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Outcome of Mulligan's NAGs Mobilization Technique along with Conventional Physiotherapy for Patients with Cervical Spondylosis: A Randomized Controlled Trail

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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 incidences are my own. I also decline that for any publication, presentation or dissemination of information of the study. I would bound to take written consent form the Department of physiotherapy, Bangladesh Health Professions Institute (BHPI).

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Acronyms

Acronyms	Full-Form
ADL	Activities of Daily Living
BMI	Body Mass Index
CNP	Chronic Neck Pain
CS	Cervical Spondylosis
MRI	Magnetic Resonance Imaging
MSD	Musculoskeletal Disorders
MVC	Motor Vehicle Collision
NAGs	Natural apiphysial glide
NDI	Neck Disability Index
QOL	Quality of Life
ROM	Range of Motion
SPSS	Statistical Package for Social Science
VAS	Visual analog scale
WHO	World Health Organization
WMSDs	Work-related musculoskeletal disorders

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Abstract

Background: Cervical spondylosis is a chronic, age-related degenerative condition of the cervical spine, impacting vertebrae, intervertebral discs, and spinal canal contents, including nerve roots and the spinal cord. It may involve disc herniation, bone spurs, and degenerative changes in facet joints and ligaments (Kuo & Tadi, 2023). **Objectives:** This Study aimed to exprement the outcome of the Mulligan's mobilization technique NAGs along with conventional physiotherapy for pain, ROM, MS aad also functional ability of the patients with cervical spondylosis. **Methodology:** Experimental study design was used in this study. 30 patients with Cervical Spondylosis were randomly allocated into two groups from outdoor musculo-skeletal unit, CRP. Among them 15 patients were assigned into Exprimental group received Mulligan's NAGs with conventional physiotherapy and another 15 into control group received only conventional physiotherpy. Mulligan's mobilization NAGs were performed at 2-3 repetions in 1 sec (for fewer than 6 repetitions) with 3 sets. Single blind procedure was used during data collection. **Outcome measurement tools**: Visual Analog Scale (VAS) was used to measure pain and universal goniometer to measure ROM, manual muscle testing (OXFORD Grade) to measure muscle strength and NDI to measure neck disability. **Results:** On comparing control group and exprimental group for post-treatment VAS score (p= 0.002), NDI score (p= 0.009) and overall ROM results showed a significant difference ($P < 0.05$) in improvement in terms VAS score, ROM and NDI score. Muscle strength (ms) improved within groups, but between groups results showed similar improvements, with no significant difference, where ($P > 0.05$). **Discussion:** The overall study proved that Mulligan's NAGs mobilization with conventional physiotherapy is effective in improving ROM, reduciong Pain and decreasing the disability level except in muscle strength, in which showed no additional benefit in treating cervical spondylosis (CS) patients.

Keywords: *Conventional, NAGs, Mobilization, Mulligan, Spondylosis*

Chapter-i	Introduction

1.1 Background

Cervical spondylosis (CS) is a chronic, age-related degenerative condition of the cervical spine that affects vertebrae, intervertebral discs, and surrounding soft tissues. Structural changes such as disc herniation, bone spur formation, and thickening of ligaments like the ligamentum flavum can lead to spinal cord or nerve root compression. (Kuo & Tadi, 2023; Anderson & Albert, 2024). These changes often result in neurological symptoms such as radiculopathy, along with mechanical issues like neck pain, stiffness, and reduced range of motion, especially during movement or sustained postures. (Lin et al., 2020).

Cervical disc herniation occurs when the disc's nucleus moves out of its normal position, pressing against the annulus and causing the disc to protrude. Eventually, the nucleus may fully herniate, leading to compression of the spinal canal or nerve roots (Dydyk, Ngnitewe, & Mesfin, 2023). Chemicals from the nucleus can also irritate nearby nerves, causing pain and inflammation (Finn et al., 2021).

It is influenced by multiple factors, age is a key risk factor and also demographic, lifestyle, occupational, and health related categories (Anderson & Albert, 2024). Lifestyle factors like smoking, alcohol use, inactivity, and poor posture raise the risk of cervical spondylosis, while regular activity such as walking may be protective. Cold environments and vibrations can worsen symptoms. Although the effect of conditions like hypertension and diabetes is uncertain, obesity, high body fat, and poor mental health are linked to higher prevalence (Ren et al., 2024).

Cervical disc degeneration shows a strong age-related trend, affecting 25% of individuals under 40, 50% over 40, and 85% over 60 (Abduljewad et al., 2024). A large-scale study reported radiographic evidence in 53.9% of the population, with the C5/C6 level most commonly involved (Tao et al., 2021). The degenerative process progresses through three stages dysfunction, instability, and stabilization each associated with specific age ranges and clinical features (Fakhoury & Dowling, 2021). Another study in Ethiopia found

cervical spondylosis in 28.6% of diagnosed spondylosis cases, with a mean patient age of 54.9 years (Abduljewad et al., 2024).

Cervical disc degeneration in a large group and found it affected 53.9% of people. The average age was 41.2 years, with degeneration increasing notably with age. Mild cases (Grade 1) were most common, seen in 36.8%, while moderate and severe forms were more frequent in older individuals. The C5/C6 disc was most affected (43.3%), and C2/C3 the least (9.6%). Degeneration often occurred in neighboring discs (53.2% of cases), with minimal gender differences except at C3/C4 (Tao et al., 2021).

According to the WHO, around 1.75 billion people (20–33% of the global population) suffer from chronic musculoskeletal pain. Neck pain is a major global health concern, with lifetime prevalence ranging widely from 0.4% to 86.8% depending on the country (Shin et al., 2022; Islam, 2023).

In cervical spondylosis, disc degeneration is associated with increased bone density in nearby vertebrae, possibly as an adaptive response (Chen et al., 2024). Degenerative changes in the spine, like disc and facet joint damage, are complex, with disc degeneration likely occurring before facet joint osteoarthritis (Lee et al., 2020).

It (CS) is a major global cause of disability and financial burden. The prognosis for chronic neck pain is often poor and can be more debilitating than low back pain (Shamsi et al., 2020). Early signs of cervical spondylotic myelopathy include gait instability and clumsiness, often misattributed to aging or arthritis, which can delay diagnosis (Cant et al., 2024). Loss of fine motor skills, particularly in the hands, leads to difficulty with tasks like writing or buttoning. Additionally, sensory disturbances such as numbness or tingling in the limbs are common and may be mistaken for peripheral neuropathy (Ahmed et al., 2019).

Various factors contribute to the development of Work-related Musculoskeletal Disorders (WMSDs), including increasing age, female gender—particularly among older women—long work shifts, sustained or awkward body positions, repetitive tasks, manual lifting, physical strain, and exposure to vibration (Chinedu et al., 2020; Hossain et al., 2022). Individuals employed in sectors such as textiles in India and Bangladesh are especially

vulnerable to conditions like cervical spondylosis and persistent neck pain due to prolonged labor-intensive activities (de Lacos et al., 2023). Common occupational triggers for WMSDs include static and awkward posture, repetitive motion, mechanical force, vibration, and extended periods of employment (Tang, 2022). Additionally, physiotherapists are frequently exposed to such risks while handling patients, often engaging in physically taxing tasks like heavy lifting, bending, twisting, and maintaining strained positions for extended durations (Ramanndi & Desai, 2021).

Females are generally more affected by cervical spondylosis than males, with some ethnic groups like the Shui people in Guizhou showing higher rates (Abduljewad et al., 2024). Multiple studies report a higher prevalence in women, and one found that 62.5% of patients were aged 36 to 50 (Ahmed et al., 2020). Another study on symptom-free individuals revealed significant degeneration in 70% of women and 95% of men aged 60 and 65. Degeneration most commonly occurs at the C5-C6 level, followed by C6-C7 and C4-C5. However, one study noted men were more frequently affected than women (3:2), mainly between ages 40 and 60 (Tao et al., 2021).

Lifestyle and occupational factors play a significant role in the risk of developing cervical spondylosis. Smoking, obesity, sedentary behavior, and prolonged TV watching are associated with increased risk, whereas computer use may have a protective effect (Ren et al., 2024). Additionally, jobs involving repetitive neck movements or extended use of handheld devices can worsen the condition, with stress and anxiety from occupational demands further contributing to its onset and progression (Ahmed et al., 2019).

According to a study the most prevalent age of cervical spondylosis in Asia is between 40 and 50 years old. Additionally, studies in South Kerala suggest that cervical spondylosis commonly occurs in individuals over the age of 30, with a peak in the 40-49 age bracket, predominantly affecting (Shahzadi et al., 2023).

Cervical spondylosis is a degenerative condition of the spine that affects individuals of all ages and both genders. According to a study, 95% of men and 70% of women over the age of 70 are affected by cervical spondylosis, indicating a degenerative process affecting various parts of their bodies (Singh, Sharma and Jaiswal, 2023). Another study conducted

within the Chinese community found that 13.76% of individuals have cervical spondylosis, with the highest rates observed among those aged 45 to 60 (Zhang, 2022).

Most people with spondylotic changes of the cervical spine on radiographic imaging remain asymptomatic, with 25% of individuals under the age of 40, 50% of individuals over the age of 40, and 85% of individuals over the age of 60 showing some evidence of degenerative changes (Kuo and Tadi, 2023).

Progressive spine degeneration begins during the second decade, with intranuclear clefts occurring around 40 years, indicating early disc degeneration impacting spinal components (Senegas et al., 2020). Symptoms of cervical spondylosis might include neurological dysfunction, neck pain, tenseness, and limb numbness. Severe instances may result in myelopathy, which impairs sensory and motor functions (Fotakopoulos et al., 2023). In cases of cervical radiculopathy, symptoms may include reflex alterations, paralysis, and numbness in the upper limbs (Waldman, 2024; Avon et al., 2023). Cervical instability can lead to dizziness and poor balance due to disrupted blood flow (Henderson, 2024).

Cervical spondylosis is primarily an age-related degenerative condition affecting the cervical spine, often resulting in neck pain, stiffness, and nerve compression. However, occupational strain also plays a key role, as shown by a prevalence of 63.6% in individuals who regularly carry heavy loads on their heads, compared to just 36% in those who do not involve carry heavy loads. This highlights that both aging and physically demanding work are significant risk factors in the development of cervical spondylosis (Varghese et al., 2023).

