific neck muscles training. Based on the results of the present study, it can be suggested that Deep cervical flexors training may be opted as a treatment of choice for reducing pain, improving function and proprioception in subjects with chronic neck pain.

Declaration by Authors

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