"Comparative Analysis of Craniocervical Flexor Training with Pressure Biofeedback vs. Scapular Stabilization Exercises on Chronic Mechanical Neck Pain Among Computer Users: A Comparative Study"

By

Prachi Keshao Aswale

Dissertation Submitted to the
Odisha University of Health Sciences, Bhubaneswar, Odisha

In Partial Fulfilment
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MASTER OF PHYSIOTHERAPY (MPT)
In

ORTHOPEDICS

Under the Guidance of

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ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE BHUBANESWAR, ODISHA - 2023-2025

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ACKNOWLEDGEMENT

At the very outset, I express my deepest gratitude to Dr. Apjit S. Bindra, Chairman, Mr. Abhinav A. Bindra, Founder, and Dr. Digpal Ranawat, Executive Director of Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha for giving me this opportunity.

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I express special thanks to My Rita Enterprises Company and Amrut Salotkar Sir ,for permitting me and helping me to make this dissertation successful. My heartfelt thanks go to all the participants who voluntarily took part in this research. Without their cooperation, the completion of this work would not have been possible

Finally, I extend my deepest appreciation to my parents, family, and friends for their patience, encouragement, and unwavering support during the entire duration of my academic journey. Their love and belief in me have been a constant source of motivation.

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Date: **Signature**

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LIST OF ABBREVIATIONS USED

1. **CCFT**-Craniocervical flexor training
2. **CMNP**-Chronic Mechanical Neck Pain
3. **NDI**-Neck Disability Index
4. **NPRS**-Numerical Pain Rating Scale
5. **PBU**-Pressure biofeedback device unit
6. **ROM**-Range of motion
7. **SF-12**- Short Form 12
8. **SSE**-Scapular stabilization exercises

ABSTRACT

Background: Chronic Mechanical Neck Pain (CMNP) is a common musculoskeletal condition that leads to pain, functional limitations, and a reduced quality of life. Exercise-based rehabilitation continues to be the mainstay of conservative treatment, but the relative effectiveness of different exercise strategies—particularly Craniocervical Flexor Training (CCFT) and Scapular Stabilization Exercises (SSE)—is still not well established.

Objective: This study aimed to evaluate and compare the effects of CCFT and SSE on pain intensity, neck-related disability, quality of life, and cervical range of motion in individuals with CMNP.

Methods: Out of 60 screened participants, 52 satisfied the inclusion criteria and were randomly divided into two equal groups (n=26). Group A underwent CCFT, while Group B performed SSE for a defined intervention period. The outcome measures included the Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), SF-12 Health Survey (Physical and Mental Components), and goniometric measurements of cervical mobility. Data before and after intervention were analyzed using paired and independent t-tests, with significance set at $p<0.05$.

Results: Both groups demonstrated significant improvements in most parameters. Group A (CCFT), however, showed greater benefits in reducing pain (NPRS), lowering disability scores (NDI), and enhancing cervical flexion and rotation. Improvements in quality of life (SF-12 PCS/MCS) were observed in both groups, with slightly higher gains

in Group A. The effect size for CCFT indicated substantial clinical as well as statistical improvement.

Conclusion: The findings of this study suggest that CCFT is more effective than SSE in reducing pain, improving functional outcomes, and enhancing cervical mobility in individuals with CMNP. Therefore, CCFT may be recommended as a primary intervention strategy, while SSE could be considered a useful adjunct, especially in patients presenting with postural imbalances or scapular dysfunction

Keywords : Neck pain , Quality of life, Pain Measurment , Chronic Pain, Pain Measurment, Musculoskeletal Diseases, Outcome Assesment, Health care.

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INTRODUCTION

Mechanical neck pain (MNP) is one of the most commonly encountered musculoskeletal disorders in clinical practice, particularly among the adult working population. It is generally described as pain originating from cervical spine structures such as muscles, ligaments, intervertebral discs, facet joints, and neural elements, but without signs of significant neurological involvement or systemic disease [(1)]. Unlike specific cervical conditions, such as fractures, tumors, or inflammatory disorders, MNP is considered a non-specific condition, though it frequently arises in association with mechanical dysfunctions and poor neuromuscular control of cervical stabilizing muscles [(2)]. Beyond the physical discomfort, MNP has substantial consequences for occupational performance, productivity, and quality of life, making it a growing concern in modern sedentary lifestyles.A rising prevalence of neck pain is reported in individuals engaged in prolonged computer use and other desk-based occupations. Poor ergonomics, static postures, and repetitive strain contribute to musculoskeletal overload, often resulting in persistent pain. Epidemiological data suggest that 30–50% of adults experience neck pain annually, with a notable proportion developing chronic symptoms [(3)]. Transition from acute to chronic stages is often associated with unaddressed muscle dysfunctions, reduced endurance of the deep cervical flexors, and maladaptive postural changes.The underlying mechanisms of MNP are largely related to muscular and joint imbalances within the cervical spine. Forward head posture and upper-crossed syndrome commonly lead to overactivation of superficial muscles, such as the upper trapezius and levator scapulae, while deep stabilizers like the longus colli and longus capitis are inhibited [(4)]. This

imbalance contributes to impaired proprioception, altered motor control, and a self-perpetuating cycle of pain and dysfunction. Prolonged desk work, characterized by sustained cervical flexion and scapular protraction, further intensifies mechanical loading. Studies also highlight the role of muscle fatigue and reduced segmental stability in the persistence of symptoms [5].

Clinically, MNP manifests as localized or referred pain in the cervical and upper thoracic regions, stiffness, dull aching pain, and reduced cervical mobility. While neurological deficits are absent, the condition can significantly limit daily and occupational activities. Tools such as the Neck Disability Index (NDI) and Short Form-12 (SF-12) are frequently used to measure the extent of functional and psychosocial impact [6].With increasing reliance on digital technology, chronic mechanical neck pain (CMNP) is particularly prevalent among computer users, including software professionals, administrative workers, students, and data entry operators. These individuals typically present with forward head posture, poor scapular alignment, and limited awareness of ergonomics. Prolonged sitting and minimal movement variability further contribute to cervical strain [7].

Epidemiological studies reinforce this association: Mekonnen et al[8]. reported that over 60% of office workers experienced neck pain within a year, while Janwantanakul et al[9]. found the risk of pain significantly increased in individuals using computers for more than three hours daily. Static postures and suboptimal workstation setups amplify cervical load and muscle fatigue. Szeto et al[10]. observed increased electromyographic activity in the upper trapezius and cervical erector spinae during prolonged non-neutral postures,

while Cagnie et al. [11] linked pain intensity and frequency directly with computer use duration.

Psychosocial stressors such as high job demands, low task control, and workplace strain further aggravate neck symptoms. Ariëns et al., showed that individuals with high psychological job strain were at a greater risk of neck and shoulder complaints[11]. Gender and age differences are also relevant, with women, particularly between 25 and 45 years, reporting higher prevalence rates—possibly due to muscle endurance differences, hormonal influences, and multitasking demands [12].Chronic mechanical neck pain impairs mobility, endurance, and postural control, thereby reducing the ability to perform everyday activities. Patients often report difficulty with driving, sitting for long periods, lifting, or maintaining upright posture [13]. Neuromuscular dysfunction, including delayed deep cervical muscle activation and overuse of superficial muscles, reduces proprioceptive control and increases fatigue [14]. These impairments extend beyond biomechanics, contributing to sensorimotor deficits such as impaired joint position sense and delayed reflexes [15].CMNP is also linked with psychological consequences such as anxiety, depression, and sleep disturbances [16]. These factors create a feedback loop where emotional stress exacerbates muscle tension and pain, further impairing function. Assessments like the NDI and SF-12 consistently demonstrate that higher pain intensity correlates with reduced quality of life, confirming the biopsychosocial nature of CMNP.Cervical and scapular muscles form a functional kinetic chain that maintains postural alignment and upper quarter stability[17]. The deep cervical flexors (longus colli and longus capitis) stabilize cervical segments and maintain cervical lordosis, counteracting excessive forward head posture [18,19]. Weakness or delayed activation of

these muscles results in compensatory overactivity of superficial flexors like the sternocleidomastoid.

Similarly, scapular stabilizers—including the lower trapezius, rhomboids, and serratus anterior—anchor the scapula, optimize shoulder mechanics, and offload cervical structures. Dysfunctional scapular control leads to increased cervical loading, especially in forward head and rounded shoulder postures [20,21]. Impairments in cervicoscapular rhythm often perpetuate strain and dysfunction, contributing to chronicity.Given the multifactorial nature of CMNP, exercise-based rehabilitation remains central to management. Among the most evidence-supported methods are Craniocervical Flexor Training (CCFT) and Scapular Stabilization Exercises (SSE).CCFT is specifically designed to retrain and strengthen deep cervical flexors using a pressure biofeedback device. By performing gentle nodding actions while incrementally increasing pressure (20–30 mmHg), patients learn to activate these deep muscles while minimizing superficial compensation [22,23]. This targeted training enhances motor control, endurance, and postural stability.SSE focuses on re-establishing scapular mechanics and stability. Exercises such as scapular retraction, wall slides, prone Y/T raises, push-up plus, and dynamic hug target the lower trapezius, rhomboids, and serratus anterior [24]. These exercises restore scapulothoracic rhythm, reduce cervical strain, and improve posture. Evidence suggests that combining cervical and scapular retraining provides greater benefits than either approach alone [25].Chronic mechanical neck pain has become a growing public health issue, particularly in sedentary populations such as computer users. While pharmacological interventions provide temporary relief, recurrence rates remain high when underlying neuromuscular dysfunction is not addressed. This underscores the

need for physiotherapy interventions that target both cervical and scapular systems.CCFT has been shown to effectively retrain deep cervical flexors, but its comparative efficacy against scapular stabilization strategies in improving pain, disability, range of motion, and quality of life remains underexplored. Similarly, SSE addresses scapular dyskinesis—a major contributor to cervicoscapular dysfunction—but requires further comparison with cervical-specific interventions.Given the interdependence of cervical and scapular systems, this study seeks to compare the effectiveness of CCFT with pressure biofeedback and SSE in patients with chronic mechanical neck pain. The findings are expected to guide clinicians in tailoring rehabilitation strategies, optimizing outcomes, and reducing recurrence. Outcome measures will include pain intensity (NPRS), functional disability (NDI), cervical ROM, and health-related quality of life (SF-12), providing a comprehensive evaluation of intervention effects.

AIM AND OBJECTIVES

AIM OF THE STUDY

To compare the effectiveness of craniocervical flexor training with pressure biofeedback and scapular stabilization exercises in reducing neck pain and improving function and quality of life in computer users with chronic mechanical neck pain.

OBJECTIVE OF THE STUDY

- To compare the effectiveness of craniocervical flexor training with pressure biofeedback and scapular stabilization exercises in reducing pain intensity, improving functional ability, and enhancing quality of life among computer users with chronic mechanical neck pain.
- To assess the effect of craniocervical flexor training with pressure biofeedback on pain, disability, and cervical mobility in individuals with chronic mechanical neck pain.
- To assess the effect of scapular stabilization exercises on pain, disability, and cervical mobility in individuals with chronic mechanical neck pain.
- To analyze and compare the impact of both interventions on health-related quality of life using standardized outcome measures.
- To determine the relative clinical significance of each intervention in improving overall functional outcomes.

HYPOTHESIS

Null Hypothesis (H0): No significant difference between CCFT with pressure biofeedback and scapular stabilization exercises in reducing pain or improving functionality.

Alternate Hypothesis (H1): A significant difference exists between the two intervention.

REVIEW OF LITERATURE

1. Rabia Ashfaq,et.al (2021)

In a randomized controlled trial, Ashfaq and Riaz (2021) assessed the impact of pressure biofeedback-guided craniocervical flexor training (CCFT) in individuals with mechanical neck pain. Participants received low-load, precise activation exercises using a pressure feedback unit to ensure proper deep cervical flexor engagement. This method significantly enhanced muscle endurance of the deep flexors and yielded notable reductions in pain and disability scores compared to a control group undergoing standard exercises. Their findings underscore the value of neuromuscular retraining that focuses on segmental control, demonstrating both statistical significance and clinical relevance for improving cervical function and alleviating pain in CMNP patients.

2. Senthilkumar,et.al (2023)

Senthilkumar and colleagues (2023) conducted a six-week randomized controlled study among precision workers experiencing chronic neck pain to evaluate the effects of scapular stabilization exercises (SSE). Subjects in the intervention group performed targeted activation of scapular muscles such as the lower trapezius, rhomboids, and serratus anterior via progressive resistance bands and specific movement patterns. The group exhibited significant improvements in pain intensity, cervical range of motion, and muscle strength compared to the control group receiving usual care. The study highlighted that addressing scapular mechanics can significantly contribute to cervical rehabilitation by correcting postural strain and overcompensation in neck musculature.

3. Blomgren,et.al (2018)

Blomgren et al. (2018) delivered a systematic review evaluating the efficacy of deep cervical flexor training across multiple trials. Their analysis revealed consistent positive effects on neck pain and neuromuscular control across different intervention protocols, especially those employing feedback-based activation techniques. While variability existed regarding improvements in muscle strength and endurance, the authors emphasized the consistent benefits in motor,proprioceptive function, and reduction of postural strain through targeted CCFT a key consideration in long-term management of CMNP.

4. Gölgem Mehmetoğlu,et.al (2025)

This randomized clinical trial examined the combined effects of postural stabilization and cervical stabilization exercises on individuals with chronic neck pain. Over several weeks, participants performed exercises focused on controlling craniovertebral angle (CVA) while concurrently strengthening deep cervical flexors. The results were compelling: significant improvements were observed in pain levels, NDI scores, CVA alignment, and SF-12 quality of life metrics. The dual emphasis on postural correction and segmental control yielded comprehensive improvements, underscoring that multifactorial approaches which integrate postural realignment with targeted muscle control may offer superior outcomes in chronic mechanical neck pain rehabilitation.

