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Effect of Gaze Direction Recognition Exercise (GDRE) Program in Reducing Pain & Increasing Range of Motion in Chronic Neck Pain

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Abstract

Introduction: Chronic neck is a prevalent musculoskeletal condition affecting individuals worldwide, often leading to decreased range of motion and diminished quality of life. It is characterized by persistent discomfort and functional limitations in the cervical region. The increasing prevalence of chronic neck pain is attributed to various factors, including sedentary lifestyles, poor ergonomics, and psychological stressors. This study presents a comparative investigation into the effects of proprioceptive training vs conventional training on increasing range of motion and reducing pain in patients with chronic neck pain.

Objectives of the Study:

- To improve range of motion and reduce pain in patients with chronic neck pain.
- To assess the effectiveness of Gaze Direction Recognition Exercise (GDRE) Program.

Procedure: All the participants were explained about the purpose of study. The subjects were screened for inclusion and exclusion criteria and then the baseline measurement was taken. An informed consent was taken from patients who were willing to participate in the study. Eligible subjects were randomly allocated into two groups. Group A participants receiving conventional training. Group B participants receiving proprioceptive training. Both groups had received exercises program for chronic neck pain. The study was of 6 weeks, 5 days per week at department of physiotherapy in SMIH. Examination include assessment which was performed on first and the last day of treatment & data was recorded in group A pre scoring was via VAS, NDI, cervical goniometer and after the scoring the patient undergone treatment with proprioceptive training.

Conclusion: Gaze Direction Recognition Exercise (GDRE) Program shows more improvement in range of motion and pain in chronic neck pain after 6 weeks of therapy.

Keywords: NDI; VAS; ACROM; Gaze Direction Recognition Exercise (GDRE) Program; Chronic neck pain.

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INTRODUCTION

Chronic neck pain is defined as a debilitating condition characterized by persistent and widespread discomfort experienced in the neck and shoulder region. This condition is often accompanied by hyperalgesia, a heightened sensitivity to pain, which can be detected through palpation and observed in both passive and active movements of the neck and shoulder.[1]

It is a prevalent and burdensome musculoskeletal condition that affects a significant portion of the adult population. With a changing prevalence ranging from 43% to 66.7% in adults, chronic neck pain poses a considerable challenge to individuals worldwide.[2]

Neck pain is one of the most common persisting symptoms in the general population with an estimate lifetime prevalence of 67% among adults of age group 20 to 69 years. Limited range of motion and a subjective felling of stiffness may accompany neck pain, which is often precipitated or aggravated by neck movements or sustained neck postures. Headache, brachialgia, dizziness and other signs and symptoms may also be present in combination of neck pain.[3]

Cervical proprioception, in conjunction with visual and vestibular systems, plays a vital role in maintaining bodily balance, posture, and optimizing motor control. The cervical spine possesses a rich density of muscle spindles, contributing to a sophisticated proprioceptive system that governs neck reflex systems. These reflexes are essential for maintaining balance, coordinating head and eye movements, and ensuring equilibrium in both static and dynamic conditions. Individuals with various neck syndrome exhibit cervical proprioception, characterised by increased reposition errors compared to asymptomatic individuals. Such somatosensory dysfunction can lead to delays and errors in updating the information necessary to maintain balance. Furthermore, impaired proprioception significantly impacts postural stability across different diseases conditions.[4]

Aim of the Study

The aim of the study is to determine the "A comparative study between Proprioceptive on increasing range of motion and reducing pain in chronic neck pain patients".

Objectives of the Study

- To improve range of motion and reduce pain in patients with chronic neck pain. To assess the effectiveness of Gaze Direction Recognition Exercise (GDRE) Program.

Need of the Study

- Although various studies have been using proprioceptive training with different techniques but none has done this study which I will do. Thus it was needed to see the effect of Gaze Direction Recognition Exercise (GDRE) Program on reducing pain and increasing range of motion in chronic neck pain patients and find out which one is better.