The study involved patients with cervical spondylosis who self-reported being diagnosed by doctors. In China, clinical symptoms, signs, and imaging examinations were used for diagnosis, with radiography, computed tomography, and magnetic resonance imaging being mandatory (Yamshikov et al., 2022).

Clinical and radiological findings in cervical spondylosis show consistent correlation. Diagnosis includes assessing canal size, osteophytes, disc herniation, and myelopathy signs on imaging studies like X-ray and MRI (Hesni, S., Baxter, D. and Saifuddin, A.,

2023). MRI is usually used to investigate neck pain sources, although the link between cervical spine degenerative changes and neck problems is unclear. MRI of the spine is crucial for detecting age-related changes in the general population. MRI studies on cervical spine degeneration in elderly individuals are currently few. This population-based research examined the incidence of cervical spine degenerative MRI findings in old Chinese men and females (Wang et al., 2019). MRI is essential for identifying spinal cord stenosis, with 84% of patients exhibiting this condition. Compression images were noted in 50.7% of cases, particularly at the C5-C6 level, where herniated discs were also prevalent (75%) (Thi et al. 2023).

Cervical traction helps relieve neck pain by reducing pressure on intervertebral discs, minimizing nerve root irritation, breaking dural adhesions, and improving epidural circulation, thereby easing inflammation and muscle spasms (Asiduba et al., 2020). Infrared therapy complements this by enhancing blood flow and reducing inflammation, promoting pain relief and better neck mobility, especially when combined with traction (Rulleau et al., 2021; Igwe et al., 2022).

Manual therapy paired with therapeutic exercises is proven to be more effective in reducing pain and disability in cervical spondylosis than exercise alone, although it yields results similar to manual therapy by itself (Wilhelm et al., 2023). Electrotherapy methods like TENS and ultrasound are effective in alleviating pain, while heat therapy supports muscle relaxation and boosts mobility (He et al., 2023 & Chen et al.,2023).

1.2 Justification of the study

The incidence of cervical spondylosis is steadily increasing, making life challenging for those affected as they struggle to move and perform daily tasks. This condition leads to activity limitations and a decreased quality of life. Researchers are motivated to conduct studies to uncover new insights into cervical spondylosis. By identifying the characteristics of neck pain in cervical spondylosis such as vulnerable age groups, affected populations, aggravating factors, and clinical manifestations physiotherapists can more easily diagnose the condition and provide detailed information to patients.

Studies showed that Mulligan's NAGs significantly improve cervical muscle strength, pain reduction, and neck function when combined with conventional therapies for non-specific chronic neck pain. For example, NAGs were found to reduce pain intensity and enhance cervical mobility (Waqas et al., 2017), and their combination with stabilization exercises improved muscle endurance and quality of life (Kocaman et al., 2023). Additionally, NAGs improved craniovertebral angles and cervical range of motion (Short-term Effect of Mulligan's SNAGs, 2022).

There is a notable lack of research on Mulligan's NAGs Mobilization for cervical spondylosis. This study aims to fill that gap by clearly identifying the patient population, intervention, and treatment setting. The title distinguishes this study by highlighting a unique treatment strategy (Mulligan's NAGs mobilization) combined with standard physiotherapy, reflecting a real-world clinical scenario. It is effective treatment for patient with cervical spondylosis.

This study will help physiotherapists become more aware of cervical spondylosis, enabling them to offer better treatments and essential advice to patients. For health professionals, this research enhances knowledge and strengthens the profession. Conducting research is crucial for professional development and improving the quality of care provided to patients.

1.3 Aim of this study

To experiment the outcome of Mulligan's NAGs mobilization technique along with conventional physiotherapy of the patients with cervical spondylosis.

1.4 Objective of the study

a. General Objectives

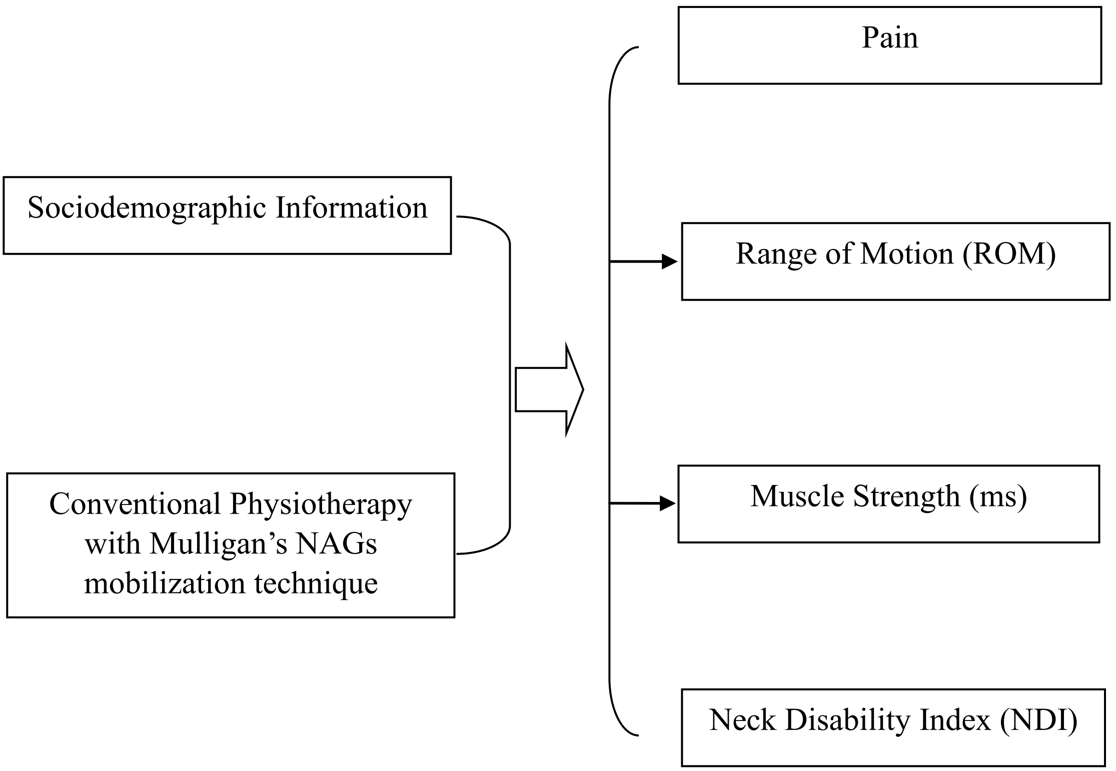
To examine the outcome of Mulligan's NAGs mobilization technique in patient with cervical spondylosis.

b. Specific Objectives

- To find out the baseline socio-demographic (age, gender, occupation, educational status) information of the participants.
- To evaluate the effects of Mulligan's NAGs mobilization technique along with conventional physiotherapy for Neck Pain
- To find out the impact of Mulligan's NAGs mobilization technique along with conventional physiotherapy for muscle strength (ms)
- To find out the impact of Mulligan's NAGs mobilization technique along with conventional physiotherapy for range of motion of cervical spine
- To evaluate the impact of Mulligan's NAGs mobilization technique along with conventional physiotherapy for neck disability index (NDI)

1.5 List of variables

Independent variables **Dependent variables**



1.6 Hypothesis

1.6.1 Null hypothesis (Ho)

Mulligan's NAGs mobilization technique along with conventional physiotherapy is not more effective rather than conventional physiotherapy for the patients with cervical spondylosis.

Statistical form:

H_0: $\mu_1 - \mu_2 = 0$

(where μ_1 = mean improvement in the intervention group, μ_2 = mean improvement in the control group)

1.6.2 Alternative Hypothesis (Hα)

Mulligan's NAGs mobilization technique along with conventional physiotherapy is more effective rather than conventional physiotherapy for the patients with cervical spondylosis.

Statistical form:

H_a: $\mu_1 - \mu_2 \neq 0$

(where μ_1 = mean improvement in the intervention group, μ_2 = mean improvement in the control group)

1.5 Operational Definition

1.5.a Pain: The revised definition of pain is "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage." (Raja et al., 2020).

1.5.b Chronic pain: Chronic pain is defined as pain persisting or recurring for over 3 months, requiring specialized treatment.

1.5.c Cervical spondylosis: Cervical spondylosis is an age-related spine degeneration that can compress nerves or the spinal cord due to osteophytes, disc herniation, or thickened ligaments as well as demographic, lifestyle, occupational, and health factors.

1.5.d NAGs: It is a Mulligan's mobilization technique Natural apophyseal glides

(NAGs).

1.5.e BMI: A standardized estimate of an individual's relative body fat calculated from his or her height or weight. The formula for calculating BMI is weight in kilogram (kg) divided by height in meter (m) squared.

1.5.f Conventional treatment: Treatment techniques that are conventionally preferred by physiotherapist in a particular setting.

15.g Excremental treatment

Excremental treatment refers to the processes and systems designed to manage and process excreta, ensuring effective decomposition, sanitation, and environmental safety. This encompasses various technologies and materials aimed at treating excrement efficiently.

Chapter- ii Literature review

Cervical spondylosis (CS) is an age-related degenerative disorder that usually starts in the intervertebral discs and gradually affects several levels of the cervical spine. It leads to both structural damage and neurological symptoms (Kido & Sola, 2024). The condition is more common in middle-aged people, often due to poor posture, work-related stress, and muscle imbalances. Studies have consistently shown that age is a key risk factor, with a higher occurrence seen in middle-aged adults than in younger individuals (Alare et al., 2021; Li et al., 2025).

Cervical or neck pain is a widespread musculoskeletal issue, with prevalence rates ranging from 17% to 75%. It poses a considerable burden not only on individuals but also on society and the economy. Research highlights its association with decreased quality of life, increased rates of disability and illness, more frequent sick leave, rising healthcare expenditures, and diminished workplace productivity (Karatrantou & Gerodimos, 2023). The condition typically results from the progressive degeneration of the cervical spine's bony and cartilaginous structures, a process that tends to accelerate with aging (Theodore, 2020).

As degeneration progresses, the nucleus pulposus within the disc loses its ability to absorb shock and may herniate through the weakened annulus fibrosus. This leads to a reduction in disc height, ligamentous laxity, and spinal compression. Dehydration of the disc compromises the structural integrity of the annular fibers, making them more vulnerable to compressive forces and disrupting the normal load distribution across the cervical spine (Shahzadi et al., 2023).