5. Soliman,et.al (2023)

In their innovative trial, Soliman and colleagues implemented scapular muscle training through a suspension system in patients with chronic neck pain and scapular dyskinesia. Participants performed dynamic scapular stabilization tasks under suspended load, stimulating neuromuscular coordination and strength. Compared to traditional closed-

chain exercises, the intervention group demonstrated superior gains in pain relief, scapular posture, and functional metrics. The study highlights that progressive loading and proprioceptive challenge when applied to the scapular region can produce significant neuromuscular adaptations, making suspension-based training a promising adjunct in neck pain rehabilitation.

6. Blomgren,et.al (2018)

Their systematic review consolidated evidence from several trials focused on deep cervical flexor training for chronic neck pain patients. Across diverse methodologies, consistent improvements emerged in neuromuscular function, such as enhanced proprioception and segmental control. Although results on strength and endurance varied, the most striking outcomes were seen in motor coordination and postural alignment. The authors emphasized that motor control rehabilitation especially that focused on the deep flexors should be prioritized in chronic cases, where movement quality and control deficits often maintain persistent pain.

7. Norollah Javdaneh,et.al (2021)

Aimed to compare the effects of neck exercise training (NET) with and without scapular stabilization training (SST) on pain intensity, the scapula downward rotation index (SDRI), forward head angle (FHA) and neck range of motion (ROM) in patients with chronic neck pain and scapular dyskinesia and the study concluded that neck exercise training combined with the scapular stabilization exercise was more effective for reducing pain, forward head angle, scapula upward rotation and increasing cervical ROM in patients' chronic neck pain

with scapular downward rotation defects. These findings indicate that focus on the scapular posture in the rehabilitation of chronic neck pain effectively improves the symptoms.

8. Bhuvan Deep Gupta,et.al(2013)

In a comparative study, two groups of participants with forward head posture and neck pain underwent either deep cervical flexor training or scapular stabilization exercises. Both interventions reduced pain and improved posture, but CCFT demonstrated greater effects on head realignment, while SSE led to better shoulder girdle positioning. This study underscores that while both methods are beneficial, they may exert domain-specific advantages informing tailored treatment planning based on individual biomechanical presentations.

9. Katherine Harman, et. al (2013)

Through a randomized exercise program targeting forward head posture, this trial compared cervical retraining alone and combined cervical-scapular rehabilitation. The combined intervention group achieved the most profound improvements in pain reduction, endurance, and cervical range of motion. The results advocate for integrative approaches that address both regions to maximize neuromuscular and postural outcomes.

10. Shekari, et.al (2021)

This study assessed neck pain and functional outcomes following either deep neck flexor training or scapular stabilization exercises. While both methods produced significant improvements, each drove domain-specific changes deep neck flexor training enhanced

proprioceptive control and motor reeducation, whereas scapular exercises had a stronger impact on posture and upper limb function.

11. Na-Yeon Kang ,et.al (2021)

In a controlled clinical trial examining office workers with forward head posture, Kang et al. investigated the effects of deep cervical flexor training using pressure biofeedback. Subjects undertook a structured six-week program with progressive targets (from 20 to 30 mmHg), aiming to enhance neuromuscular precision of the deep cervical flexors. Results revealed significant improvements in neck posture, pain levels, and endurance when compared to participants receiving standard exercise protocols. This demonstrates that precise, feedback-guided activation of deep stabilizers not only alleviates symptoms but contributes to postural correction in sedentary populations.

12. Tomás Gallego Izquierdo [1], Daniel Pecos-Martin,et.al. (2016)

This randomized clinical trial compared direct cranio-cervical flexion training versus cervical proprioception training among individuals with chronic neck pain. Beyond instructing participants to focus on deep flexor activation, the protocol incorporated sensorimotor challenges like repositioning and head movement tasks. The cranio-cervical flexion group showed superior gains in proprioceptive accuracy and neck control, while both groups experienced comparable reductions in pain and disability. The findings underscore that combining motor control and proprioceptive feedback may enhance outcomes more than isolated muscle re-education.

13. Marwa Shafiek Mustafa Saleh,et.al (2018)

Saleh and colleagues explored the impact of deep cervical flexor training on patients with cervical spondylosis, assessing pain, proprioception, muscle strength, and dizziness. Participants performed low-load flexor activation with gradual progression and feedback. The study found significant improvements across all metrics, particularly in proprioceptive acuity and functional stability, suggesting that DCF training may also benefit individuals with degenerative spinal conditions not just non-specific neck pain.

14. Kwan-Woo Lee ,et.al(2016)

This clinical trial investigated the combined effect of thoracic manipulation and deep craniocervical flexor training on neck pain, range of motion, and disability. The dual-approach group displayed more rapid pain relief and greater mobility improvements than those receiving either technique alone. This suggests that integrating manual therapy with motor control training can facilitate functional gain possibly by priming neuromuscular responsiveness and enhancing tissue mobility.

15. Tang L, Chen K, et.al (2021)

In a randomized controlled design spanning multiple centers, researchers examined whether adding scapular stabilization to standard neck exercises would yield superior outcomes. The results were clear: combined rehabilitation significantly reduced neck pain, improved disability scores, and enhanced quality-of-life measures more than cervical exercises alone. These findings highlight the value of blending regional control strategies for optimizing rehabilitation of chronic neck dysfunctions.

16. Fatma Sadeek Amin,et.al(2024)

A recent trial evaluated the relative effects of Maitland mobilization versus deep cervical flexor training on proprioception and pain in individuals with mechanical neck pain. While both interventions demonstrated benefit, the CCFT group had greater enhancements in joint position sense, indicating improved sensorimotor control. The findings underscore the role of active retraining in addition to passive mobilization in developing proprioceptive awareness essential for cervical stability.

17. Gölgem Mehmetoˇglu,et.al (2025)

This contemporary study assessed the functional implications of combined postural stabilization and cervical control exercises. Results showed marked improvements in cervicothoracic alignment (craniovertebral angle), pain levels, disability indices, and life-quality scores. Their protocol reinforces that integrating segmental activation with postural realignment can yield comprehensive rehabilitation outcomes for CMNP.

18. Valente,et.al aimed of the current study was to compare the relative validity of VAS, NRS, VRS, and FPS-R for detecting differences in painful stimulation and for detecting sex effects in response to painful stimulation and results showed statistically significant differences in pain intensity between temperatures for each scale, with lower temperatures resulting in higher pain intensity. The order of responsivity was as follows: NRS, VAS, VRS, and FPS-R.

19. Ziyi Zhong,et.al (2024)

This systematic review and meta-analysis assessed several randomized clinical trials involving scapular treatment for chronic neck pain. Across studies involving scapular retraction training, lower trapezius strengthening, and postural exercises, consistent

reductions in pain and disability were noted. The strength of the evidence lies in the convergence of outcomes across diverse exercise regimes affirming scapular rehabilitation as a cornerstone of multidimensional neck care.

20. Georgios Tsiringakis ,et.al (2020)

A meta-analysis investigating motor control training with pressure biofeedback concluded that such intervention strategies consistently outperform general strengthening exercises in both pain reduction and functional recovery for CMNP patients. Effect sizes in favor of biofeedback techniques emphasize the relevance of precision-based neuromuscular re-education.

21. Deborah L Falla,et.al (2004)

Falla and colleagues conducted an electromyographic study that illuminated the distribution and recruitment patterns of deep cervical flexor muscles during craniocervical flexion tasks. Their findings revealed that individuals with chronic neck pain exhibited significant underactivation of the longus colli and longus capitis, while the superficial flexors like the sternocleidomastoid dominated movement. This neuromuscular imbalance was associated with reduced endurance and impaired postural control. The study highlights the necessity of targeted CCFT to restore the deep flexor engagement that supports segmental spinal stability and reduces compensatory strain.

22. Julia Treleaven ,et.al(2006)

Treleaven and colleagues explored the relationship between cervical joint position sense and postural balance in patients with whiplash-associated disorders. Their research

demonstrated that impaired proprioception and delayed neuromuscular responses in the neck region significantly contributed to balance deficits. Given the cervical spine's role in guiding head-on-trunk orientation and visual stabilization, this sensorimotor impairment had profound functional consequences. The study underscores the broader value of motor-control interventions like CCFT, which aim to restore sensory feedback alongside muscle function.

23. Paula M. Ludewig,et.al (2011)

Through biomechanical observation, Ludewig and Braman emphasized how scapular kinematics directly impact cervical loading and shoulder–neck mechanics. They showed that downward rotation or anterior tilting of the scapula forces the neck extensors to increase activity, contributing to postural strain. This work laid the theoretical foundation for SSE, demonstrating that improving scapular alignment through targeted control of muscles like the lower trapezius effectively alleviates excessive cervical muscle demand.

24. Cagnie,et.al (2014)

In their electromyographic investigation, Cagnie and co-authors analyzed activation patterns of scapular muscles in individuals with chronic neck pain. They identified delayed and attenuated activity in the lower trapezius and serratus anterior during overhead arm movements movements that are frequently encountered in occupational tasks. These impairments contributed to scapular dyskinesis and compromised cervicothoracic rhythm. Consequently, the study strongly supports the need for SSE that specifically targets timing and coordination of scapular stabilizers to minimize compensatory neck strain.

25. Johannes Blomgren1,et.al (2018)

In this systematic review, Blomgren and team synthesized evidence from randomized trials examining DCF training. Their meta-analytic analysis confirmed that such training significantly improves proprioceptive control and reduces forward head posture both key factors in chronic neck pain. While results on long-term strength gains were variable, improvements in motor control were consistently documented, reinforcing the value of CCFT in rehabilitative protocols focused on neuromuscular accuracy and posture retraining.

26. Marwa Shafiek Mustafa Saleh,et.al (2018)

Saleh and colleagues investigated the effects of deep cervical flexor activation in patients with cervical spondylosis, focusing on a broad spectrum of outcomes including proprioception, neck strength, pain, and dizziness. Their training protocol involved low-load, precision-based flexor exercises that emphasized segmental stability. Participants demonstrated meaningful improvements not only in pain and muscle strength but also in proprioceptive acuity and balance outcomes particularly relevant in degenerative cervical conditions. These results reinforce the applicability of CCFT beyond non-specific neck pain, highlighting its capacity to enhance sensorimotor integration in more complex clinical scenarios.

27. Kwan-Woo Lee,et.al (2016)

Lee and Kim's study evaluated the synergistic outcomes of combining thoracic spine manipulation with craniocervical flexor training. Patients receiving both treatments experienced significantly faster pain relief and greater improvement in cervical mobility than those undergoing CCFT alone. The authors propose that manual therapy may enhance

neural and mechanical responsiveness, thereby augmenting the efficacy of active motor control training. This integrative approach suggests an optimized pathway to accelerate functional recovery in CMNP rehabilitation.

28. Obaidat et al. (2024)

This innovative study used machine learning to predict neck pain severity among computer professionals, revealing that deficiency in scapular muscle endurance and poor cervical motor control were primary predictors of increased discomfort. This predictive modeling underscores the clinical imperative to include both cervical and scapular rehabilitation in preventive and therapeutic strategies, especially for high-risk sedentary populations.

29. Georgios Tsiringakis , Zacharias Dimitriadis,et.al(2024)

A meta-analysis conducted by Tsiringakis et al. confirmed that motor control training using pressure biofeedback provides superior outcomes in both pain reduction and functional improvement compared to generic strengthening protocols. The pooled data showed significant effect sizes favoring biofeedback-guided interventions, reinforcing their clinical utility and advocating for their integration into standard CMNP rehabilitation practices.

METHODOLOGY

Study Design : Comparitive study

Study Population: Computer users

Study Setting: Rita Enterprises Company,Nagpur

Sampling Design: Convenience sampling

Sample size: 68 (Formula :$N=2k\ SD^2/d^{2)}$

Study Duration : 1 year

Ethical clearance: 6 months

Sample collection, data collection: 4months

Stastical analysis , results and discussions: 2 months

Sampling Criteria:

Inclusion:

Gender -both male and female

Age group-25-45 years

Subject with chronic mechanical neck pain

Pain with duration >3months

Subject willing to participate.

Exclusion:

Any traumatic surgery

Previous history of cervical and thoracic and shoulder surgery.

Acute or subacute type of neck pain

Materials to be used:

- Pressure biofeedback device
- Goniometer
- Paper
- Pen

PROCEDURE

- Approval from the Institutional Ethical Committee was taken.
- Particiapants were screened and then selected on the basis of inclusion criteria.
- After properly informing about the procedure, basic demographic data was obtained and consent forms were signed from the participants. Eligible participants were explained the purpose, process, risks and benefits of the study.
- The participants were randomly assigned into Group Aand Group B by simple randomization using Chit method. Group A received craniocervical flexor training with pressure biofeedback exercises and Group B received Scapular stabalization exercises
- The Particpants of Group A were treated on Monday,Wednesday,Friday of the week while the Group B were treated on Tuesday,Thursday and Saturdays of the week for 6 weeks.Case report form was filled which included basic demographic data,NPRS ,NDI ,SF-12 form,Cervical (flexion ,extension,lateral flexion and rotation)and Shoulder ROM (flexion,abduction,external rotation and internal rotation) were assessed on first day and last day of intervention.
- The partcipants demographic data such as age ,gender, severity and duration of disease and outcome measures as mentioned previously were recorded.
- The end point of the study was 6 weeks durations.
- Data was collected and analyzed.

Group A: Craniocervical Flexor Training (CCFT)

Duration: The program spans 6 weeks, with participants attending 3 sessions per week. Each session lasts 20 minutes.

