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Outcome of Neural Mobilization among Patients with Chronic Neck Pain

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance this dissertation entitled.**“Outcome of Neural Mobilization among Patients with Chronic Neck Pain: A Randomized control trail”** Submitted by **Md Forkan Hossain** for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy.

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DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also decline that for any publication or dissemination of information of the study be bound to take written consent of my supervisor.

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ACRONYMS

AROM	Active Range of Motion
CR	Cervical Radiculopathy
CTS	Carpal Tunnel Syndrome
DM	Diabetes Mellitus
DNF	Deep Neck Flexor
HTN	Hypertension
IRM	Incomplete Rest Method
MND	Musculoskeletal Neck Disorder
MRI	Magnetic Resonance Imaging
MST	Myokinetic Stretching Technique
NDI	Neck Disability Index
NM	Neural mobilization
NPRS	Numeric Pain Rating Scale
NRS	Nerve related symptoms
PBU	Preesure Biofeedback Unit
RMS	Repetitive Magnetic Stimulation
ROM	Range of Motion
SMWAM	Spinal Movement Combined with Arm Mobilization
UST	Ultrasound Therapy

ABSTARCT

Background: One of the most prevalent musculoskeletal conditions in daily life is neck pain, which significantly impairs functionality and quality of life. Neck pain ranks as the fourth most prevalent factor contributing to disability, manifesting an annual prevalence rate surpassing 30%. However Individuals with persistent neck pain have poor postural control, changed neck muscular control patterns, and even less stable balance when they experience exhaustion in their neck flexor muscles. In addition to reduced range of motion, compromised quality of life, and altered muscle function, CNP has also been linked to joint position awareness deficiency and postural stability disruption. **Objectives:** To determine and compare the outcome of neural mobilization along with conventional physiotherapy and only conventional physiotherapy among patients with chronic neck pain. **Methodology:** A total of 36 participants were randomly assigned to experimental and control groups. Socio-demographic characteristics, including age, gender, and educational background, were recorded. Outcomes were assessed using the Numeric Pain Rating Scale (NPRS), cervical spine ROM measurements using gonimeter, and the Neck Disability Index (NDI**). Results**: The scores for neck pain in all positions and movements showed reductions for both groups after the intervention; however, they were not statistically significant between the two groups, with p-values of > 0.05. In addition, cervical spine ROM improved in the experimental group but did not reach the level of statistical difference compared to the control group. Despite these findings, the experimental group still had a significant improvement in NDI scores, with a mean reduction of 8.73 compared to the control group, reaching a statistical significance of p = 0.031, indicating greater reduction in neck disability. **Conclusion:** The intervention led to minor insignificant improvements in neck pain and cervical ROM. However, significant reductions in neck disability were observed in the experimental group, indicating greater potential of the intervention on functional outcomes. The study findings indicate that future research should be conducted with larger samples, longer durations, and more intensive interventions to definitely establish the efficacy of treatment.

Key Words*:* *Chronic Neck pain,Neural mobilization, pain, disability, range of motion.*

CHAPTER-I	**INTRODUCTION**

1.1 Background

One of the most prevalent issues within the field of musculoskeletal health pertains to disorders affecting the neck region, which not only pose substantial challenges to individuals on a social and functional level but also exert a considerable influence on economic dimensions due to their widespread occurrence and associated healthcare costs (Reuter & Fichthorn, 2019, p. 76). Neck pain (with or without pain referred into the upper limb) that lasts for at least one day. The neck includes the area from the occiput to the first thoracic vertebra (IHME, 2023).

A multifaceted illness, neck discomfort is a significant issue in contemporary life. Even though it might not be the most prevalent musculoskeletal condition, neck pain is nevertheless a serious concern (Cohen, 2015, p. 32). The underlying causes of neck pain are complex, but research indicates that sedentary lifestyles, office jobs, frequent sleep issues, obesity, bad posture, anxiety, depression, increased computer use, switching to a different type of work, being a woman, and males experiencing emotional exhaustion from their jobs are all significant risk factors (Farooq et al. 2018, p. 24).

The human body frequently experiences neck pain, which not only pain but also may render a person disabled and lead to financial difficulties (Henschke et al. 2015, p. 139). Neck pain ranks as the fourth most prevalent factor contributing to disability, manifesting an annual prevalence rate surpassing 30%. The majority of instances involving sudden onset neck pain tend to dissipate with or without intervention; however, close to half of the population affected will persist in enduring a certain level of pain or recurrent episodes, and neck pain can be categorized in a variety of ways, such as by intensity, etiology or structure, type (mechanical vs neuropathic), duration (acute, <6 weeks; subacute, 3 months; chronic, >3 months), and so on (Cohen, 2015, p. 284).

Chronic pain is frequently linked to various factors such as anatomical, psychological, social, and professional elements. This correlation aligns with the biopsychosocial model, a theoretical framework that views pain as a multifaceted phenomenon resulting from the dynamic interplay of biological, psychological, and social determinants that are specific to each person. The model emphasizes the complexity of chronic pain experiences, highlighting the importance of considering the individual's unique biological, psychological, and social makeup when addressing and managing chronic pain conditions (Cohen & Hooten, 2017, p. 32).

Low back and neck pain were responsible for the most significant proportion of healthcare expenditures in the United States during the year 2016, surpassing 152 other conditions, and it was reported that a substantial sum of approximately $134.5 billion was allocated towards addressing these specific health issues (Dieleman et al., 2020). In the worldwide context, the highest age-standardized rates pertaining to the prevalence, incidence, and Years of Healthy Life lost due to disability (YLD) for neck pain, per 100,000 individuals, were reported to be 2,696.5. & At the national level, the Philippines exhibited the highest YLD due to neck pain. High-income North America experienced the most significant rise in YLD attributed to neck pain per 100,000 individuals, with a range of 17.0 (95% UI 9.0 to 25.4%). Similarly, Southeast Asia saw an increase in YLD with a range of 416.1 (95% UI 273.7 to 596.5) from 1990 to 2019. The global burden of neck pain surged with age, peaking at 70–74 years, and proved to be more prevalent among women than men. Notably, there were discernible positive correlations between the sociodemographic index and the burden of neck pain (Shin et al. 2022, p. 95).

Individuals with persistent neck pain have poor postural control, changed neck muscular control patterns, and even less stable balance when they experience exhaustion in their neck flexor muscles (Hsu et al. 2020, p. 530). In addition to reduced range of motion, compromised quality of life, and altered muscle function, CNP has also been linked to joint position awareness deficiency and postural stability disruption (Cheng et al. 2015, p. 801). Chronic neck pain exerts a significant impact on the intricate three-dimensional kinematics and coordination of movements that occur between the cervical and thoracic spines. This impact is characterized by a noticable decrease in cervical angular velocity and acceleration, leading to diminished overall mobility and function in the affected area. Furthermore, there is a discernible reduction in the levels of coordination observed between the cervical and upper thoracic spines, indicating a disruption in the harmonious interplay of these crucial spinal segments (Tsang et al. 2013, p. 610).

NP may occasionally exhibit a range of nerve-related symptoms, including radiating pain, increased mechanosensitivity, altered sensation, or other neurological indicators (Blanpied et al. 2017, p. 1). Some patients who are suffering from chronic nonspecific neck pain exhibit various manifestations indicative of underlying sensory and sympathetic nerve-related dysfunctions. These individuals were often present with observable signs of functional deficits in innervation, which manifest as alterations in tactile sensitivity and disruptions in vasoactive sympathetic function (Rampazo et al. 2021, p. 104).

Compression of the cervical nerve roots causes a clinical disease called cervical radiculopathy. Wide-ranging clinical symptoms of cervical radiculopathy could include discomfort, impaired reflexes, motor impairments, sensory abnormalities, or any combination of these. Likewise, a multitude of distinct pathophysiologic mechanisms may give rise to dysfunction of the cervical nerve roots (Iyer & Kim, 2016, p. 273).

1.2 Justification

The frequency of neck pain in the population is large, it's anticipated that between 30 and 50 percent of individuals suffer from neck pain in any given year (McCartney et al. 2018, p.1). On a global scale, it was observed that the total number of prevalent cases related to neck pain reached 288.7 million in the year 2017 (Safiri et al. 2020, p. 791). Individuals with Chronic neck pain have poor postural control, changed neck muscular control patterns, and even less balance when they experience exhaustion in their neck muscles (Hsu et al. 2020, p. 530).

Neck pain also exerts a significant impact on the intricate three-dimensional kinematics and coordination of movements that occur between the cervical and thoracic spines. This impact is characterized by decrease in cervical angular velocity and acceleration, leading to diminished overall mobility and function in the affected area. Furthermore, there is a discernible reduction in the levels of coordination observed between the cervical and upper thoracic spines, indicating a disruption in the harmonious interplay of these crucial spinal segments (Tsang et al. 2013, p. 610).

For neck pain a variety of pharmaceutical and non-pharmacological therapies, such as acupuncture, yoga, and aquatic therapy, some exercise (e.g., range of motion exercises, strength training), manual therapy (including muscle energy techniques, non-thrust mobilization, and manipulation), modalities (e.g., transcutaneous electrical nerve stimulation (TENS), laser therapy, cryotherapy, traction), massage therapy can be applied and the use of cervical collars (Bryans et al. 2014, p. 42; Corvillo et al. 2020, p. 915). In addition, Cervical and scapular stretching and strengthening exercises have been demonstrated to offer intermediate-term alleviation for mechanical neck discomfort (Bertozzi et al. 2013, p. 1026).

Many patients in our nation don't have the socioeconomic circumstances necessary for lengthy physiotherapy treatments. As a result, patients suffer more throughout their lives and are less satisfied while undergoing treatment.

The purpose of this study was to determine the outcomes of neural mobilization combined with conventional physiotherapy among patients with chronic neck pain. While many research exists on the effects of neural mobilization, there is limited evidence specifically comparing its combination with conventional physiotherapy in terms of pain reduction, improvement in cervical range of motion, and reduction in disability among chronic neck pain patients. This study aims to bridge this gap by evaluating the specific benefits of this combined approach. By contributing to the growing body of evidence, this research seeks to guide physiotherapists in utilizing evidence-based interventions to optimize patient outcomes. Additionally, the results of this study will help further develop clinical practices in physiotherapy, benefiting both patients and the profession as a whole.

1.3 Research question:

What are the outcome of neural mobilization among the patients with chronic neck pain?

1.4 Aim of the Study:

The purpose of the study is to find out the outcomes of neural mobilization along with conventional physiotherapy and only conventional physiotherapy in patients with chronic neck pain.

1.5 Objectives of the study :

1.5.1 General Objective:

- To determine and compare the outcome of neural mobilization along with conventional physiotherapy and only conventional physiotherapy among patients with chronic neck pain at Mirpur in Dhaka city.

15.2 Specific objective:

i. To assess the level of pain of the patients of experimental and control group by using NPRS before and after intervention.
ii. To assess ROM of the patients of experimental and control group by using Goniometer before and after intervention.
iii. To assess the cervical spine disability of the patients of experimental and control group by NDI before and after intervention.
iv. To compare the outcome due to intervention within experimental and control group.
v. To determine the socio-demographic characteristics and pain-related information of participants.

1.3 Statement of Hypothesis:

Null hypothesis (Ho):

Neural mobilization along with conventional therapy is not effective than only conventional therapy in patients with chronic neck pain.

$$\mu_1 - \mu_2 = 0 \text{ or } \mu_1 \geq \mu_2$$

Alternative hypothesis (Ha):

Neural mobilization along with conventional therapy is effective than only conventional therapy in patients with chronic neck pain.

$$\mu_1 - \mu_2 \neq 0 \text{ or } \mu_1 \neq \mu_2$$

Here,

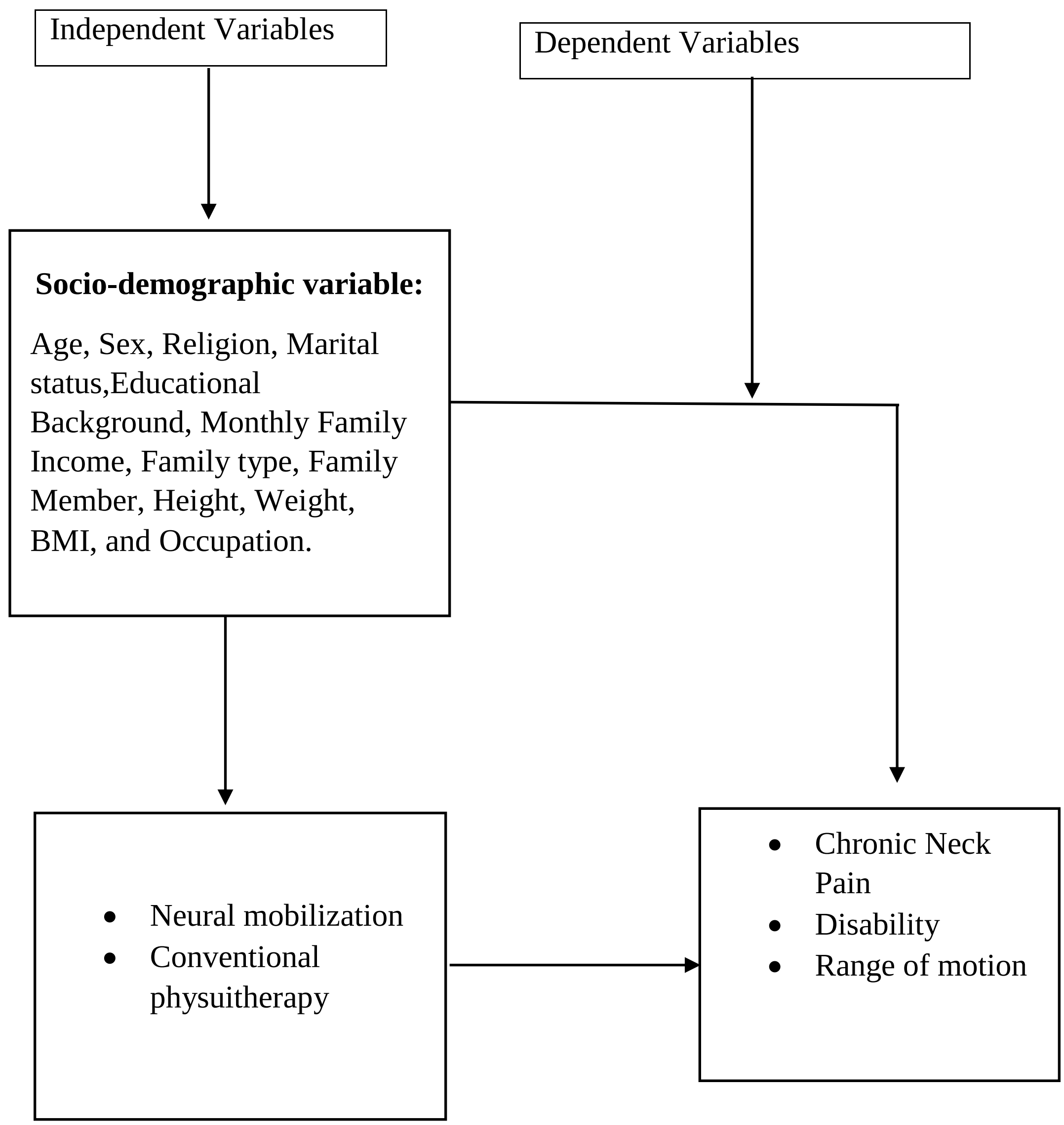
Ho = Null hypothesis

Ha = Alternative hypothesis

$\mu_1 =$ Mean of population 1

$\mu_2 =$ Mean of population 2

1.6 List of Variable /Conceptual Framework



1.7 Operational definition:

Age:

Age refers to the age of a person (or subject) of interest at the last birthday (or relative to a specified, well-defined reference date).

Sex:

Sex refers to the biological and physiological characteristics that define humans as female or male.

Height:

distance, measured along a perpendicular, between. a point and a reference surface.

Weight:

Weight is the Gravitational force with which the Earth attracts the masses towards its center.

BMI:

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters.

Occupation:

set of jobs whose main tasks and duties are characterized by a high degree of similarity

Chronic Neck pain:

The pain must be continued for more than 3 months. Chronic pain is any pain that lasts for more than three months. The pain can become progressively worse and reoccur intermittently, outlasting the usual healing process.

Neural Mobilization Technique:
This is utilizing controlled neural tension maneuvers to mobilize the nerve up and down.

Stinging:
A kind of pain; something as sudden and painful as being stung; it is just like a cutting
Pain.

Tingling:
An uncommon sensation known as tingling (paraesthesia) is typically experienced in the hands, feet, arms, and legs. Numbness or a loss of feeling or sensing pressure or texture are frequently linked to tingling. It feels like a scorching feeling.

Numbness:
Partial or total lack of sensation in a part of the body; symptoms of nerve damage or dysfunction.

Conventional Physiotherapy:
Physiotherapeutic interventions that are evidence-based practiced (like mobilization, retraction, manual traction, IRR, stretching, strengthening exercise) by graduate physiotherapist.

Neck pain, a prevalent symptom experienced by individuals, is a form of discomfort that manifests in the cervical region of the human body, resulting not only in physical distress but also in neck pain-related disability and various socio-economic challenges. This type of pain can significantly impact an individual's quality of life, limiting their ability to perform daily activities and engage in work-related tasks, thus contributing to a decrease in productivity and potential financial burdens (Henschke et al. 2015, p. 139)**.**

On a global scale, it was observed that the total number of prevalent cases related to neck pain reached 288.7 million in the year 2017. This Figure nowas accompanied by an age-standardized point prevalence of 3551.1 per 100,000 population, a metric that exhibited no significant alteration when compared to data from the year 1990. Furthermore, an analysis revealed that incidents of neck pain amounted to 65.3 million cases globally, showcasing an age-standardized rate of 806.6 per 100,000 population, a value that remained relatively over the years, mirroring the lack of significant change observed from 1990. Delving deeper into the impact of neck pain on global health, it was found that the total number of years lived with disability as a result of this condition in 2017 stood at 28.6 million. This metric was paired with an age-standardized rate per 100,000 population of 352 years lived with disability, a value that persisted without no fluctuations from 1990 through to 2017 (Safiri et al. 2020, p. 791).

There are several classifications for neck pain, such as length (acute, less than six weeks; subacute, three months; chronic, more than three months); intensity; etiology/structure; and kind mechanical vs neuropathic (Cohen, 2015, p. 284).

There is a strong correlation between physical, psychological, social, and occupational variables and chronic pain. This is consistent with the biopsychosocial paradigm, which views pain as the result of a dynamic interplay of social, psychological, and biological elements that are particular to each person (Cohen & Hooten, 2017, p. 32)**.**

A potential contribution of lifestyle variables to the onset of chronic musculoskeletal pain has received attention recently. Higher physical activity levels are linked to fewer cases of neck and shoulder pain, whereas being physically inactive and having a high body mass index are associated with increased risk of chronic low back and neck/shoulder pain in the general adult population, according to epidemiological studies (Guddal et al. 2017, p. 232). Additionally, it has been demonstrated that sleep issues are linked to a higher chance of developing chronic neck/shoulder and low back discomfort (Mork et al. 2014, p. 924).