Common symptoms include shoulder pain (82.5%), neck pain (77.4%), and numbness (55%). Many patients reported moderate pain and radiating sensations, with a notable percentage experiencing no relief from medication (Zhang et al., 2022). Shoulder pain may suggest a problem with the cervical spine, specifically when a cervical nerve root becomes compressed as it exits the neural foramen, leading to symptoms such as pain, weakness, and sensory issues. This condition, known as cervical radiculopathy,

commonly causes pain in both the neck and shoulder (Kang et al., 2020; Patnaik et al., 2021; Weng, 2022).

Several factors can contribute to neck pain in adults. These include a sedentary lifestyle (limited physical activity), poor ergonomic conditions (bad posture while using electronic devices, repetitive and hurried movements, extended periods of sitting, poor sleep quality, etc.), individual factors (age, sex, history of musculoskeletal pain, etc.), and psychosocial factors (stress, anxiety, depression, etc.) (Walankar et al., 2021).

Neck pain is affected by various factors including genetics, mental health issues like depression and anxiety, poor coping strategies, sleep disturbances, smoking, and a sedentary lifestyle. Epidemiological studies generally show a positive link between higher body mass index (BMI) and neck and shoulder pain, especially in obese individuals (Zhang et al., 2020; Qian et al., 2023). This increased pain risk is attributed to systemic inflammation, mechanical stress, weakened muscles, psychosocial challenges, and fear of movement (Kazeminasab et al., 2022).

Stressful jobs and extended working hours (>7 hours) were identified as major contributors to the condition (Peterson, and Pihlström, 2021). Additionally, a significant number of patients exhibited anxiety and depression, further complicating their clinical presentation (Ni et al., 2022).

A study found age, sex, and occupation as significant risk factors for cervical spondylosis, radiculopathy, and neck pain, with age remaining significant relationship (Shi et al., 2020). A hospital-based study has shown a correlation between high blood pressure and cervical spondylosis. A study evaluated the influence of diabetes mellitus on patients with cervical spondylotic myelopathy, indicating that inadequate management of blood sugar levels may impede the recovery of spinal cord function after surgery (Jiang et al., 2020; Katikar, Katikar, & Sharma, 2022).

Musculoskeletal disorders (MSDs) are among the top contributors to years lived with disability globally (Shahrezaee et al., 2020). Epidemiological evidence has consistently shown a strong association between physical activity in the workplace and the development of work-related musculoskeletal disorders (WMSDs) (Hamid & Hilmi,

2024). According to the World Health Organization, work-related musculoskeletal disorders (WRMDs) are multifactorial in nature, often influenced by a combination of occupational tasks, ergonomic factors, and psychosocial stressors in the work environment (Takala et al., 2021).

Heavy physical activity, strong psychosocial job demands, and working above shoulder level are all risk factors for MSD development (Tobias et al., 2021). Furthermore, repetitive and confined work situations increase the incidence of neck and upper limb problems, with equivalent increases found in both males and females across diverse occupational conditions (Mekonnen et al., 2020).

Additionally, traumatic brain injuries, whiplash, and sports-related injuries from activities like wrestling, ice hockey, and football can heighten the risk of neck pain. Workplace factors, such as low job satisfaction and an uncomfortable work environment, are significant contributors to neck discomfort. Although office workers, manual laborers, and healthcare professionals tend to have higher rates of neck pain, these workplace issues are critical to consider (Guduru et al., 2022; Jun et al., 2021).

Cervical spondylosis patients experience 79.5% sleep disruption, with smoking, osteoarthritis, radicular paresthesia, and neck pain contributing to non-improvement. Physical therapy and heating elements, along with cervical spondylosis pillows and sleeping bags, may improve sleep quality (Bisson et al., 2023).

The onset of cervical spondylosis is influenced by a variety of risk factors, including sedentary work, prolonged desk time, the absence of physical activity, and incorrect working postures (Ahmed et al., 2020). Furthermore, aging-related biomechanical modifications in the cervical spine may result in degenerative processes, altered posture, height loss, and eventually kyphotic progression- all of which exacerbate cervical spondylosis (Galbusera, 2022).

Spondylotic changes are frequently found in many asymptomatic adults, resulting in stenosis of the spinal canal, lateral recess, and foramina. Radiculopathy is a result of intervertebral foramina narrowing. Spinal canal stenosis can lead to spinal cord

compression, ultimately resulting in cervical spondylosis myelopathy (Petro and Rejaei, 2020).

According to the study, the patient with cervical spondylosis had neck pain and stiffness throughout the day, especially in the morning, as the day progressed, evening, and go to sleep (Ved, Bhasme, and Malvade, 2022). In additionally, patients with cervical spondylosis have more intense pain throughout the day, especially in the evening, as a result of worsening after everyday activities (Trivedi, and Yoon, 2022).

Headaches, arm and neck stiffness, numbness, weakness, and burning in the arms and neck are common symptoms of cervical spondylosis (CS) (Negi et al., 2022). Patients with cervical spondylosis frequently suffer from persistent neck pain and restricted movement, which impacts their ability to bend their neck forward and backward, turn their neck to the right and left, and rise from lying or sitting positions (Ved et al., 2022; Chu, and Lee, 2022).

Cervical spondylosis is more likely among workers who repeatedly shift cervical spine posture. Housewives and instructors/teacher are more likely to have cervical spondylosis, according to a Banaras Hindu University study in Varanasi. This is because cleaning, cooking, and mopping, and desk activities like lesson planning, require regular neck bending (Alare, Omoniyo, and Adekanle, 2021).

Spondylosis is an age-related degenerative condition of the spine, characterized by changes such as disc dehydration, facet joint arthritis, osteophyte (bone spur) formation, and thickening of the ligamentum flavum. These structural changes can lead to narrowing of the spinal canal, particularly in the cervical and lumbar regions, causing symptoms like neck or back pain. In more advanced cases, individuals may experience neuropathic symptoms, including tingling, numbness, or burning sensations in the limbs (Santamaria et al., 2022).

Spondylosis, such as cervical spondylosis, may manifest with either localized symptoms or pain that radiates to other areas. Typical signs linked to a herniated disc include ongoing dull discomfort, restricted movement, and a sense of instability. If bulging discs or bone spurs compress spinal nerves, the symptoms can extend to areas like the

shoulders and arms. Degeneration of the cervical spine can cause pain, numbness, tingling sensations, and in severe cases, paralysis in these regions (Theodore, 2020).

Compression of the spinal cord and nerve roots in cervical spondylosis may result in a wide range of neurological symptoms, including radiculopathy and myelopathy (Liang et al., 2022). Cervical spondylotic myelopathy (CSM) is an age-related degenerative condition that results in motor and sensory dysfunction due to anterior spinal cord compression from disc herniation, osteophyte formation, or ligament thickening. Common symptoms include neck and arm pain, tingling, numbness, weakness, and coordination issues. In severe cases, especially among elderly individuals with comorbidities, CSM may cause dysphagia and dyspnea (Cant et al., 2024).

Hypertrophy and ossification of the ligamentum flavum further narrow the spinal canal, intensifying neural compression (Anderson & Albert, 2024). Many asymptomatic individuals show spondylotic changes on imaging. However, cervical spondylosis can cause stenosis of the spinal canal, lateral recess, and foramina, leading to clinical symptoms such as neck discomfort (Ruan et al., 2023). This type of neck pain is often accompanied by symptoms such as neck stiffness, headaches, unilateral or bilateral shoulder pain, non-root arm discomfort, vestibular and ocular dysfunction, and anterior chest wall pain (Gong et al., 2021).

Cervical spondylosis affects both males and females, but there are some gender differences in its presentation. A study shows that women are more likely to suffer from cervical spondylosis than men, with the most common age group being 50-60 years, where men are affected earlier around the age of 50 and women around 60 (Negi et al., 2022). In early-stage axial spondyloarthritis, males tend to have more severe degenerative changes in the cervical spine, while females show a higher prevalence of cervical and thoracic spine MRI signs, such as inflammatory-corner-lesions and fat lesions (Lorenzin et al., 2022).

A study at King Fahd Hospital in Dammam, Saudi Arabia, found that cervical spondylosis was more common among women than men, with 7.8% of female patients and 3.3% of male patients referred for physical therapy affected by the condition (Alshami., 2015). Similarly, a large cross-sectional study of 3,859 Chinese adults showed

a higher prevalence in women (16.51%) compared to men (10.49%). The Chinese study also highlighted that menopausal women were more likely to have cervical spondylosis than non-menopausal women, suggesting that hormonal changes may play a role (Lv et al., 2018).

According to a study in Hong Kong, cell phone use is a major contributor to neck pain, accounting for 17.3% to 67.8% of musculoskeletal issues (Alahmari et al., 2020). Poor posture during smartphone use is common, with 95.6% of individuals exhibiting improper alignment (Topcu et al., 2022), and increased usage duration is strongly linked to greater neck pain severity among university students, emphasizing the need for ergonomic interventions (Iqbal et al., 2024). Various factors may contribute to neck discomfort, including trauma, stress, anxiety, poor posture, sports, occupational challenges, and extensive use of computers or mobile devices (Waldman, 2024).

Additionally, a study on cervical spondylosis patients in South Kerala found a male predominance in the 40-49 years age group, with consistent clinical and radiological findings (Shenoy, Leena, and Shenoy, 2020). In addition, that a typical radiographic modifications of cervical spondylosis impact roughly 50 percent of persons over the age of 50 and 75% of those over the age of 60 (Kumar et al., 2022).

The prevalence of cervical spondylosis (CS) varies dependent on age, gender, occupation, and race. CS becomes more common after age 40, with increasing prevalence as age advances: 25% under 40, 50% over 40, and 85% over 60 show signs of disc degeneration. Males are reported to have a 3:2 ratio of developing CS compared to females (Tao et al., 2021; Guvercin et al., 2023).

A study conducted among coolies in Narayangonj City, Bangladesh, revealed that 39.8% of workers were affected by cervical spondylosis. This condition showed strong links to factors such as increasing age, longer work duration, and the heavy loads commonly carried in their occupation (Hossain et al., 2022). Meanwhile, in developed countries like the United Kingdom, neck pain remains a significant public health issue. Data from the Global Burden of Disease Study 2017 reported that the age-adjusted prevalence of neck pain in the UK was 3,551.1 cases per 100,000 people, with an annual incidence rate of 806.6 per 100,000 individuals (Vos et al., 2020).