Purpose of Study

The prevalence of neck pain is quite high and tendency of acute pain to transcend into chronic neck pain is high as well. A large number of population suffer from neck pain and number of people vulnerable to develop CNP is on rise not only due to lifestyle changes but also the challenges posed by pandemic recently. Hence we need to cover all the shortcomings in our conventional treatment in order to have a multi factorial approach to combat the disabilities faced by patients of chronic neck pain.

Hypothesis

- **Alternate Hypothesis:** There may be significant difference between the Gaze Direction Recognition Exercise (GDRE) Program for increasing range of motion and reducing pain in chronic neck pain patients.
- **Null Hypothesis:** There may not be significant difference between the Gaze Direction Recognition Exercise (GDRE) Program for increasing range of motion and reducing pain in chronic neck pain patients.

REVIEW OF LITERATURE

Rene Fejer, Kirsten Ohm Kyvik, *et al*, 29 June 2004, Eur spine J (2006) 15: 834-848, conducted a study on the prevalence of neck pain in the world population: a systematic critical review of the literature. The objective of this study was to determine the prevalence of neck pain (NP) in the world population and to identify areas of methodological variation between studies. A systematic search was conducted in five databases (MED-LINE, EMBASE, CINAHL, OSH-ROM, and PsycINFO), followed by a screening of reference lists of relevant papers. The study concluded that NP is common system in the population. The prevalence increases with longer prevalence periods and generally women have more NP than men.[21]

Niraj Kumar, et al (2020) did study on Neck Pain. A convenience sample of 30 subject with neck pain randomly assigned into two

groups like group A and B. The Group A subject received Isometric Strengthening Exercise and Hot Pack. The Group B subject received Postural Correction, Hot Pack. All two groups were treated for four week. Instrumentation For Data Collection: - Instrumentation for Data Collection is Visual analogue Scale (VAS) – For Pain and Functional rating index (FRI) – For functional limitation/disabilities. In the present study, there was significant difference between the Isometric strengthening exercise treatment and Postural Correction for neck pain. The Isometric strengthening exercise protocol has been found to be more beneficial that the Postural Correction.

Tasha R. Stanton, Hayley B. Leake, et al 15, October 2015, Physical therapy volume 96, No. 6, conducted a study on Evidence of impaired proprioception in chronic, idiopathic neck pain: systematic review and meta-analysis. 13 studies were included in the present review. Meta-analysis on 10 studies demonstrated that people with chronic neck pain perform significantly worse on head-to-neutral repositioning tests, with a moderate standardized mean difference of 0.44. Two studies evaluated head repositioning using trunk movement and showed conflict results. Three studies evaluated complex or postural repositioning test. They concluded that people with chronic, idiopathic neck pain are worse than asymptomatic controls at head- to- neutral repositioning tests.[22]

Vito Enrico Pettorossi and Marco Schieppati, et al 4 November 2014, conducted a study on neck proprioception shapes body orientation and perception of motion. This review article concluded that neck muscle inflow has prominent immediate and late effects on perception of body orientation and motion. Prolonged, intense proprioceptive input from neck muscles can induce persistent influences on self- motion perception and cognitive body representation. These plastic changes might adapt motion sensitiveness to lasting or permanent head positional or motor changes, like those accompanying movement disorders or those accompanying weightlessness.[2]

Baogan Peng, Liang Yang, et al 12 January 2021, conducted a study on Cervical proprioception impairment in neck pain pathophysiology, clinical evaluation, and management: A narrative review. They concluded that neck pain is common cause of disability worldwide, but its pathophysiology is still unclear. Current studies recommend training on different aspects of sensorimotor function, particularly retraining aimed at improving proprioception and muscles coordination in the neck.