Progression:

Training begins with participants maintaining 20 mmHg pressure using an air-filled biofeedback device. Over the course of the program, this pressure target is gradually increased to 30 mmHg as participants build strength and neuromuscular control.

Group B: Scapular Stabilization Exercises

Duration: This program also spans 6 weeks, with participants attending 3 sessions per week. Each session lasts 30 minutes.

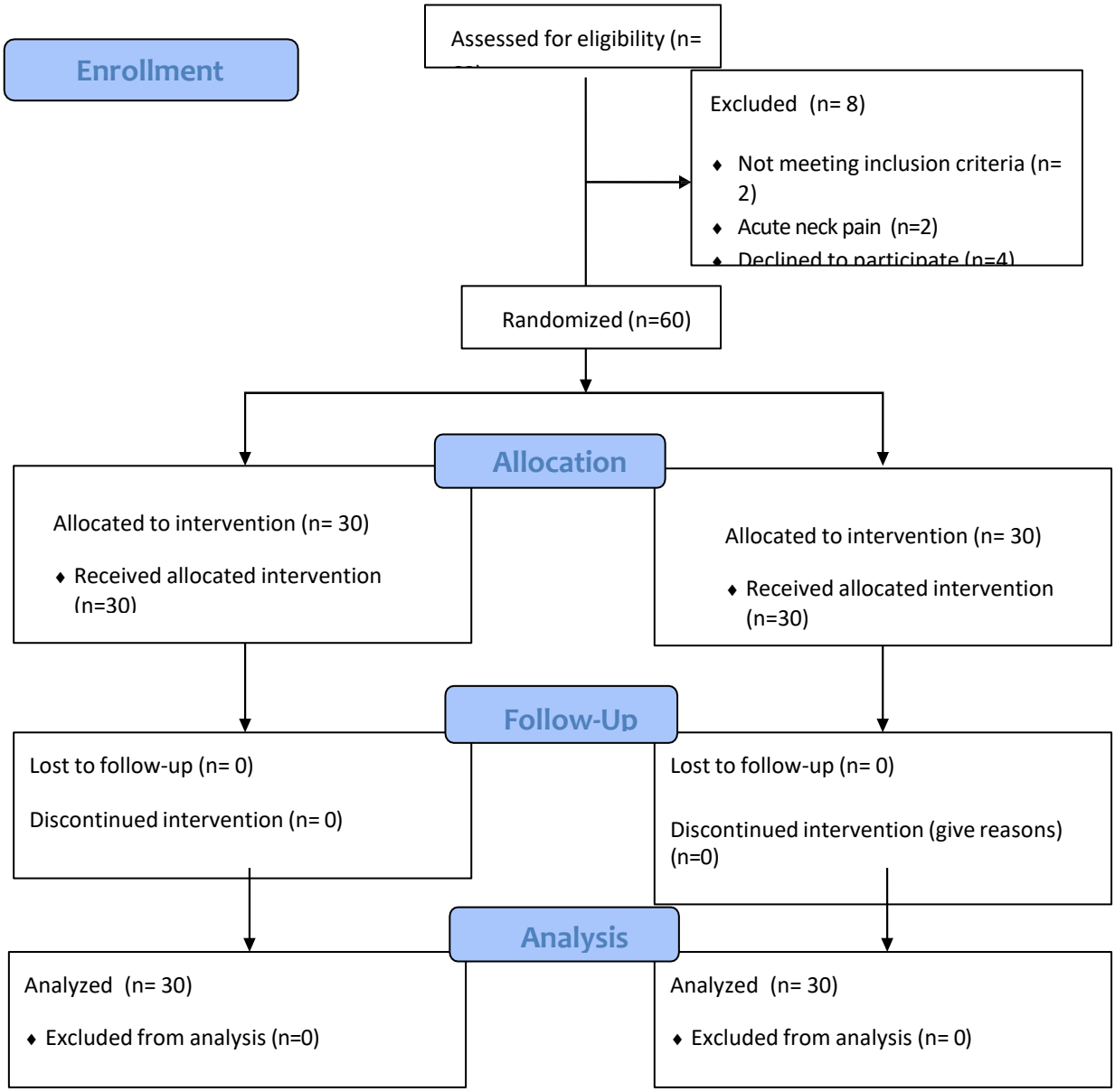
Progression:

- During the initial weeks, participants performed unresisted scapular exercises to establish baseline stability and muscle coordination. In later weeks, resistance is introduced using elastic bands with varying intensities.
- Exercises includes shoulder shrugs, and prone I, Y and T exercises.
- Pre and post assessment of both groups was taken of all the subjects.

Table No.1 -Dosage Of Intervention (for both groups)

Groups	**Intervention**	**Dosage**	**Duration**
Group A	CCFT with pressure biofeedback exercises	20mins+ 3sets 10 repetitons	3 sessions per week for 6 weeks
Group B	Scapular stabalization exercises (Prone I , Prone Y and Prone T)	20 mins+3 sets 10repetitions	3 sessions per week for 6 weeks

Fig 1. CONSORT Flow Diagram



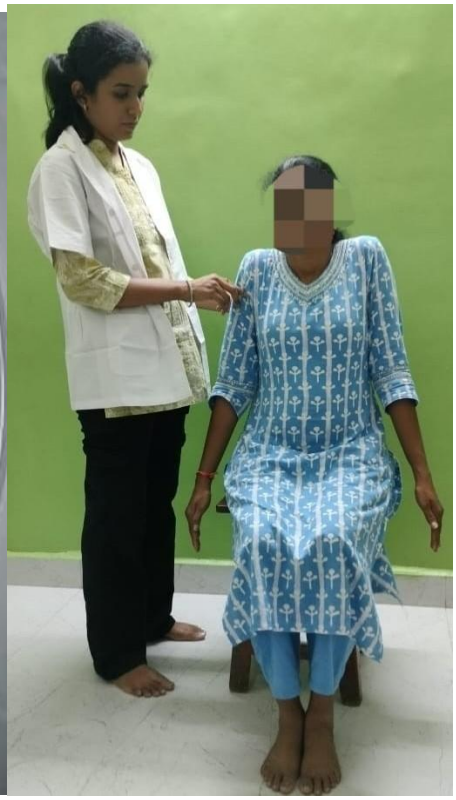


FIGURE2. PRESSURE BIOFEEDBACK DEVICE **FIGURE3. SHOULDER SHRUGS**

FIGURE 4 . CCFT WITH PBD

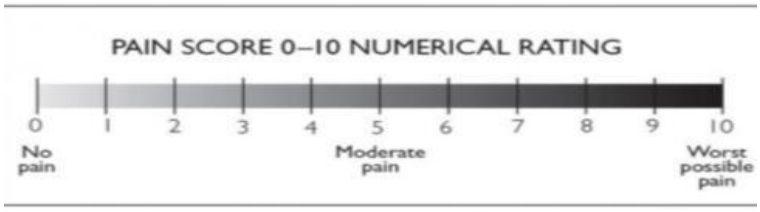
FIGURE 5. PRONE I

FIGURE 6. PRONE T

FIGURE 7. PRONE Y

OUTCOME MEASURES

1. **Numeric Pain Rating Scale (NPRS)**



Pain intensity was measured using the 11-point Numeric Pain Rating Scale, where participants rate their pain from 0 (“no pain”) to 10 (“worst pain imaginable”). This tool is simple, quick to administer, and widely accepted in clinical research. Previous studies have reported high test–retest reliability, with intraclass correlation coefficients (ICC) ranging between 0.67 and 0.96. The scale also shows strong correlation with other pain measures, supporting its validity. A change of around two points is considered the minimal detectable change for chronic musculoskeletal pain, indicating that even small differences can reflect meaningful clinical improvement.

2. Neck Disability Index (NDI)

Functional disability related to neck pain was assessed with the Neck Disability Index, a 10-item questionnaire covering areas such as pain intensity, personal care, lifting, reading, work, and concentration. It is one of the most commonly used self-report measures for neck disorders. The NDI demonstrates excellent test–retest reliability (ICC values between 0.89 and 0.94) and good internal consistency (Cronbach’s α ranging from 0.80 to 0.93). It has strong construct validity when compared with other health-related quality of life measures. Clinically, a change of at least 5 points is considered the

minimal detectable change, while a difference of 7–10 points represents a meaningful clinical improvement.

3. Short Form-12 Health Survey (SF-12)

Overall health-related quality of life was captured using the SF-12, which generates two summary scores: the Physical Component Summary (PCS) and the Mental Component Summary (MCS). This short questionnaire is a reliable alternative to the longer SF-36 and has been validated across different musculoskeletal populations. Reported test–retest reliability values for the PCS and MCS range from 0.76 to 0.89, with internal consistency coefficients typically between 0.70 and 0.89. A change of 3–5 points on the SF-12 is generally considered clinically significant.

4. Range of motions

Cervical and shoulder mobility were measured using a standard goniometer, which records the joint angle in degrees during flexion, extension, lateral flexion, rotation, abduction, and rotation movements. The goniometer is widely recognized for its clinical utility, provided standardized landmarks are used during measurement. Reported intra-rater reliability ranges from 0.80 to 0.99, while inter-rater reliability ranges from 0.76 to 0.98. For cervical movements, the minimal detectable change is typically between 5–10 degrees, indicating that even moderate improvements are clinically meaningful.

STASTICAL ANALYSIS

Table no. 2 – Age group (in years) wise distribution

Age (years)	Group A		Group B	
	No. of patients	Percentage	No. of patients	Percentage
25 – 30	20	66.67%	15	73.33%
31 – 35	5	16.67%	5	16.67%
36 – 40	4	13.33%	9	30.00%
41 – 45	1	3.33%	1	3.33%
Total	30	100%	30	100%

Group A, the majority of participants (20; 66.67%) were in the age range of 25–30 years, followed by 5 (16.67%) in 31–35 years, 4 (13.33%) in 36–40 years, and 1 (3.33%) in 41–45 years.

Group B, 15 participants (50%) were in 25–30 years, 9 (30%) in 36–40 years, 5 (16.67%) in 31–35 years, and 1 (3.33%) in 41–45 years.