Conservative management of cervical issues comprises, among other things, cervical collars, massage therapy, medication, modalities (such as transcutaneous electrical nerve stimulation, or TENS), manual therapy muscle energy techniques, non-thrust mobilization, manipulation, and traction and range of motion exercises (Bryans et al. 2014, p. 42). n the short term, strengthening activities for the upper quadrant and neck have a mild impact on neck pain. Based on research of low to intermediate quality, reassurance, counsel, and instruction typically have minor effects.Evidence of extremely low to intermediate quality suggests that psychological treatments alone have minimal impact and Physiotherapists' combined psychological and physical therapies might work better (Sterling et al. 2019, p. 1219).

Riordan et al. (2014, p. 1219) recommended that multimodal programs that incorporate education and vigorous exercise are for those with chronic neck pain. It is advised to exercise for 30 to 60 minutes, three times a week, at an intensity of up to 80% of maximum voluntary contraction (MVC) in order to increase strength and decrease discomfort and impairment. In order to ensure proper muscle recruitment and function, resistance training to raise the deep cervical flexors' isometric strength is required. When endurance exercises are included in a program that employs gravity as resistance, the deeper cervical muscles' postural performance is improved, potentially alleviating discomfort in those with chronic neck pain. Increased reported feelings of overall well-being and health-related quality can be induced by aerobic exercise.

In addition Kim et al. (2015, p. 2461) evaluate the investigation and place great emphasis on the significance of engaging in active exercises as a crucial component of long-term therapeutic strategies for managing neck pain, with a specific focus on the efficacy of these interventions in enhancing postural stability and potentially alleviating neck discomfort among individuals exhibiting forward head postures induced by prolonged smartphone usage. Within the scope of the research, the implementation of specialized exercises targeting the strengthening of deep cervical flexors through the utilization of a Pressure Biofeedback Unit (PBU) and the application of McKenzie cervical exercises were employed, both of which yielded enhancements in measures such as neck disability indexes and the static muscular strength of deep cervical flexors.

Khan, et al. (2014, p. 1719) Studies revealed that engaging in isometric exercises utilizing Theraband as a resistance tool aimed at enhancing the strength and endurance of the muscles responsible for neck flexion, extension, lateral flexion, and rotation has been acknowledged as a highly efficacious therapeutic intervention. The prescribed protocol for each exercise entailed completing 20 repetitions during each session, with a frequency of three times per week, over the course of a 12-week period.

For those suffering from chronic neck pain, Maitland and Mulligan's mobilization was evaluated in a randomized clinical study(Gautam et al. 2014, p. 482). In this work, grade 2 oscillatory motions at 2-3 hertz were used for 60 seconds to apply Maitland mobilization. While Mulligan mobilizations like Natural Appophyseal Gliding (NAGS) were administered at 2-3 Hz (for fewer than 6 repetitions) and Sustained Natural Appophyseal Gliding (SNAGS) for 6 repetitions in 3 sets, the repetitions were gradually increased starting with grade 2. Less than six mobilization cycles were completed before the movement underwent another evaluation. For a total of 30 days, treatment was administered four times each week. In addition, Kim et al. (2015, p. 482) found the effectiveness of the myofascial release technique in comparison to joint mobilization for chronic neck pain caused by tightness in the neck musculature demonstrated in the study. Within the group that received the release technique, the approach involved the application of myofascial release to address the muscles exhibiting signs of shortening. Additionally, soft tissue mobilization techniques were employed at Grade II B as outlined by the Granter King Scale. This involved incorporating either active or passive stretching methods to facilitate the elongation of the soft tissues.

A researcher Kroeling et al. (2013, p. 510) to examine the effectiveness of electrotherapy in managing neck pain through a systematic review. The methodology employed in this study involved the utilization of evidence of notably low quality to ascertain the comparative efficacy of various electrotherapy modalities. Specifically, the findings indicated that PEMF, or pulsed electromagnetic field therapy, and RMS, or repeated magnetic stimulation, demonstrated superior outcomes in alleviating neck pain when compared to a placebo. Conversely, the use of transcutaneous electrical nerve stimulation (TENS) yielded inconsistent results. A recent study has demonstrated the enhanced efficacy of Transcutaneous Electrical Nerve Stimulation (TENS) when utilized in conjunction with isometric exercises targeting the muscles of the neck region. The specific parameters of the TENS application in this study included a frequency of 5 Hertz, a high intensity of pulses, a duration of 300 microseconds, and a total session duration of 20 minutes, which were administered four times weekly (Sharma et al. 2014, p. 787)

As compared to the conventional physiotherapy group, the multi-modal mobilization group showed higher improvements in pain, disability, NME, and neck range of motion, with statistically significant differences in favor of the mobilization group. Neck disability considerably decreased in both groups; however, at four weeks, there was a significant difference in the Neck Disability Index (NDI) change scores favoring mobilization, with the multi-modal mobilization group showing a greater mean change relative to conventional physiotherapy (Farooq et al. 2018, p. 24).

NP may occasionally exhibit a range of nerve-related symptoms, including radiating pain, increased mechanosensitivity, altered sensation, or other neurological indicators (Blanpied et al. 2017, p. 1). Compression of the cervical nerve roots causes a clinical disease called cervical radiculopathy. Wide-ranging clinical symptoms of cervical radiculopathy could include discomfort, impaired reflexes, motor impairments, sensory abnormalities, or any combination of these. Likewise, a multitude of distinct pathophysiologic mechanisms may give rise to dysfunction of the cervical nerve roots (Iyer & Kim, 2016, p. 272). Cervical radiculopathy manifests itself at a yearly occurrence rate of 85 cases per 100,000 individuals, a significantly lower frequency when compared to radiculopathy affecting the lumbar spine. This particular condition exhibits a higher occurrence in individuals within the fifth decade of life, with a prevalence rate of 203 cases per 100,000 individuals (Priya et al., 2015, p. 232)

Acute intervertebral disc herniation-induced nerve root compression may first cause neck pain, and then arm pain. Though it is present in less than 15% of patients, a history of physical activity or trauma is frequently thought to be a causal component. Although more than half of the population has multiple nerve root involvement and significant dermatomal overlap, radicular pain usually follows a dermatomal pattern (Cohen & Hooten, 2017, p. 32). In terms of lowering neck pain intensity, neck impairment, or enhancing quality of life, a comprehensive review of RCTs encompassing both WAD and non-traumatic neck pain found that manual treatment and exercise together were no more beneficial than exercise alone (Fredin & Loras, 2017, p. 62).

On the other hand Hidalgo et al. (2018, p. 1149) moderate to strong evidence for chronic neck pain and moderate evidence for acute to subacute neck pain were identified when manual treatment and exercise were combined. Sutton et al. (2016, p. 1541) showed that patients suffering from non-traumatic neck discomfort and WAD can benefit from multimodal care, which includes manual therapy, exercise, and education. They also came to the conclusion that giving patients with neck pain multiple sessions of multimodal therapy over a lengthy period of time has no further benefits.

The use of upper quarter (neck, scapula, and upper limb) strength training to reduce pain right after treatment was supported by moderately high quality evidence. At short-term follow-up, the effect was moderate to large (pooled SMD (pain) 0.71 (95% CI: 1.33 to 0.10)). Additionally, there was moderate-quality evidence to support: (i) upper-quarter endurance training for a minor positive impact on pain at short-term follow-up and immediately after treatment; (ii) exercises for shoulder girdle muscle control (stabilisation) to improve function and pain at intermediate-term follow-up as well as (iii) Qigong, which consists of slow movement exercises and mindfulness, to somewhat enhance function but not the overall patient's perception in the short term. Stretching by itself, general fitness training, breathing techniques, and vestibular rehabilitation exercises may not improve pain or function at short-term follow-up, according to low-quality research. At short-term follow-up, very poor quality data indicated that neuromuscular eye-neck coordination and proprioceptive training would enhance function and reduce pain (McCaskey et al. 2014, p. 1)

Nerve entrapment syndromes, which encompass a variety of clinical conditions characterized by the compression or irritation of peripheral nerves, can now be effectively addressed through the application of the neuromobilization manoeuvre, a therapeutic technique designed to enhance nerve function. This innovative approach encompasses a comprehensive series of both active and passive movements, specifically tailored to facilitate the restoration of the nerve's natural mechanical properties, which are essential for optimal function in various everyday postures and during the dynamic motions of the extremities. Through the implementation of neuromobilization techniques, it is possible to reinstate the longitudinal motion of the affected nerve, thereby alleviating symptoms associated with nerve dysfunction. Furthermore, any pathological condition that hinders the normal mobility of nerves and disrupts their typical strain response may lead to an abnormal increase in tension within the affected nerve, particularly noticeable during routine postures and the active movement of the extremities (Martinez, 2015, p. 91). If the phenomenon of compression is systematically applied to the anatomical boundaries surrounding the affected areas, then it is subsequently alleviated through the principles and practices associated with neurodynamics, which focus on the intricate relationship between the nervous system and surrounding structures. Conversely, it has been observed that the implementation of cervical mobilization techniques contributes to a reduction in the pressure exerted on the nerve roots, thereby facilitating improved neural function and pain relief. When considered separately, these therapeutic modalities demonstrate a significant degree of effectiveness in the management of cervicobrachialgia; however, it is important to recognize that they are accompanied by certain inherent limitations that may affect their overall efficacy in clinical practice (Khan et al. 2015, p. 2461; Oskouei et al. 2014, p. 1017)

In patient populations that frequently exhibit treatment resistance, such as those with chronic N-LBP and N-NAP and plantar heel pain, slump and SLR mobilization as well as a cervical lateral glide approach have been demonstrated to enhance pain and function. The results of this analysis might contribute to the development of guidelines for the treatment of low back and neck pain as well as CTS (Basson et al. 2017, p. 593).

More symptom relief was brought about by neural mobilization, which may have been produced by the normalization of the nerve's internal defective mechanical and physiological components. The factors mentioned previously might be responsible for the neural mobilization technique's potential to reduce subjects' degree of impairment and increase their range of motion in cervical radiculopathy patients (Chettri et al. 2014, p. 449). On a study 27 CR patients received treatment using a multifaceted approach. Individualised treatment plans were developed for each patient, and only methods judged suitable following a comprehensive evaluation were applied. The following modalities were employed in this study: end range loading manoeuvres, over-the-door traction, cervical manipulation, and NM applied to the afflicted nerve root. In the three-month follow-up, 25 out of 27 patients reported a clinically meaningful reduction in their disability and discomfort. This study design precludes drawing any useful conclusions regarding the efficacy of NMs in isolation, albeit the encouraging results (Murphy et al. 2014, p. 279)

A systematic review studies, which focus on evaluating the efficacy of neural mobilization (NM) techniques in the management of musculoskeletal neck disorders presenting with nerve-related symptoms (MND-NRS). The primary outcome measures that were scrutinized across the various studies included pain intensity, level of disability, perceived functional abilities, range of motion in the cervical region, and sensitivity to mechanical stimuli. The analysis revealed that the utilization of NM yielded positive results in terms of ameliorating the overall pain intensity when incorporated into the realm of physiotherapeutic interventions for individuals suffering from musculoskeletal neck disorders accompanied by nerve-related symptoms in comparison to a lack of intervention, NM demonstrated effectiveness in enhancing neck rotation, reducing disability, and improving overall functional capacity. Nevertheless, it was observed that NM did not exhibit superiority over alternative forms of treatment modalities in terms of alleviating general pain intensity, neck-specific pain levels, intensity of arm pain, range of motion in the cervical area, and levels of disability, with the exception of mechanosensitivity, where NM showcased superior outcomes when juxtaposed with alternative treatment options (Varangot-Reille et al. 2022, p. 707).On the other side, a systematic review with meta-analysis of twenty different studies was conducted recently to investigate the impact and influence of neural mobilization (NM) on chronic health conditions. The findings of this extensive review indicated that NM does not exhibit a higher level of efficacy when compared to alternative interventions available for addressing similar health issues (Su & Lim, 2016, p. 991). In the present investigation, the utilization of cervical traction as well as neural mobilization has been demonstrated to yield advantageous outcomes for individuals afflicted with cervical radiculopathy. Upon conducting a comparative assessment between the aforementioned two intervention cohorts, no statistically significant findings were observed. Similarly, an evaluation of disability levels in the cervical region within the context of both intervention groups failed to yield statistically significant results ($P>0.05$). Furthermore, the examination of the neck range of motion in relation to the traction and neural mobilization cohorts also did not reveal any statistically significant disparities ($P>0.05$) (Chettri et al. 2014, p. 549).

Research carried out by Leaver et al. (2013, p. 31) is centered on examining the clinical attributes of individuals seeking manual therapy treatment for a new instance of non-specific neck discomfort. Participants in the investigation experienced pain of moderate severity (rated at 6.1 out of 10) and displayed disability levels (15.7 out of 50). The preponderance of subjects were women holding university degrees, engaged in employment, and self-reported their overall health as satisfactory. Frequently reported accompanying symptoms encompassed pain in the upper limbs, headaches, discomfort in the upper and lower back, sensations of dizziness, and episodes of nausea. Factors linked with heightened pain levels included elevated Neck Disability Index (NDI) ratings, diminished SF-12 physical component scores, the absence of lower back pain, and the utilization of analgesic medications. Elevated levels of disability were correlated with variables such as suboptimal general health, occurrences of nausea, smoking habits, lower SF-12 mental health ratings, and shorter durations of symptom manifestation.

When the comparison was made between the NPRS score and NDI means both at pre-intervention and at the 2nd-week post-intervention among the groups, it was observed that there existed no statistically significant difference between the groups. However, at the 4th-week post-intervention, a statistically significant difference was noted between the groups. The simultaneous application of Mechanical Cervical Traction in conjunction with Neural Mobilization on the subjects resulted in a reduction of -71.33% in NPRS and -59.71% in NDI, demonstrating a higher percentage of reduction in radicular symptoms subsequent to 12 sessions of treatment over a duration of 4 weeks. Consequently, the findings of this study revealed that the simultaneous application of mechanical cervical traction along with neural mobilization proved to be more effective (Raval et al. 2014, p. 329).

A slider NM method was simultaneously administered on the median nerve with cervical tension in a patient with CR in one case study (Savva & Giakas, 2013, p. 443). Following 12 sessions spaced out over a month, the patient reported improvements in all end measures, including pain and functional activities, grip strength, and cervical spine range of motion.

The presence of mechanical stimuli surrounding the CNRs, however, may prevent their mobilisation in nerve root compression, which could exacerbate CR pain. In order to decompress the C5 nerve root and lengthen the cervical neural foramen at the C4 and C5 levels, cervical traction was used. Slider neural mobilisations were administered for one minute while maintaining cervical traction in order to mobilise and restore the C5 nerve root's normal structure and function (Savva & Giakas, 2013, p. 443).

3.1. Study Design: The study design was a Randomized Controlled Trial (RCT). This design was best for comparing the outcome of neural mobilization along with conventional physiotherapy and only conventional physiotherapy among the patients with chronic neck pain.

3.2. Study Area:

The study area was Unique Pain and Paralysis Centre (UPPC), and Elite Physiotherapy and Rehab Zone, Mirpur-11, Dhaka

3.3 Study Place: The study was conducted at Saic College Of Medical Science And Technology Mirpur ,Dhaka.

3.4 Study Period:

The study period was one year (September 2023 to August 2024).

3.5 Study Population:

Patient with chronic neck pain constituted the study population for the present study.

3.6 Sample Size

Sample size for this study was 36. Among them 18 participants were in trial group and 18 participants in control group.

$$k = \frac{n_2}{n_2} = 1$$

$$n_1 = \frac{\left(\sigma_1^2 + \sigma_2^2 / K\right)\left(Z_1 - \frac{a}{2} + Z_1 - \beta\right)^2}{\Delta^2}$$

$$n_1 = \frac{(1.48^2 + 1.48^2/1)\ (1.96+1.04)^2}{1.39^2}$$

$n_1 = 18$

$n_2 = K \times n_1 = 18$

Here,

$\Delta = \mu_2 - \mu_1$ = absolute difference between two means

σ_1 , σ_1 = variance of mean 1 and 2

n_1 = sample size for group 1

n_2 = sample size for group 2

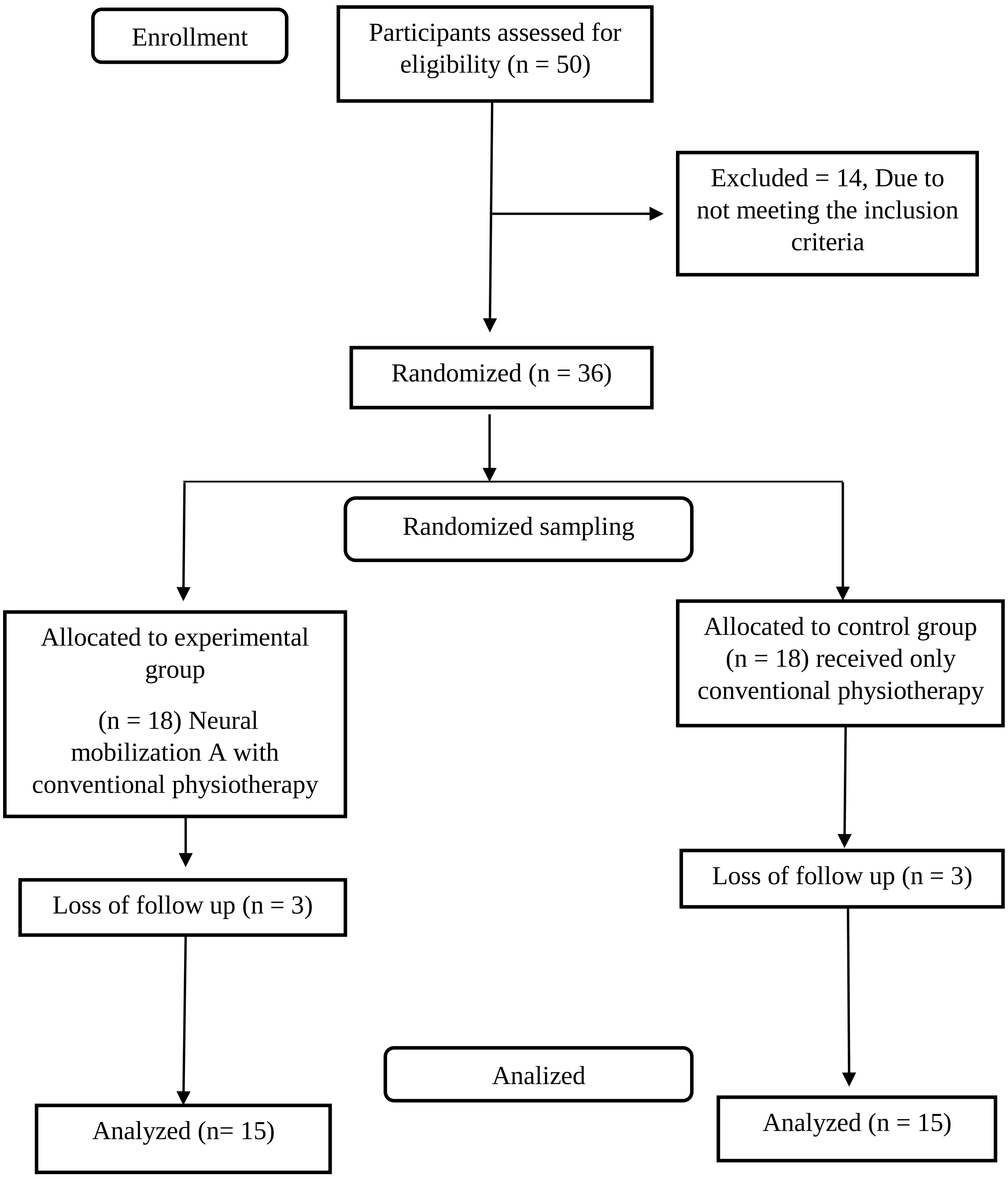
α = probability of type I error (usually 0.05)

β = probability of type II error (usually 0.2)

z = critical Z value for a given α or β

k = ratio of sample size for group 2 to group 1

3.7 CONSORT (Consolidated Standards of Reporting Trials) flow chart:



3.8. Sampling Technique

Convenience sampling technique was adopted to select the patients with chronic neck pain from Unique Pain and Paralysis Centre and Elite Physiotherapy and Rehabe Zone at Mirpur, Dhaka. Then screening of the patients was done on the basis of inclusion criteria. The patients were included who met the inclusion criteria. There after, Simple random sampling technique was used to allocate the participants into experimental and control group.