METHODOLOGY

In this study simple random sampling technique was used and 30 patients were divided into two groups. 15 patients were selected randomly and was included in group A and 15 patients in group B. These subjects were solicited from the Shri Mahant Indiresh Hospital, Department of Physiotherapy, Patel Nagar, Dehradun (Uttarakhand) and selected according to inclusion and exclusion criteria. **Inclusion criteria:** Age 18-45 years, Neck pain persist for at least 3 months, Both sex groups and Patients with minimum 10% limitation in range of motion of neck rotation. **Exclusion criteria:** Patient with acute neck pain, Pain due to specific cause (e.g., fracture, spondylolisthesis, disc herniation and cervical stenosis), Neurological disorders, Orthopaedics disorders, Other systemic disease that may affect balance, History of any congenital anomalies and Pregnant woman. **Outcome Measures:** Neck Disability Index (NDI), Visual Analogue Scale (VAS) and Active Cervical Range of Motion Device

Procedure

- All the participants were explained about the purpose of study. The subjects were screened for inclusion and exclusion criteria and then the baseline measurement was taken. An informed consent was taken from patients who were willing to participate in the study. Eligible subjects were randomly allocated into one groups. Group A participants receiving Gaze Direction Recognition Exercise (GDRE) Program. Groups A had received exercise program for chronic neck pain. The study was of 6 week, 5 days per week at department of physiotherapy in SMIH. Examination included assessment which was performed on first and the last day of treatment & data was recorded.
- **In group A,** comprised of chronic neck pain subjects to be treated with the Gaze Direction Recognition Exercise (GDRE) Program. Gaze Direction Recognition Exercise (GDRE) program will be used to improve the proprioceptive balance of neck in chronic neck pain.
- **GDRE Protocol Involves:** small boxes between 1 and 6 will be ordered on a table with the same interval to divide 5 equal parts for GDRE. A researcher sits towards the table at a distance of 75 cm. The patient sits behind the researcher at a distance of 75 cm and toward the table. The researcher looks the boxes randomly with

cervical rotations. The patient at the back will tell which box the researcher looks at by saying number of the box.

Exercises consisted of eye-follow, gaze stability, eye head coordination and position sense and movement sense.

In eye follow exercise, patients moved their eyes to follow the target while seated with their head stationary. The target was a pen held by physical therapist, who initially moved it slowly in one plane and then increased the speed and changed the direction of movement.

For the gaze stability exercise, patients actively moved their head in all directions while visually fixing on the target.

The exercise for eye-head coordination began by moving the head and eyes to the same direction. Then participants moved their eyes first to keep focused on the target, and then moved their head. Finally, they moved their eyes in one direction while simultaneously rotating their head in opposite direction.

These exercises will be initially done slowly in a restricted range of movements, then the speed and range of movements gradually increased. Exercises will be done in both vertical and horizontal directions.

For joint position sense and movement sense exercise, participants will wear a laser pointer attached to a head band. The participants will sit 1 meter from a point marked on the wall, and will be instructed to move their head until the laser beam was aimed on the point, and then close their eyes and memorize their head neck position for 5 sec. Maximal movements of the head will be performed in one direction (flexion, extension, rotation and lateral rotation flexion) after which the patients tried to recover their head position as closely as possible, and opened their eyes.

Fig. 1: Performing cervical isometrics

Fig. 2: Performing Gaze Direction Recognition exercise

Fig. 3: Patient performing joint position sense and movement sense exercise with laser pointer attached to the head band.

This chapter deals with the result of data analysis of three outcome measures that is with NDI, ACROM, and VAS, within group A and group B and between group A and group B. The score was analysed and interpreted to determine which intervention is more effective in improving pain and range of motion in chronic neck pain patients.

Paired t-test was used to analyse and compared pre and post treatment score within the group A and group B.

Analysing NDI revealed significant difference in group A post treatment, mean and standard deviation (21.13, 5.85) when compared to group A pre-treatment, mean and standard deviation of mean (28.93, 7.88) (table 1).

Analysing ACROM (flexion, extension, lateral flexion left, lateral flexion right, rotation left, rotation right) revealed significant difference in group A post-treatment, mean and standard deviation of mean (54.57, 4.69) (50.13, 3.07) (28.47, 5.73) (30.33, 4.37) (35.53, 3.72) (41.13, 3.23) when compared to group A pre-treatment, mean and standard deviation of mean (51.33, 5.25) (45.13, 3.07) (20.00, 2.67) (23.73, 2.34) (31.33, 2.00) (36.20, 2.88) (table 1).