GRAPH NO.1- Age wise distribution

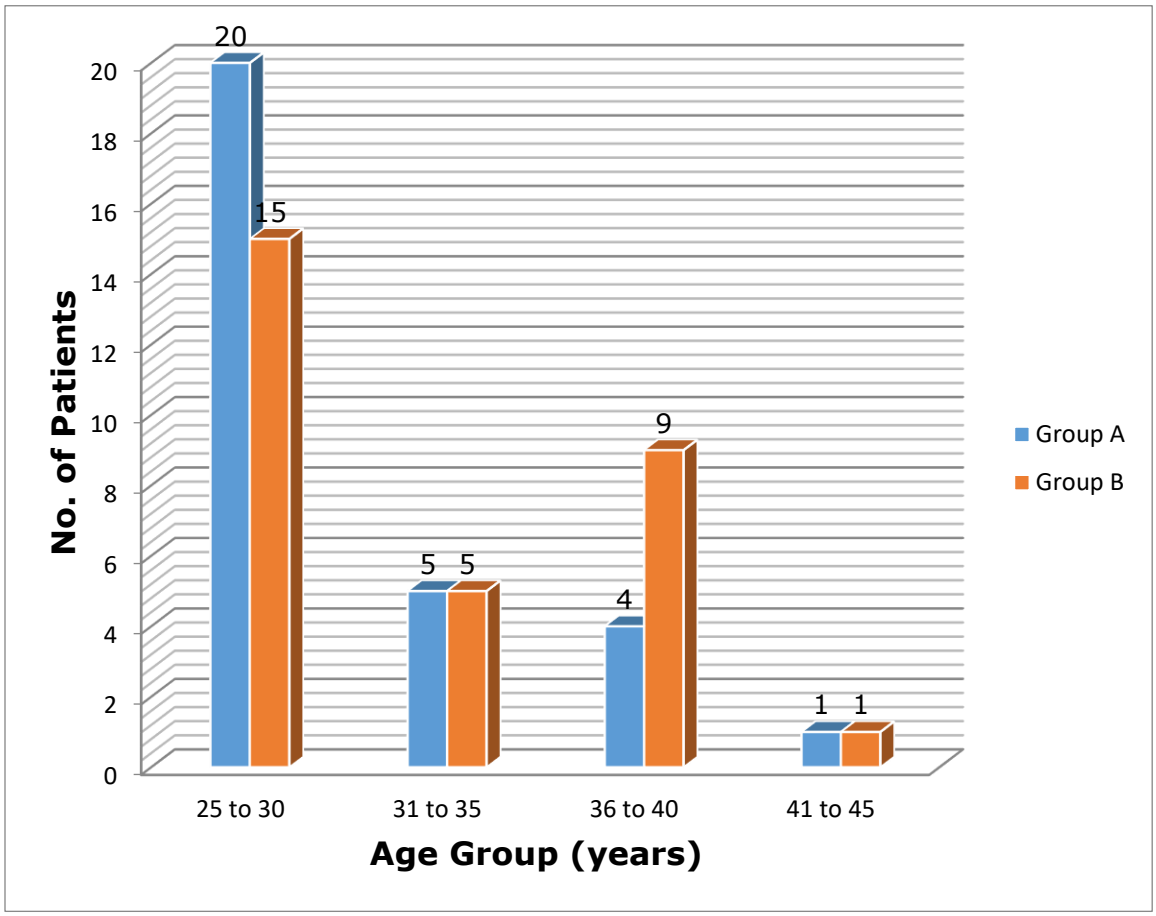


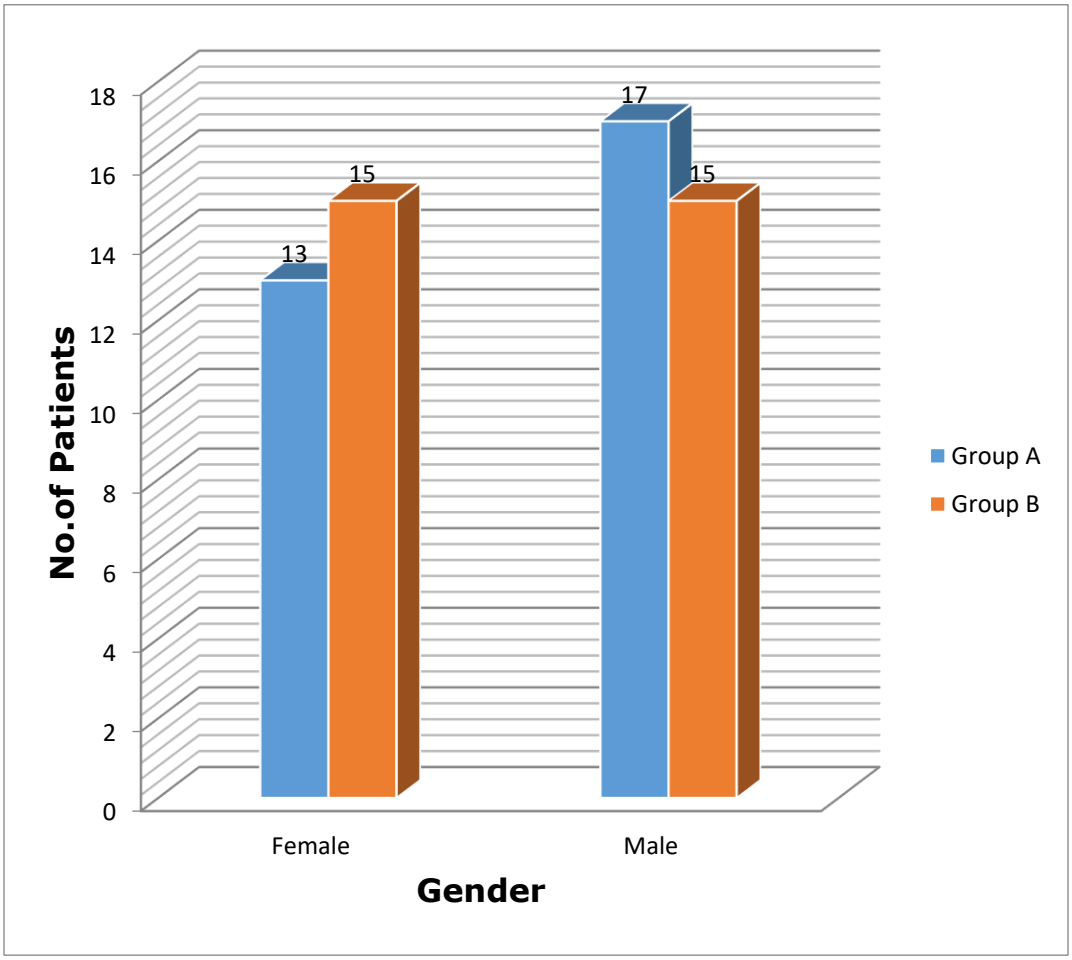
Table no. 3 – Gender wise distribution

Gender	Group A		Group B	
	No. of patients	Percentage	No. of patients	Percentage
Female	13	43.33%	15	50.00%
Male	17	56.67%	15	50.00%
Total	30	100%	30	100%

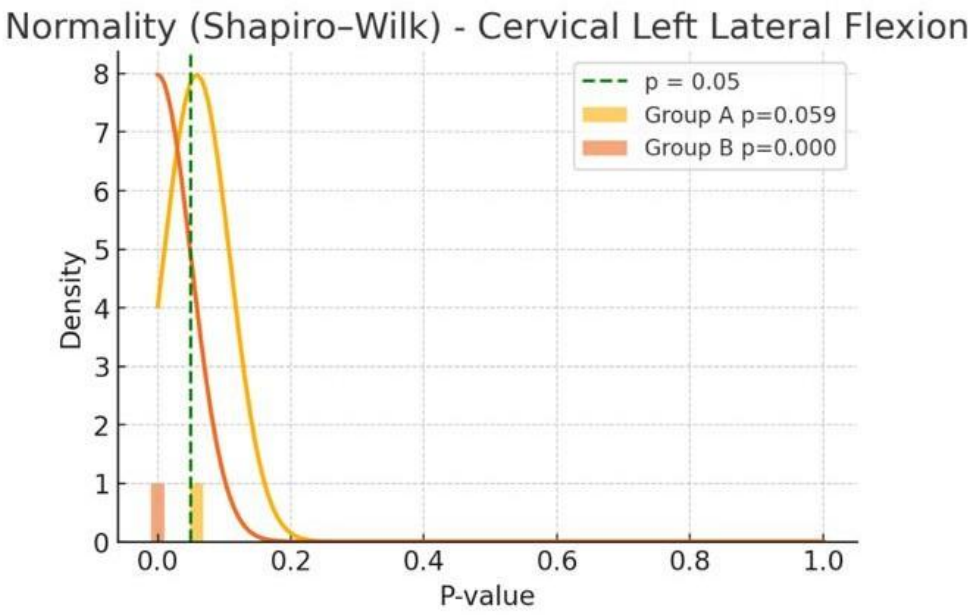
Group A, 17 (56.67%) were male and 13 (43.33%) were female.

Group B, the ratio was equal with 15 males (50%) and 15 females (50%).

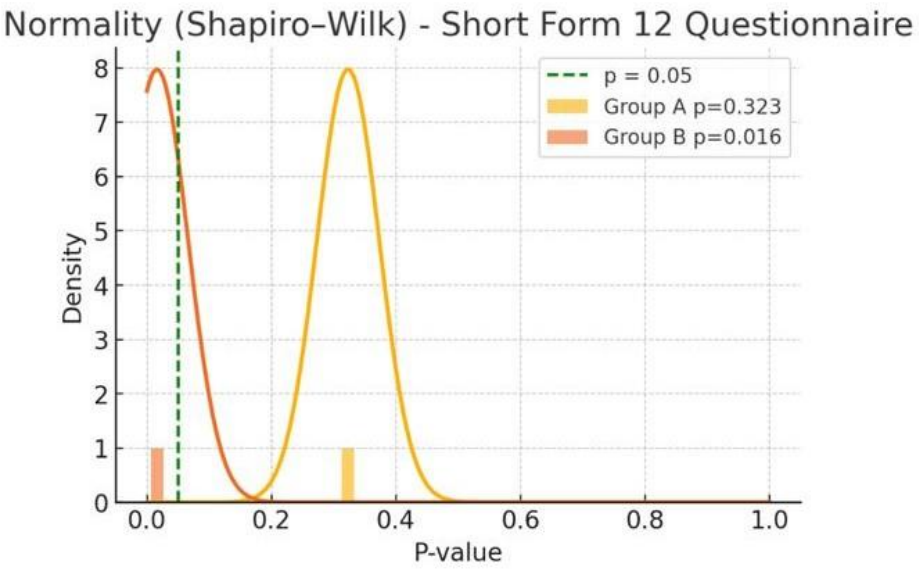
Graph no.2- Gender wise distribution



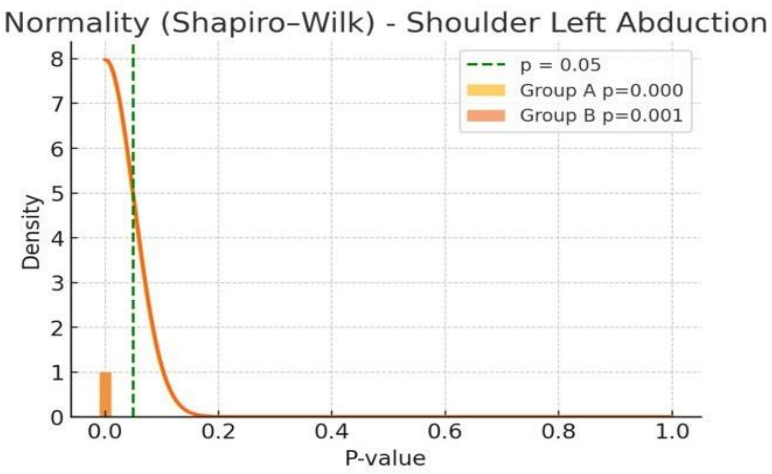
Graph no.3


Normality (Shapiro–Wilk) - Cervical Left Lateral Flexion
p = 0.05
Group A p=0.059
Group B p=0.000
Density
P-value
0
1
2
3
4
5
6
7
8
0.0
0.2
0.4
0.6
0.8
1.0

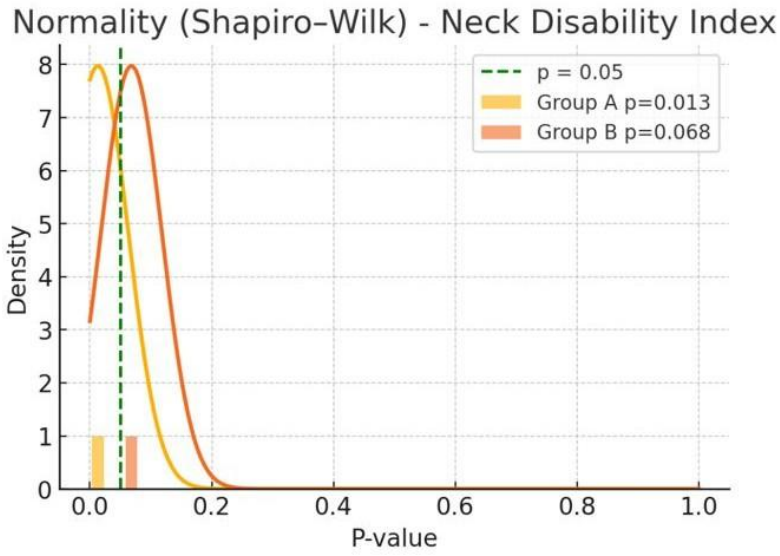
Graph No.4


Normality (Shapiro–Wilk) - Short Form 12 Questionnaire
p = 0.05
Group A p=0.323
Group B p=0.016
Density
P-value
0
1
2
3
4
5
6
7
8
0.0
0.2
0.4
0.6
0.8
1.0

Graph No.5


Normality (Shapiro–Wilk) - Shoulder Left Abduction
p = 0.05
Group A p=0.000
Group B p=0.001
Density
P-value
0
1
2
3
4
5
6
7
8
0.0
0.2
0.4
0.6
0.8
1.0

Graph No.6



The analysis of mean score for Numerical Pain Rating Scale, Neck Disability Index, Short Form 12 Questionnaire, Cervical Flexion, Cervical Extension, Cervical Right Lateral Flexion, Cervical Left Lateral Flexion, Cervical Right Rotation, Cervical Left Rotation, Shoulder Right Flexion, Shoulder Left Flexion, Shoulder Right Abduction, Shoulder Left Abduction, Shoulder Right External Rotation, Shoulder Left External Rotation, Shoulder Right Internal Rotation and Shoulder Left Internal Rotation by using Shapiro – Wilk normality test, the data observed is not normally distributed so the non-parametric test – Wilcoxon's signed rank test will be applicable within the Group and Mann Whitney U test will be applicable between the groups.

A. Effect of Craniocervical Flexor Training:

In this group, 30 patients of Chronic mechanical neck pain completed the full course of treatment and so the effect of group A therapy quoted from here onwards. The data presented in the subsequent tables were analyzed using Wilcoxon's signed rank test, and the statistical findings for each variable are detailed individually.

TABLE NO.4-Effect of CCFT NPRS,NDI and Sf-12

OUTCOMES	PRE Mean±SD	POST Mean±SD	P VALUE
NPRS	6.90±0.884	5.00±0.694	0.001
NDI	19±5.38	10.67±3.26	0.001
SF12	26.57±2.97	31.47±2.22	0.001

TABLE NO.5-Effect of CCFT on Cervical ROM

CERVICAL MOVEMENT	PREMean±SD	POSTMean±SD	P VALUE
FLEXION	48.03 ±5.14	51.50±4.57	0.01
EXTENSION	60.90±8.19	64.30±7.58	0.01
RT LATERAL FLEXION	38.96±8.25	42.40±8.29	0.01
LT LATERAL FLEXION	40.53±3.79	44.30±3.57	0.01
RT ROTATION	66.73±7.64	70.96±7.95	0.01
LT ROTATION	71.73±8.48	75.23±8.38	0.01

TABLE NO.6- Effect of CCFT on Shoulder ROM

SHOULDER MOVEMENT	PREMean±SD	POSTMean±SD	P VALUE
RIGHT FLEXION	168.23±8.91	172.47±7.88	0.01
LEFT FLEXION	172.83±15.92	176.13±5.38	0.01
RIGHT ABDUCTION	161.73±15.92	166.73±15.43	0.01
LEFT ABDUCTION	167.73±13.14	171.30±12.69	0.01
RIGHT EXETERNAL ROTATION	71.36±6.37	74.86±5.97	0.01
LEFT EXTERNAL ROTATION	76.30±5.57	80.23±5.36	0.01
RIGHT INTERNAL ROTATION	80.93±6.50	84.10±5.45	0.01
LEFT INTERNAL ROTATION	83.06±4.66	86.50±3.91	0.01

Significant improvements were observed in NPRS, NDI, SF-12, cervical ROM, and shoulder ROM after the intervention. As $p < 0.01$ for all measures, the null hypothesis was rejected, indicating CCFT produced meaningful improvements in pain, function, and mobility.

B. Effect of Scapular Stabilization Exercises:

In this group, 30 patients of Chronic mechanical neck pain For this group, the results were also evaluated with Wilcoxon's signed rank test, with each outcome analyzed and presented in the tables below.