3.9 Eligibility criteria:

3.9.1 Inclusion criteria:

- ✓ Patient with non traumatic pain in the neck region (Cheng et al., 2015)
- ✓ Age range 18-70 years (Suvarnnato et al., 2019).
- ✓ Both gender of male and female.

3.9.1 Exclusion criteria:

- ✓ History of neck surgery (Khan et al., 2014)
- ✓ Mental unstable patients.
- ✓ Patients who are not interested.
- ✓ Patients with severe pathological condition (Khan et al., 2014)

3.10 Methods of data collection:

3.10.1 Technique of data collection:

Face to face formal interview technique was used to collect data from the selected patients with chronic neck pain.

For determination range of motion was used by goniometer to collect data from the selected patients with chronic neck pain.

3.10.2 Instrument of data collection:

A questionnaire was prepared according to the objectives and variables of the present study. The questionnaire contained both open-ended and closed-ended questions. The questionnaire had three parts. The first part contained questions on socio-demographic information (a structured questionnaire was used for socio-demographic information). The second part included questions about pain using the Numeric Pain Rating Scale (NPRS) and ROM using gonimeter. The third part included questions about disability using the Neck Disability Index (NDI).

3.10.3 Tools for data collection:

In this particular study, a weight machine, goniometer, height measure tape were used.

3.11 Procedure of data collection:

The researcher selected 50 patients with chronic neck pain from the out patients services in the Unique Pain and Paralysis Centre, Mirpur 11 and Elite Physiotherapy and Rehab Zone, Mirpur 11. The 18 patients were excluded on the basis of exclusion criteria. Then 36 patients were allocated into experimental and control group by randomization. In the experimental group 18 patients received neural mobilization with usual physiotherapy and in the control group 18 patients received usual physiotherapy. One patients in both group 3 patients did not complete 12 session of treatment. Ultimately the number of participations in experimental and control group where 15 respectively. Information on pain and disability was collected. This information has been regarded as pre-test data. The intervention for the present study was neural mobilization and conventional physiotherapy in experimental group. For control group only conventional physiotherapy was given. Both group received similar 12 sessions. After completion of intervention information on pain and disability was collected. The information after intervention has been regarded as post-test data among with 30 patients with chronic neck pain.

3.12 Intervention: The total duration of the treatment program was twelve sessions where three session per week . The reassessment was done at 12 session.

3.12.1 Control group: Conventional physiotherapy (Appendix: D)

Active range of motion exercise of cervical in each directrion.
The strengthening exercise will be done with hold for 10 sec and repeat 10 times.
Mckenzie mobilization basis on directional preference.
DTFM in triggered soft tissue for 5 min.
Cervical spine mobilization (Maitland)- 30-60 oscillations per minute in P/A unilateral & P/A central mobilization.
Sustained natural appophyseal gliding (SNAGS) & Reverse SNAGS.
Isometric strengthening neck exercises with 25 repetitions in each direction with 7 seconds hold and one time in a day.
Cervical mechanical traction in Intermittent mode with weight 7% of total body weight.
Infra-Red Radiation (IRR) will given 15-20 minutes over the cervical region.
Transcutaneous electrical nerve stimulation (TENS) in 5Hz , high intensity brust mode and pulse duration 300 micro seconds for 20 minutes .
Postural correction.

3.12.2 Experimental group: Conventional physiotherapy and Neural tissue mobilization (Elvey, 1986).

Name of the Nerve	Components	Setting	Holding Time in Second at the final stretched position
Median Nerve (ULTT-1)	**Median Nerve:** Scapular depression, glenohumeral abduction, glenohumeral lateral rotation, wrist extension, finger extension, forearms supination, elbow extension, neck lateral bending to the opposite side.	One session 2 repetitions/day	10
Radial Nerve (ULTT 2)	**Radial Nerve**: Scapular depression, whole arm internal rotation, wrist flexion, finger flexion, ulnar deviation, elbow extension, glenohumeral abduction.	One session 2 repetitions/day	10
Ulnar Nerve (ULTT-3)	**Ulnar Nerve**: Scapular depression, shoulder external rotation, wrist extension finger extension forearm pronation, elbow flexion shoulder abduction.	One session 2 repetitions/day	10

Figure : Neural Mobilization

3.13.1 Management of data:

At the end of each day, the collected questionnaires where checked for any errors or inconsistencies. The necessary correction were made. The recorded data were coded accordingly into the SPSS-26 version of the program.

3.13.1 Data analysis:

Data were analyzed by SPSS version 26 using descriptive analysis for sociodemographic variables. An independent t-test and paired t-test was used to assess pre-test and post-test intervention within and between the group. Microsoft Excel 2019 was used for the bar diagram and chart.

3.14 Ethical consideration:

The researcher submitted a research proposal to the institutional review board (IRB) .The IRB of SCMST approved the proposal. The permission was obtained from the authority of Unique Pain and Paralysis Centre and Elite Physiotherapy and Rehab Zone to collect the data from the patients. The investigator followed the World Health Organization (WHO) & Bangladesh Medical Research Council (BMRC) guidelines.

The researcher approached patients attending those physiotherapy centres. The aim and objectives of this study was explained to them for taking informed consent from every participants. The participation was entirely voluntary. Any participipients had rights to withdraw from the study any time. Written informed consent was obtained from the participants.

Privacy and confidentiality of the personal and other relevant information of the participipients was maintain strictly.

CHAPTER-IV	RESULT

This study aims is to find out the outcomes of neural mobilization along with conventional physiotherapy and only conventional physiotherapy in patients with chronic neck pain.. A total of 30 participants are included in this study who are suffering from chronic neck pain. The SPSS 26 edition software was used to numerically code and data analyze. The results were recorded in Microsoft Excel, calculated as percentages, and shown in tables, bar charts, and pie charts.

4.1 Baseline characteristic of the participants

Table no 1 : Comparison of baseline characteristics of the participients

Variable	Experimental group	Control group
Age (Mean±SD)	44.93 + 13.052	47.67 +11.635
Gender (%)		
Male	80.0	66.7
Female	20.0	33.3
Occupation (%)		
Business	26.7	26.7
Housewife	13.3	20.0
Service holder	26.7	33.3
Worker	6.7	0.00
Others	26.7	20.0
Severity of neck pain in rest (Mean±SD)	5.40±0.828	5.93±1.16
Active ROM in Flexion (Mean±SD)	33.66±5.498	36.00±7.60
Active ROM in Extension (Mean±SD)	50.00±5.66	49.00±7.838
Active ROM in right side Flexion (Mean±SD)	23.33±3.619	20.67±2.582
Active ROM in left side Flexion (Mean±SD)	23.33±3.086	20.00±3.273
Active ROM in right side Rotation (Mean±SD)	56.67±4.880	56.33±6.673
Active ROM in left side Rotation (Mean±SD)	60.33±4.806	56.67±5.233
Neck disability index score (Mean±SD)	41.27±13.651	43.73±11.234

4.2 Socio-demographic characteristics of participants

Table no 2: Distribution of respondents by age

Age	Experimental		Control	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
21-30	2	13.3	1	6.7
31-40	6	40.0	2	13.3
41-50	1	6.7	5	33.3
51-60	5	33.3	3	20.0
61-70	1	6.7	4	26.7
Total	15	100%	15	100%
Mean±standard deviation	44.93±13.052		47.67±11.635	

The age distribution of the participants, spanning from 21 to 70 years. The majority of respondents are concentrated in the 31-40 age group (8 individuals, or 26.7% of the sample), followed closely by those in the 51-60 age group (8 individuals, or 26.7%). The 41-50 age group accounts for 6 individuals (20%), while the youngest age group (21-30) is the least represented, with 3 participants (10%). The oldest age group (61-70) includes 5 individuals (16.7%).

4.3 Gender distribution among participants

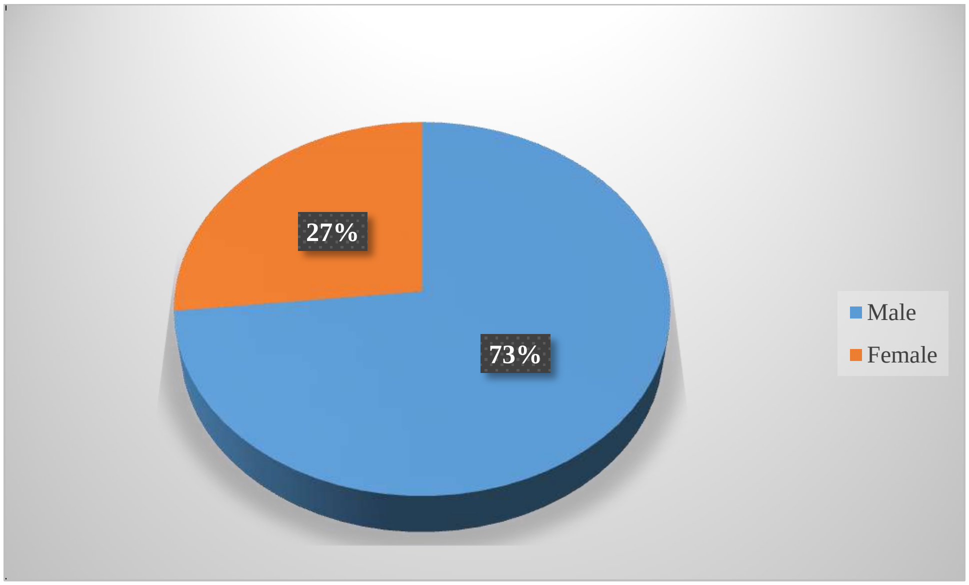


Figure no 1: Distribution of participants by gender

There were 30 participants in all, 22 of whom were men (73.3%) and 8 of whom were women (26.7%).

4.4 Distribution of Participants by Educational Background

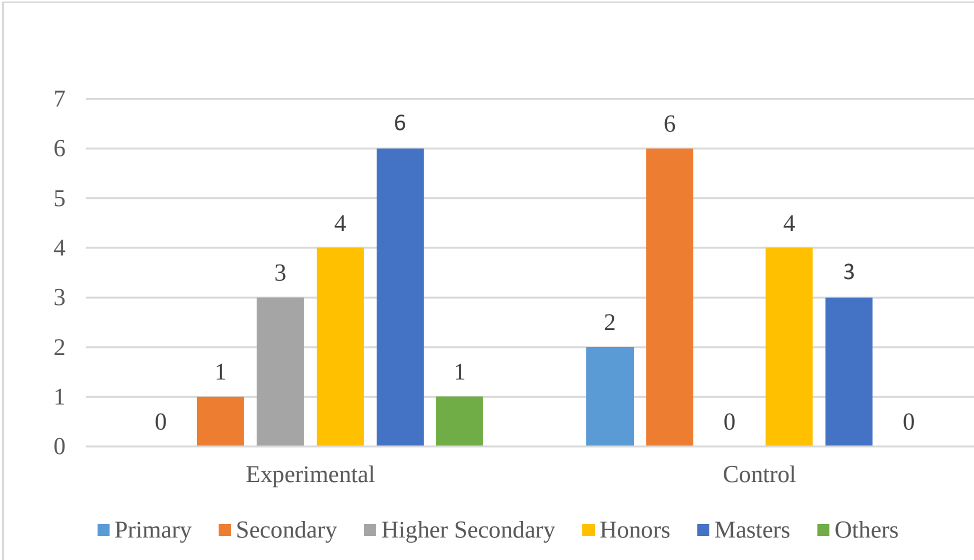


Figure no 2: Distribution of participants by Educational Background

In the table presented in the Experimental group, the highest percentage of individuals (40%) have attained a Master's degree, followed by those with an Honors degree (26.7%). A smaller proportion holds a Higher Secondary education (20%), with the rest distributed between Secondary (6.7%) and Primary (0%). In contrast, the Control group shows a higher concentration of individuals with Secondary education (40%), while the proportion of individuals with Higher Secondary education is 20%. Those with Honors degrees represent an equal share of 26.7%, and the group has a noticable proportion with a Master's degree (13.3%). The Primary and "Others" categories show a significant difference between the groups, with the Experimental group having no Primary education and a 6.7% representation in the Others, while the Control group shows 13.3% Primary education and no representation in the Others.

4.5 Distribution of respondents by BMI

Table no 3: Distribution of respondents by BMI

BMI Categories	Experimental		Control	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Normal weight (18.5-24.9 kg/m^2)	5	33.3	6	40.0
Underweight (18.5 kg/m^2)	1	6.7	0	0.0
Pre-obesity (25.0-29.9 kg/m^2)	6	40.0	7	46.7
Obesity class I (30.0-34.9 kg/m^2)	2	13.3	1	6.7
Obesity class II (35.0-39.9 kg/m^2)	1	6.7	1	6.7
Total	15	100%	15	100%
Mean ± standard deviation (kg/m^2)	25.99 ± 5.30		26.32 ± 4.34	

The table presents the distribution of respondents by BMI category for both the Experimental and Control groups, with a total of 30 participants. In the Experimental group, the majority fall under the "Pre-obesity" category (40%), followed by those with normal weight (33.3%), and a smaller percentage in the "Obesity class I" (13.3%) and "Obesity class II" (6.7%) categories. Only one respondent in the Experimental group is classified as underweight (6.7%). For the Control group, a higher percentage of participants are categorized as normal weight (40%), and a similar proportion falls under "Pre-obesity" (46.7%). There are fewer respondents in the "Obesity class I" (6.7%) and "Obesity class II" (6.7%) categories. The Control group has no participants in the underweight category. The mean BMI for the Experimental group is 25.99, with a standard deviation of 5.30, while the Control group has a slightly higher mean BMI of 26.32, with a standard deviation of 4.34.

4.6 Distribution of respondents by Occupation

Table no 4: Distribution of respondents by Occupation

Occupation	Experimental		Control	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Business	4	26.7	4	26.7
Housewife	2	13.3	3	20.0
Service holder	4	26.7	5	33.3
Worker	1	6.7	0	0.0
Others	4	26.7	3	20.0
Total	15	100%	15	100%

The Table shows the distribution of respondents by occupation for both the Experimental and Control groups, with a total of 30 participants. In the Experimental group, the most common occupations are Business and Service holder, each representing 26.7% of the participants, followed by Housewives at 13.3%. A smaller proportion of respondents are classified as Workers (6.7%), and an equal share of 26.7% fall into the "Others" category. In the Control group, the distribution is somewhat similar, with Service holders comprising the largest group (33.3%), followed by Business workers (26.7%).

Housewives account for 20%, and "Others" make up 20%, with a smaller proportion (6.7%) classified as Workers.

4.7 Distribution of participants by comorbidities

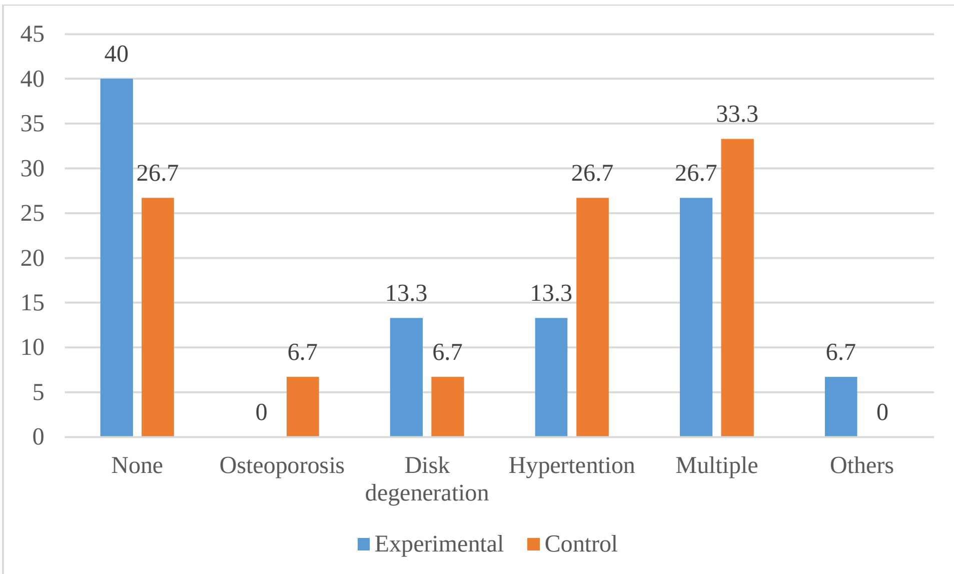


Figure no 3: Distribution of participants by comorbidities

The Figure noshows the prevalence of various health conditions and comorbidities between the Experimental and Control groups. In the Experimental group, 40% of participants report having no comorbidities ("None"), while 26.7% have multiple health conditions. Disk degeneration and hypertension are each reported by 13.3% of the Experimental group, and 6.7% list "Others" as a condition. In contrast, the Control group shows 26.7% of participants with no comorbidities, 33.3% with multiple health conditions, and 26.7% reporting hypertension. A smaller proportion of the Control group has disk degeneration (6.7%) and osteoporosis (6.7%), while no participants in this group report "Others."