Analysing VAS revealed significant difference in group A post treatment, mean and standard deviation (3.73, 1.33) when compared to group A pre-treatment, mean and standard deviation of mean (6.73, 1.49) (table 1).

Table 1: Within group comparison of pre and post data of all outcome measures in group A

Chronic Neck Pain	Mean	SD	t-value	P-value
Measured By				
PRE- NDI	28.93	7.88	14.0851	<0.0001
POST- NDI	21.13	5.85		
PRE- VAS	6.73	1.49	30.7409	<0.0001
POST- VAS	3.73	1.33		
PRE- ACROM (Flex)	51.33	5.25	14.3486	<0.0001
POST-ACROM (Flex)	54.67	4.69		
PRE- ACROM (Ext)	45.13	3.07	4.4639	<0.0001
POST-ACROM (Ext)	50.13	3.07		
PRE- ACROM (LFL)	20.00	2.67	6.1833	<0.0001
POST-ACROM (LFL)	28.47	5.73		
PRE- ACROM (LFR)	23.73	2.34	6.1789	<0.0001
POST-ACROM (LFR)	30.33	4.37		
PRE- ACROM (RL)	31.13	2.00	6.0906	<0.0001
POST-ACROM (RL)	35.53	3.72		
PRE- ACROM (RR)	36.20	2.88	7.5808	<0.0001
POST-ACROM (RR)	41.13	3.23		

Analysing NDI revealed significant difference in group B post treatment, mean and standard deviation (20.93, 6.64) when compared to group B pre-treatment, mean and standard deviation of mean (227.67, 8.40) (table 2).

Analysing ACROM (flexion, extension, lateral flexion left, lateral flexion right, rotation left, rotation right) revealed significant difference in group B post-treatment, mean and standard deviation of mean (58.76, 5.38) (52.53, 4.05) (32.40, 5.72) (32.73, 3.06) (37.21, 1.70) (41.47, 1.92) when compared to group B pre-treatment, mean and standard deviation of mean (51.57, 4.91) (46.93, 4.11) (24.40, 5.37) (24.60, 1.88) (31.47, 1.68) (35.80, 1.82) (table 2).

Analysing VAS revealed significant difference in group B post treatment, mean and standard deviation (3.80, 1.78) when compared to group B pre- treatment, mean and standard deviation of mean (6.73, 1.58) (table 3).

Table 2: Within group comparison of pre and post data of all outcome measures in group B

Chronic Neck Pain	Mean	SD	t-Value	P-Value
Measured By				
PRE- NDI	27.67	8.40	12.2998	<0.0001
POST- NDI	20.93	6.64		
PRE- VAS	6.73	1.58	9.2908	<0.0001
POST- VAS	3.80	1.78		
PRE- ACROM (Flex)	51.57	4.91	8.5078	<0.0001
POST-ACROM (Flex)	58.76	5.38		
PRE- ACROM (Ext)	46.93	4.11	13.6011	<0.0001
POST-ACROM (Ext)	52.53	4.05		
PRE- ACROM (LFL)	24.40	5.37	11.5931	<0.0001
POST-ACROM (LFL)	32.40	5.72		
PRE- ACROM (LFR)	24.60	1.88	10.9559	<0.0001
POST-ACROM (LFR)	32.73	3.06		
PRE- ACROM (RL)	31.47	1.68	17.3494	<0.0001
POST-ACROM (RL)	37.21	1.70		
PRE- ACROM (RR)	35.80	1.82	17.7790	<0.0001
POST-ACROM (RR)	41.47	1.92		

Result: The data were analysed using the statistical software SPSS version 15. To analyse the difference of NDI, ACROM and VAS of Group A (Conventional therapy) and Group B (Proprioceptive training), the paired t-test was applied. The p values <0.0001 in Group A and Group B showing extremely significant.