TABLE NO.7-Effect of SSE on NPRS , NDI & SF12

OUTCOMES	PRE Mean±SD	POST Mean±SD	P VALUE
NPRS	7.20± 0.714	5.67± 0.606	0.001
NDI	19.90± 5.16	15.23± 4.44	0.001
SF12	27.53± 2.83	31.30± 2.69	0.001

TABLE NO.8- Effect of SSE on Cervical ROM

CERVICAL MOVEMENT	PREMean ±SD	POSTMean±SD	P VALUE
FLEXION	45.27± 6.57	47.76± 6.64	0.01
EXTENSION	62.63± 6.50	65.23± 6.40	0.01
RT LATERAL FLEXION	38.13± 4.95	40.67± 4..63	0.01
LT LATERAL FLEXION	40.70± 4.01	43.23± 3.95	0.01
RT ROTATION	64.53± 9.75	67.70± 9.69	0.01
LT ROTATION	69.20± 10.25	71.93± 10.30	0.01

TABLE NO.9-Effect of SSE on Shoulder ROM

SHOULDER MOVEMENT	PREMean±SD	POSTMean±SD	P VALUE
RIGHT FLEXION	168.33± 6.69	171.13± 5.84	0.01
LEFT FLEXION	173.57± 5.85	175.70± 5.17	0.01
RIGHT ABDUCTION	163.27± 12.21	166.87± 11.68	0.01
LEFT ABDUCTION	169.30± 11.49	171.27± 10.86	0.01
RIGHT EXETERNAL ROTATION	72.83± 5.01	75.40± 5.03	0.01
LEFT EXTERNAL ROTATION	76.57± 6.25	79.10± 6.04	0.01
RIGHT INTERNAL ROTATION	80.80± 6.89	80.80± 5.51	0.01
LEFT INTERNAL ROTATION	83.47± 6.54	83.47± 5.53	0.01

This group also showed significant pre- to post-intervention improvements in pain, disability, quality of life, and mobility measures.Since $p < 0.01$, SSE was also effective in reducing symptoms and enhancing function, though to a relatively lesser extent compared to Group A.

COMPARATIVE ANALYSIS:

The data were compared between groups using the Mann–Whitney U test, and the statistical outcomes for each parameter are outlined in the following tables."

Table no10-Comparitive Analysis on NPRS , NDI & SF12

Symptom	Numerical Pain Rating Scale	Neck Disability Index	Short Form 12 Questionnaire
Mean difference score, Group A	1.90	8.33	4.90
Mean difference score, Group B	1.53	4.67	3.76
S.D. (±) of Group A	0.66	4.32	3.07
S.D. (±) of Group B	0.50	2.21	1.54
P	0.03	0.003	0.23

TABLE NO.11-Comparitive Analysis on Cervical flexion,Extension,Lateral flexion &Rotation

Symptom	Cervical			
	Flexion	Extension	Right Lateral Flexion	Left Lateral Flexion
Mean difference score, Group A	3.46	3.40	3.43	3.50
Mean difference score, Group B	2.50	2.60	2.53	2.53
S.D. (±) of Group A	1.59	1.56	1.19	1.35
S.D. (±) of Group B	1.22	0.85	1.22	0.73
P	0.034	0.043	0.028	0.032

TABLE No.12-Comparitive Analysis on Cervical Rotation

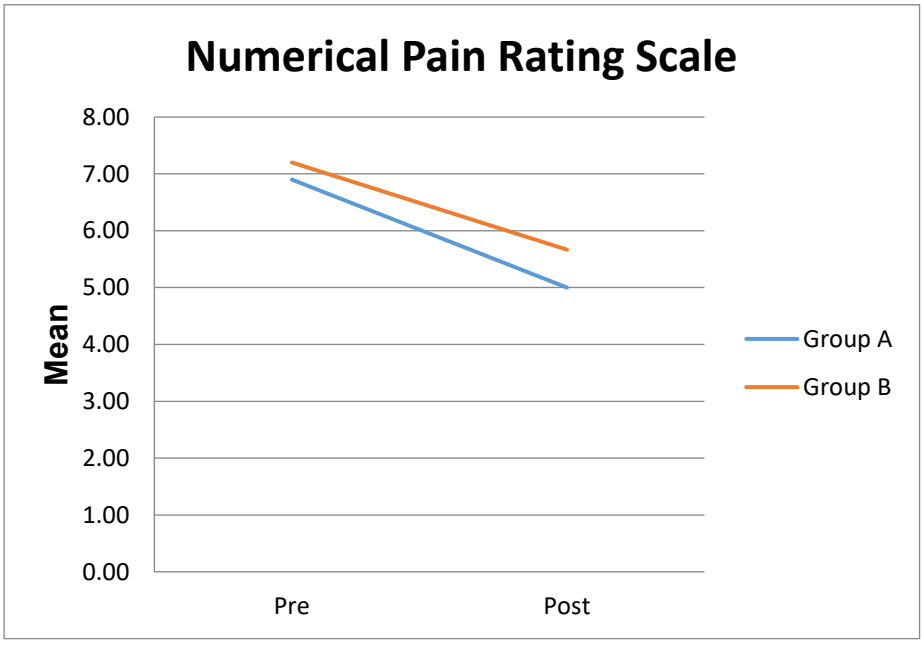
	Cervical	
	Right Rotation	Left Rotation
Mean difference score, Group A	4.23	3.60
Mean difference score, Group B	3.16	2.73
S.D. (±) of Group A	1.90	1.54
S.D. (±) of Group B	1.26	1.11
P	0.039	0.041

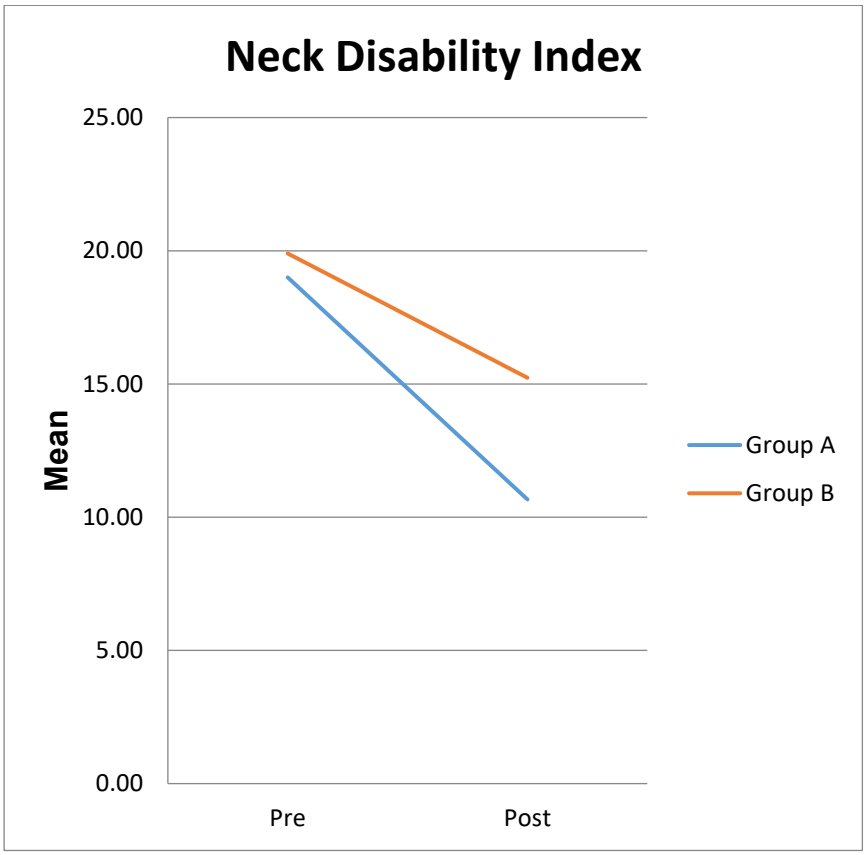
TABLE NO.13-Comparitive Analysis on Shoulder Flexion & Abduction

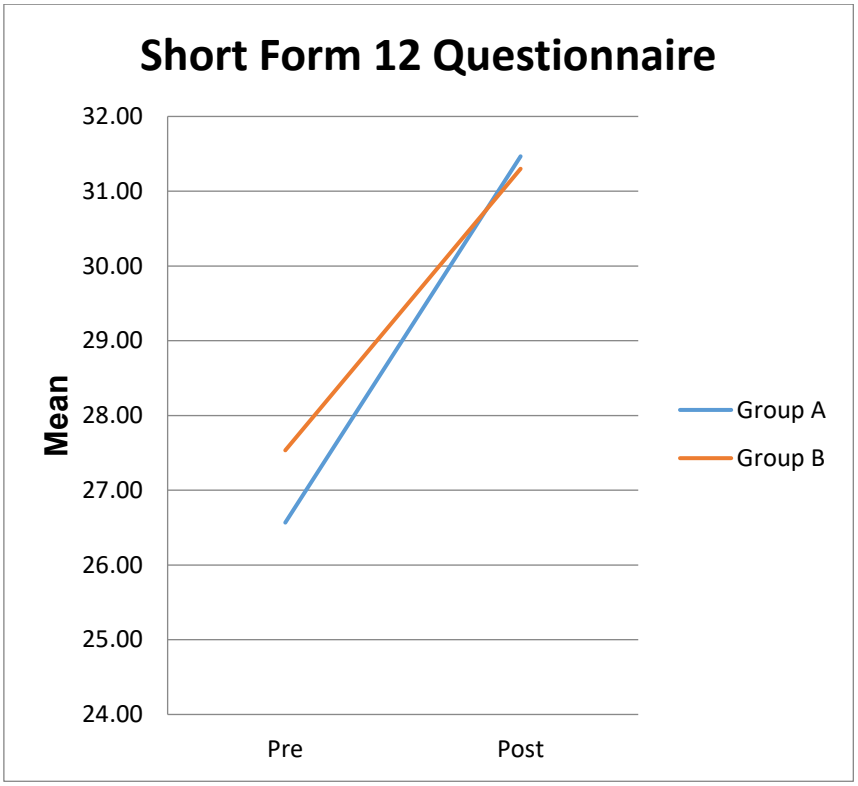
Symptom	**Shoulder**			
	Right Flexion	Left Flexion	Right Abduction	Left Abduction
Mean difference score, Group A	4.23	3.30	5.00	3.56
Mean difference score, Group B	2.86	2.13	3.60	1.97
S.D. (±) of Group A	2.04	1.55	2.33	2.44
S.D. (±) of Group B	1.57	1.97	1.67	2.02
P	0.014	0.026	0.039	0.03

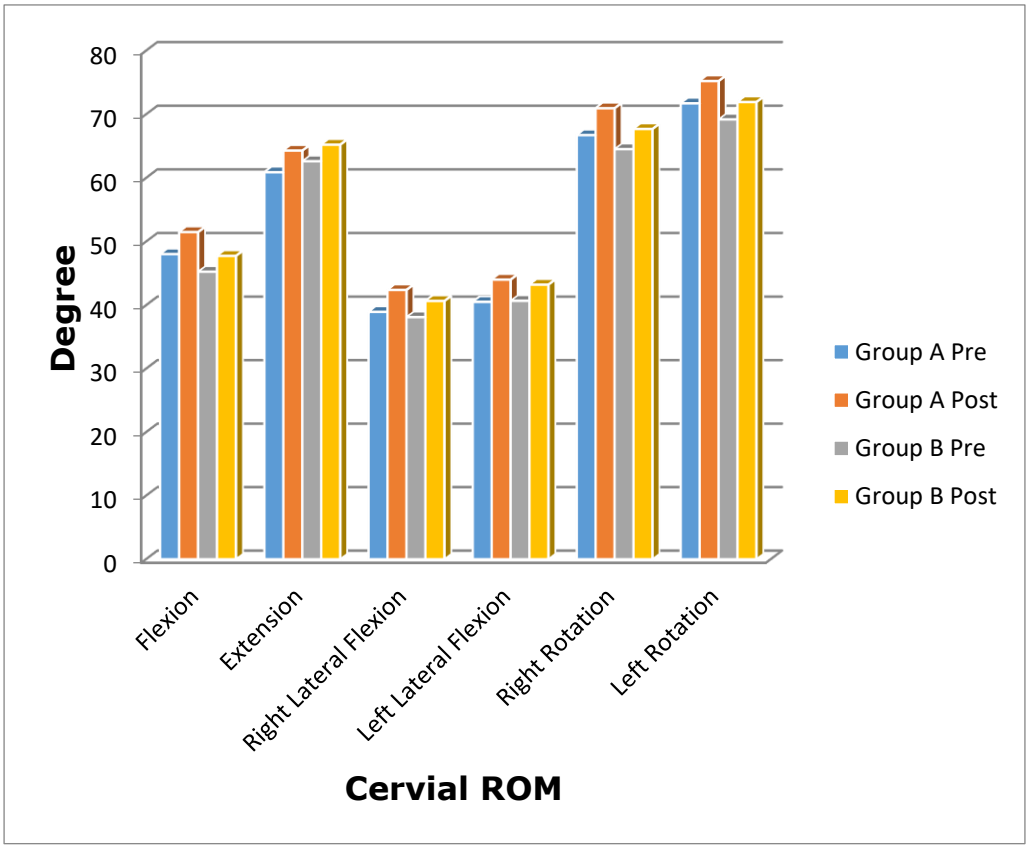
TABLE NO.14-Comparitive analysis on Shoulder ER &IR