Furthermore, the analysis showed the largest rise in age-standardized point prevalence estimates between 1990 and 2017 was in the UK, with an increase of 9.1% (6.1%-12.4%) throughout this time (Safiri et al., 2020). CS is a prevalent condition, particularly among older adults, contributing significantly to spinal cord dysfunction. It is characterized by degenerative changes in the cervical spine, with studies indicating that 90% of men over 50 and women over 60 exhibit such changes (Thi et al., 2023).

The condition is often diagnosed through MRI, which reveals spinal cord stenosis and other degenerative features (Thi et al., 2023). Advanced imaging techniques like diffusion tensor imaging (DTI) and diffusion tensor tractography enhance diagnostic accuracy by quantifying the extent of neural compression and aligning with functional assessments such as the mJOA score (Liang et al., 2022). The prevalence of cervical spondylotic myelopathy (CSM) is notably high, estimated at 605 per 1,000,000 in North America (Saunders et al., 2023). Genetic predisposition has also been identified as a contributing factor to CSM (Wang et al., 2024). Treatment typically involves surgical intervention for severe cases, while conservative management may be suitable for milder presentations (Saunders et al., 2023).

Chronic neck pain is a major global health concern, ranking fourth in years lived with disability (YLD) and affecting millions worldwide. In 2019, the global age-standardized YLD rate for neck pain was 267.4 per 100,000, with higher prevalence in regions like North America and Southeast Asia, in Iran notably, reported a significantly higher rate of 8,710.6 per 100,000 (Ahangar-Sirous et al., 2023).

Cervical range of motion exercises are intended to enhance flexibility and mobility in the cervical spine, which can help relieve stiffness and discomfort (Rasmussen-Barr et al., 2023). Cervical isometric strengthening exercises specifically target the neck muscles and have been found to alleviate pain and improve functionality in individuals with cervicogenic headaches (Singh et al., 2024).

Cervical dynamic resistance strengthening exercises focus on building strength through movement, contributing to overall neck stability and helping to prevent injuries (Daly & Ryan, 2024). Furthermore, shoulder range of motion and strengthening exercises complement neck rehabilitation by improving posture and reducing strain on the cervical

spine (Panihar & Joshi, 2023). Stretching programs are crucial for maintaining flexibility and preventing muscle tightness, which can worsen neck pain (Rasmussen-Barr et al., 2023). Finally, general exercise programs that incorporate a variety of physical activities promote overall health and can indirectly assist in managing neck pain (Garzonio et al., 2022).

Exercise therapy, which includes activities like resistance training, endurance workouts, and strengthening exercises, has been shown to help ease pain and improve the range of motion in people dealing with chronic non-specific neck pain-all without causing any harmful side effects. In fact, a recent systematic review highlights how exercise plays a key role in boosting overall function during recovery (Alshahrani et al., 2024). When comparing types of exercises, isometric exercises tend to be more effective than general exercises paired with cervical spine mobilization, offering better results in reducing pain, disability, and increasing range of motion (Hayat et al., 2023). Moreover, focusing on deep neck muscle exercises alongside traditional physiotherapy provides noticeable improvements in pain relief, neck movement, and muscle endurance (Najafi et al., 2024).

Manual therapy, which involves hands-on techniques like manipulation and mobilization, also proves to be a safe and effective approach to lessen pain and enhance neck mobility, making it a solid option for those with chronic neck issues (Shamsi et al., 2024). Combining Muscle Energy Techniques (MET) with Interferential Current Therapy (ICT) works particularly well to reduce pain and muscle tenderness, especially in trigger points around the upper trapezius (Satyaprakash et al., 2024).

Adding myofascial release to regular physiotherapy treatments can significantly decrease pain and increase movement in various directions (Islam et al., 2024). And, of course, conventional physiotherapy methods-including electrotherapy and stretching exercises-continue to be effective in managing pain and improving daily function for people with non-specific neck pain (Gandhi & Upadhyay, 2022)

Advanced physiotherapy techniques such as cervical traction, manual therapy, acupuncture, and laser therapy have proven effective in reducing pain and enhancing cervical range of motion in patients with cervical spondylosis (Kachhadiya et al., 2023).

Other physiotherapy methods for cervical spondylosis include cryotherapy, transcutaneous electrical nerve stimulation (TENS), exercise programs, task-specific training, and the use of stabilometric platforms, all of which contribute to better range of motion and muscle strength, as demonstrated in a recent case study (Sawalkar, Athawale, & Fating, 2024). Various physiotherapy techniques, including McKenzie therapy and regional approaches, have shown significant improvements in pain and range of motion (Outcome Evaluation of Physiotherapy & Drug Management for Chronic Cervical Radiculopathy, 2023; Siddique et al., 2023).

Additionally, manual Mulligan traction, when used alongside conventional physiotherapy, has been found effective in reducing pain and enhancing cervical range of motion in patients with cervical spondylosis (Arul et at., 2019).

A study comparing Mulligan natural apophyseal glides (NAGs) to Grade I and II Maitland mobilization for nonspecific neck pain found that NAGs resulted in greater improvements in Numeric Pain Rating Scale (NPRS) and Neck Disability Index (NDI) scores than Maitland mobilization, suggesting that NAGs effectively reduce pain and enhances function in these patients (Hussain et al., 2016).

The patient was seated, and the cradle head and neck were kept straight. The therapist’s hands placed the third and fourth fingers on the occiput, while the little finger was positioned on the spinous process. The thenar eminence applied pressure, creating a gentle force. Mulligan mobilization NAGs were performed at 2-3 hertz (for fewer than 6 repetitions) in 3 sets. The treatment was given 4 sessions per week for 4 weeks. A physiotherapist with 2-3 years of clinical experience or additional training or knowledge about the Mulligan’s NAGs mobilization technique applied the treatment (Hussain et al., 2016). The duration of treatment was 4 weeks for both groups: the control group (A) received conventional treatment, while the experimental group (B) received conventional treatment plus the Mulligan’s NAGs mobilization technique.

Furthermore, a study comparing Mulligan mobilization with Maitland mobilization in cervical radiculopathy concluded that Mulligan techniques were more effective in reducing pain and restoring normal range of motion in patients (Niaz et al., 2022).

Therefore, incorporating Mulligan's NAGs mobilization technique alongside conventional physiotherapy can be beneficial for cervical spondylosis patients, offering pain relief and improved functional outcomes. As a result, researchers should continue to focus on determining the best therapeutic techniques for people with neck discomfort (Silva et al.,2019). Patients with mechanical neck discomfort often get physical therapy as their first course of treatment; these patients make up about 25% of all physical therapy appointments. The treatment of choice for neck discomfort is often manual therapy (Arjona Retamal et al., 2021).

Physiotherapy and pain medication are common nonoperative management options for chronic neck pain like cervical radiculopathy, with this study comparing specialized physiotherapy approaches to pain medication efficacy (Siddique et at., 2023). Management of chronic neck pain varies based on causative conditions. Pharmacological treatment includes NSAIDs, muscle relaxants for nociceptive pain, and tricyclic antidepressants, pregabalin for neuropathic pain. Physiotherapy complements treatment (Anna, Pilipovich., 2022).

Chapter- iii Methodology

This thesis was designed to evaluate the efficacy of Mulligan's NAGs mobilization combined with conventional therapy in patients with cervical spondylosis. To identify the effectiveness of this treatment regimen, various measurement tools were employed, including the VAS scale for pain assessment, a goniometer for measuring range of motion, manual muscle testing for evaluating muscle strength, and the neck disability index to assess the functional disability.

3.1 Study Design

The study was a quantitative evaluation of experimental research design. Kumar, Sandhu, and Broota, (2011) started that traditional experimental research found out the causal relationship between independent and dependent variables and infer the findings for generalization. In fact, the study was an experiment between different subject designs. Mulligan's NAGs mobilization combined with conventional physiotherapy techniques applied to the treatment group and only usual physiotherapy techniques applied to the control group. A pre-test (before intervention) and post-test (after intervention) was administered with each subject of both groups to compare the effects on pain, range of motion, muscle strength and neck disability.

3.2 Study site

At the Department of Physiotherapy, Outdoor Musculoskeletal Unit, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka-1343.

3.3 Study Population

The study population will be the patients diagnosed as cervical spondylosis attend in the musculoskeletal outpatient unit of physiotherapy department at CRP, Savar, Dhaka-1343.

3.4 Sample Size

The sample size for this thesis was 30. These participants divided into two groups. Among them, 15 participants were in the control group and 15 participants were in the experimental group.

3.5 Sampling Technique

Simple Random sampling technique was used for group allocation of this study.

Subjects, who met the inclusion criteria, were taken as sample in this study. 30 patients were conveniently selected from population. Group allocations were conducted by using computer generated random number in the process of simple random sampling technique as it improves internal validity of experimental research. For this process 15 patients were randomly assigned to Experimental group comprising of treatment approaches of cervicothoracic stabilization exercise along with conventional physiotherapy and 15 patients only conventional physiotherapy for this study. So, the divided number of experimental groups were **Control Group:** 1, 17, 25, 8, 26, 15, 7, 21, 10, 22, 27, 2, 11, 18, 19; **Excremental Group:** 5, 24, 16, 4, 3, 14, 30, 9, 6, 23, 13, 20, 12, 29, 28

3.6 Inclusion Criteria

- **Age Range Between 40 to 60 Years:** This age range was selected because most individuals begin to show spondylotic changes of the cervical spine within this period of life (Kuo and Tadi, 2023).
- **Both males and females were included:** Cervical spondylosis affects both men and women, but women are more commonly affected than male (Negi et al., 2022).
- **Chronic Neck Pain:** Patients suffering from neck pain for at least 3 months were included, as chronic neck pain is defined by suffering from neck pain for this duration (Multanen et al., 2021).
- **Radiculopathy pain:** Radicular or non-radicular neck pain without acute cervical nerve root compression (Sadeghi et al., 2022).

3.7 Exclusion Criteria

- Age Below 40 Years and Above 60 Years
- These include active infection, inflammation, congenital spinal malformations, or inflammatory arthritis such as ankylosing spondylitis (AS). Traumatic injury like cervical fracture, whiplash injury, instability, subluxation, or spondylolisthesis should be excluded. Neurological signs such as myelopathy, thoracic outlet syndrome, presence of a cervical rib, cervicogenic headaches, or vertigo also serve as red flags (Sadeghi et al., 2022).
- Other contraindications include radiating pain to the shoulders or upper limbs and a history of prior cervical or upper thoracic spine surgery (Rehab et al., 2021).