Table 3: Mean Difference in NDI, ACROM and VAS in between Groups A & B

	Group A			Group B		
	NDI	**ACROM**	**VAS**	**NDI**	**ACROM**	**VAS**
Mean difference	21.13	Flex- 54.67 Ext- 50.13 LRL- 28.47 LRR- 30.33 RL- 35.53 RR- 41.13	3.73	20.93	Flex- 58.67 Ext- 52.53 LRL- 32.40 LRR- 32.73 RL- 37.20 RR- 41.44	3.80
SD	5.85	Flex- 4.69 Ext- 3.07 LRL- 5.73 LRR- 4.37 RL- 3.72 RR- 3.23	1.33	6.61	Flex- 5.38 Ext- 4.05 LRL- 5.72 LRR- 3.06 RL- 1.70 RR- 1.92	1.78
t- Value	0.087	Flex- 2.17 Ext- 1.82 LRL- 1.88 LRR- 1.74 RL- 1.58 RR- 0.35	0.122	0.087	Flex- 2.17 Ext- 1.82 LRL- 1.88 LRR- 1.74 RL- 1.58 RR- 0.35	0.122
p- Value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

The result of Group A and Group B showing differences at p values <0.0001. As comparing the mean difference between both groups, the mean difference in NDI for group A is 21.13 and Group B is 20.93, this result showed that Group A is more effective in NDI as compared to Group B. On the other hand, while comparing the mean difference between both the group A and B in ACROM and VAS. Group A showed (flex- 54.67) (Ext- 50.13) (LRL- 28.47) (LRR- 30.33) (RL- 35.53) (41.13) and VAS (3.73), and Group B ACROM (flex- 58.67) (Ext- 52.53) (LRL- 32.40) (LRR- 32.73) (RL- 37.20) (RR- 41.44) and VAS (3.80) that indicated that the Group B is more effective in ACROM and VAS than Group B (table 3).

Therefore, result suggest that after 6 weeks of conventional therapy and proprioceptive training, both groups shows improvement in pain and range of motion but proprioceptive training shows more improvement in pain and range of motion of neck in chronic neck pain patients.

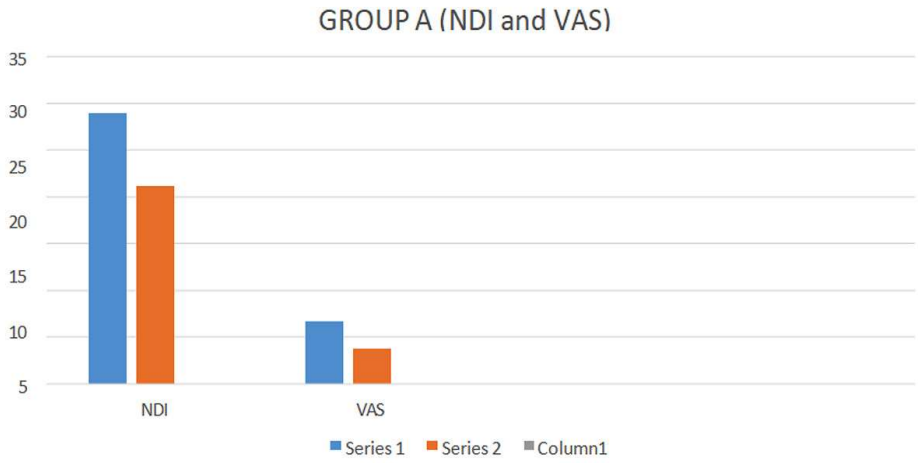

Fig. 1: Mean of Group A (NDI and VAS)