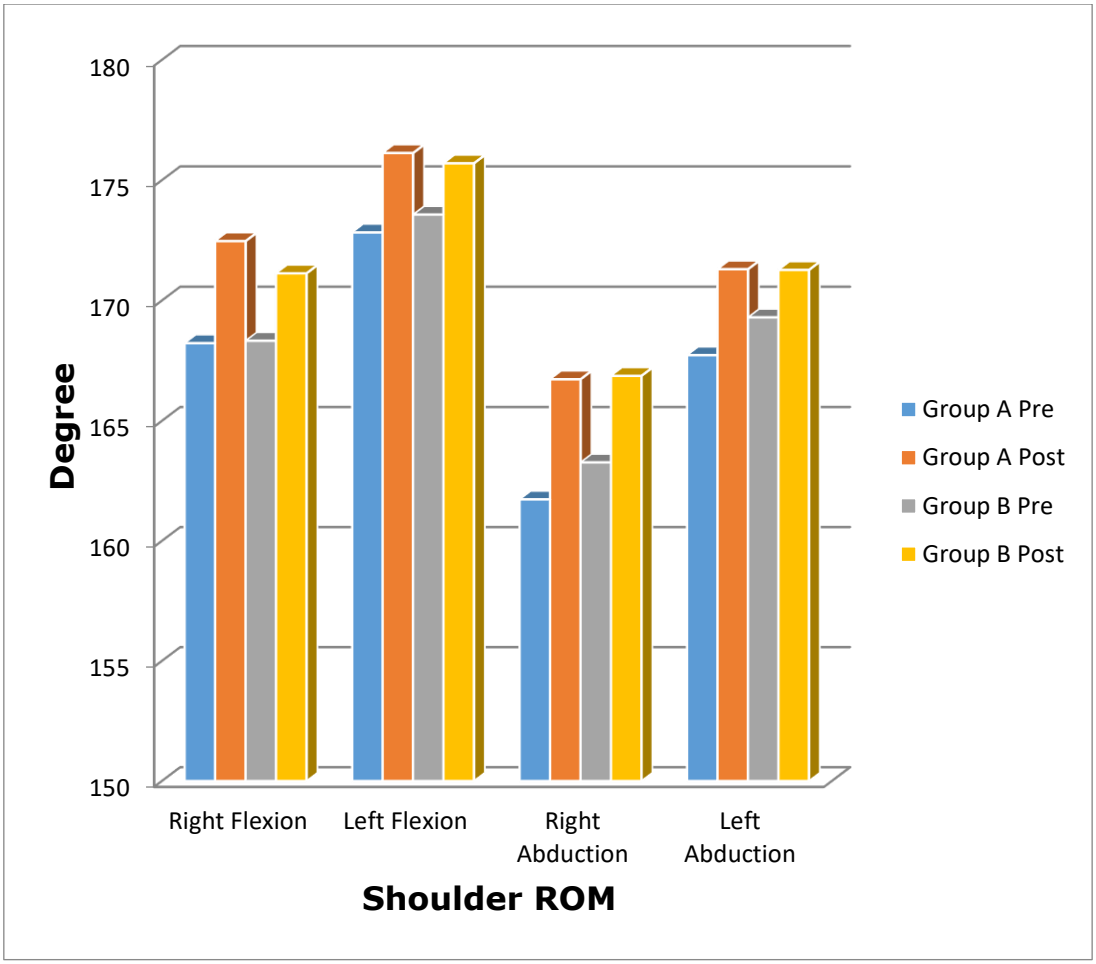
Symptom	**Shoulder**			
	Right External Rotation	Left External Rotation	Right Internal Rotation	Left Internal Rotation
Mean difference score, Group A	3.50	3.93	3.16	3.43
Mean difference score, Group B	2.57	2.53	1.50	2.00
S.D. (+) of Group A	1.63	2.62	2.86	2.62
S.D. (+) of Group B	1.27	2.09	2.19	2.42
P	0.035	0.037	0.036	0.026

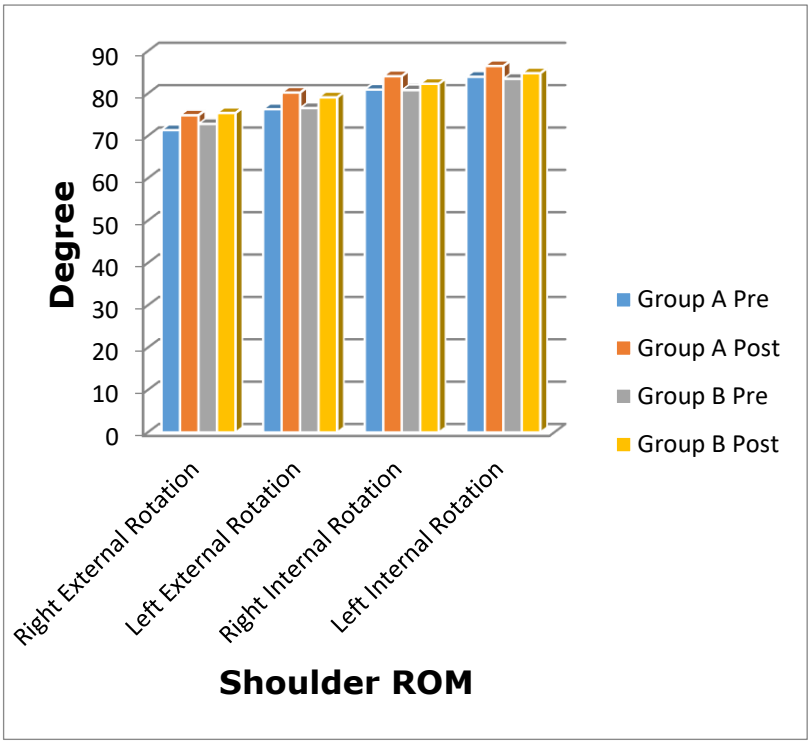

Numerical Pain Rating Scale
Mean
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Pre
Post
Group A
Group B


Neck Disability Index
25.00
20.00
15.00
10.00
5.00
0.00
Mean
Pre
Post
Group A
Group B


Short Form 12 Questionnaire
32.00
31.00
30.00
29.00
28.00
27.00
26.00
25.00
24.00
Mean
Pre
Post
Group A
Group B


80
70
60
50
40
30
20
10
0
Degree
Flexion
Extension
Right Lateral Flexion
Left Lateral Flexion
Right Rotation
Left Rotation
Cervial ROM
Group A Pre
Group A Post
Group B Pre
Group B Post


180
175
170
165
160
155
150
Degree
Right Flexion
Left Flexion
Right Abduction
Left Abduction
Shoulder ROM
Group A Pre
Group A Post
Group B Pre
Group B Post



Pain (NPRS) and Disability (NDI): Group A demonstrated significantly greater improvements than Group B ($p < 0.01$). Quality of Life (SF-12): Both groups improved, with no significant difference between them ($p > 0.01$). Cervical and Shoulder ROM: Group A achieved more improvement than Group B, with statistically significant differences ($p < 0.01$).

RESULT

On comparison, participants in Group A (Craniocervical Flexor Training) showed markedly greater improvements in pain reduction, disability scores, and cervical as well as shoulder mobility than those in Group B (Scapular Stabilization Exercises) ($p<0.05$). However, both groups demonstrated similar outcomes for quality of life, as measured by the Short Form-12 Questionnaire.

DISCUSSION

This study explored the relative effectiveness of Craniocervical Flexor Training (CCFT, Group A) and Scapular Stabilization Exercises (SSE, Group B) in individuals suffering from chronic mechanical neck pain. Results indicated that both treatment approaches produced statistically significant improvements in pain levels (NPRS), disability scores (NDI), quality of life (SF-12), and cervical as well as shoulder mobility. Nevertheless, comparison between groups showed that CCFT achieved greater improvements in most parameters—especially in reducing pain, lowering disability, and enhancing cervical and shoulder mobility—while both groups achieved similar progress in quality of life.

The within-group analysis confirmed that structured exercise interventions are effective in chronic mechanical neck pain management. CCFT improved deep cervical flexor endurance, motor control, and cervical segmental stability—deficits frequently identified in individuals with chronic neck pain. These findings are consistent with Jull et al., who reported that selective activation of deep cervical flexors significantly decreases pain and disability by improving postural control and muscle coordination .SSE, on the other hand, contributed to pain reduction and mobility gains by enhancing scapular muscle strength and endurance, thereby optimizing scapulothoracic rhythm and unloading the cervical spine. According to Cagnie et al., altered scapular movement patterns are strongly linked to neck pain, and restoring them through stabilization exercises can help alleviate discomfort and enhance functional ability.

. Thus, both protocols independently addressed important biomechanical impairments contributing to cervical pain syndromes. The comparative analysis indicated that CCFT was more effective than SSE in reducing pain (NPRS), disability (NDI), and improving cervical and shoulder mobility. This suggests that interventions focusing on cervical motor control at the segmental level may have a stronger impact on symptom relief than

proximal (scapular-based) approaches alone. Falla et al. reported that specific training of deep flexors not only restores neuromuscular coordination but also produces longer-lasting improvements compared to generalized or scapular-based training [3].

Interestingly, both groups demonstrated similar improvements in SF-12 scores, suggesting that overall quality of life may respond to any structured exercise intervention. Michener et al. highlighted that exercise exerts multidimensional effects on musculoskeletal health by addressing not only biomechanical dysfunction but also psychosocial well-being [4]. Therefore, while CCFT outperformed SSE in clinical parameters, the broader impact on patient-perceived well-being may not differ substantially between interventions. Our findings are consistent with systematic reviews reporting that multimodal physiotherapy interventions are effective for mechanical neck pain, but deep cervical flexor training shows distinct benefits in pain and disability outcomes [5]. A randomized controlled trial by O'Leary et al. demonstrated that CCFT significantly improved deep cervical flexor activation and endurance, with greater clinical gains than general strengthening approaches [6].Conversely, studies focusing on scapular stabilization exercises emphasize their role in reducing compensatory muscle activity and mechanical overload in the cervical spine [7]. While effective, these improvements may be more indirect compared to the direct motor retraining effects achieved by CCFT, which likely explains the superior outcomes in our study.

CONCLUSION

Both Craniocervical Flexor Training and scapular stabilization exercises were effective in reducing pain, disability, and improving cervical as well as shoulder mobility among patients with chronic mechanical neck pain. Nonetheless, Craniocervical Flexor Training yielded better results than Scapular Stabilization Exercises in most aspects, except for quality of life (Short Form-12 Questionnaire), where both interventions produced similar improvements.

LIMITATIONS AND RECOMMENDATION FOR FUTURE STUDY

LIMITATIONS

1. The main limitation of this study was the brief duration of the intervention."

2.While significant improvements were noted within the study timeline, long-term follow-up was not conducted, limiting the understanding of whether the benefits were sustained over months or years.

3 The absence of subgroup analysis limits our understanding of which patient profiles benefit most from which intervention.

RECOMMENDATION FOR FUTURE STUDY

1.Future studies should include long-term follow-up to determine whether improvements are maintained over several months or years, as chronic pain often requires ongoing management.

2.Psychosocial variables such as anxiety, depression, and fear-avoidance beliefs should be assessed alongside physical outcomes to better capture the biopsychosocial nature of CMNP.

3.Stratification of participants by occupation, posture type, and physical activity levels may help identify which subgroups benefit most from each intervention.

4.Exploring combined or phased protocols (CCFT + SSE) may provide evidence on whether a multimodal approach yields superior outcomes compared to single met

SUMMARY

Chronic mechanical neck pain is a common musculoskeletal disorder, particularly prevalent among computer users due to sustained postures and repetitive strain. It is often associated with impaired deep cervical flexor function, reduced scapular stability, pain, disability, and decreased quality of life.This study compared the effectiveness of Craniocervical Flexor Training (CCFT) with pressure biofeedback and Scapular Stabilization Exercises (SSE) in individuals with chronic mechanical neck pain. Participants were randomly divided into two groups: Group A received CCFT, while Group B performed SSE. Outcome measures included Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), Short Form-12 (SF-12) for quality of life, and assessment of cervical and shoulder range of motion (ROM).Both interventions produced significant improvements in pain reduction, functional ability, quality of life, and mobility. However, CCFT showed superior results in reducing pain, lowering disability scores, and improving cervical and shoulder ROM compared to SSE. In contrast, quality of life improvements were comparable between the two groups.The findings highlight that targeted activation of the deep cervical flexors using biofeedback is more effective for managing chronic mechanical neck pain than scapular stabilization alone. Nevertheless, both exercise approaches are valuable, and combining them may offer additional clinical benefits.

STATEMENT OF FUNDING

Source of Funding: Not Applicable

Nature of Funding : Not Applicable

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ANNEXURES

ANNEXURE 1

Consent form

I _____, aged ____ years, confirm that I have understood about Effects of Craniocervical Flexor Training and Scapular Stabalization Exercises procedure on chronic mechanical neck pain and its potential benefits on computer operators as explained by Prachi Aswale and is as mentioned in his study which is taking place under the guidance of Dr. Priyadarshini Mishra (PT), Associate professor, Abhinav Bindra sports medicine and research institute (ABSMARI) and, co-guidance of Dr. Anand Chandra Sahoo (PT), Assistant Professor, ABSMARI.

I understand that my participation is voluntary and I'm free to withdraw at any time, without giving any reason.

I understand that confidentiality will be maintained.

I voluntarily agree to and give my consent to be a part of the above-mentioned study.

Signature

Comparative Analysis of Craniocervical Flexor Training With Pressure Biofeedback vs. Scapular Stabilization Exercises on Chronic Mechanical Neck Pain Among Computer Users: A Comparative Study

हे प्रमाणित करण्यासाठी आहे की मी …….. माझ्या भाषेत अभ्यासाच्या फॉर्मची सामग्री मला समजावून सांगण्यात आली आहे.

मी पुष्टी करतो की मी स्वेच्छेने संमती फॉर्मच्या या प्रतवर स्वाक्षरी केली आहे. मला अभ्यासाचे स्वरूप समजले आणि मी या संशोधन अभ्यासामध्ये विषय म्हणून सहभागी होण्यासाठी स्वेच्छेने काम केले.