3.8 Data Processing

3.8.1. Technique of data collection

During the initial session, a history, subjective and objective examination and thorough orthopedic examination will be performed. On 0th day cervical range of motion will be measured using universal goniometer. Disability will be assessed by using Neck disability index and pain on Visual Analogue Scale**.** Muscal strength will be measured by using OXFORD muscle grade scale.

3.8.2 Data Collection Procedure

The study procedure was conducted by taking face to face interview. After taking the interview of the patient at department, the patients were assessed by a graduate qualified physiotherapist.

Data was gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form. Pre-test was performed before beginning the treatment and the intensity of pain was noted with VAS scale and NDI questionnaire form. The same procedure was performed to take post-test at the end of 16 sessions of treatment. The assessment form was provided to each subject before starting treatment and after 16 sessions of treatment patient was instructed to put mark on the line of VAS

according to their intensity of pain. The data were collected from both in experimental and control group in front of a graduate qualified physiotherapist and verified by a witness selected by the Head of clinical setting in order to reduce the biasness. At the end of the study, for statistical analysis different tests were carried out to perform statistical analysis.

3.8.3 Outcome measurement Tools

- 10 cm Visual Analogue Scale for measuring pain intensity in resting position.
- Universal Goniometer to measure range of motion in cervical spine.
- Manual muscle testing technique by using OXFORD muscle grade scale to assess the muscle strength of cervical spine.
- 50 points Neck disability scale to measure the disability status among patients with cervical Spondylosis.

Instruments and tools

Data collection tools were data collection form, informed consent form, structured questionnaire, papers, pen and pencil. Universal Goniometer, Towels, IIR, TENS, Neck Disability Index, VAS scale.

3.8.4 Data Analysis

Data was calculated by using descriptive statistics for demographic questionnaire and inferential statistics for group differences through statistical package for social science (SPSS) version 26.

3.8.5 Statistical Test

According to Hicks (2009), experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is nominal or scale and should be analyzed with unrelated t test. Between groups pain, range of motion, was analyzed by unrelated t -test and muscle strength and neck disability were analyzed by Mann-Whitney U-test. The within group analysis of muscle strength and neck

disability was done by Wilcoxon signed rank test and pain, range of motion was analyzed by related t-test.

3.8.6 Level of Significance

In order to find out the significance of the study, the “p” value was calculated. The “p” values refer to the probability of the results for experimental study. The word probability refers to the accuracy of the findings. A “p” value is called level of significance for an experiment and a “p” value of <0.05 was accepted as significant result for health service research. If the “p” value is equal or smaller than the significant level, the results are said to be significant.

Experimental Group

Experimental Group was given Mulligan’s NAGs mobilization along with conventional physiotherapy. Conventional physiotherapy was common treatment protocol for both groups. But Mulligan’s NAGs mobilization was given along with conventional physiotherapy given by single qualified physiotherapist who is experienced in Mulligan’s NAGs mobilization technique.

3.9 Ethical consideration

The proposal of the dissertation including methodology was approved by Institutional Review Board and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guidelines and World Health Organization (WHO) Research guidelines. Again, before the beginning of the data collection, the researcher obtained the permission ensuring the safety of the participants from the concerned authorities of the clinical setting and was allotted with a witness from the authority for the verification of the collected data. The researcher strictly maintained the confidentiality regarding participant’s condition and treatments.

3.10 Informed Consent

The researcher obtained informed consent from all subjects participating in the study, with each participant signing an informed consent form. They were informed of their right to consult an external doctor if they felt that the treatment was insufficient or if their condition worsened. Participants were also made aware that they could choose not to answer any questions during the study and could withdraw their consent and discontinue participation at any time without it impacting their treatment in the physiotherapy department. They would continue to receive the same level of care. Additionally, each subject had the opportunity to discuss any concerns with senior authority or administration at the CRP and have their questions answered to their satisfaction.

Chapter- iv	Result

Table -1: Comparison of baseline characteristic of participations

Variable(s)	Experimental group (n=15)	Control group(n=15)	p
Age, mean (SD), years	50.06 ± 9.4	48.87 ± 8.1	0.71
Gender	Male 9; 60% Female:6; 40%	Male 9; 60% Female:6; 40%	
Duration of pain (month), SD	14.53 ± 17.32	10.06 ± 9.45	0.287
Weight (kg), mean (SD)	62.13 ± 6.87	64.47 ± 9.8	0.354
Height (cm), mean (SD)	164 ± 04	163±14	0.73
BMI (kg/m2), SD	23.29 ± 2.1	23.51± 3.28	0.027
NDI mean (SD), Pretest	32.80 ± 9.5	30.86 ±7.8	0.308

Table 1 compares the baseline characteristics of participants between experimental and control group. In addition, two groups did not show significant differences at baseline regarding demographic characteristics and disease-related parameters. In experimental group, the mean age (± SD) of the participants was 50.06 (± 9.4) years and in control group 48.87 ± 8.1 years. In experimental group the mean ratio of male was 60 % and female ratio was 40% and in control group the man ratio was 60% and female was 40%. In addition, mean weight (± SD) in experimental group was 62.13 ± 6.87 kg and 64.47 ± 9.8 kg. Mean height (± SD) was 164 ± 04 cm in experimental group and in contrast 163±14 in control group participants. Mean (± SD) BMI in experimental group was 31.93 ± 10 and in contrast mean (± SD) in control was 30.86 ±7.8 and Mean NDI in experimental group was 32.80 ± 9.5 and in contrast mean (± SD) in control was 30.86 ±7.8.

4.0 Sociodemographic information

4.1: Gender distribution of participants

Among 30 participants, men were 18 and female were 12   In control group (male 9 and female 6), in experimental group (male 9 and female 6).

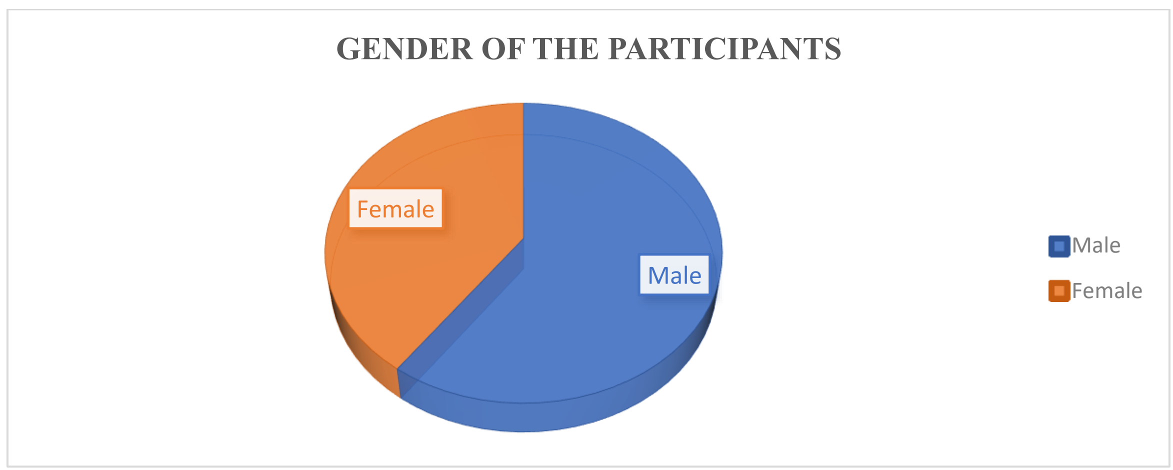


Figure-1: Gender of the participants

4.2. Cross tabulation between sex and category of participants

Table 2: Cross tabulation between sex and category of participants

		Category of	**Participants**
		Experimental group	Control group
Sex of the participants	Male	60%	60%
	Female	40%	40%
Total			

Table -2: Cross tabulation between sex and category of participants

Table 2 showed cross tabulation between sex and category of participants (Percentages) and found that among all participants, there was equal number, Among the 30 participants, 60% were men (18 participants), and 40% were women (12 participants). In both the control and experimental groups, the gender distribution was identical, with each group comprising 9 men (60%) and 6 women (40%).