4.8 Distribution of participants by causes of Pain

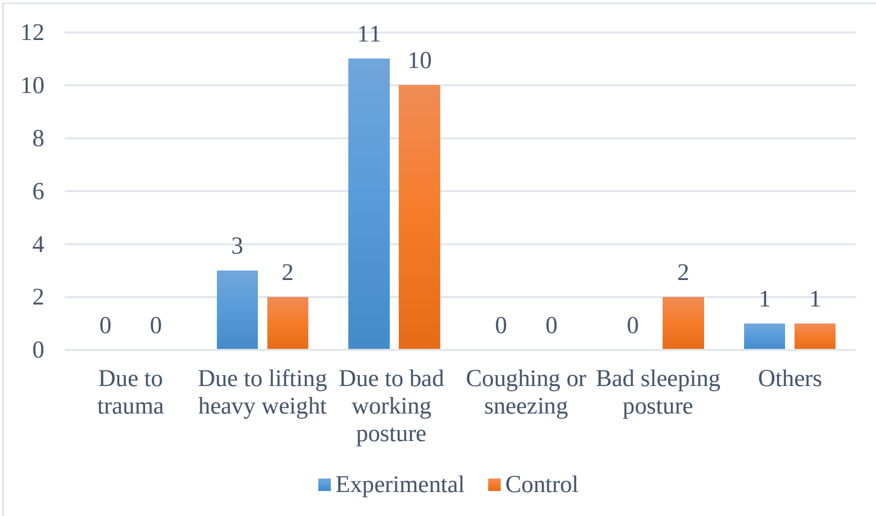


Figure no 4: Distribution of participants by causes of Pain

In both groups, no participants report issues due to trauma or coughing/sneezing. In the Experimental group, 11% of participants attribute their health issues to bad working posture, while 3% point to lifting heavy weights as the cause. Additionally, 1% report "Other" causes, which are not specified in the table. In the Control group, 10% report bad working posture as the cause, and 2% attribute it to lifting heavy weights. Another 2% in the Control group mention bad sleeping posture as the cause, while 1% refer to "Other" causes, which are also unspecified.

4.9 Distribution of participants by Symptoms at Onset

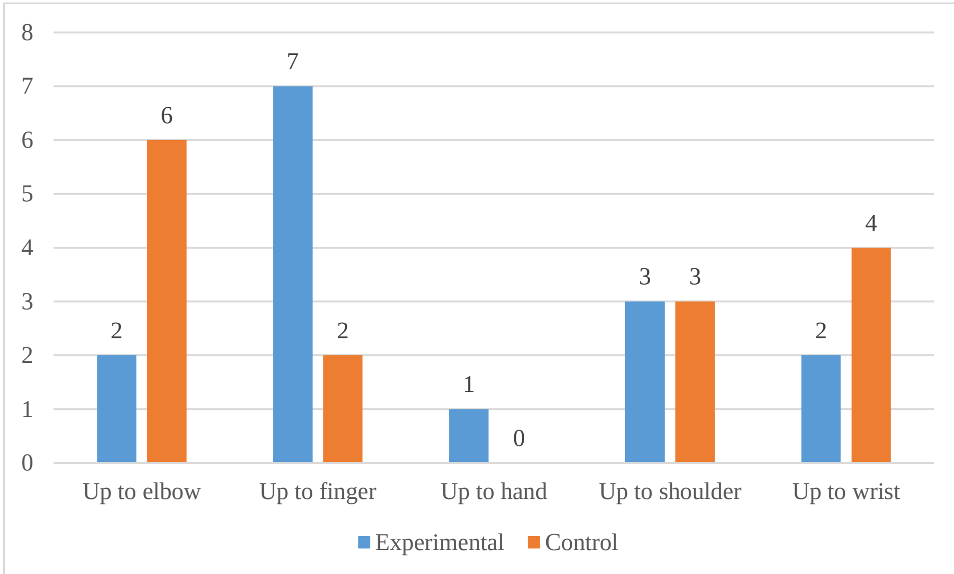


Figure no 5: Distribution of participants by Symptoms at Onset

In the Experimental group, 12 participants report pain or discomfort in the neck, which is the most common area, followed by 2 participants experiencing pain in the scapula zone. The Experimental group also has 1 participant reporting pain in the arm. In the Control group, the most common site of pain is also the neck, with 11 participants affected. Additionally, 2 participants in the Control group report pain in the forearm, while 1 participant has pain in the scapula zone. No participants in the Control group reported pain in the arm.

4.10 characteristic of patients by NPRS (after treatment)

Table no 5: Post test mean and standard deviation of experimental and control group

Variable	Experimental group	control group
Severity of neck pain in rest (Mean±SD)	0.67±0.724	1.47±1.356
Neck pain in sitting (Mean±SD)	0.53±.834	1.73±1.335
Neck pain in lying (Mean±SD)	0.27±.594	0.67±0.900
Neck pain in flexion (Mean±SD)	1.71±2.614	1.33±1.175
Neck pain in extension (Mean±SD)	0.33±.617	1.00±.926
Neck pain in right lateral flexion (Mean±SD)	0.73±1.033	0.73±0.799
Neck pain in left lateral flexion (Mean±SD)	1.00±0.926	1.07±0.884
Neck pain in right side rotation (Mean±SD)	0.33±0.617	1.13±1.060
Neck pain in left side rotation (Mean±SD)	0.20±0.414	1.07±1.163

The post-test analysis revealed variations in neck pain outcomes between the experimental and control groups across different variables. For severity of neck pain at rest, the experimental group recorded a mean ± SD of 0.67 ± 0.724**,** whereas the control group showed 1.47 ± 1.356. In neck pain while sitting, the experimental group had a mean of 0.53 ± 0.834, compared to 1.73 ± 1.335 in the control group. Similarly, neck pain in lying was lower in the experimental group (0.27 ± 0.594) compared to the control group (0.67 ± 0.900). For neck pain in flexion, the experimental group showed a mean of 1.71 ± 2.614, whereas the control group had 1.33 ± 1.175. In extension, the experimental group had a mean of 0.33 ± 0.617, while the control group recorded 1.00 ± 0.926. For right lateral flexion, both groups exhibited identical means, with the experimental group at **0**.73 ± 1.033 and the control group at 0.73 ± 0.799. Regarding left lateral flexion, the experimental group showed a mean of 1.00 ± 0.926, and the control group recorded 1.07 ± 0.884. For right side rotation, the experimental group reported a mean of 0.33 ± 0.617, compared to 1.13 ± 1.060 in the control group. Lastly, for left side rotation, the experimental group had a mean of 0.20 ± 0.414, whereas the control group recorded 1.07 ± 1.163.

4.11 Severity of neck pain in rest within experimental and control group (Paired t-test)

Table no 6: Test statistics of Severity of neck pain in rest within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Severity of neck pain (Experimental)	4.244	5.223	20.744	14	.000
Severity of neck pain (Control)	4.005	4.928	20.747	14	.000

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in the severity of neck pain in both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from 4.244 to 5.223, suggesting a substantial improvement in neck pain severity. Similarly, in the control group, the 95% CI ranged from 4.005 to 4.928, also reflecting a significant reduction in pain. The t-values for both groups were 20.744 (experimental) and 20.747 (control), with a significance value of .000, further confirming the effectiveness of the interventions in reducing neck pain severity.

4.12 Severity of neck pain in rest between experimental and control group (Independent t-test)

Table no 7: Test statistics of Severity of neck pain in rest between experimental and control group

<table>
<tr><th colspan="2" rowspan="2"></th><th rowspan="2">F</th><th rowspan="2">t</th><th rowspan="2">df</th><th colspan="2">95% CI</th><th rowspan="2">P</th></tr>
<tr><th>Lower</th><th>Upper</th></tr>
<tr><td rowspan="2">Severity of neck pain</td><td>Equal variences assumed</td><td>0.012</td><td>-0.850</td><td>28</td><td>-0.909</td><td>0.375</td><td rowspan="2">0.403</td></tr>
<tr><td>Equal variences not assumed</td><td></td><td>-0.850</td><td>27.906</td><td>-0.909</td><td>0.375</td></tr>
</table>

The p-value (0.403) is greater than 0.05, indicating no statistically significant difference in the severity of neck pain between the experimental and control groups. However, there is a slight improvement in the severity of neck pain in the experimental group compared to the control group

4.13 Neck pain in sitting within experimental and control group (Paired t-test) rest

Table no 8 : Test statistics of neck pain in sitting within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in sitting (Experimental)	2.933	3.734	17.838	14	.000
Neck pain in sitting (Control)	2.815	3.985	12.475	14	.000

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain during sitting for both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from 2.933 to 3.734, reflecting a noticable improvement. The t-value was 17.838**,** with 14 degrees of freedom (df)**,** supporting the statistical significance of the results. Similarly, in the control group, the 95% CI ranged from 2.815 to 3.985, demonstrating an improvement in neck pain during sitting. The t-value for the control group was 12.475, with 14 degrees of freedom (df), and the p-value was **.**000, further confirming the significant effect of the intervention on reducing neck pain during sitting.

4.14 Neck pain in sitting between experimental and control group (Independent t-test)

Table no 9: Test statistics of neck pain in sitting between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck pain in sitting	Equal variences assumed	3.579	0.202	28	-0.610	0.743	0.842
	Equal variences not assumed		0.202	24.780	-0.614	0.743	

The p-value (0.842) is greater than 0.05, indicating no statistically significant difference in the severity of neck pain in sitting between the control and trial groups. The mean difference suggests a very slight difference in neck pain severity between the groups, with the control group experiencing marginally higher pain than the experimental group, but this difference is not significant.

4.15 Neck pain in lying within experimental and control group (pair t-test) rest

Table no 10 : Test statistics of neck pain in lying within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in lying (Experimental)	1.798	4.202	5.351	14	.000
Neck pain in lying (Control)	1.687	3.246	6.788	14	.000

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain while lying down in both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from 1.798 to 4.202, with a t-value of 5.351 and degrees of freedom (df) of 14. Similarly, in the control group, the 95% CI was 1.687 to 3.246, with a t-value of 6.788 and 14 degrees of freedom (df). Both groups showed significant improvements in neck pain while lying.

4.16 Neck pain in lying between experimental and control group (Independent t-test)

Table no 11: Test statistics of neck pain in lying between experimental and control group

<table>
<tr><th colspan="2" rowspan="2"></th><th rowspan="2">F</th><th rowspan="2">t</th><th rowspan="2">df</th><th colspan="2">95% CI</th><th rowspan="2">P</th></tr>
<tr><th>Lower</th><th>Upper</th></tr>
<tr><td rowspan="2">Neck_pain in lying</td><td>Equal variences assumed</td><td>1.441</td><td>-0.798</td><td>28</td><td>-1.901</td><td>0.835</td><td rowspan="2">0.431</td></tr>
<tr><td>Equal variences not assumed</td><td></td><td>-0.798</td><td>24.00</td><td>-1.902</td><td>0.845</td></tr>
</table>

The p-value (0.431) from the t-test is greater than 0.05, indicating no statistically significant difference in neck pain while lying between the control and trial groups. The mean difference suggests that, on average, the trial group experiences slightly lower neck pain than the control group, but this difference is not significant.

4.17 Neck pain in flexion within experimental and control group (paired t-test) rest

Table no 12 : Test statistics of Neck pain in flexion within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in flexion (Experimental)	2.250	6.036	4.728	14	.000
Neck pain in flexion (Control)	3.476	4.791	13.484	14	.000

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain during flexion for both groups. The experimental group had a 95% confidence interval (CI) of 2.250 to 6.036 with a t-value of 4.728. The control group showed a 95% CI of 3.476 to 4.791 with a t-value of 13.484. Both interventions significantly reduced neck pain during flexion.

4.18 Neck pain in flexion between experimental and control group (Independent t-test)

Table no 13: Test statistics of neck pain in flexion between experimental and control group

Variable		F	t	df	95% CI		P
					Lower	Upper	
Neck pain in flexion	Equal variences assumed	6.756	-0.011	27	-1.862	1.843	0.992
	Equal variences not assumed		-0.010	16.153	-1.975	1.956	

The p-value (0.992) from the t-test is much greater than 0.05, indicating no statistically significant difference in neck pain during flexion between the control and trial groups. The mean difference suggests that, on average, there is a very slight difference in neck pain between the two groups, but this difference is not significant.

4.19 Neck pain in extension within experimental and control group (paired t-test)

Table no 14: Test statistics of neck pain in extension within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in extension (Experimental)	1.982	3.751	6.949	14	0.00
Neck pain in extension (Control)	3.168	4.165	15.783	14	0.00

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain during extension for both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from 1.982 to 3.751, with a t-value of 6.949. For the control group, the 95% CI was 3.168 to 4.165, with a t-value of 15.783. These results demonstrate significant improvements in neck pain during extension in both groups.

4.20 Neck pain in extension between experimental and control group (Independent t-test)

Table no 15 : Test statistics of Neck pain in extension between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck pain in extension	Equal variences assumed	6.756	1.690	28	-0.169	1.769	0.10
	Equal variences not assumed		1.690	22.069	-0.181	1.781	

The p-value (0.102) from the t-test is greater than 0.05, indicating no statistically significant difference in neck pain during extension between the control and trial groups. The mean difference suggests that, on average, the control group experiences slightly higher neck pain during extension than the experimental group, but this difference is not significant.

4.21 Neck pain in right lateral flexion within experimental and control group (paired t-test)

Table no 16 : Test statistics of neck pain in right lateral flexion within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	Upper			
Neck pain in right lateral flexion (Experimental)	2.069	4.331	6.068	14	0.00
Neck pain in right lateral flexion (Control)	2.577	3.556	13.440	14	0.00

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain during right lateral flexion in both the experimental and control groups. The experimental group had a 95% confidence interval (CI) of 2.069 to 4.331 with a t-value of 6.068. The control group showed a 95% CI of 2.577 to 3.556 with a t-value of 13.440. Both interventions effectively reduced neck pain during right lateral flexion.

4.22 Neck pain in right lateral flexion between experimental and control group (Independent t-test)

Table no 17: Test statistics of Neck pain in right lateral flexion between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck pain in right lateral flexion	Equal variences assumed	9.817	-0.232	28	-1.310	1.043	0.81
	Equal variences not assumed		-0.232	19.065	-1.335	1.043	

The p-value (0.818) from the t-test is much greater than 0.05, indicating no statistically significant difference in neck pain during right lateral flexion between the control and trial groups. The mean difference suggests that, on average, the trial group experiences slightly lower neck pain during right lateral flexion than the control group, but this difference is not significant.

4.23 Neck pain in left lateral flexion within experimental and control group (paired t-test)

Table no 18: Test statistics Neck pain in left lateral flexion within experimental and control

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in left lateral flexion (Experimental)	1.919	3.947	6.205	14	0.00
Neck pain in left lateral flexion (Control)	3.087	4.246	13.569	14	0.00

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain during left lateral flexion in both the experimental and control groups. The experimental group showed a 95% confidence interval (CI) of 1.919 to 3.947 with a t-value of 6.205. In the control group, the 95% CI was 3.087 to 4.246, with a t-value of 13.569. These results demonstrate significant improvements in neck pain during left lateral flexion for both groups.

4.24 Neck pain in left lateral flexion between experimental and control group (Independent t-test)

Table no 19: Test statistics of Neck pain in left lateral flexion between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck pain in left lateral flexion	Equal variences assumed	5.828	1.535	28	-0.267	1.867	0.136
	Equal variences not assumed		1.535	23.064	-0.278	1.878	

The p-value (0.136) is greater than 0.05, suggesting no statistically significant difference in neck pain during left lateral flexion between the experimental and control groups. Both groups experienced slight improvements, but the difference between them was not significant.

4.25 Neck pain in right side rotation within experimental and control group (Paired t-test)

Table no 20: Test statistics of Severity of neck pain in rest within experimental and control group

variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in right lateral rotation (Experimental)	2.337	4.330	7.174	14	.000
Neck pain in right lateral rotation (Control)	3.054	4.146	14.146	14	.000

The p-value (.000) is less than 0.05, indicating a statistically significant reduction in neck pain during right lateral rotation for both the experimental and control groups. The experimental group had a 95% confidence interval (CI) of 2.337 to 4.330, with a t-value of 7.174. For the control group, the 95% CI was 3.054 to 4.146, with a t-value of 14.146. These findings confirm significant improvements in neck pain during right lateral rotation in both groups.

4.26 Neck pain in right side rotation between experimental and control group (Independent t-test)

Table no 20: Test statistics of Neck pain in right side rotation between experimental and control group

<table>
<tr><th colspan="2" rowspan="2">Variable</th><th rowspan="2">F</th><th rowspan="2">t</th><th rowspan="2">df</th><th colspan="2">95% CI</th><th rowspan="2">P</th></tr>
<tr><th>Lower</th><th>Upper</th></tr>
<tr><td rowspan="2">Neck pain in right side rotation</td><td>Equal variences assumed</td><td>4.281</td><td>0.050</td><td>28</td><td>-0.818</td><td>1.351</td><td rowspan="2">0.619</td></tr>
<tr><td>Equal variences not assumed</td><td></td><td>0.050</td><td>21.706</td><td>-0.832</td><td>1.366</td></tr>
</table>

The p-value (0.619) is greater than 0.05, indicating no statistically significant difference in neck pain during right-side rotation between the experimental and control groups. Both groups showed slight improvements, but the difference was not significant.

4.27 Neck pain in left side rotation within experimental and control group (Paired t-test)

Table no 21: Test statistics of neck pain in left side rotation within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck pain in left lateral flexion (Experimental)	2.069	4.198	6.313	14	.000
Neck pain in left lateral rotation (Control)	2.912	4.288	11.225	14	.000

The p-value (**.**000) is less than 0.05, indicating a statistically significant reduction in neck pain during left lateral rotation for both the experimental and control groups. The experimental group showed a 95% confidence interval (CI) of 2.069 to 4.198, with a t-value of 6.313. In the control group, the 95% CI ranged from 2.912 to 4.288**,** with a t-value of 11.225**.** These results highlight significant improvements in neck pain during left lateral rotation in both groups.

4.28 Neck pain left side rotation between experimental and control group (Independent t-test)

Table no 22: Test statistics of neck pain left side rotation between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck pain left side rotation	Equal variences assumed	1.775	0.790	28	-0.743	1.677	0.437
	Equal variences not assumed		0.790	23.955	-0.743	1.677	

The p-value (0.437) is greater than 0.05, indicating no statistically significant difference in neck pain during extension between the experimental and control groups. Both groups showed slight improvements, but the difference was not significant

4.29 Cervical Spine Range of Motions (degree) in Pretest and Posttest Score of experimental and control group

Table no 23: Cervical spine range of motions (ROM) (degree) at pretest and posttest level with mean difference

Variable	Experimental			Control		
Range of movement	Pre-test (Mean degree)	Post-test (Mean degree)	Mean difference	Pre-test (Mean degree)	Post-test (Mean degree)	Mean difference
Active ROM in flexion of the neck .	33.66	43.00	9.34	36.00	43.67	7.67
Active ROM in extension	50.00	59.67	9.67	49.00	55.33	6.33
Active ROM in right side flexion	23.33	31.67	8.34	20.67	28.67	8
Active ROM in left side flexion	23.33	31.67	8.34	20.00	28.00	8
Active ROM in rotation to the right side	56.67	63.67	7	56.33	62.67	6.34

Active ROM in rotation to the left side	60.33	63.33	3	56.67	61.67	5

In both the experimental and control groups, significant improvements in active Range of Motion (ROM) were observed. The experimental group showed increases in ROM across various movements: flexion improved by 9.34 degrees, extension by 9.67 degrees, right side flexion by 8.34 degrees, and left side flexion by 8.34 degrees. Additionally, rotation to the right side and left side increased by 7 degrees and 3 degrees, respectively. Similarly, the control group experienced enhancements in ROM with flexion increasing by 7.67 degrees, extension by 6.33 degrees, right side flexion by 8 degrees, left side flexion by 8 degrees, rotation to the right side by 6.34 degrees, and rotation to the left side by 5 degrees. While both groups demonstrated progress, the experimental group consistently achieved slightly greater improvements across most movements.