नाव: -…….

वय/लिंग: …….

पत्ता: …….

संपर्क क्रमांक: …….

तारीख: / / 25

साइन:

ठिकाण:

मी, अधोरेखित प्राची आस्वले यांनी अभ्यासाचे तपशील स्पष्ट केले आहेत आणि वरील स्वयंसेवकांनी माझ्या क्षमतेनुसार सर्व प्रश्न साफ केल्या आहेत. मी पुष्टी करतो की सर्व डेटा आणि चाचणी निकाल काटेकोरपणे गोपनीय ठेवले जातील आणि कोणत्याही गैरवापरापासून रोखले जातील.

तारीख: / / 25

साइन: -

ठिकाण

ANNEXURE 2

ASSESSMENT FORM

Demographic Data:

Name:

Age: _Gender:

Occupation:

Address:

Dominance :

Lifestyle: (sedentary/active)

Date of Assessment:

Chief complaint:

History of Present illness:

Mode of Onset : (Acute/Chronic/Recurrent)

Progression of Symptoms: (Improving/Worsening/Same)

History of Similar Complaints: (Yes/No)

Previous Diagnosis Related to Neck/Shoulder: (Yes/No)

Lifestyle & Postural Habits:(Prolonged sitting,lack of break,slouched sitting)

Past Medical & Surgical History:

Previous Neck/Shoulder Issues: Yes _No_

Previous Surgeries: Yes _ No_

Medications: (Pain killers, Muscle relaxants, Others)

OUTCOME MEASURES	**PRE INTERVENTION SCORE**
NPRS	
NDI	
FLEXION AROM	
EXTENSION AROM	
LEFT LATERAL FLEXION AROM	
RIGHT LATERAL FLEXION AROM	
LEFT ROTATION AROM	
RIGHT ROTATION AROM	

OUTCOME MEASURES	**POST INTERVENTION SCORE**
NPRS	
NDI	
FLEXION AROM	
EXTENSION AROM	
LEFT LATERAL FLEXION AROM	
RIGHT LATERAL FLEXION AROM	

LEFT ROTATION AROM	
RIGHT ROTATION AROM	

Neck Disability Index (NDI)

This questionnaire has been designed to give the doctor information as to how your neck pain has affected your ability to manage in everyday life. Please answer every section and mark in each section only the ONE box which applies to you. We realize you may consider that two of the statements in any one section relate to you, but please just mark the box which most closely describes your problem.

Section 1 — Pain Intensity

- I have no pain at the moment. (0)
- The pain is very mild at the moment. (1)
- The pain is moderate at the moment. (2)
- The pain is fairly severe at the moment. (3)
- The pain is very severe at the moment. (4)
- The pain is the worst imaginable at the moment. (5)

Section 2 — Personal Care (Washing, Dressing, etc.)

- I can look after myself normally without causing extra pain. (0)
- I can look after myself normally but it causes extra pain. (1)
- It is painful to look after myself and I am slow and careful. (2)
- I need some help but manage most of my personal care. (3)
- I need help every day in most aspects of self care. (4)
- I do not get dressed. I wash with difficulty and stay in bed. (5)

Section 3 — Lifting

- I can lift heavy weights without extra pain. (0)
- I can lift heavy weights but it gives extra pain. (1)
- Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table. (2)
- Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned. (3)
- I can lift very light weights. (4)
- I cannot lift or carry anything at all. (5)

Section 4 — Reading

- I can read as much as I want to with no pain in my neck. (0)
- I can read as much as I want to with slight pain in my neck. (1)
- I can read as much as I want with moderate pain in my neck. (2)
- I cannot read as much as I want because of moderate pain in my neck. (3)
- I can hardly read at all because of severe pain in my neck. (4)
- I cannot read at all. (5)

Section 5 — Headaches

- I have no headaches at all. (0)
- I have slight headaches that come infrequently. (1)
- I have moderate headaches which come infrequently. (2)
- I have moderate headaches which come frequently. (3)
- I have severe headaches which come frequently. (4)
- I have headaches almost all the time. (5)

Section 6 — Concentration

- I can concentrate fully when I want to with no difficulty. (0)
- I can concentrate fully when I want to with slight difficulty. (1)
- I have a fair degree of difficulty in concentrating when I want to. (2)
- I have a lot of difficulty in concentrating when I want to. (3)
- I have a great deal of difficulty in concentrating when I want to. (4)
- I cannot concentrate at all. (5)

Section 7 — Work

- I can do as much work as I want to. (0)
- I can do my usual work, but no more. (1)
- I can do most of my usual work, but no more. (2)
- I cannot do my usual work. (3)
- I can hardly do any work at all. (4)
- I cannot do any work at all. (5)

Section 8 — Driving

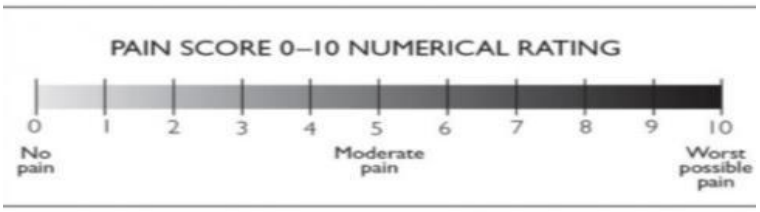
- I can drive my car without any neck pain. (0)
- I can drive my car as long as I want with slight pain in my neck. (1)
- I can drive my car as long as I want with moderate pain in my neck. (2)
- I cannot drive my car as long as I want because of moderate pain in my neck. (3)
- I can hardly drive at all because of severe pain in my neck. (4)
- I cannot drive my car at all. (5)

Section 9 — Sleeping

- I have no trouble sleeping. (0)
- My sleep is slightly disturbed (less than 1 hr. sleepless). (1)
- My sleep is mildly disturbed (1–2 hrs. sleepless). (2)
- My sleep is moderately disturbed (2–3 hrs. sleepless). (3)
- My sleep is greatly disturbed (3–5 hrs. sleepless). (4)
- My sleep is completely disturbed (5–7 hrs. sleepless). (5)

Section 10 — Recreation

- I am able to engage in all my recreation activities with no neck pain at all. (0)
- I am able to engage in all my recreation activities, with some pain in my neck. (1)
- I am able to engage in most, but not all, of my usual recreation activities because of pain in my neck. (2)
- I am able to engage in a few of my usual recreation activities because of pain in my neck. (3)
- I can hardly do any recreation activities because of pain in my neck. (4)
- I cannot do any recreation activities at all. (5)



SF-12 Health Survey

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. **Answer each question by choosing just one answer**. If you are unsure how to answer a question, please give the best answer you can.

1. **In general, would you say your health is:**

□1 Excellent □2 Very good □3 Good □4 Fair □5 Poor

The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?

	YES, limited a lot	YES, limited a little	NO, not limited at all
2. **Moderate activities** such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	□1	□2	□3
3. Climbing **several** flights of stairs.	□1	□2	□3

During the <u>past 4 weeks</u>, have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?

	YES	NO
4. **Accomplished less** than you would like.	□1	□2
5. Were limited in the **kind** of work or other activities.	□1	□2

During the <u>past 4 weeks</u>, have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?

	YES	NO
6. **Accomplished less** than you would like.	□1	□2
7. Did work or activities **less carefully than usual**.	□1	□2

8. **During the <u>past 4 weeks</u>, how much <u>did pain interfere</u> with your normal work (including work outside the home and housework)?**

□1 Not at all □2 A little bit □3 Moderately □4 Quite a bit □5 Extremely

These questions are about how you have been feeling during the <u>past 4 weeks</u>.
For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the <u>past 4 weeks</u>…

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
9. Have you felt calm & peaceful?	□1	□2	□3	□4	□5	□6
10. Did you have a lot of energy?	□1	□2	□3	□4	□5	□6
11. Have you felt down-hearted and blue?	□1	□2	□3	□4	□5	□6

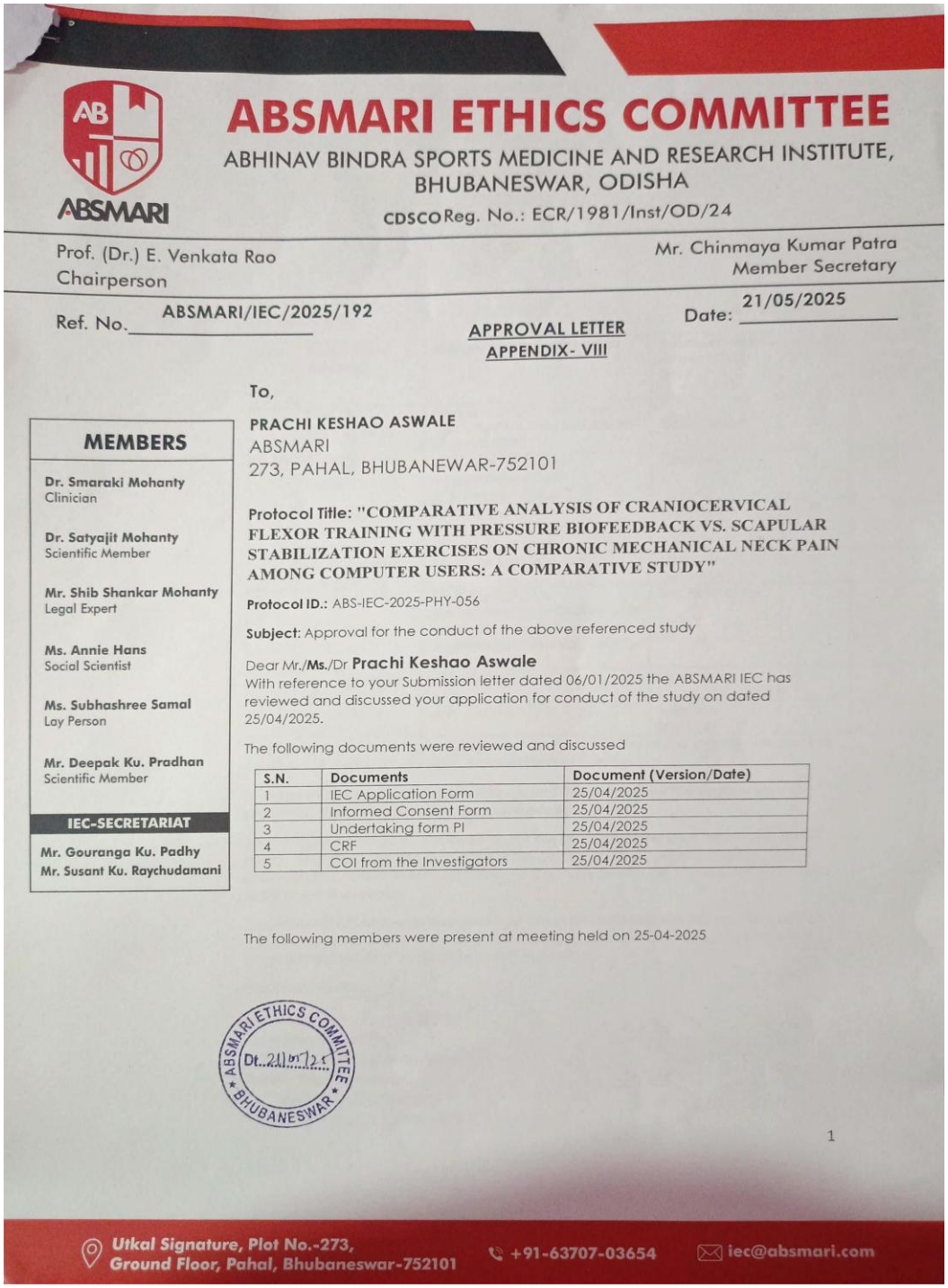
12. **During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?**

□1 All of the time □2 Most of the time □3 Some of the time □4 A little of the time □5 None of the time

Patient name: Date: PCS: MCS:

ANNEXURE 3

IEC INSTUTIONAL ETHICAL COMMITTEE



ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE, BHUBANESWAR, ODISHA

CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/192

Date: 21/05/2025

APPROVAL LETTER
APPENDIX- VIII

To,

PRACHI KESHAO ASWALE
ABSMARI
273, PAHAL, BHUBANEWAR-752101

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

Protocol Title: "COMPARATIVE ANALYSIS OF CRANIOCERVICAL FLEXOR TRAINING WITH PRESSURE BIOFEEDBACK VS. SCAPULAR STABILIZATION EXERCISES ON CHRONIC MECHANICAL NECK PAIN AMONG COMPUTER USERS: A COMPARATIVE STUDY"

Protocol ID.: ABS-IEC-2025-PHY-056

Subject: Approval for the conduct of the above referenced study

Dear Mr./**Ms.**/Dr **Prachi Keshao Aswale**
With reference to your Submission letter dated 06/01/2025 the ABSMARI IEC has reviewed and discussed your application for conduct of the study on dated 25/04/2025.

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	25/04/2025
2	Informed Consent Form	25/04/2025
3	Undertaking form PI	25/04/2025
4	CRF	25/04/2025
5	COI from the Investigators	25/04/2025

The following members were present at meeting held on 25-04-2025

ABSMARI ETHICS COMMITTEE * BHUBANESWAR * Dt. 21/05/25

1

Utkal Signature, Plot No.-273, Ground Floor, Pahal, Bhubaneswar-752101 +91-63707-03654 iec@absmari.com

Rita Enterprises

GST No. : 27GCVPS5020M1ZR

Ref. No. RE./NAC/12783 Date 10/05/2025

To,

DR. PRACHI KESHAO ASWALE (PT) PHYSIOTHERAPIST

Study Title: "COMPARATIVE ANALYSIS OF CRANIOCERVICAL FLEXOR TRAINING WITH PRESSURE BIOFEEDBACK VS SCAPULAR STABILIZATION EXERCISES ON CHRONIC MECHANICAL NECK PAIN AMONG COMPUTER USERS: A COMPARATIVE STUDY."