4.3 Occupation of the participants

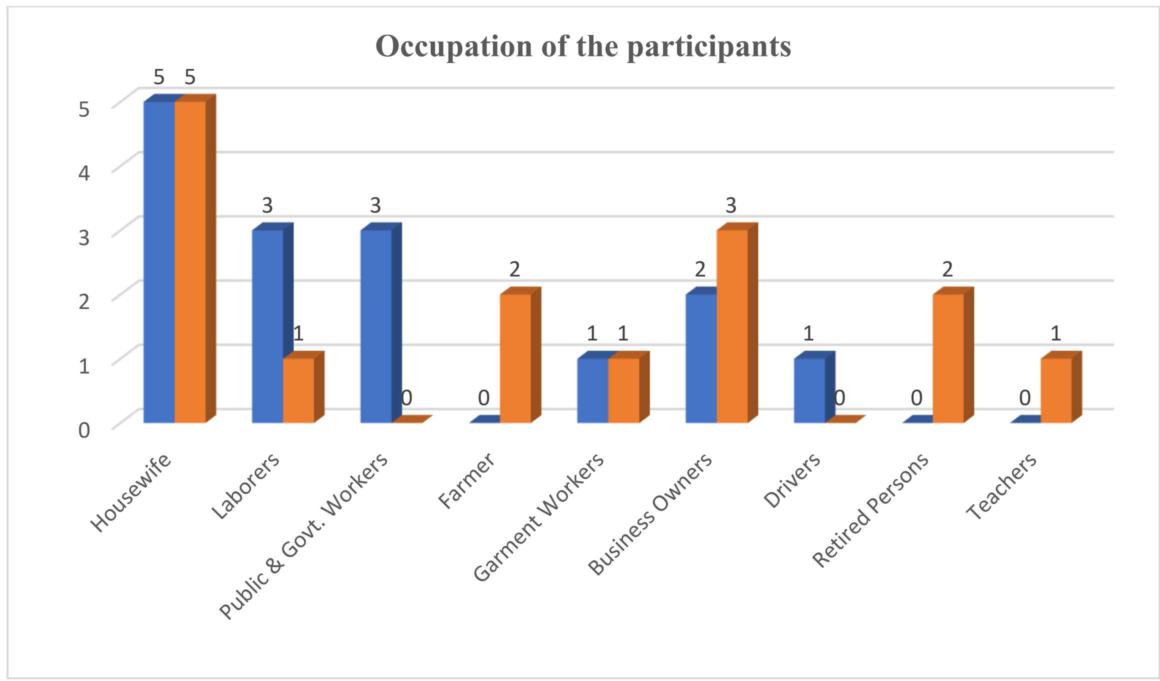
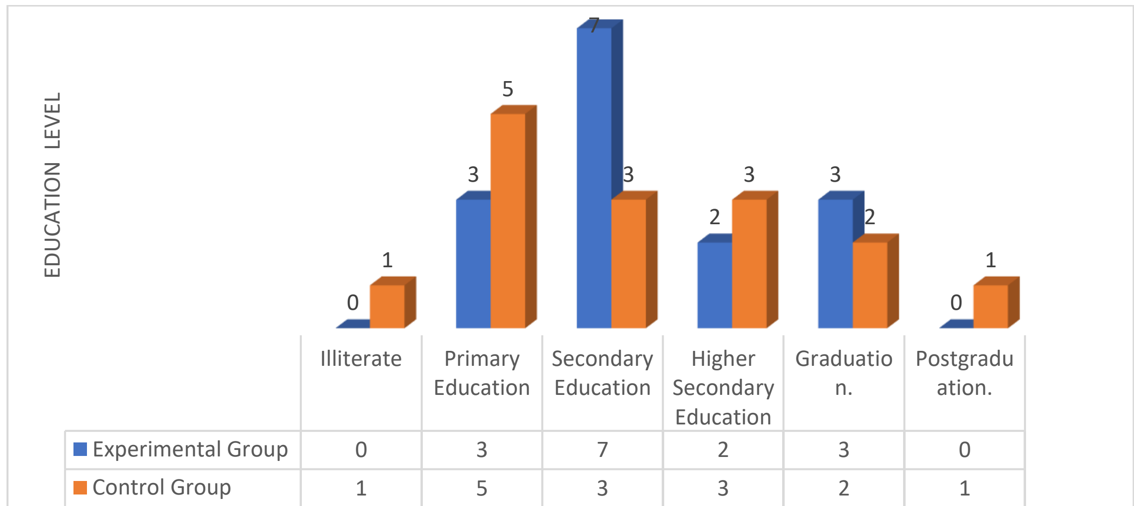


Figure-2: Occupation of the participants

Among 30 participants, "Occupation of the Participants, 10 (5 in control and 5 in experimental) was housewife, 5 (3 in control and 2 in experimental) Business owners. Laborers were more common in (1in control and 3 in the experimental). 3 (0 in control and 2 in the experimental) Public and government workers. 2 (1 in control and 1 in the experimental) were Govt. Workers. 2 (2 in control and 0 in the experimental) were retired persons and 2 (2 in control and 0 in the experimental) were farmers. And 2 (1 in control and 0 in the experimental) was teacher and 1 (0 in control and 1 in the experimental) was diver.

4.4 Education level of the participants

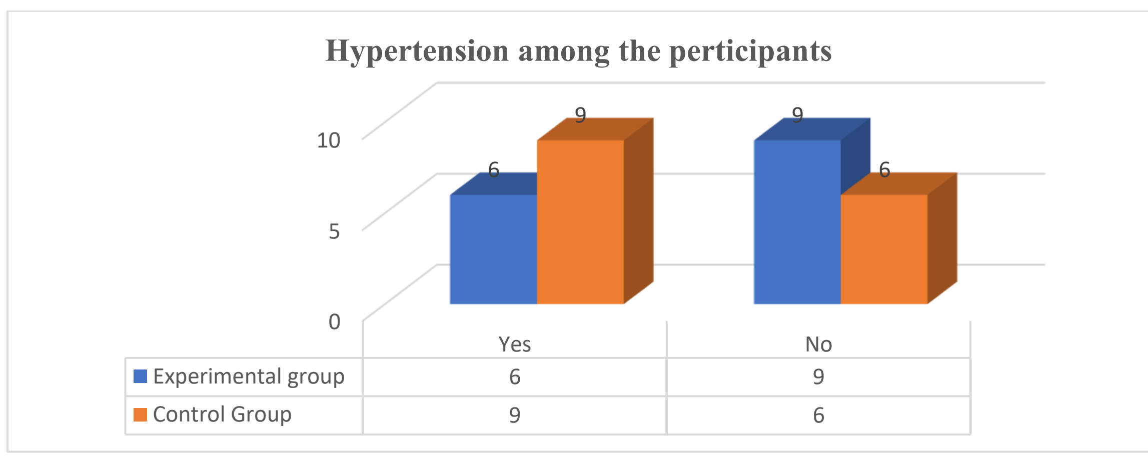


	Illiterate	Primary Education	Secondary Education	Higher Secondary Education	Graduation.	Postgraduation.
Experimental Group	0	3	7	2	3	0
Control Group	1	5	3	3	2	1

Figure-3: Education level of the participants

Among 30 participants, the education level distribution was as follows: 1 (1 in control and 0 in experimental) participant was illiterate. Primary education was completed by 8 participants (5 in control and 3 in experimental). Secondary education was the most common level, with 10 participants (3 in control and 7 in experimental). Higher secondary education was achieved by 5 participants (3 in control and 2 in experimental). Graduation was completed by 5 participants (2 in control and 3 in experimental), and 1 participant in the control group had postgraduate education.

4.5 Hypertension (HTN) of the participants



	Yes	No
Experimental group	6	9
Control Group	9	6

Figure - 4: Hypertension (HTN) of the participants

Among n=15 participants of experimental group, n=6 had suffering hypertension and 9 had been not suffering hypertension. In control group, among 15 of the participants, 9 had been suffering from hypertension and 6 had not suffering from HTP.

4.6 Diabetes Mellitus (DM) among participants

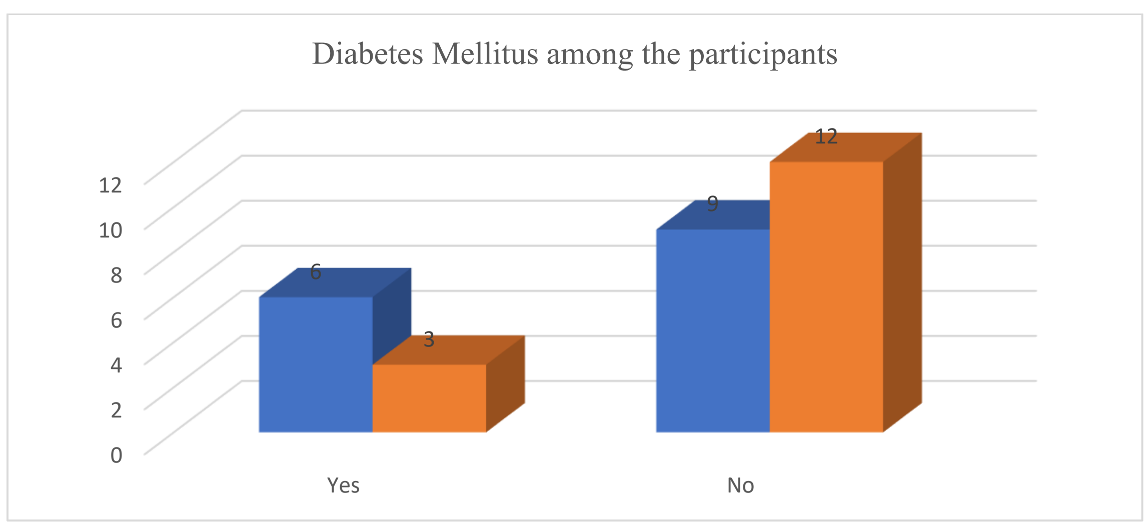


Figure-5: Diabetes Mellitus (DM) among participants

Among n=15 participants of experimental group, n=6 had suffering DM and 9 had been not suffering hypertension. In control group, among 15 of the participants, 3 had been suffering from DM and 12 had not suffering from DM.

4.7 BMI of the participants

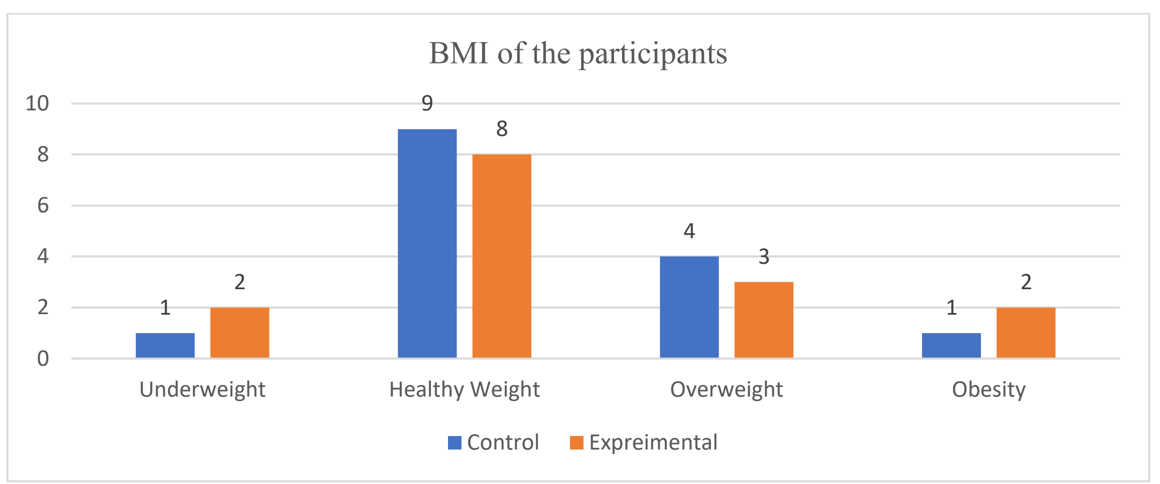


Figure-6: BMI of the participants

The figure 6 showed, among the participations, in expremental group, underweight 2, healthy weight 8, over weight 3 and obisity 2 . on the other hand in control group underweight 2, healthy weight 9, over weight 4 and obisity 2 .