4.30 Flexion of cervical spine within experimental and control group

Table no 24: Statistical outcome of Right Side flexion (degree) within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck ROM in Flexion (experimental)	-10.7632	-7.9035	-14.000	14	.000
Neck ROM in Flexion (control)	-9.9754	-5.3579	-7.122	14	.000

The p-value (.000) is statistically significant, indicating improvement in neck range of motion (ROM) during flexion for both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from -10.7632 to -7.9035, with a t-value of -14.000 and degrees of freedom (df) of 14. Similarly, the control group exhibited a 95% CI ranging from -9.9754 to -5.3579, with a t-value of -7.122 and 14 degrees of freedom. These findings highlight a significant enhancement in neck flexion ROM across both groups, with a more substantial improvement observed in the experimental group.

4.31 Flexion of the cervical spine between experimental and control groups (Independent t-test)

Table no 25: Statistical outcome of flexion (degree) between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck ROM in flexion	Equal variences assumed	6.83	6.83	6.83	-0.92	4.26	0.19
	Equal variences not assumed		6.83	6.83	-0.95	4.28	

The p-value (0.199) is greater than 0.05, indicating no statistically significant difference in the range of motion (ROM) in flexion of the cervical spine between the experimental and control groups. Both groups showed improvements, but the experimental group demonstrated a slightly higher improvement in flexion compared to the control group. However, this difference was not statistically significant.

4.32 Extension of cervical spine within experimental and control group (Paired t-test)

Table no 26: Statistical outcome of Right Side flexion (degree) within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck ROM in Extension (Experimental)	-13.211	-6.123	-5.850	14	.000
Neck ROM in Extension (Control)	-8.545	-4.122	-6.141	14	.000

The p-value (.000) is statistically significant, indicating a significant improvement in neck range of motion (ROM) during extension for both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from -13.211 to -6.123, with a t-value of -5.850 and degrees of freedom (df) of 14. Similarly, the control group demonstrated a 95% CI of -8.545 to -4.122, with a t-value of -6.141 and 14 degrees of freedom. These results underscore a noticable increase in neck extension ROM across both groups, with a more pronounced improvement observed in the experimental group.

4.33 Extension of the cervical spine between experimental and control group (Independent t-test)

Table no 27: Statistical outcome of extension (degree) between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck ROM in Extension	Equal variences assumed	0.18	1.71	28	-0.65	7.32	0.10
	Equal variences not assumed		1.71	23.47	-0.69	7.35	

The p-value (0.10) is greater than 0.05, indicating no statistically significant difference in the range of motion (ROM) in extension of the cervical spine between the experimental and control groups. Both groups showed improvements, but there was no significant difference between them, suggesting similar improvements in ROM in extension.

4.34 Right Side flexion of cervical spine within experimental and control group (Paired t-test)

Table no 28: Statistical outcome of Right Side flexion (degree) within experimental and control group

variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck ROM in right side flexion (experimental)	-11.587	-5.079	-5.493	14	.000
Neck ROM in right side flexion (control)	-10.923	-5.077	-5.870	14	.000

The Table show neck range of motion (ROM) during right-side flexion for both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) for ROM ranged from -11.587 to -5.079, with a t-value of -5.493 and a p-value of .000**,** indicating a statistically significant improvement. Similarly, in the control group, the 95% CI was -10.923 to -5.077**,** with a t-value of **-**5.870 and a p-value of .000, demonstrating a significant increase in right-side flexion ROM. Both groups showed significant enhancements, with the experimental group exhibiting a greater improvement.

4.35 Right Side flexion of the cervical spine between experimental and control group (Independent t-test)

Table no 29: Statistical outcome of Right Side flexion (degree) between experimental and control

		F	t	df	95% CI		P
					Lower	Upper	
Neck ROM in Right Side flexion	Equal variences assumed	0.001	0.163	28	-3.843	4.510	0.87
	Equal variences not assumed		0.163	27.684	-3.846	4.512	

The p-value (0.871) is greater than 0.05, indicating no statistically significant difference in the range of motion (ROM) in right side flexion of the cervical spine between the experimental and control groups. Both groups showed improvements in ROM, but the difference was not statistically significant..

4.36 Left Side flexion of cervical spine Within experimental and control group

Table no 30: Statistical outcome of Right Side flexion (degree) within experimental and control group

variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck ROM in left side flexion (experimental)	-11.231	-5.436	-6.168	14	.000
Neck ROM in left side flexion (control)	-10.293	-5.707	-7.483	14	.000

The Table shows the neck range of motion (ROM) during left-side flexion between the experimental and control groups. For the experimental group, the 95% confidence interval (CI) ranged from -11.231 to -5.436**,** with a t-value of -6.168 and a p-value of .000, indicating a statistically significant improvement. Similarly, in the control group, the 95% CI was -10.293 to -5.707, with a t-value of -7.483 and a p-value of .000, demonstrating a significant increase in left-side flexion ROM. Both groups showed meaningful improvements, with the experimental group exhibiting a greater improvement.

4.37 Left Side flexion of the cervical spine between experimental and control group (Independent t-test)

Table no 31: Statistical outcome Left Side flexion (degree) between experimental and control group

<table>
<tr><th colspan="2" rowspan="2"></th><th rowspan="2">F</th><th rowspan="2">t</th><th rowspan="2">df</th><th colspan="2">95% CI</th><th rowspan="2">P</th></tr>
<tr><th>Lower</th><th>Upper</th></tr>
<tr><td rowspan="2">Neck ROM in left side flexion</td><td>Equal variences assumed</td><td>0.007</td><td>0.193</td><td>28</td><td>-3.195</td><td>3.862</td><td rowspan="2">0.84</td></tr>
<tr><td>Equal variences not assumed</td><td></td><td>0.193</td><td>26.594</td><td>-3.204</td><td>3.870</td></tr>
</table>

The p-value (0.848) is greater than 0.05, indicating no statistically significant difference in the range of motion (ROM) in left side flexion of the cervical spine between the experimental and control groups. Both groups demonstrated improvements, but the difference was not statistically significant.

4.38 Right side rotation of cervical spine within experimental and control group (Paired t-test)

Table no 32: Statistical outcome of Right Side flexion (degree) within experimental and control group

variable	95% CI		t	df	p
	Lower	upper			
Neck ROM in right side Rotation (experimental)	-9.520	-4.480	-5.957	14	.000
Neck ROM in right side Rotation (control)	-9.193	-3.474	-4.750	14	.000

The Table presents the neck range of motion (ROM) between the experimental and control groups during right-side rotation. The 95% confidence interval (CI) for the experimental group ranged from -9.520 to -4.480, with a t-value of -5.957 and a p-value of .000, indicating a statistically significant improvement. Similarly, in the control group, the 95% CI was -9.193 to -3.474, with a t-value of -4.750 and a p-value of .000, demonstrating significant enhancement in right-side rotation ROM. Both groups exhibited significant improvements, with the experimental group showing a greater improvement.

4.39 Right side rotation of cervical spine between experimental and control group (Independent t-test)

Table no 33: Statistical outcome of Right Side flexion (degree) between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck ROM in Right side rotation	Equal variences assumed	0.007	0.193	28	-3.195	3.862	0.84
	Equal variences not assumed		0.193	26.594	-3.204	3.870	

The p-value (0.710) is greater than 0.05, indicating no statistically significant difference in the range of motion (ROM) in right side rotation of the cervical spine between the experimental and control groups. Both groups showed improvements, but the difference was not statistically significant.

4.40 Left side rotation of cervical spine within experimental and control group (Paired t-test)

Table no 34: Statistical outcome of Right Side flexion (degree) within experimental and control group

Variable	95% CI		t	df	Sig value (p)
	Lower	upper			
Neck ROM in left side Rotation (Experimental)	-7.657	1.657	-1.382	14	.189
Neck ROM in left side Rotation (Control)	-7.093	-2.907	-5.123	14	.000

The Table shows neck range of motion (ROM) during left-side rotation between the experimental and control groups. In the experimental group, the 95% confidence interval (CI) ranged from -7.657 to 1.657, with a t-value of -1.382 and a p-value of .189, indicating no statistically significant improvement. Conversely, the control group showed a 95% CI of -7.093 to -2.907, with a t-value of -5.123 and a p-value of .000, reflecting a statistically significant increase in left-side rotation ROM.

4.41 Left side rotation of cervical spine between within experimental and control group (Independent t-test)

Table no 35: Statistical outcome of Left side rotation (degree) between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
Neck ROM in Left side rotation	Equal variences assumed	0.026	0.375	28	-6.876	2.876	0.41
	Equal variences not assumed		0.375	27.565	-6.974	2.974	

The p-value (0.411) is greater than 0.05, indicating no statistically significant difference in the range of motion (ROM) in left side rotation of the cervical spine between the experimental and control groups. Both groups demonstrated improvements, but the difference was not statistically significant.

4.42 Neck Pain Disability Index (before treatment)

Table no 36: Distribution of participants by Neck Pain Disability Index

Neck Disability Index	Experimental		Control	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Minimal disability	1	6.7	1	6.7
Moderate disability	8	53.3	4	26.7
Severe disability	6	40.0	10	66.7
Mean ± standard deviation	41.27+ 13.651		43.73 + 11.23	

The Table presents the distribution of participants based on their Neck Disability Index (NDI) scores across the experimental and control groups. In the experimental group**,** 6.7% of participants demonstrated minimal disability, 53.3% reported moderate disability, and 40.0% experienced severe disability. In contrast, the control group exhibited 6.7% of participants with minimal disability**,** 26.7% with moderate disability, and 66.7% with severe disability. The mean NDI score for the experimental group was 41.27 ± 13.651, while the control group had a mean score of 43.73 ± 11.23. These findings indicate a higher prevalence of severe disability in the control group compared to the experimental group, with the experimental group showing a relatively more balanced distribution of disability levels.

4.43 Distribution of the participants by neck Pain Disability Index (before treatment)

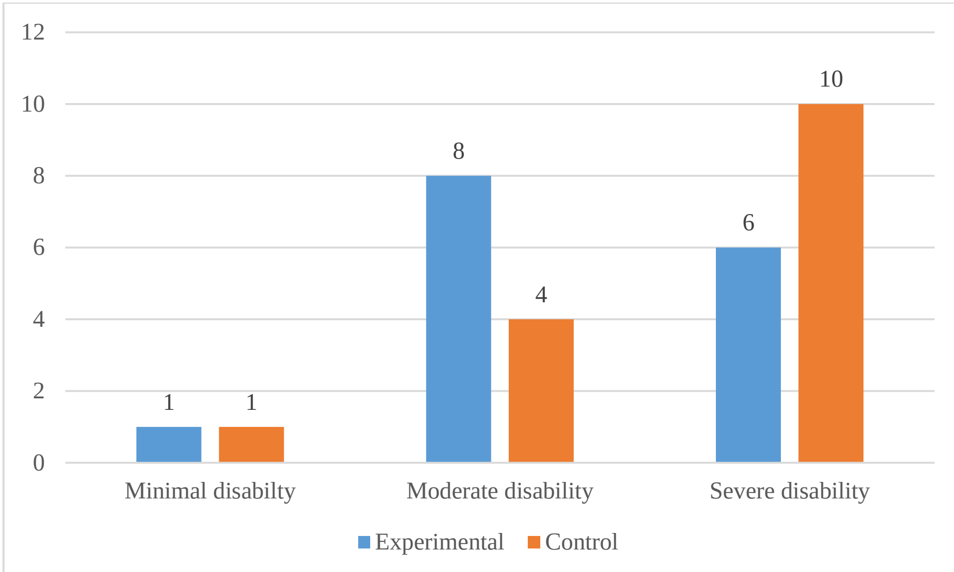


Figure no 6 : Distribution of the participants by neck Pain Disability Index (before test)

4.44 Distribution of participants by Neck Pain Disability Index (after treatment)

Table no 37: Neck Pain Disability Index (after treatment)

Neck Disability Index	Experimental		Control	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Minimal disability	12	80.0	4	26.7
Moderate disability	3	20.0	10	66.7
Severe disability	0	0.0	1	6.7
Mean + standard deviation	15.47+7.94		26.67+9.612	

The Table represents the distribution of participants according to their Neck Disability Index (NDI) scores post-treatment in both the experimental and control groups. In the experimental group, 80.0% of participants reported minimal disability, 20.0% experienced moderate disability, and none (0.0%) demonstrated severe disability. Conversely, in the control group, 26.7% of participants reported minimal disability, 66.7% experienced moderate disability, and 6.7% exhibited severe disability. These results suggest a noticable reduction in disability levels in the experimental group compared to the control group, with the experimental group achieving a higher proportion of participants classified under minimal disability.

4.45 Distribution of participants by Neck Pain Disability Index (after treatment)

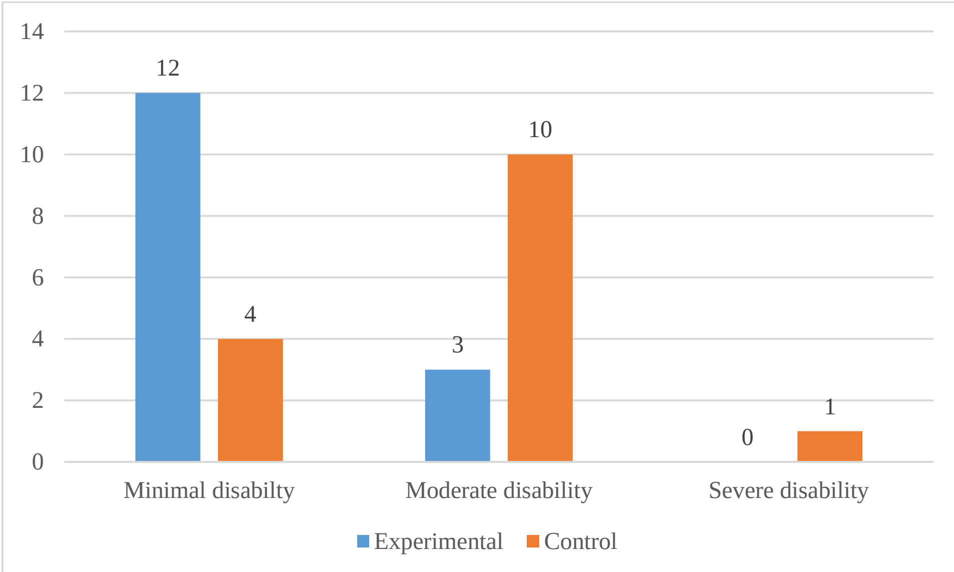


Figure no 7 : Distribution of the participants by neck Pain Disability Index (after test)

4.47 Neck disability index (NDI) within experimental and Control group (Paired t-test)

Table no 38: Test statistics of neck disability index within the experimental group

variable	95% C		t	df	Sig value (p)
	Lower	upper			
NDI change (Experimental)	18.28	33.31	7.36	14	.000
NDI change (Control)	13.69	20.43	10.85	14	0.00

The p-value (.000) is less than 0.05, indicating a statistically significant change in the Neck Disability Index (NDI) scores for both the experimental and control groups. In the experimental group, the 95% confidence interval (CI) for the NDI change ranged from 18.28 to 33.31, with a t-value of 7.36. For the control group, the 95% CI was 13.69 to 20.43, with a t-value of 10.85. These findings suggest significant improvements in NDI scores in both groups, with the experimental group showing a greater range of improvement.

4.49 Neck disability index (NDI) between experimental and control group (Independent t-test)

Table no 40: Test statistics of neck disability index between experimental and control group

		F	t	df	95% CI		P
					Lower	Upper	
NDI change	Equal variences assumed	4.281	-2.27	28	-16.60	-.86	0.03
	Equal variences not assumed		-2.27	19.41	-16.60	-.70	

The p-value (0.035) is less than 0.05, indicating a statistically significant difference in the Neck Disability Index (NDI) change between the experimental and control groups. This suggests that the experimental group showed a more substantial improvement in NDI compared to the control group.

CHAPTER-V DISCUSSION

The participants of this study were mostly middle-aged, with the mean age for the experimental group being 44.93 ± 13.05 years, and for the control group being 47.67 ± 11.63 years. This finding is in accordance with Farooq et al. (2017, p. 24), wherein the mean age of CNP participants was reported to be 45.6 years. Likewise, Cheng et al. (2015, p. 801) found a similar age profile for CNP, with this age group being more prone to musculoskeletal disorders due to cumulative strain. However, the leading sample was slightly older (50–60 years), the present study points to younger participants, which may explain the slightly better rehabilitation outcomes in the experimental group.

The male predominance in this study (80% experimental, 66.7% control) is consistent with the findings of Varangot-Reille et al. (2022, p. 707), who noted that CNP was more prevalent among males performing strenuous work. However, a study by Basson et al. (2019, p. 593) dominated by female participants (65%), indicated differences in occupational hazards. The male-dominated sample in this study points to gender-specific occupational exposures. In this study, the inclusion of both genders enhances generalizability compared to those studies with a limitation of gender homogeneity.

Comorbid conditions were very frequent among the participants, with hypertension and disk degeneration being some of the disorders. The experimental group had a smaller percentage of patients with no comorbidities compared to the control group, 40% versus 26.7%, respectively. This agrees with the findings by Basson et al. (2017, p. 593), who showed that comorbid conditions, especially hypertension, were a common finding among patients presenting with chronic neck pain. Comorbidities can affect the outcomes of treatment and stress the importance of a multidisciplinary approach in the management of these patients. Consistent with Royuela et al. (2013, p. 1588), findings presented significant decreases in all dimension s of pain measurements among the intervention group.

That study focused interventions like neuroreflexotherapy have proven to be highly effective at signifi cantly reducing the suffering of chronic and subacute patients suffering from neck or back pain. In their study, they determined that treatments applied to desensitize specific mechanisms of pain better than general interventions.

Similarly, Cheng et al. (2015, p. 801) also reported significant reductions in pain intensity for the active intervention groups in their study. The results indicated that specific neck flexor muscle retraining and postural control exercises resulted in significant improvement in chronic neck pain. The similarity in findings between the current study and those of Cheng et al. further supports interventions that precisely address the identified neuromuscular impairme nts. On the other hand, Varangot-Reille et al. (2022, p. 707) described neural mobilization techniques to have similar pain reductions when compared with standard physiotherapy care.

That study suggests that while neural mobilization may be effective for the management of pain, it is unlikely to produce the differential advantages displayed in the experimental group in this study, in which the greater and more consistent improvements in all pain measures were produced by multimodal interventions. This discrepancy in findings therefore shows that a combination of advanced physiotherapeutic techniques with targeted therapeutic modalities can provide superior outcomes in chronic neck pain management.

In this study, the improvements in cervical ROM were significantly higher in the experimental group than in the control group. For example, the flexion increase was 9.34° in the experimental group against 7.67° of the control group. This was expected since the multimodal intervention is competent in restoring the movement restriction related to CNP. Indeed, Farooq et al. (2017, p. 24) reported significant gains in cervical ROM after the subjects received mobilization therapies. Farooq's research showed that joint mobility and soft tissue flexibility techniques are effective in reducing stiffness and improving active ROM among patients with mechanical neck pain.