We are pleased to inform you that your request has been reviewed and approved. You are

hereby granted permission to carry out data collection and associated research activities, subject to the following conditions:

1. All participants must provide informed consent prior to participation.

2. Data confidentiality and privacy must be strictly maintained.

3. The research should not disrupt the regular functioning or operations of the club/institution.

4. A copy of the final report or findings is to be shared upon completion of the study.

We appreciate your interest in conducting ethical and meaningful research and wish you success in your work. Should you require further support or clarification, please feel free to contact us.

Yours Sincerely,

Amrut Salotkar

ANNEXURE 4

MASTERCHART

GROUP A

GROUP A CRANOCERVICAL FLEXOR TRAINING

													CERVICAL ROM								
S	Age	Gender	PRE NP	POST NP	PRE ND	POST N	PRE SF	POST S	PRE FLEXIONRO	POST FLEXION R	PRE EXTENSION R	POST EXTENSION	PRE RT LATER	POST RT L	PRE LT LATERAL FLEX	POST LT LATERAL FL	PRE RT ROTATION	POST RT ROTATION	PRE LT ROTATION	POST LT ROTATIO
1	33yrs	M	7	5	19	17	25	35	50	54	63	69	40	43	43	45	70	74	75	77
2	29yrs	F	6	5	11	7	25	34	50	55	60	65	40	43	45	47	70	73	75	78
3	40yrs	F	7	5	19	10	24	35	45	51	50	55	40	45	42	47	60	67	60	65
4	29yrs	F	5	5	15	10	27	29	46	50	68	69	43	45	45	47	72	78	80	82
5	28yrs	F	8	6	32	11	30	33	35	43	60	65	32	35	35	40	72	75	75	80
6	28yrs	M	8	6	26	10	28	29	46	50	56	60	32	35	35	40	60	65	63	65
7	32yrs	M	7	5	20	10	24	35	55	56	60	63	40	45	42	47	74	77	78	80
8	30yrs	F	8	6	22	11	26	34	35	37	60	63	32	34	40	42	38	40	42	45
9	27yrs	F	7	5	14	10	28	35	49	52	62	65	44	48	45	47	65	68	80	82
#	32yrs	F	6	4	12	6	23	31	50	53	65	68	35	37	38	40	72	75	75	78
11	33 yrs	F	7	5	17	8	28	29	50	52	64	66	30	33	34	37	67	70	74	76
#	42yrs	F	7	5	20	10	27	29	50	52	63	65	35	38	40	42	70	72	74	77
#	28yrs	M	7	5	22	12	23	30	55	57	75	77	45	47	48	50	75	82	85	87
#	28yrs	M	7	5	23	12	27	32	45	47	55	57	42	45	40	42	70	75	72	75
#	26yrs	F	8	5	22	12	24	32	47	50	64	66	35	38	40	45	63	72	68	75
#	30yrs	M	7	6	29	12	20	32	45	50	60	66	38	40	40	42	64	67	75	78
#	30yrs	M	5	4	6	2	28	30	51	55	68	70	42	45	42	45	65	70	76	84
#	29yrs	M	7	5	16	8	24	32	50	52	68	70	38	40	40	43	74	78	83	85
#	27yrs	F	6	5	18	10	25	29	53	55	60	63	30	35	35	40	60	66	63	68
#	28yrs	F	6	5	12	9	23	28	55	57	73	75	45	50	45	50	74	78	75	80
#	29yrs	M	7	5	15	6	25	29	40	45	66	69	45	48	40	45	70	73	70	75
#	30yrs	M	8	6	26	17	20	30	45	47	40	48	32	35	35	38	60	67	63	65
#	28yrs	M	5	3	16	14	24	28	52	55	70	75	42	45	43	47	60	63	65	68
#	29yrs	M	7	5	20	17	28	32	50	53	62	65	34	38	35	40	69	73	74	79
#	30yrs	M	8	5	20	14	32	34	40	45	35	38	74	77	38	43	72	80	76	80
#	38yrs	M	8	6	20	10	28	33	50	56	60	63	35	40	40	45	68	70	70	73
#	37yrs	M	7	4	19	11	26	32	52	55	60	63	40	46	43	45	70	75	75	78
#	30yrs	F	7	5	22	13	30	31	50	53	60	63	30	33	45	50	55	58	60	65
#	36yrs	M	7	4	20	11	31	31	50	53	60	65	44	48	45	48	68	70	75	79
#	32yrs	M	7	5	17	10	24	31	50	55	60	63	35	41	38	42	75	78	76	80

SHOULDER															
PRERTFLEXION	POSTRTFLEXION	PRELTFLEXION	POSTLTFLEXIO	PRERTABDUCT	POSTRTABDUCT	PRELTABDUCT	POSTLTABDUCTI	PRERTER	POSTRTER	PRELTER	POSTLTER	PRERTIR	POSTRTIR	PRELTI	POSTLTIR
170	180	178	180	176	180	180	180	70	75	73	75	80	84	80	85
172	180	175	180	175	177	175	178	70	73	73	75	80	85	85	90
145	150	170	175	135	137	160	165	60	63	70	75	65	70	75	80
176	180	176	180	172	180	180	180	68	70	70	73	80	83	80	83
170	175	173	175	178	180	180	180	70	73	73	75	80	85	90	90
155	160	158	160	143	150	147	150	65	70	69	74	72	75	75	80
160	163	165	168	165	168	168	170	80	83	80	85	90	90	90	90
168	172	170	173	165	172	175	178	68	70	70	73	70	75	75	77
173	175	175	178	150	154	155	156	70	73	80	82	75	77	80	82
174	177	176	179	168	170	170	172	72	75	70	75	80	80	85	85
167	170	174	176	163	169	170	175	70	75	72	75	85	86	90	90
160	165	168	170	172	175	175	177	70	72	70	75	80	84	85	85
170	173	180	182	175	180	178	180	80	82	85	87	85	87	90	90
160	163	162	165	170	176	170	173	70	73	80	85	90	90	85	90
173	178	168	170	168	176	168	173	68	73	70	85	80	90	80	85
160	165	175	180	145	150	170	180	65	70	75	77	75	82	80	85
175	177	176	180	172	180	172	180	78	80	72	80	90	90	84	90
160	165	175	178	125	135	138	145	60	63	70	74	85	85	85	88
174	180	172	180	170	177	174	180	70	73	80	83	80	85	80	85
172	177	175	178	170	173	178	180	82	85	85	87	85	87	85	90
170	175	173	175	175	178	172	180	70	73	74	80	80	80	90	90
180	180	178	180	120	125	120	125	80	85	85	90	90	90	82	90
172	180	174	180	174	180	176	180	90	90	85	90	90	90	86	90
170	175	178	180	145	150	163	165	74	78	80	82	90	90	85	90
178	180	170	176	173	180	170	175	74	77	80	85	80	90	82	90
160	163	175	178	143	152	165	168	70	75	75	78	74	80	85	85
175	180	175	180	175	177	178	180	65	73	80	82	86	90	84	90
160	163	165	168	170	173	175	178	70	72	85	87	75	78	74	80
173	175	178	180	160	165	165	168	72	79	80	83	80	85	80	85
175	178	178	180	168	162	165	168	70	72	78	80	78	80	85	85

GROUP B SCAPULAR STABALIZATION EXERCISES																						
										CERVICAL ROM												
Sr.No.	Age	Gender	PRENPR	POSTNPR	PRENDI	POSTNDI	PRESFR	POSTSFR	PRECERVICALFLEXI	POSTCERVICALFLEXI	PREEXTENSION	POSTEXTENSION	PRERTLATERALFLEXIO	POSTRTLATERALFLEX	PRELTLATERALFLE	POSTLTLATERALFLEXI	PRERTROTATIO	POSTRTROTATION	PRELTROTATION	POSTLTROTATIO
1	26yrs	F	7	5	20	18	29	34	40	45	60	63	40	43	45	48	60	63	65	68
2	28yrs	M	7	5	16	10	24	28	50	52	68	70	40	40	45	47	70	75	75	78
3	30yrs	M	8	6	22	12	29	32	50	50	66	68	32	35	35	38	75	78	78	80
4	32yrs	M	7	5	24	14	27	32	53	55	68	70	32	35	35	38	60	65	63	65
5	37yrs	M	8	6	29	25	32	33	50	53	68	70	40	43	44	45	38	40	42	45
6	28yrs	M	6	5	15	12	25	27	52	55	68	70	42	45	45	48	70	75	73	75
7	25yrs	F	7	6	28	22	25	29	50	55	70	75	40	42	45	48	60	65	80	85
8	28yrs	F	7	6	16	12	27	30	40	45	63	65	30	35	33	35	70	75	75	78
9	29yrs	M	7	5	18	14	25	28	40	43	65	68	45	48	42	45	76	78	68	70
10	38yrs	M	8	6	21	18	28	31	48	50	62	65	40	43	34	42	60	62	65	68
11	25yrs	F	6	5	21	16	25	30	44	47	48	50	35	38	34	42	65	68	64	73
12	26yrs	M	7	5	18	15	26	30	55	58	68	70	34	36	38	40	65	70	70	75
13	37yrs	M	8	6	22	18	35	38	40	42	55	58	40	40	45	48	65	68	75	78
14	28yrs	M	8	6	25	17	30	33	50	53	65	66	40	43	43	45	73	75	76	79
15	30yrs	M	7	5	18	16	25	31	50	53	65	68	42	45	45	47	72	75	76	78
16	26yrs	F	7	6	12	11	31	30	38	40	68	70	32	35	36	38	68	70	76	78
17	29yrs	F	8	6	27	21	26	30	40	42	60	62	36	34	34	42	64	68	69	72
18	27yrs	F	7	5	18	15	32	34	40	42	55	58	32	35	35	38	60	65	63	65
19	28yrs	F	7	6	19	15	29	33	50	50	60	65	33	35	40	43	62	66	60	65
20	31yrs	M	9	7	26	20	26	31	30	32	47	50	42	45	45	48	55	50	58	60
21	36yrs	F	8	7	26	20	33	39	45	48	50	53	50	53	45	48	50	53	55	56
22	30yrs	F	7	5	15	12	26	28	55	58	68	70	38	40	40	43	75	78	80	83
23	28yrs	F	7	6	19	15	28	32	50	53	70	73	40	43	45	48	40	42	48	50
24	34yrs	M	7	6	19	13	27	32	40	42	55	58	42	45	40	42	60	63	56	60
25	32yrs	M	6	5	15	11	27	32	50	50	63	65	40	40	40	42	63	65	73	75
26	36yrs	F	7	6	15	10	25	31	45	48	60	63	30	35	35	38	75	78	80	82
27	38yrs	F	6	5	11	10	25	30	40	42	70	72	40	42	41	43	70	72	80	83
28	29yrs	F	8	6	30	25	29	33	30	32	65	68	45	45	45	45	62	65	65	68
29	45yrs	F	7	6	17	12	25	29	45	48	65	68	40	42	42	45	78	80	85	88

S

SHOULDER ROM															
PRE RT FLEXION	POST RT FLEXI	PRE LT FLEXION	POST LT FLEXIO	PRE RT ABDUCTI	POST RT ABDUCT	PRE LT ABDUCTIO	POST LT ABDUCTI	PRE RT E	POST RT E	PRE LT E	POST LT I	PRE RT I	POST RT I	PRE LT I	POST LTI
170	175	175	175	165	170	175	175	80	83	85	87	85	85	85	87
170	173	175	175	175	175	180	180	74	76	75	78	75	78	78	80
160	165	165	168	168	170	170	175	68	70	70	75	80	80	90	90
160	165	170	170	125	130	140	143	68	70	74	78	80	80	85	85
160	165	170	175	155	159	168	170	68	70	70	73	75	78	80	80
180	180	180	180	170	175	175	180	70	75	80	85	70	75	80	85
160	165	170	178	130	135	135	138	85	90	90	90	90	85	90	90
170	173	180	180	175	178	180	180	70	73	75	78	90	90	90	90
178	180	169	170	175	178	165	170	68	70	65	70	70	75	68	70
180	180	163	165	170	170	173	175	70	73	73	75	80	83	85	85
155	158	172	175	160	163	159	163	75	78	68	70	69	70	80	80
170	173	180	183	175	178	178	180	70	73	80	83	80	83	80	85
180	180	185	185	160	165	170	173	80	80	80	80	90	90	90	90
160	165	168	170	170	173	175	178	70	75	80	83	80	83	80	83
170	173	174	177	164	167	166	168	68	71	70	73	75	78	78	80
170	172	175	178	176	177	178	178	68	70	70	70	80	80	85	85
160	165	170	175	145	148	148	150	70	72	75	78	80	82	85	87
172	175	175	178	175	178	180	180	70	73	75	78	80	82	85	88
170	173	175	178	160	163	165	168	80	83	85	88	85	86	85	88
162	165	167	170	155	158	158	160	68	70	70	73	70	75	70	75
174	175	178	180	169	173	175	178	70	73	75	78	90	90	90	90
175	178	178	180	168	170	178	173	80	83	85	85	90	90	90	90
165	168	170	173	160	168	165	168	75	79	80	90	90	90	80	90
172	175	178	180	160	165	168	170	70	73	68	70	80	83	70	75
170	173	180	180	160	163	175	178	80	80	85	85	90	90	90	90
170	172	180	180	160	165	170	173	75	76	80	80	85	85	90	90
175	175	160	165	165	170	180	180	75	78	80	82	70	73	75	78
173	176	175	178	173	177	180	180	70	73	75	78	80	85	85	90
175	178	180	180	170	175	175	178	80	80	84	85	85	85	90	90
168	170	170	170	165	170	175	176	70	72	75	75	80	80	85	[illegible]

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