4.7 Causes of pain among category of participants

Table 3: Cross tabulation between causes and category of participants

	Category of	Participants	Total
	Excremental	Control	
Due to Trauma	4	1	5
Due to lifting heavy weight	2	3	5
Due to bad working posture	4	5	9
Due to Degenerative change	4	6	10
Others	1	0	1
Total	**15**	**15**	**30**

Table-3: Causes of pain among category of participants

Among 30 participants, 10 were affected by cervical spondylitis due to degenerative changes, (with 6 in control group and 4 in experimental group). A history of poor working posture was noted in 9 participants, (5 in the control group and 4 in the experimental). 5 participants (3 control and 2 experimental) reported complaints related to lifting heavy weights. Additionally, 5 participants (1 control and 4 experimental) attributed their condition to traumatic injuries. There was 1 case attributed to other complications.

4.8 Sever affected side of neck pain of the participant

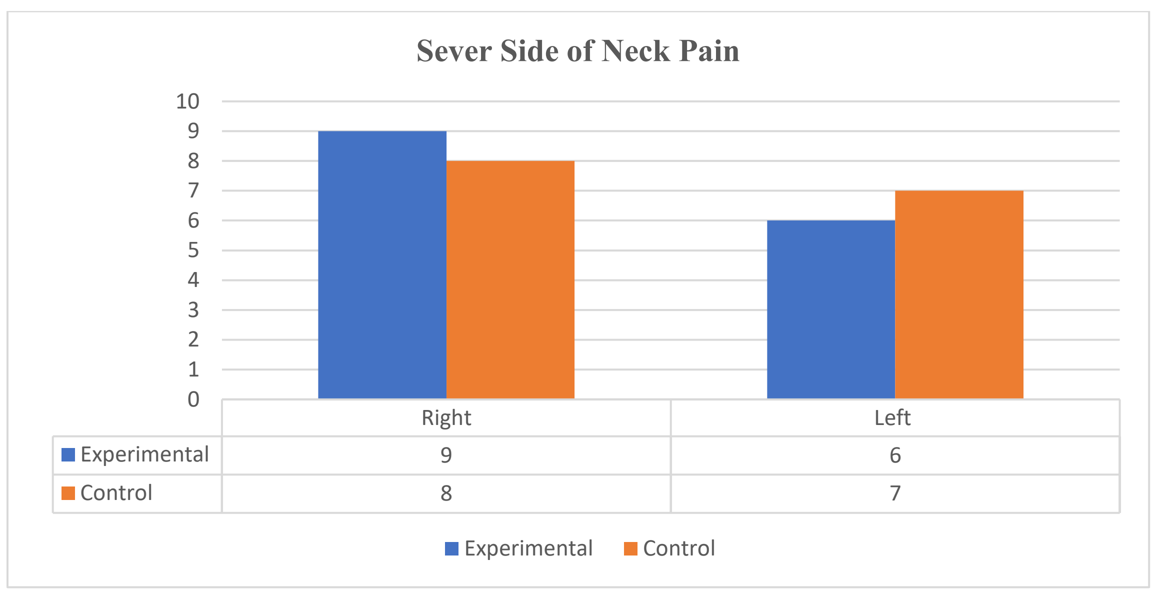


Figure-7: Sever affected side of neck pain

Among 30 participants, 17 (8 in control and 9 in experimental group) had been suffering severe pain in right side rather than left side on the other hand 13 (7 in control and 7 in experimental group) had been suffering in left side rather than right side of neck pain.

4.9 Pain radiates to the shoulder

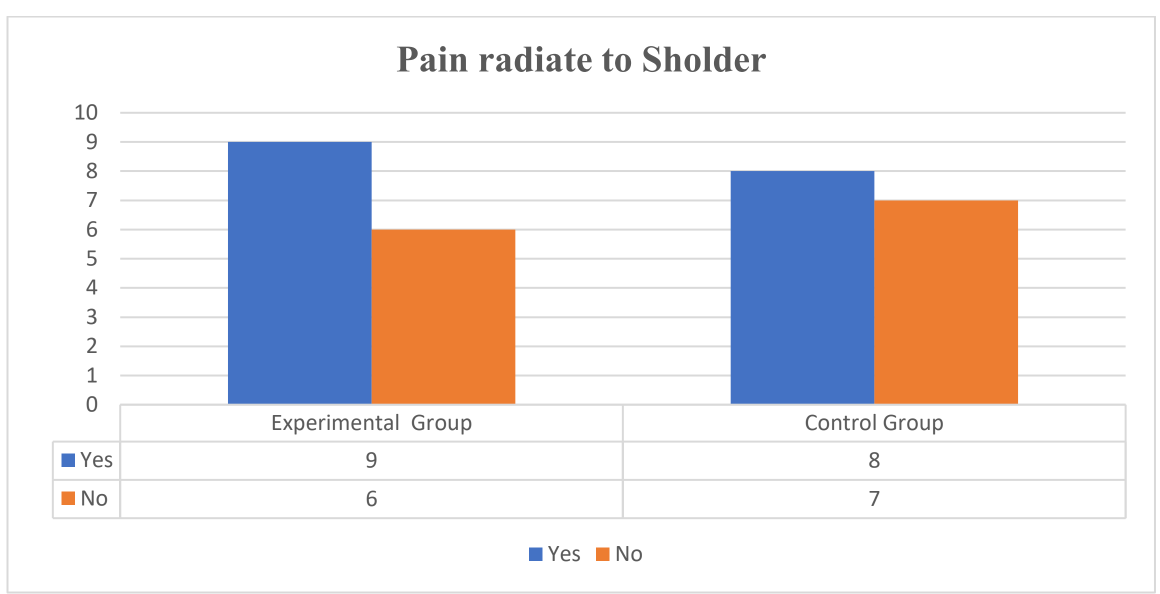


Figure- 8: Pain radiates to the shoulder

Among 30 participants, 17 (9 in experimental group and 8 in control group) the pain radiates to shoulder, and 13 (6 in experimental group and 7 in control group) did not radiates pain to shoulder.

4.10 Pain the most commonly (side) spread below the Neck

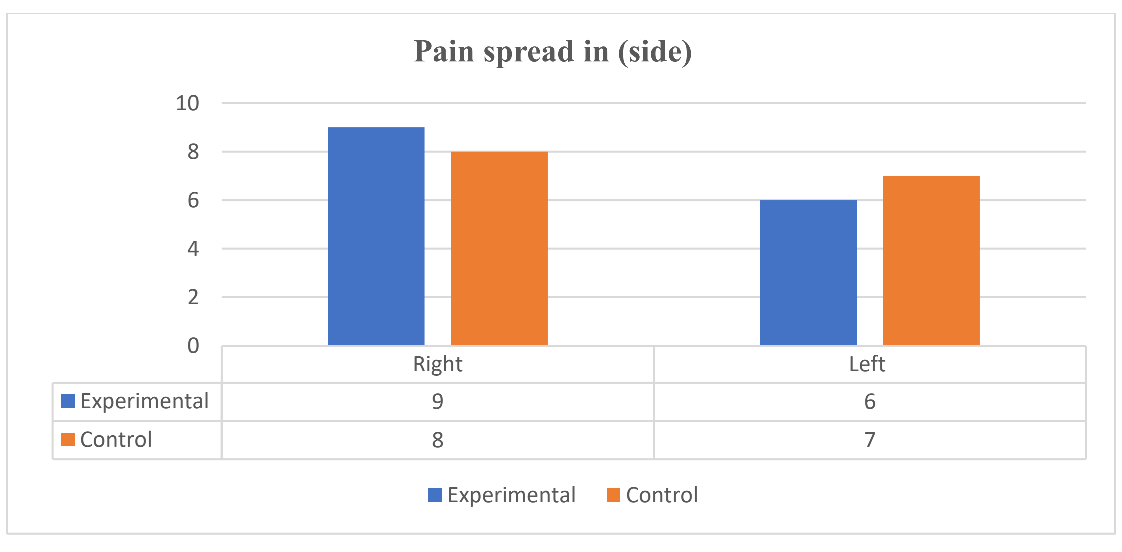


Figure-9: Pain the most commonly (side) spread below the Neck

Among 30 participants, 17 (9 in experimental and 8 in control) pain spread the most (side) in right side. And 13 (6 in experimental and 7 in control) pain spread the most (side) in left side.

4.11 Cross tabulation between dominant side of pain between neck and shoulder within experimental and control group

		Category of Participants		Total
		Experimental	Control	
Dominant pain area between neck and shoulder	Neck pain is more than shoulder girdle	6	9	15
	Shoulder girdle is more than neck	8	5	13
	Neck pain and shoulder girdle pain are equal	1	1	2
Total		**15**	**15**	**30**

Table 4: Cross tabulation between dominant side of pain between neck and shoulder within experimental and control group

Among the 30 participants, 15 (9 in control and 6 in experimental) participants complained neck pain is more than shoulder girdle, 13 (8 in control and 5 in experimental) complained shoulder girdle is more than neck and 2 (1 in control and 1 in experimental) complained neck pain and shoulder girdle pain are equal.

4.12 Cross tabulation between dominant side of increasing pain between neck and shoulder within experimental and control group

		Category of	Participants	Total
		Excremental	Control	
	Neck forward bending	10	7	17
	Neck backward bending	3	0	0
	Neck turning to right	1	5	6
	Neck turning to left	0	2	2
	Raising from lying	1	1	2
	Raising from sitting	0	0	0
Total		15	15	30

Table 5: Cross tabulation between dominant side of increasing pain between neck and shoulder within experimental and control group

Among the 30 participants, 17 (7 in control and 10 in experimental) participants complained Neck forward bending, 6 (5 in control and 1 in experimental) complained Neck turning to right and 3 (3 in control and 0 in experimental) complained Neck backward bending and 2 (2 in control and 0 in experimental) complained Neck turning to left and (1 in control and 1 in experimental) Raising from lying and there was on complained in Raising from sitting direction

4.13 Cross tabulation between dominant side of increasing pain between neck and shoulder within experimental and control group

	Category of	Participants	Total
	Experimental	Control	
Neck forward bending	3	0	3
Neck backward bending	10	7	17
Neck turning to right	2	1	3
Neck turning to left	0	6	6
Raising from lying	0	0	0
Raising from sitting	0	1	1
Total	**15**	**15**	**30**

Table 6: Cross tabulation between dominant side of increasing pain between neck and shoulder within experimental and control group

Among the 30 participants, 17 (7 in control and 10 in experimental) participants complained Neck backward bending, 6 (6 in control and 0 in experimental) complained Neck turning to left and 3 (0 in control and 3 in experimental) complained Neck forward bending and 3 (2 in control and 1 in experimental) complained Neck turning to right and (1 in control and 0 in experimental) Raising from sitting and there was on complained in Raising from lying direction.