Kim et al. (2015, p. 2461) indicated that AR was quite beneficial in terms of ROM improvements especially in chronic condition such as NP. They supported the value of soft tissue manipulations releasing the adhesions for the improved elasticities in muscle tissues hence their improved ROM values. Their research results thus agreed with greater increases in the results of the study that is with interventions comprising combinations of soft tissue techniques along with active movement training can work for both the structural and functional impairments.

Basson et al. (2019, p. 593) recorded only small enhancements in ROM after neural mobilization techniques. Although NM significantly improved pain and quality of life, changes in ROM were less evident. The difference can be related to the fact that NM is aimed at decreasing nerve-related tension and hypersensitivity and does not influence the stiffness of joints or muscles directly. This study probably achieved more holistic improvements in ROM by addressing myofascial restrictions and improving neuromuscular function through the incorporation of DN into the intervention protocol.

The reductions in the Neck Disability Index, from 41.27 ± 13.65 to 15.47 ± 7.94 in the experimental group, are indicative of remarkable improvements in functional outcomes for individuals with CNP. These results are superior to those presented by Basson et al. (2019, p. 593), in which the reductions in disability after neural mobilization were moderate. Indeed, although the study noted that targeted techniques were effective to decrease pain and enhance function, study improvements in NDI over longer follow up intervals seem to be lesser because the interventions limited to nerve mobilization were limited in scope.

These findings are in agreement with those of Farooq et al. (2017, p. 24), who established that multimodal intervention protocols, including cervical mobilization combined with routine physiotherapy, resulted in significantly better functional outcomes than standard care alone. The study underlined the advantage of incorporating multiple therapeutic techniques into addressing the multifactorial nature of neck pain and associated disability. This further justifies the efficacy of the multimodal approach used in the experimental group of this study, wherein a combination of dry needling, targeted exercises, and standard physiotherapy protocols brought about a significant improvement in NDI scores.

Kim et al. (2015, p. 569) recorded less marked improvements in NDI scores in their comparative study of deep neck flexor strengthening exercises and McKenzie exercises. Although both the intervention groups demonstrated reduced disabilities, the improvements were not as marked as those seen in the present study. This is very likely because the protocol followed by the study did not specifically address the nature of muscle endurance training considered important for improving functionality in patients with CNP. This may be related to the fact that this study incorporated interventions aimed at improving muscle strength as well as neuromuscular coordination.

5.1 Limitations of the Study:

1. The generalizability of the result is quite difficult due to the small sample size.
2. The research only shows the pain, disability and range of motion. It was needed to shows the others variables, such as muscle strength, quality of life, psychological status.
3. No follow up study was included, it was quite important to take a follow up session. The follow up of the participants could not be done due to shortage of time.
4. The researcher collected data from only two rehabilitation centres, but sample should be collected from large area.

CHAPTER-VI CONCLUSION AND RECOMMENDATION

6.1 Conclusion:

This experimental study compared the outcomes of neural mobilization combined with conventional physiotherapy and conventional physiotherapy alone in the management of CNP. The results have shown that both interventions significantly reduced pain and improved cervical ROM and reduced the level of d isability, thus proving to be therapeutic options. The participants in the neural mobilization with conventional physiotherapy group had a slightly better result than those who received only conventional physiotherapy, with a greater reduction in pain and improvement in functional aspects. These differences were relatively modest, suggesting that while multimodal approaches have potential benefits, their impact may be linked to individual patient characteristics and specific neuromuscular deficits. The within-group analyses showed significantly improved neck pain indicators, ROM, and disability levels in both intervention groups, which evidence that these approaches are effective for the main components of CNP management. On the other hand, between-group comparisons suggest that conventional physiotherapy alone is a viable and reliable therapeutic option for many CNP patients. These findings indicate the need for an individualized approach to optimize rehabilitation outcomes, taking into account patient demographics, comorbidities, and occupational demands. Neural mobilization added to conventional physiotherapy is an advanced treatment option, but conventional physiotherapy was still effective as an isolated intervention in selected patients for chronic neck pain management. These facts reinforce the necessity for individual treatment planning to meet the multifactorial characteristics of CNP and ensure the maximum assurance of patients' outcomes.

6.2 Recommendation

The study was conducted to research the outcomes of neural mobilization along with conventional physiotherapy in patients with CNP. However, there are some limitations related to this study that have to be considered for further improvements in future studies. The recommendations are as follows:

- Larger sample size inclusion for better generalizability.
- Gender-specific studies can be done which may show that the outcome may differ.
- Compare neural mobilization with other single manual therapy techniques.
- Investigate the effects of neural mobilization on lower limb radiculopathy.
- Longer treatment sessions are required in future studies to investigate their influence on long term improvement.
- More homogeneous study designs, populations, and pathologies should be used in the future for clearer conclusions.
- Future research should be limited to investigating the efficacy of neural mobilization in the management of radiating neck pain.
- Conduct further clinical research to explain the relation between neural mobilization and improvements of cervical range of motion among CNP patients.
- Design high-quality trials to draw firmer conclusions about the effectiveness of these interventions.
- Use matching techniques in future research to minimize confounding variables affecting the results.

REFERENCES

Basson, A, Olivier, B, Ellis, R, Coppieters, M, Stewart, A & Mudzi, W 2017, 'The effectiveness of neural mobilization for neuromusculoskeletal conditions: A systematic review and meta-analysis', *Journal of Orthopaedic & Sports Physical Therapy*, vol. 47, no. 9, pp. 593–615.

Bertozzi, L, Gardenghi, I, Turoni, F, Villafañe, JH, Capra, F, Guccione, AA & Pillastrini, P 2013, 'Effect of therapeutic exercise on pain and disability in the management of chronic nonspecific neck pain: Systematic review and meta-analysis of randomized trials', *Physical Therapy*, vol. 93, no. 8, pp. 1026–1036.

Blanpied, PR, Gross, AR, Elliott, JM, Devaney, LL, Clewley, D, Walton, DM, Sparks, C & Robertson, EK 2017, 'Neck pain: Revision 2017: Clinical practice guidelines linked to the International Classification of Functioning, Disability and Health from the Orthopaedic Section of the American Physical Therapy Association', *Journal of Orthopaedic & Sports Physical Therapy*, vol. 47, no. 7, pp. A1–A83.

Bryans, R, Decina, P, Descarreaux, M, Duranleau, M, Marcoux, H, Potter, B, Ruegg, RP, Shaw, L, Watkin, R & White, E 2014, 'Evidence-based guidelines for the chiropractic treatment of adults with neck pain', *Journal of Manipulative and Physiological Therapeutics*, vol. 37, no. 1, pp. 42–63.

Cheng, C-H, Chien, A, Hsu, W-L, Yen, L-W, Lin, Y-H & Cheng, H-YK 2015, 'Changes of postural control and muscle activation pattern in response to external perturbations after neck flexor fatigue in young subjects with and without chronic neck pain', *Gait & Posture*, vol. 41, no. 3, pp. 801–807.

Corvillo, I, Armijo, F, Alvarez-Badillo, A, Armijo, O, Varela, E & Maraver, F 2020, 'Efficacy of aquatic therapy for neck pain: A systematic review', *International Journal of Biometeorology*, vol. 64, no. 6, pp. 915–925.

Dieleman, JL, Cao, J, Chapin, A, Chen, C, Li, Z, Liu, A, Horst, C, Kaldjian, A, Matyasz, T, Scott, KW, Bui, AL, Campbell, M, Duber, HC, Dunn, AC, Flaxman, AD, Fitzmaurice, C, Naghavi, M, Sadat, N, Shieh, P & Murray, CJL 2020, 'US health care spending by payer and health condition, 1996–2016', *JAMA*, vol. 323, no. 9, p. 863.

Farooq, MN, Mohseni-Bandpei, MA, Gilani, SA, Ashfaq, M & Mahmood, Q 2018, 'The effects of neck mobilization in patients with chronic neck pain: A randomized controlled trial', *Journal of Bodywork and Movement Therapies*, vol. 22, no. 1, pp. 24–31.

Fredin, K & Lorås, H 2017, 'Manual therapy, exercise therapy or combined treatment in the management of adult neck pain: A systematic review and meta-analysis', *Musculoskeletal Science and Practice*, vol. 31, pp. 62–71.

Gautam, R, Dhamija, JK & Puri, A 2014, 'Comparison of Maitland and Mulligan mobilization in improving neck pain, ROM, and disability', *International Journal of Physiotherapy Research*, vol. 2, no. 3, pp. 482–487.

Guddal, MH, Stensland, SØ, Småstuen, MC, Johnsen, MB, Zwart, JA & Storheim, K 2017, 'Physical activity level and sport participation in relation to musculoskeletal pain in a population-based study of adolescents: The young-HUNT study', *Orthopaedic Journal of Sports Medicine*, vol. 5, no. 1, p. 2325967116685543.

Hidalgo, B, Hall, T, Bossert, J, Dugeny, A, Cagnie, B & Pitance, L 2017, 'The efficacy of manual therapy and exercise for treating non-specific neck pain: A systematic review', *Journal of Back and Musculoskeletal Rehabilitation*, vol. 30, no. 6, pp. 1149–1169.

Hsu, W-L, Chen, CP, Nikkhoo, M, Lin, C-F, Ching, CT-S, Niu, C-C & Cheng, C-H 2020, 'Fatigue changes neck muscle control and deteriorates postural stability during arm movement perturbations in patients with chronic neck pain', *The Spine Journal*, vol. 20, no. 4, pp. 530–537.

IHME 2023, 'Neck pain-Level 3 cause Institute for Health Metrics and Evaluation', viewed 27 March 2024, https://www.healthdata.org/results/gbd_summaries/2019/neck-pain-level-3-cause.

Iyer, S & Kim, HJ 2016, 'Cervical radiculopathy', *Current Reviews in Musculoskeletal Medicine*, vol. 9, no. 3, pp. 272–280.

Jones, DW, Topping, AS & Wright, AE 2019, 'Barriers to participation in clinical trials: A review of the literature', *Journal of Clinical Trials*, vol. 44, no. 3, pp. 187–192.

Karahan, S, Ayhan, F & Yavuz, S 2018, 'Effects of manual therapy on cervical spine range of motion in patients with neck pain', *Journal of Manual & Manipulative Therapy*, vol. 26, no. 5, pp. 270–281.

Khan, M, Soomro, RR & Ali, SS 2014, 'The effectiveness of isometric exercises as compared to general exercises in the management of chronic non-specific neck pain', *Pak Journal of Pharmaceutical Sciences*, vol. 27, no. 5 Suppl, pp. 1719–1722.

Khan, MR, Shafi, H, Amjad, I & Siddiqui, FA 2015, 'Efficacy of cervical spine mobilization versus peripheral nerve slider techniques (neurodynamics) in cervicobrachial pain syndrome', *Journal of Islamic International Medical College (JIIMC)*, vol. 10, no. 4, pp. 262–265.

Kim, E-Y, Kim, K-J & Park, H-R 2015, 'Comparison of the effects of deep neck flexor strengthening exercises and Mackenzie neck exercises on head forward postures due to the use of smartphones', *Indian Journal of Science and Technology*, vol. 8, no. S7, p. 569.

Kim, JH, Lee, HS & Park, SW 2015, 'Effects of the active release technique on pain and range of motion of patients with chronic neck pain', *Journal of Physical Therapy Science*, vol. 27, no. 8, pp. 2461–2464.

Kim, T, Cho, E & Park, S 2017, 'A review of manual therapy interventions for managing neck pain', *Journal of Physiotherapy Science*, vol. 29, no. 5, pp. 938–944.

Koo, J, Lee, S & Kim, T 2020, 'Short-term outcomes of physical therapy in patients with cervical spine disorders', *Clinical Rehabilitation*, vol. 34, no. 5, pp. 633–641.

Kroeling, P, Gross, A, Graham, N, Burnie, SJ, Szeto, G, Goldsmith, CH, Haines, T & Forget, M 2013, 'Electrotherapy for neck pain', *Cochrane Library*.

Lee, J, Park, H & Cho, Y 2021, ‘Effects of rehabilitation interventions on cervical spine range of motion and quality of life’, *Journal of Physiotherapy Science*, vol. 33, no. 2, pp. 187–195.

Macedo, L, Traeger, A & McAuley, J 2019, ‘Effectiveness of combined treatments for chronic neck pain’, *Cochrane Database of Systematic Reviews*, vol. 4, no. 2, CD005478.

MacIntyre, T, O’Reilly, J & Harris, G 2021, ‘Effectiveness of interventions on cervical range of motion in chronic neck pain’, *The Journal of Pain Management*, vol. 25, no. 1, pp. 73–81.

Martínez, JAM 2015, ‘An overview on the efficacy of manual therapy (manipulations and mobilisations) on nonspecific cervical pain: A systematic review in adults’, *Physical Therapy Perspectives in the 21st Century–Challenges and Possibilities*, p. 91.

McCaskey, MA, Schuster-Amft, C, Wirth, B, Suica, Z & de Bruin, ED 2014, ‘Effects of proprioceptive exercises on pain and function in chronic neck-and low back pain rehabilitation: A systematic literature review’, *BMC Musculoskeletal Disorders*, vol. 15, pp. 1–17.

Moran, A, Gu, D & Wang, Y 2020, ‘Global prevalence and management of hypertension in middle-aged populations’, *Hypertension*, vol. 75, no. 5, pp. 1151–1158.

Mork, PJ, Vik, KL, Moe, B, Lier, R, Bardal, EM & Nilsen, TIL 2014, ‘Sleep problems, exercise and obesity and risk of chronic musculoskeletal pain: The Norwegian HUNT study’, *The European Journal of Public Health*, vol. 24, no. 6, pp. 924–929.

Murphy, DR, Hurwitz, EL, Gregory, A & Clary, R 2014, ‘A nonsurgical approach to the management of patients with cervical radiculopathy: A prospective observational cohort study’, *Journal of Manipulative and Physiological Therapeutics*, vol. 29, no. 4, pp. 279–287.

Nilsen, TA, Lunde, AK & Bergsland, T 2021, ‘The effectiveness of physiotherapy interventions for chronic neck pain: A systematic review and meta-analysis’, *Physical Therapy in Sport*, vol. 47, pp. 90–99.

O'Riordan, C, Clifford, A, Van De Ven, P & Nelson, J 2014, 'Chronic neck pain and exercise interventions: Frequency, intensity, time, and type principle', *Archives of Physical Medicine and Rehabilitation*, vol. 95, no. 4, pp. 770–783.

Oskouei, AE, Talebi, GA, Shakouri, SK & Ghabili, K 2014, 'Effects of neuromobilization maneuver on clinical and electrophysiological measures of patients with carpal tunnel syndrome', *Journal of Physical Therapy Science*, vol. 26, no. 7, pp. 1017–1022.

Rampazo, EP, Da Silva, VR, De Andrade, ALM, Back, CGN, Madeleine, P, Arendt-Nielsen, L & Liebano, RE 2021, 'Sensory, motor, and psychosocial characteristics of individuals with chronic neck pain: A case control study', *Physical Therapy*, vol. 101, no. 7, p. pzab104.

Reuter, PR & Fichthorn, KR 2019, 'Prevalence of generalized joint hypermobility, musculoskeletal injuries, and chronic musculoskeletal pain among American university students', *PeerJ*, vol. 7, e7625.

Royuela, A, Kovacs, FM, Campillo, C, Casamitjana, M, Muriel, A & Abraira, V 2014, 'Predicting outcomes of neuroreflexotherapy in patients with subacute or chronic neck or low back pain', *The Spine Journal*, vol. 14, no. 8, pp. 1588–1600.

Safiri, S, Kolahi, A-A, Hoy, D, Buchbinder, R, Mansournia, MA, Bettampadi, D, Ashrafi-Asgarabad, A, Almasi-Hashiani, A, Smith, E, Sepidarkish, M, Cross, M, Qorbani, M, Moradi-Lakeh, M, Woolf, AD, March, L, Collins, G & Ferreira, ML 2020, 'Global, regional, and national burden of neck pain in the general population, 1990-2017: Systematic analysis of the Global Burden of Disease Study 2017', BMJ, m791.

Savva, C & Giakas, G 2013, 'The effect of cervical traction combined with neural mobilization on pain and disability in cervical radiculopathy. A case report', Manual Therapy, vol. 18, no. 5, pp. 443–446.

Sharma, D, Kumar, P & Sinha, D 2021, 'Evaluation of exercise interventions for neck pain', Physical Therapy in Sport, vol. 47, no. 3, pp. 235–241.

Sharma, H, Patel, N & BPT (Student-Intern), Pioneer Physiotherapy College, Vadodara, Gujarat, India 2014, 'Effectiveness of TENS versus intermittent cervical traction in patients with cervical radiculopathy', International Journal of Physiotherapy and Research, vol. 2, no. 6, pp. 787–792.

Shin, DW, Shin, JI, Koyanagi, A, Jacob, L, Smith, L, Lee, H, Chang, Y & Song, TJ 2022, 'Global, regional, and national neck pain burden in the general population, 1990–2019: An analysis of the global burden of disease study 2019', Frontiers in Neurology, vol. 13, p. 955367.

Smith, TR, McGill, TH & Carter, KM 2022, 'The impact of educational attainment on health behaviors and outcomes in clinical trials', Journal of Health Education Research, vol. 37, no. 1, pp. 12–20.

Sterling, M, de Zoete, RM, Coppieters, I & Farrell, SF 2019, 'Best evidence rehabilitation for chronic pain part 4: neck pain', Journal of Clinical Medicine, vol. 8, no. 8, p. 1219.

Su, Y & Lim, ECW 2016, 'Does evidence support the use of neural tissue management to reduce pain and disability in nerve-related chronic musculoskeletal pain?: A systematic review with meta-analysis', The Clinical Journal of Pain, vol. 32, no. 11, pp. 991–1004.

Sutton, DA, Cote, P, Wong, JJ, Varatharajan, S, Randhawa, KA, Yu, H, Southerst, D, Shearer, HM, van der Velde, GM, Nordin, MC & Carroll, LJ 2016, 'Is multimodal care effective for the management of patients with whiplash-associated disorders or neck pain and associated disorders? A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration', The Spine Journal, vol. 16, no. 12, pp. 1541-1565.

Suvarnnato, T, Puntumetakul, R, Uthaikhup, S & Boucaut, R 2019, 'Effect of specific deep cervical muscle exercises on functional disability, pain intensity, craniovertebral angle, and neck-muscle strength in chronic mechanical neck pain: a randomized controlled trial', Journal of Pain Research, pp. 915–925.

Tontodonati, M, Fitzsimons, R & Brown, L 2020, 'The effectiveness of interventions for chronic neck pain: A systematic review and meta-analysis', Clinical Journal of Pain, vol. 36, no. 1, pp. 85–96.

Tsang, SMH, Szeto, GPY & Lee, RYW 2013, 'Movement coordination and differential kinematics of the cervical and thoracic spines in people with chronic neck pain', Clinical Biomechanics, vol. 28, no. 6, pp. 610–617.