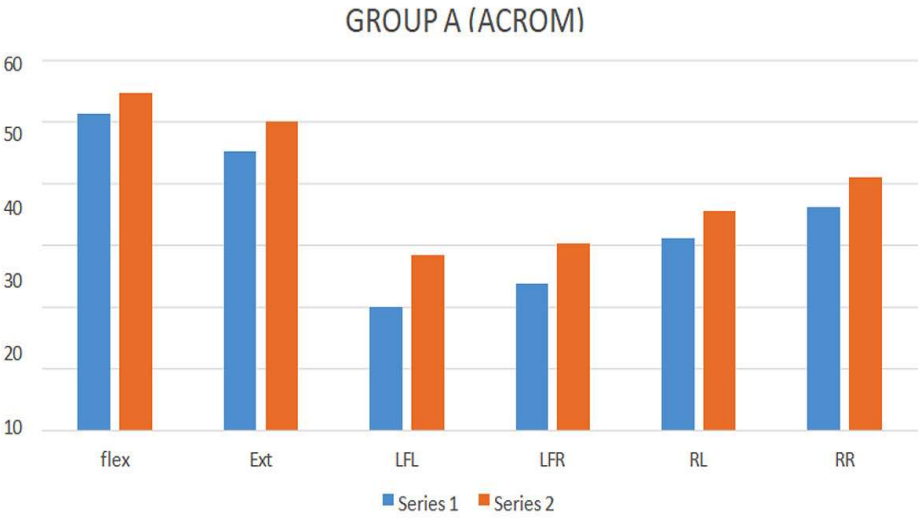

Fig. 2: Mean of Group A (ACROM)

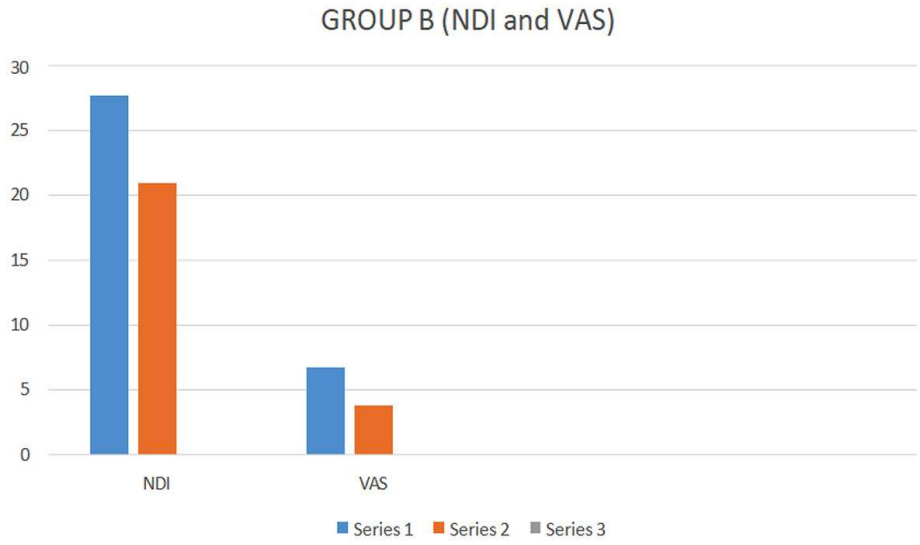

Fig. 3: Mean of Group B (NDI and VAS)