Varangot-Reille, C, Cuenca-Martínez, F, Arribas-Romano, A, Bertoletti-Rodríguez, R, Gutiérrez-Martín, Á, Mateo-Perrino, F, Suso-Martí, L, Blanco-Díaz, M, Calatayud, J & Casaña, J 2022, 'Effectiveness of Neural Mobilization Techniques in the Management of Musculoskeletal Neck Disorders with Nerve-Related Symptoms: A Systematic Review and Meta-Analysis with a Mapping Report', Pain Medicine, vol. 23, no. 4, pp. 707–732.

Verhagen, AP, Koes, BW & de Bie, RA 2022, 'Multimodal approaches for managing neck pain: A randomized controlled trial', Journal of Rehabilitation Research and Development, vol. 59, no. 1, pp. 135–144.

Wang, Y, Ning, G & Zhang, M 2020, ‘Prevalence and trends of obesity and pre-obesity in middle-aged adults: A global review’, Obesity Reviews, vol. 21, no. 6, pp. 678–689.

Appendix- A

Title: Outcomes of Neural Mobilization Among Patients with Chronic Neck Pain.

Questionnaire (English)

Part- 1: Patient's Identification

No.	**Questions**	**Response**
1.1	Date:	
1.2	Patients name:	
1.3	Patients ID:	
1.4	Address:	0. House no: 1. Village: 2. P.O: 3. P.S: 4. District:
1.5	Contact Number	

Part-2: Socio-Demographic Characteristics Related Variables

Sl. No.	Questions	Option	Responses
2.1	Age	…… Years	
2.2	Sex	0. Male **1.** Female	
2.3	Religion	0. Islam 1. Hinduism **2.** others	
2.4	Marital status	0. Married 1. Unmarried 2. Divorced 3. Widow	
2.5	Family type	0. Nuclear family 1. Extended family	
2.6	Living area	0. Rural 1. Urban	
2.7	Educational Qualification	0. Illiterate 1. Primary 2. Secondary 3. Higher Secondary 4. Honors 5. Masters 6. Others	
2.8	Occupation	0. Student 1. Housewife 2. Worker	

		3. Service holder 4. Business 5. Others	
2.9	Monthly family income	(Tk)	
2.10	Height	In meter	
2.11	Body weight	In Kg	
2.12	BMI		
2.13	Comorbidities	0. Diabetes mellitus 1. Hypertension 2. Asthma 3. Osteoporosis 4. Disk degeneration 5. Multiple 6. Others	

Part-3: Assessment-Related Variables

Sl. No.	Questions	Option	Responses
3.1	What do you think about the cause of your pain?	0. Due to Trauma. 1. Due to lifting heavy weight. 2. Due to bad working posture. 3. Coughing or sneezing. 4. Bad sleeping posture. 5. Others.	
3.2	Posture	0. Good 1. Fair 2. Poor	
3.3	Duration of pain since the last episode	Month/Year	
3.4	Symptoms at Onset	1. Head 2. Neck 3. Scapula zone 4. Arm 5. Forearm	
3.5	Duration of symptoms	0. Constant 1. Intermittent	
3.6	Aggravating factors	0. Activities with movement 1. Loading activities	
3.7	Relieving factors	0. Rest in sitting 1. Rest in lying 2. Activity modification 3. Positioning	
3.8	Radiating pain	0. Right upper limb 1. Left upper limb	

3.9	Nature of pain site/spread	0. Up to shoulder 1. Up to elbow 2. Up to wrist 3. Up to hand 4. Up to finger	
3.10	When do you feel worse pain	0. AM 1. As the Day Progress 2. PM 3. When Still 4. On the Move	

Part- 4: Neck pain-related Variables

0–10 Numeric Pain Rating Scale (NPRS) where “0” means no pain and “10” means the worst pain.

4.1 How severe is your neck pain present?

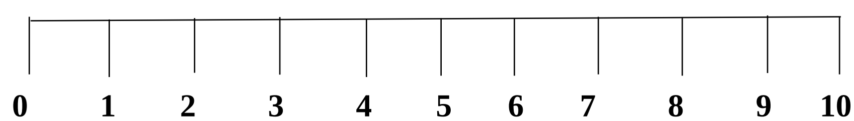


Fig. 6.6: Zero (0) means no pain and Ten (10) means extreme pain

4.2 How severe is your pain in the sitting position of your neck?

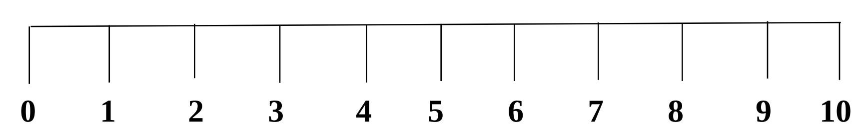


Fig. Zero (0) means no pain and Ten (10) means extreme pain

4.3 How severe is your pain in the lying position of your neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means extreme pain

4.4 How severe your pain is during flexion of the neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means worst pain

4.5 How severe your pain is during the extension of the neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means worst pain

4.6 How severe your pain is during side flexion to the right side of the neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means worst pain

4.7 How severe your pain is during side flexion to the left side of your neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means worst pain

4.8 How severe your pain is during rotation to the right side of the neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means worst pain

4.9 How severe your pain is during rotation to the left side of the neck?

0 1 2 3 4 5 6 7 8 9 10

Fig. Zero (0) means no pain and Ten (10) means worst pain

Part 5: (Neck Range of Motion-Related Variables)

No.	Questions	Degree
5.1	Active ROM in Flexion of the neck.	
5.2	Active ROM in Extension of the neck.	
5.3	Active ROM in right side Flexion of the neck.	
5.4	Active ROM in left side Flexion of the neck.	
5.5	Active ROM in Rotation to the right side of the neck.	
5.6	Active ROM in Rotation to the left side of the neck.	

Part 6: (Neck Disability Index related variables)

No	Questions	Options	Response
6.1	**(Pain Intensity)** How much pain do you have today?	0. I have no pain at the moment. 1. The pain is very mild at the moment. 2. The pain is moderate at the moment. 3. The pain is fairly severe at the moment. 4. The pain is very severe at the moment. 5. 5. The pain is the worst imaginable at the moment.	

6.2	**(Personal Care)** How independent are you with personal care (washing, dressing, etc)	0. I can look after myself normally without causing extra pain. 1. I can look after myself normally but it causes extra pain. 2. It is painful to look after myself and I am slow and careful. 3. I need some help but manage most of my personal care. 4. I need help every day in most aspects of self-care. 5. 5. I do not get dressed, wash with difficulty and stay in bed	
6.3	**(Lifting)** How independent are you when lifting objects?	0. I can lift heavy weights without extra pain. 1. I can lift heavy weights but it gives extra pain. 2. Pain prevents me from lifting heavy objects off the floor, but. I can manage if they are conveniently positioned, e.g. on a table 3. Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned. 4. I can lift very light weights. 5. 5. I can not lift or carry anything at all.	

6.4	**(Reading)** How do you feel while reading newspapers or books?	0. I can read as much as I want with no pain in my neck. 1. I can read as much as I want with slight pain in my neck. 2. I can read as much as I want with moderate pain in my neck. 3. I cannot read as much as I want because of moderate pain in my neck. 4. I can hardly read at all because of severe pain in my neck. 5. 5. I cannot read at all.	
6.5	**(Headaches)** To which state of headache do you feel?	0. I have no headaches at all. 1. I have slight headaches which come infrequently. 2. I have moderate headaches which come infrequently. 3. I have moderate headaches which come frequently. 4. I have severe headaches which come frequently. 5. I have headaches almost all the time	
6.6	**(Concentration)** To which level of concentration do you keep during working despite neck pain?	0. I can concentrate fully when I want to with no difficulty. 1. I can concentrate fully when I want to with slight difficulty. 2. I have a fair degree of difficulty in concentrating when I want to. 3. I have a lot of difficulty	

		concentrating when I want to. 4. 4. I have a great deal of difficulty concentrating when I want to. 5. I cannot concentrate at all.	
6.7	**(Work)** To which state neck pain affect your daily work? .	0. I can do as much work as I want to. 1. I can only do my usual work, but no more. 2. I can do most of my usual work, but no more. 3. I cannot do my usual work. 4. I can hardly do any work at all. 5. 5. I cannot do any work at all	
6.8	**(Driving/ Traveling)** How do you feel your neck pain during traveling?	0. I can travel without any neck pain 1. I can travel as long as I want with slight pain in my neck. 2. I can travel as long as I want with moderate pain in my neck. 3. I can't travel as long as I want because of moderate pain in my neck. 4. I can hardly travel at all because of severe pain in my neck. 5. I can't travel at all.	
6.9	**(Sleeping)** To which state does neck pain affect your	0. I have no trouble sleeping. 1. My sleep is slightly disturbed (less than 1 hr. sleepless). 2. My sleep is mildly disturbed	

	sleep?	(1-2 hrs. sleepless). 3. My sleep is moderately disturbed (2-5 hrs. sleepless). 4. My sleep is greatly disturbed (3-5hrs. sleepless). 5. 5. My sleep is completely disturbed (5-7 hrs. sleepless).	
6.10	**(Recreation)** To which state does your neck pain affect your recreational activities?	0. I am able to engage in all my recreation activities with no neck pain at all. 1. I am able to engage in all my recreation activities with some pain in my neck. 2. I am able to engage in most, but not all of my usual recreational activities because of pain in my neck. 3. I am able to engage in a few of my usual recreational activities because of pain in my neck. 4. I can hardly do any recreational activities because of pain in my neck. 5. I cannot do any recreational activities at all	

Neck Disability Index Interpretation

Disability Scoring	Response
0. (0-20%) Minimal Disability 1. (21-40%) Moderate Disability 2. (41-60%) Severe Disability 3. (61-80%) Crippled Disability 4. (81-100%) Bed Bound	

সম্মতিপত্র

আসসালামু আলাইকুম,

আমি মোঃ ফোরকান হোসেন , ঢাকা বিশ্ববিদ্যালয়ের চিকিৎসা অনুষদের অধীনে সাইক কলেজ অব মেডিকেল সায়েন্স অ্যান্ড টেকনোলজি (এসসিএমএসটি) এর বিএসসি ফিজিওথেরাপির চতুর্থ বর্ষের শিক্ষার্থী। আমার স্নাতক ডিগ্রি অর্জনের জন্য আমাকে একটি গবেষণা সম্পাদন করতে হবে এবং এটি আমার অধ্যয়নের একটি অংশ। আমার গবেষণার শিরোনাম "ক্রনিক ঘাড় ব্যাথার রোগীদের মধ্যে নিউরাল মোবিলাইজেশন করানোর ফলাফল"। আমার গবেষণা প্রকল্পটি পূরণ করার জন্য আপনার ঘাড় ব্যথা সম্পর্কিত, ব্যক্তিগত ও অন্যান্য তথ্য সংগ্রহ করতে হবে। সুতরাং, আপনি এই গবেষণায় একজন সম্মানিত অংশগ্রহণকারী হতে পারেন এবং কথোপকথনের সময়টি দুই বার করে ১৫-৩০ মিনিট হবে। আমি আপনাকে জানাতে চাই যে এটি একটি সম্পূর্ণরূপে একাডেমিক গবেষণা ও এটি অন্য কোনও উদ্দেশ্যে ব্যবহার করা হবে না। আমি আপনাকে আশ্বাস দিচ্ছি যে সমস্ত তথ্য গোপন রাখা হবে। আপনার অংশগ্রহণ ঐচ্ছিক হবে। এই গবেষণা থেকে আপনি যে কোনো সময় আপনার সম্মতি ও অংশগ্রহণ প্রত্যাহার করতে প্‌রবেন। আপনার যদি কোন প্রশ্ন পছন্দ না হয় সেক্ষেত্রে আপনি প্রশ্ন প্রত্যাখান করার অধিকার রাখেন।

গবেষণা সম্পর্কে আপনার যদি কোনও প্রশ্ন থাকে তাহলে আপনি যোগাযোগ করতে পারেন গবেষক মোঃ ফোরকান হোসেন অথবা গবেষনার সুপারভাইজার মোহাম্মদ হাবিবুর রহমান, সহকারী অধ্যাপক ফিজিওথেরাপি বিভাগ, বাংলাদেশ উন্মুক্ত বিশ্ববিদ্যালয় (বাউবি) এর সাথে । শুরু করার আগে আপনার কি কোন প্রশ্ন আছে?

সুতরাং, আমি কি সাক্ষাত্‌কারটি শুরু করতে পারি?

হ্যাঁ ☐ না ☐

অংশগ্রহণকারীরস্বাক্ষর……………………………………………তারিখ………………………

ফিজিওথেরাপিস্ট/ সাক্ষীর স্বাক্ষর……………………………………………. তারিখ……………………..

তথ্যসংগ্রহকারীরস্বাক্ষর ………………………………………………………তারিখ………………………

গবেষকেরস্বাক্ষর……………………………………………………………তারিখ…………………….

শিরোনামঃ ক্রনিক ঘাড় ব্যাথার রোগীদের মধ্যে নিউরাল মোবিলাইজেশন করানোর ফলাফল

<u>প্রশ্নাবলী (বাংলা)</u>

পর্ব- ১ (রোগীর শনাক্তকরণ)

নং	প্রশ্ন	উত্তর
১.১	তারিখ:	
১.২	রোগীর নাম:	
১.৩	রোগীর আইডি:	
১.৪	ঠিকানা:	০. বাড়ি নাম্বার ১. গ্রাম: ২. ডাকঘর: ৩. থানা: ৪. জেলা:
১.৫	ফোন নাম্বার :	

পর্ব - ২ (সামাজিক জনতাত্ত্বিক তথ্যাবলী)

নং	প্রশ্ন	পছন্দমতো বেছে নিন	উত্তর
২.১	বয়স:	.... বছর	
২.২	লিঙ্গ:	০. পুরুষ ১. মহিলা	

২.৩	ধর্ম:	০. ইসলাম ১. হিন্দু ২. অন্যান্য	
২.৪	বৈবাহিক অবস্থা:	০. বিবাহিত ১. অবিবাহিত ২. তালাকপ্রাপ্ত ৩. বিধবা	
২.৫	পরিবারের ধরণ:	০. একক পরিবার ১. যৌথ পরিবার	
২.৬	বাসস্থানের ধরণ:	০. গ্রাম ১. শহর	
২.৭	শিক্ষাগত যোগ্যতা :	০. নিরক্ষর ১. প্রাথমিক ২. মাধ্যমিক ৩. উচ্চ মাধ্যমিক ৪. স্নাতক ৫. স্নাতকোত্তর ৬. অন্যান্য	

২.৮	পেশা:	০. ছাত্র ১. গৃহিণী ২. কর্মী ৩. চাকরিজীবি ৪. ব্যাবসা ৫. অন্যান্য	
২.৯	মাসিক আয়:	টাকা	
২.১০	উচ্চতা:	…মিটার	
২.১১	ওজন:	কেজি	
২.১২	বিএমআই		
২.১৩	অন্যান্য রোগ	০. ডায়বেটিস ১. উচ্চ রক্তচাপ ২. হাপানী ৩. হাড় ক্ষয় ৪. ডিস্কে বয়সজনিত সমস্যা ৫. অন্যান্য	

পর্ব -৩ (এসেসমেন্ট সম্পর্কিত ভেরিয়েবল)

নং	প্রশ্ন	পছন্দমতো বেছে নিন	উত্তর
৩.১	ব্যাথার কারন সম্পরকে আপনি কি মনে করেন ?	০. আঘাতের কারনে ১. ভারি ওজন বহনের কারনে ২. কাজের সময়ে শরিরের সঠিক অবস্থান না রাখার জন্য ৩. কাশি অথবা হাঁচি ৪. ঘুমানর সময় শরিরের সঠিক অবস্থান না রাখার জন্য	
৩.২	অঙ্গবিন্যাস	০. ভালো ১. মোটামোটী ভালো ৩. খারাপ	
৩.৩	ব্যাথার স্থিতিকাল	…… মাস/ বছর	
৩.৪	কোথায় শুরু হয়	০. মাথা ১. ঘাড় ২. কাঁধের পেছনে ৩. বাহুতে ৪. হাতে	
৩.৫	উপসর্গের স্থায়িত্ব	০. কিছু সময় পরপর ১. বিরতিহিন	
৩.৬	কি করলে ব্যাথা বাড়ে ?	০. হাঁটাচলা করলে ২. ওজন বহন করলে	
৩.৭	কি করলে ব্যাথা কমে যায় ?	০. বসলে ১. শুয়ে থাকলে ২. কাজের ধরণ পরিবর্তন করলে ৩. অবস্থান পরিবর্তনে	

৩.৮	ব্যাথা রেডিয়েট করে	০. ডান হাতে ১. বাম হাতে ৩ দু'হাতে	
৩.৯	ব্যাথার ধরন	০. কাঁধ পর্যন্ত ১. কনুই পর্যন্ত ২. কব্জি পর্যন্ত ৩. হাত পর্যন্ত ৪. আঙ্গুল পর্যন্ত	
৩.১০	কখন আপনি বেশি ব্যাথা অনুভব করেন	০. সকালে ১. দিন বাড়ার সাথে সাথে ২. রাতে ৩. স্থির থাকলে ৪. নড়াছড়া করলে	

পর্ব –৪ (ঘাড়ব্যাথা সম্পর্কিত ভেরিয়েবল)

৪.১ এই মুহূর্তে আপনার মাথাব্যাথা কতটুকু।

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.২ বসে থাকলে কি পরিমাণ মাথাব্যাথা থাকে?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৩ শুয়ে থাকলে কি পরিমাণ ঘাড়ব্যাথা থাকে?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৪ সামনে ঝুকলে কি পরিমাণ ঘাড়ব্যাথা থাকে?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৫ পেছনে ঝুকলে কি পরিমাণ ঘাড়ব্যাথা থাকে?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

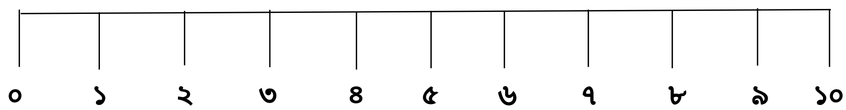
০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৬ ডান দিকে ঘাড় কাত করলে কি পরিমাণ ঘাড়ব্যাথা থাকে?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

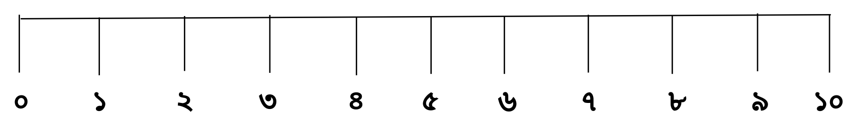
০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৭ বাম দিকে ঘাড় কাত করলে কি পরিমাণ ঘাড়ব্যাথা থাকে?



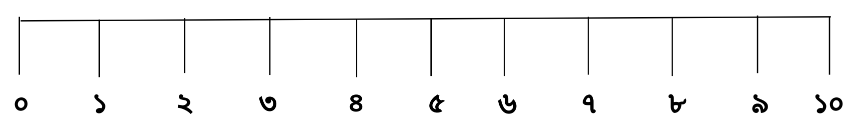
০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৮ ডান দিকে ঘাড় ঘুরালে কি পরিমাণ ঘাড়ব্যাথা থাকে?