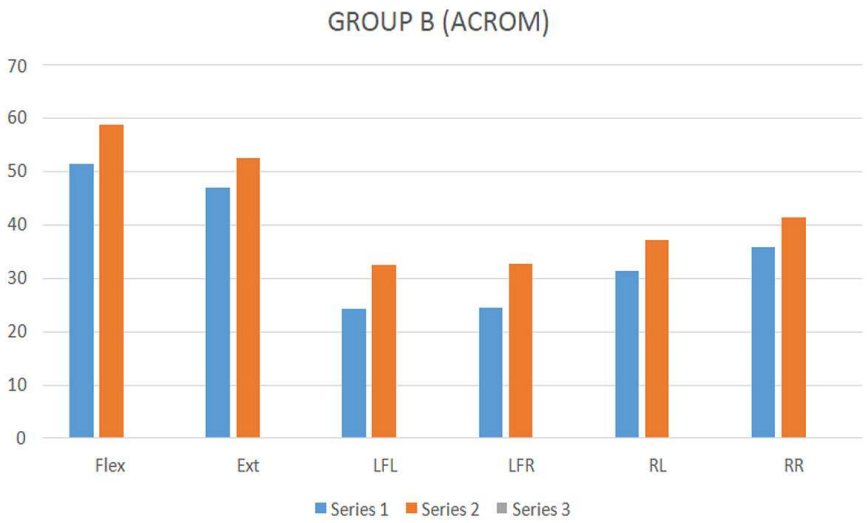

Fig. 4: Mean of Group B (ACROM)

DISCUSSION

The present study aimed to investigate the effects of proprioceptive training compared to conventional therapy on increasing range of motion and reducing pain in chronic neck pain patients. The result of this study demonstrate a significant advantage of proprioceptive training over conventional therapy in achieving these objectives.

Our findings align with previous studies that have highlighted the importance of proprioceptive training in improving motor control and kinaesthetic awareness. The proprioceptive system plays a crucial role in maintaining postural stability and joint function, and deficits in proprioceptive have been linked to various musculoskeletal conditions, including neck pain. The observed superiority of proprioceptive training in our study may be attributed to its targeted engagement of proprioception, muscle activation, and sensorimotor integration.

Comparative studies investigating the efficacy of conventional therapy have shown varying outcomes, and some have reported modest improvements in range of motion and pain reduction. However, its important to note that conventional therapy often encompasses a wide range of interventions, making direct comparisons challenging. The homogeneity and specificity of proprioceptive training in our study could have contributed to the more pronounced effects observed.

Mechanistically, proprioceptive training likely influences pain reduction through improved neuromuscular control and joint stability. Enhanced proprioception can help patients adopt more optimal movement patterns, reducing stress on affected structures and subsequently alleviating pain.

The clinical implications of our findings are noteworthy. Incorporating proprioceptive training into the rehabilitation protocol for chronic neck pain patients has the potential to enhance treatment outcomes.

Proprioceptive exercises can be tailored to target specific neck muscles and movement patterns, leading to more focused and effective interventions. Moreover, as proprioceptive training involves active patient engagement, it may promote self-management and long term adherence to exercises.

Despite the promising results, several limitations warrant consideration. The sample size in this study was relatively small, and the duration of the intervention was limited. Additionally, the specific exercises and protocols used in both training methods could influence the outcome.

Future research with larger sample sizes, longer intervention periods, and different exercises variations would provide a more comprehensive understanding of the long-term effects.

In conclusion, the present study contributes to the growing body of literature on proprioceptive training and its impact on chronic neck pain. Our findings support the notion that proprioceptive training is more effective than conventional

therapy in increasing range of motion and reducing pain in this patient population. This insight underscores the importance of considering proprioceptive interventions in the design of rehabilitation programs for chronic neck pain. Further research and clinical implementation of proprioceptive training are warranted to optimize treatment strategies and improve the quality of life for individuals with chronic neck pain.

Limitation of Study

The duration of study was only 6 weeks, so further prognosis and long-term benefits could not be recorded.

Sample size is small with less than 30 patients, Training depends on pain and range of motion of cervical spine of patients. Home exercise was not prescribed to the subject.

The study was limited only to cervical strengthening, and stretching exercises.

Future Research

Further Studies are recommended to minimize this limitation in such a way that larger sample size of both sexes that include various age groups of people are studied.

The duration of the study can be increased.

Various outcome measures can be used in order to record disability from chronic neck pain in better way.

The study can be done to investigate the ideal frequency, and intensity of training sessions for maximizing pain reduction and range of motion improvements.

The study can be done to dive into neurophysiological mechanisms behind the effects of proprioceptive and conventional training.

CONCLUSION

Conventional therapy and proprioceptive training both shows improvement in range of motion and pain in chronic neck pain patients. But proprioceptive training shows more improvement in range of motion and pain in chronic neck pain after 6 weeks of therapy.

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