০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

৪.৯ বাম দিকে ঘাড় ঘুরালে কি পরিমাণ ঘাড়ব্যাথা থাকে?



০-১০ নিউমেরিক পেইন রেটিং স্কেল যেখানে ০ বলতে ব্যাথামুক্ত অবস্থা এবং ১০ বলতে অসহনীয় ব্যাথাকে বুঝানো হচ্ছে।

পর্ব-৫ (ঘাড় নড়াচড়ার সীমা সম্পর্কিত ভেরিয়েবলস)

নং	প্রশ্ন	উত্তর
৫.১	স্বয়ংক্রিয় ভাবে সামনে ঘাড় ভাজ করার সীমা।	
৫.২	স্বয়ংক্রিয় ভাবে পেছনে ঘাড় ভাজ করার সীমা।	
৫.৩	স্বয়ংক্রিয় ভাবে ডান পাশে ঘাড় ভাজ করার সীমা।	
৫.৪	স্বয়ংক্রিয় ভাবে বাম পাশে ঘাড় ভাজ করার সীমা।	
৫.৫	স্বয়ংক্রিয় ভাবে ডান দিকে ঘাড় ঘুরানোর সীমা।	
৫.৬	স্বয়ংক্রিয় ভাবে বাম দিকে ঘাড় ঘুরানোর সীমা।	

পর্ব – ৬ (ঘাড়ে অক্ষমতা সংক্রান্ত ভেরিয়েবল)

নং	প্রশ্ন	পছন্দমতো বেছে নিন	উত্তর
৬.১	**(ব্যাথার তীব্রতা)** আজকে আপনার ব্যাথার তীব্রতা কি পরিমান ?	০. এই মুহূর্তে কোন ব্যাথা নেই। ১. এই মুহূর্তে খুব সামান্য ব্যাথা আছে। ২. এই মুহূর্তে মধ্যম মানের ব্যাথা আছে। ৩. এই মুহূর্তে মুটামুটি তীব্র ব্যাথা আছে। ৪. খুব তীব্র মানের ব্যাথা আছে। ৫. অসহনীয় পর্যায়ের ব্যাথা আছে।	

৬.২	**(নিজের যত্ন)** ব্যক্তিগত কাজে (পরিচ্ছন্নতা ,জামাকাপড় পরিধান ইত্যাদি) আপনি কি পরিমান সাবলম্বি?	০. কোন রকম অতিরিক্ত ব্যাথা ছাড়াই সব কাজ করতে পারি। ১. খুব সামান্য পরিমাণ ব্যাথা নিয়ে সব কাজ করতে পারি। ৩. ব্যাথা আছে, ধীর গতি ও সাবধানতা অবলম্বন করতে হচ্ছে। ৩. সাহায্য দরকার হচ্ছে কিন্তু মোটামুটি একাই পারি। ৪. নিজের প্রায় সব কাজগুলো করতে অন্য কারো সাহায্যের দরকার হচ্ছে। ৫. একা পোশাক পরিধান করতে পারিনা, পরিষ্কার করতে কষ্ট হচ্ছে, বিছানা থেকে উঠতে পারিনা।	
৬.৩	**(ভারী জিনিস তোলা)** কোন বস্তু উঠানোর ক্ষেত্রে আপনি কি পরিমান স্বাবলম্বী ?	০. কোন রকম ব্যাথা ছাড়াই ভারী জিনিস তুলতে পারি। ১. ভারী জিনিস তুলতে পারি কিন্তু ব্যাথা হচ্ছে। ২. মাটি থেকে ভারি জিনিস তুলতে কষ্ট হচ্ছে কিন্তু সুবিধা জনক অবস্থানে থাকলে পারি। যেমনঃ টেবিল থেকে। ৩. মাটি থেকে ভারী জিনিস তুলতে কষ্ট হচ্ছে কিন্তু সুবিধাজনক অবস্থানে থাকলে হালকা থেকে ভারী ওজন তুলতে পারি। ৪. খুব হালকা ওজন তুলতে পারি।	

		৫. কিছুই তুলতে পারি না।	
৬.৪	**(পড়াশোনা)** খবরের কাগজ অথবা বই পড়ার সময় আপনি কি রকম অনুভব করেন ?	০. কোন রকম ব্যাথা ছাড়াই যতক্ষন খুশি পড়তে পারি। ১. খুব সামান্য ব্যাথা নিয়ে যতক্ষন খুশি পড়তে পারি। ২. মোটামুটি ব্যাথা নিয়ে যতক্ষন খুশি পড়তে পারি। ৩. মধ্যম মানের ব্যাথার কারণে স্বাধীন ভাবে পড়তে পারি না। ৪. তীব্র ব্যাথার কারণে সবসময় পড়তে পারিনা। ৫. কোন ভাবেই পড়তে পারিনা।	
৬.৫	**(মাথাব্যাথা)** আপনি ঘাড় ব্যাথার জন্য কি পরিমান মাথাব্যথা অনুভব করেন ?	০. কোন মাথাব্যাথা নেই। ১. কখনো কখনো খুব সামান্য মাথাব্যাথা হয়। ২. কখনো কখনো মোটামুটি মাথাব্যাথা হয়। ৩. প্রায়শই মটামুটি মাথাব্যাথা হয়। ৪. প্রায়ই তীব্র মাথাব্যাথা হয়। ৫. প্রায় সবসময় মাথাব্যাথা থাকে।	
৬.৬	**(মনোযোগ)** ঘারেব্যথা ছাড়া আপনি কাজে কি পরিমান মনোযোগ দিতে পারেন ?	০. আমি কোন সমস্যা ছাড়াই সম্পূর্ণ মনোযোগ নিবদ্ধ করতে পারি। ১. যখন আমি সম্পূর্ণ মনোযোগ দিতে চেষ্টা করি তখন সামান্য	

		অসুবিধা হয়। ২. আমি যখন মনোযোগ দিতে চেষ্টা করি তখন আমার মনোযোগের পর্যাপ্ত অসুবিধা হয়। ৩. আমি মনোযোগ দেওয়ার সময় অনেক সমস্যা হয়। ৪. আমি যখন মনোযোগ দিতে চাই তখন অনেক সমস্যা হচ্ছে। ৫. আমি কখনোই মনোনিবেশ করতে পারিনা।	
৬.৭	**(কাজ)** ঘাড়ের ব্যথা আপনার প্রতিদিনের কাজে কি পরিমানে প্রভাবিত করে ?	০. আমি যতক্ষন চাই কাজ করতে পারি। ১. আমি স্বাভাবিক সব কাজ করতে পারি কিন্তু এর বেশি কিছু না। ২. আমি প্রায় সব নিজের স্বাভাবিক কাজ করতে পারি কিন্তু এর বেশি কিছু না। ৩. আমি আমার স্বাভাবিক কাজ করতে পারি না। ৪. আমি খুব কমই কাজ করতে পারি। ৫. আমি কোন কাজই করতে পারিনা।	

৬.৮	**(ড্রাইভিং/ ভ্রমন করা)** গাড়িতে ভ্রমনের সময় আপনার ঘাড়ে কি পরিমান ব্যথা অনুভুব হয়?	০. আমি কোন ঘাড় ব্যাথা ছাড়াই আমার গাড়িতে ভ্রমন করতে পারি। ১. আমি সামান্য ব্যাথা নিয়ে যতক্ষন চাই ততক্ষণ ভ্রমন করতে পারি। ২. আমি মাঝারি ব্যাথা নিয়ে যতক্ষন চাই ততক্ষণ ভ্রমন করতে পারি। ৩. আমার ঘাড়ে মাঝারি ব্যাথার কারণে যতক্ষন আমি চাই ততক্ষন ভ্রমন করতে পারিনা। ৪. আমার ঘাড়ে অনেক বেশি ব্যাথার কারণে আমি খুব কমই ভ্রমনকরতে পারি। ৫. আমি একদমই গাড়িতে ভ্রমন করতে পারিনা।	
৬.৯	**(ঘুম)** ঘুমানোর সময় ঘাড়ের ব্যথা আপনার ঘুমকে কি পরিমান প্রভাবিত করে ?	০.আমার ঘুমে কোন অসুবিধা নেই। ১. আমার ঘুমে খুব কম সময়ই সমস্যা হয়(১ ঘন্টার কম ঘুমহীন)। ২. আমার ঘুমে কম সমস্যা হয় (১-২ ঘন্টা ঘুমহীন)। ৩. আমার ঘুমে মাঝারি ধরনের সমস্যা হয় (২-৫ ঘন্টা ঘুমহীন)। ৪. আমার ঘুমে বেশি সমস্যা হয় (৩-৫ ঘন্টা ঘুমহীন)। ৫. আমার সম্পূর্ণ ভাবে ঘুমাতে সমস্যা হয় (৫-৭ ঘন্টা ঘুমহীন)	
৬.১০	**(বিনোদন)**	০. আমি কোন রকম ঘাড় ব্যাথা	

	ঘাড়ের ব্যথা আপনার চিত্তবিনোদনের কার্যক্রমকে কি পরিমান প্রভাবিত করে ?	ছাড়াই সব ধরনের বিনোদন মূলক কাজে অংশ গ্রহণ করতে পারি। ১. আমি আমার ঘাড়ে কিছু ব্যাথা নিয়ে সব ধরণের বিনোদন মূলক কাজে অংশগ্রহণ করতে পারি। ২. আমি আমার ঘাড় ব্যাথার কারণে বেশিরভাগ বিনোদন মূলক কাজে অংশগ্রহণ করতে পারিনা। ৩. আমি ঘাড় ব্যাথার কারণে অল্প কিছু স্বাভাবিক বিনোদন মূলক কাজে করতে পারি না। ৪. আমি আমার ঘাড়ে ব্যাথার কারণে খুব কমই বিনদনমুলক কাজে অংশ গ্রহণ করতে পারি। ৫. আমি কোন বিনোদনমূলক কাজে অংশগ্রহণ করতে পারিনা।	

ঘাড়ে অক্ষমতা সংক্রান্ত ফলাফল

অক্ষমতার মান	উত্তর
১. (০-২০%) হালকা অক্ষমতা ২. (২১-৪০) মাঝারি অক্ষমতা ৩. (৪১-৬০) তীব্র অক্ষমতা ৪. (৬১-৮০%) বিকলাঙ্গ ৫. (৮১-১০০%) শয্যাশায়ী	

Appendix- B

Institutional Review Board (IRB) Permission Letter

SCMST-BPT/IRB/...05-23/616

To
Md Forkan Hossain
4th Year Student of B.Sc. in Physiotherapy
Session: 2018-2019Reg No:10439
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Subject: Approval of the thesis proposal **"Outcomes of neural mobilization among the patients with chronic neck pain"** by the ethics committee.

Dear Md Forkan Hossain
Congratulations.
The Institutional Review Board (IRB) of SCMST has reviewed and discussed your application to conduct the above-mentioned dissertation, with you, as the principal investigator. The following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English & Bangla version)
3	Information sheet & consent form.

The purpose of the study is to determine the Outcomes of neural mobilization among patients with chronic neck pain. The study involves face-to-face interviews using a semi-structured questionnaire to explore the Outcomes of neural mobilization among patients with chronic neck pain. It may take 30 to 40 minutes to fill in the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics Committee have approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 28th September 2023 at SCMST.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring during the study, any revision in the protocol, and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working in accordance with the Nuremberg Code 1947, the World Medical Association Declaration of Helsinki, 1964 - 2013, and other applicable regulations.

Best regards,

29.05.24

Dr. Abul Kasem Mohammad Enamul Haque
Principal, SCMST &Chairman, Institutional Review Board (IRB)
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Appendix - C

Permission letter for data collection

SAIC COLLEGE OF MEDICAL SCIENCE AND TECHNOLOGY

Approved by Ministry of Health and Family Welfare
Affiliated with Dhaka University

Ref : *Date :* ....

8th September 2024

To

The Incharge

Bangladesh Spine & Orthopaedic Hospital (BSOH)

10 Main Road, Kallyanpur (Bus Stand)

Dhaka - 1216

Subject: Prayer for permission to collect data from the Bangladesh Spine & Orthopaedic Hospital (BSOH), Physiotherapy department to conduct a research project.

Sir,

With due respect and humble submission to state that I am a student of B.Sc. in Physiotherapy at SAIC College of Medical Science and Technology (SCMST). As a part of our course curriculum, we have to conduct a research project for the partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. My research title is **"Assessing the Efficacy of Iliopsoas Stretching on Pain and Disability Among the Patient with Knee Osteoarthritis"** and the aim of the study is to identify the efficacy of iliopsoas stretching on pain and disability among the patient with knee osteoarthritis.This is a randomized control trial under the supervision of Zahid Bin Sultan Nahid, Assistant Professor and Head, Department of Physiotherapy, SCMST. I want to collect data from the Bangladesh Spine & Orthopaedic Hospital (BSOH). So, I need your permission to collect data and ensure that the study will not be harmful for participants.

So, I therefore, pray and hope that you would be kind enough to give permission for data collection that will help me to complete my study.

Yours Faithfully

Kaochhar Hossain

Mohammad Kaochhar Hossain

Student of B.Sc. in Physiotherapy

Session:2018 -2019

Reg No:10481

SAIC College of Medical Science and Technology (SCMST)

Mirpur-14, Dhaka 1216, Bangladesh.

08/09/24

MD. MASUM BISWAS
BPT (Dhaka University)
Incharge (Physiotherapy Department)
Bangladesh Spine & Orthopaedic Hospital

Address: Saic Tower, M-1/6, Mirpur-14, Dhaka-1206. Mobile: 01936005804
E-mail: simt140@gmail.com, Web:www.saicmedical.edu.bd

SAIC COLLEGE OF MEDICAL SCIENCE AND TECHNOLOGY

Approved by Ministry of Health and Family Welfare
Affiliated with Dhaka University

Ref: *Date :* ....

8th October 2024
To
The Chairman
Elite Physiotherapy and Rehab Zone, Mirpur-11, Dhaka
Subject: Prayer for permission to collect data from the Elite Physiotherapy and Rehab Zone to conduct a research project.

Sir,

With due respect and humble submission to state that I am a student of B.Sc. in Physiotherapy at SAIC College of Medical Science and Technology (SCMST). As a part of our course curriculum, we have to conduct a research project for the partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. My research title is "**Outcomes of Neural Mobilization Among Patients with Chronic Neck Pain**" and the study aims to find out the outcomes of neural mobilization along with conventional physiotherapy and only conventional physiotherapy in patients with chronic neck pain. This is a randomized control trial under the supervision of Dr. Mohammad Habibur Rahman, Assistant Professor of Physiotherapy, SST Bangladesh Open University (BOU). I have chosen the Elite Physiotherapy and Rehab Zone as a site for data collection.

So, I, therefore, pray and hope that you would be kind enough to give permission for data collection that will help me to complete my study.

Yours Faithfully
Md Forkan Hossain
Student of B.Sc. in Physiotherapy
Session: 2018 -2019
Reg No: 10439
SAIC College of Medical Science and Technology (SCMST)
Mirpur-14, Dhaka 1216, Bangladesh.

8.10.2024

Dr. Rashadur Rahaman Sarker, PT
Senior Consultant Physiotherapist
Managing Director
Elite Physiotherapy & Rehab Zone

Address: Saic Tower, M-1/6, Mirpur-14, Dhaka-1206. Mobile: 01936005804
E-mail: simt140@gmail.com, Web:www.saicmedical.edu.bd

Appendix - D

ইউনিক পেইন এ্যান্ড প্যারালাইসিস সেন্টার
UNIQUE PAIN & PARALYSIS CENTRE

Ref.: *Date:*

Conventional physiotherapy treatment for chronic neck pain patient

I) Manual therapy:

• Mckenzie Mobilization:

i. Repeated retraction in lying (RRIL)
ii. Repeated retraction in sitting (RRIS)
iii. Repeated retraction with overpressure (RR with overpressure)
iv. Retraction with extension and rotation (RER)
v. Repeated right side flexion (RRSF)
vi. Repeated right side flexion with overpressure (RRSF with overpressure)
vii. Repeated left side flexion (RLSF)
viii. Repeated left side flexion with overpressure (RLSF with overpressure)
ix. Rotation mobilization in lying or sitting (RM in lying or sitting)
x. Others McKenzie directional preference techniques

• Cyriax manipulation:

i. Straight pull or rotation manipulation
ii. DTFM in triggered soft tissue

• Maitland mobilization:

i. P/A unilateral mobilization
ii. P/ A central mobilization

• Mulligan mobilization:

i. Sustained Natural Appophy•seal Gliding (SNAGS)
ii. Reverse Sustained Natural Appophyseal Gliding (Reverse SNAGS)
iii. Natural Appophyseal Gliding (NAGS)

Tawhid

Dr. A K M Minarul Tawhid, PT
BSPT (DU-CRP), MPH (SUB)
Clinical Physiotherapist
Specialist in Arthrist, Pain & Paralysis

R.S.H. TOWER, Plot#23(3rd Floor), Road#3, ...

Ref.: *Date:*

• Neural mobilization

- Median Nerve: Shoulder-Depression and abduction IO degree. Elbow and wrist is in Extension.
- Radial nerve: Shoulder-Depression and abduction 10 degree.Elbow and wrist is in flexion.
- Ulnar nerve: Shoulder-Depression and abduction IO to 90 degree. Elbow is in flexion and wrist is in extension and radial deviation,
- In each movements of spine contra lateral side flexion is to be done.

II) Exercise therapy:

- Active cervical range of motion exercises of cervical
- Stretching exercises
- Isometric neck muscles exercise

III) Electrotherapy:_Physiotherapist most commonly prefers manual therapy for patient with neck pain but in case of needs they use selective electrotherapeutic modalities based on patient's requirement.

- Infra-red radiation over the back of neck for IO- 15 minutes.
- Cervical mechanical traction: Intermittent mode with weight of 7% of total body weight for 15 minutes. Upper limit of weight maximum 13 kg and lower limit 5 kg. Force time 5 minutes with I minute rest
- Transcutaneous electrical nerve stimulation (TENS) over the greatest intensity of pain with frequency of 5Hz, high intensity burst mode and pulse duration 300 micro seconds for 20 minutes.

IV) Patient education and home advice:

- Counseling patient about the condition, avoiding the predisposing factors and home exercise including aerobic exercise, stretching exercise, retraction exercise and isometric exercise.

Tawhid

Dr. A K M Minarul Tawhid, PT
BSPT (DU-CRP), MPH (SUB)
Clinical Physiotherapist
...alist in Arthrist, Pain & Paralysis

Appendix - E

Gant Chart

Activities/ months	Jan 24	Feb 24	Mar 24	Apr 24	May 24	June 24	July 24	Aug 24	Sep 24	Oct 24	Nov 24	Dec 24	Jan 25
Proposal presentation													
Introduction													
Literature review													
Methodology													
Data collection													
Data Analysis													
Result													
1st progress presentation													
Discussion													
Calclusion And Recommendation													
2nd progress presentation													
Communication with supervisor													
Final submission													