4.14 Cross tabulation the perform involving neck between Experimental and control group

		Category of Participants		Total
		Experimental	Control	
Perform involving neck pain	Highly repetitive work	7	5	12
	Forceful exertions	0	5	5
	High level of static contractions	3	0	3
	Prolonged static loads	4	3	7
	Extreme postures / awkward posture	1	2	3
Total		**15**	**15**	**30**

Table: 7 Cross tabulation the perform involving neck between experimental and control group

Among 30 participants, 12, (5 in control group and 7 in experimental group) Highly repetitive work, 7 (3 in control and 4 in experimental) complained Prolonged static loads and 5 (5 in control and 0 in experimental) complained Forceful exertions and 3 (0 in control and 3 in experimental) complained High level of static contractions and 3 (2 in control and 1 in experimental) Extreme postures / awkward posture which involving neck pain.

4.15 Time of worse pain

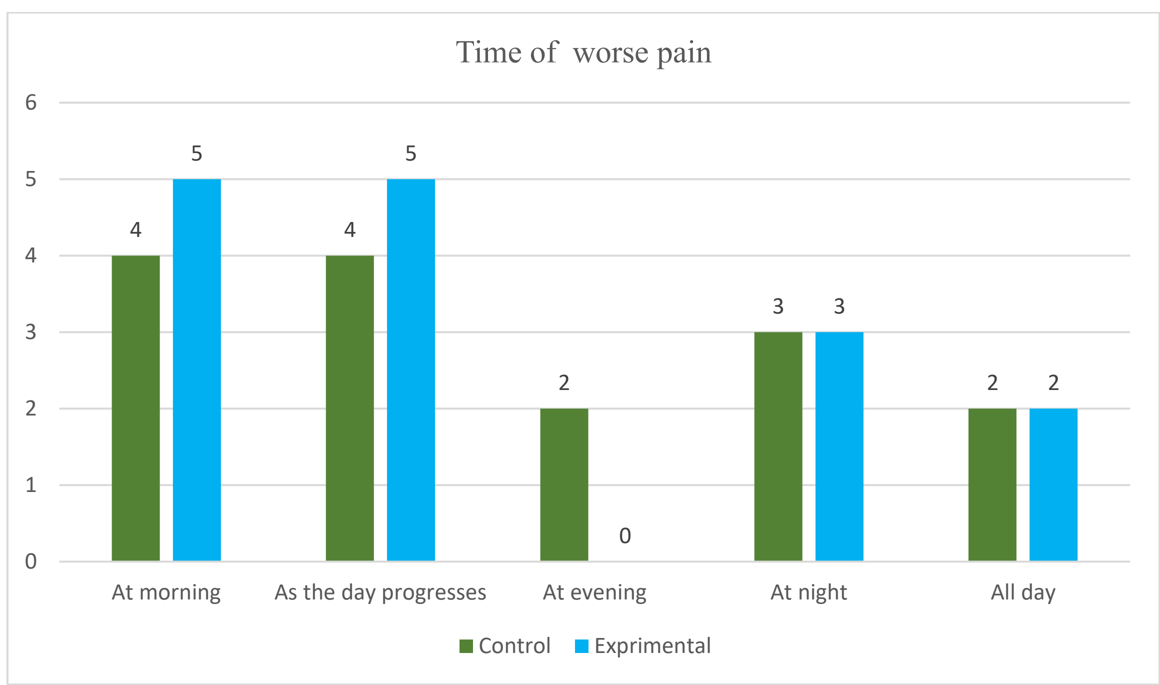


Figure 10: Time of worse pain

Figure 10 showed that in experimental group, among the 15 participations (n=5) had worse pain at morning, (n=5) had no one as the day progress, (n=0) at evening, (n=3) at night and (2) had worse pain all the day. Beside among the 15 participations (n=4) had worse pain at morning, (n=4) had as the day progress, (n=2) at evening, (n=3) at night and (n=2) had worse pain all the day.

4.16 Association between patient's rated pain (cm) and BMI, diabetes mellitus and hypertension

Variable 1	Variable 2	p value	Comments
	BMI	0.215	No significant association
Patient rated general pain (cm)	Diabetes mellitus	0.477	No significant association
	Hypertension	0.264	No significant association

Table 8: showed that there was no statistically significant association between patient rated general pretest pain (cm) and BMI (p=0.215), diabetes mellitus (p=0.477) and hypertension (0.264).

4.17 Pretest and posttest score of patients rated pain (cm) in general

Table 9: Comparison of pretest and posttest patient rated pain in experimental and control group

	Control				**Experimental**		
	Pre test				Post test		
	Pretest	**Post test**	**Difference**		**Pretest**	**Post test**	**Difference**
C1	7.80	2.00	5.8	**E1**	5.00	1.50	3
C2	4.00	1.00	3.0	**E2**	7.00	1.80	6
C3	7.00	1.00	6.0	**E3**	7.00	2.30	5.7
C4	5.70	1.00	4.7	**E4**	9.00	1.00	8.0
C5	6.30	2.00	4.3	**E5**	6.00	1.20	4.8
C6	6.30	1.60	4.7	**E6**	7.80	0.00	7.8
C7	8.40	1.80	6.6	**E7**	6.00	1.20	4.8
C8	6.00	2.50	3.5	**E8**	7.80	0.00	7.8
C9	6.80	1.20	5.6	**E9**	6.00	1.30	4.7
C10	7.50	2.80	4.7	**E10**	9.00	1.00	8.0
C11	6.40	2.20	4.2	**E11**	5.40	1.60	3.8
C12	7.80	1.00	6.8	**E12**	7.80	1.50	6.3
C13	7.20	3.60	3.6	**E13**	7.20	1.00	6.2
C14	6.70	3.00	3.7	**E14**	5.80	0.00	5.8
C15	5.50	3.00	2.5	**E15**	4.60	0.00	4.6
Total =15				**Total= 15**			

4.18 Visual analog scale (VAS) within control and experimental group

Table 10: Visual analog scale (VAS) of the participants within experimental and control group

	Experimental	Group	**Control**	Group
Variable	t	**Sig. (2-tailed)**	t	**Sig. (2-tailed)**
Visual analog scale (VAS)	14.35	0.000***	13.89	0.000***

The paired t test for experimental group provides t value = 14.35 with p value = 0.000 (Table -10). Therefore, the test is highly significant at any reasonable level of significant. Hence, we have very strong evidence to conclude that the difference in before-after values is considered statistically significant.

One the other hand, the paired t test for experimental group provides t value = 13.89 with p value = 0.000 (Table -10). Therefore, the test is highly significant at any reasonable level of significant. Hence, we have very strong evidence to conclude that the difference in before-after values is considered statistically significant.

4.19 Visual analog scale (VAS) between experimental and control group

Table 11: Visual analog scale (VAS) of the participants between experimental and control group

Variables	Unpaired t	df	Sig. (2-tailed)
Visual analog scale (VAS)	3.3	28	0.003***

We note that we have violated the homogeneity assumption of variances. The observed t value (t=3.3) has a p value of 0.003 which is less than 0.05 with degree of freedom 28 (Table 9). Therefore, the test is significant at 5% level of significance. Therefore, the test is significant at 5% level of significant. Hence, we concluded that there is significant difference in the efficacy of these two treatments in case of pain.

4.20 Cervical Spine Range of Motions (degree) in Pretest and Posttest Score of Experimental and Control Group

Table 12: Cervical spine range of motions (ROM) (degree) at pretest and posttest level with mean difference

	Experimental Group			**Control** Group		
Movement	**Pretest**	**Post test**	**Difference**	**Pretest**	**Posttest**	**Difference**
Flexion, mean (degree)	31.60	54.33	22.73	32.87	47.47	14.60
Extension, mean (degree)	34.53	63.47	28.94	36.60	52.4	15.80
Right Side flexion, mean (degree)	28.8	42.27	13.47	27.07	39.33	12.26
Left Side flexion, mean (degree)	27.2	42.67	15.47	28.60	39.53	10.93
Right Rotation, mean (degree)	36.53	62.07	25.54	38.26	50.27	12.01
Left Rotation, mean (degree)	37.53	65.07	27.54	40.00	52.73	12.73

Table 12 showed mean differences of cervical range of motion (degree) between experimental and control group. In addition, each type of movements showed small amount mean difference in experimental group compared with control group.

4.21 Flexion of cervical spine between control and experimental group

Table 13: Statistical outcome of flexion (degree) between control and experimental group

	Unpaired t	**df**	**P**	**95% Confidence Interval**	
				Lower	**Upper**
Difference between control and experimental group in flexion (degree)	-3.67	28	0.001**	-10.28	-2.92

The table describe the t-value is (-3.67) for (df)= 28 and the calculated *t* = (-3.67) is larger than value is -14.87, that has an associated probability level of 0.1%. This means that the probability of random error being responsible for the outcome of this experiment was 0.1 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.5% and it could be said that the result was statistically significant.

This means that difference between experimental group treatment (Mulligan's NAGs along with conventional physiotherapy) and control group treatment (conventional physiotherapy) was significant i. e. improvement occur in the experimental group were more than control group. They differ significantly as experimental group improvement was more than control group.

4.22 Flexion of cervical spine within control and Experimental group

Table 14: Statistical outcome of flexion (degree) within control and Experimental group

	Mean	**Std. Deviation**	**95% Confidence Interval**		**Paired t- test**	**df**	**p**
			Lower	**Upper**			
Flexion (degree) of cervical spine (control group)	-14.87	7.68	-19.12	-10.61	-7.5	14	0.000
Flexion (degree) of cervical spine (Experimental group)	-22.73	7.89	-27.11	-18.37	-11.15	14	0.000

Table 14: showed that within group analysis of cervical flexion (degree), the improvement of ROM was highly significant and in fact in control group (p= 0.000) and Experimental group (p= 0.000).

4.23 Extension of cervical spine within control and Experimental group

Table 15: Statistical outcome of extension (degree) within control and Experimental group

	Unpaired t-test	df	P	95% Confidence	Interval
				Lower	Upper
Difference between control and Experimental group in extension (degree)	-5.17	28	0.00**	-15.03	-7.10

The t-value is -5.17 with (df)= 28 and a p-value of 0.00, the t value is smaller than the p-value (0.00) and less than (-15.8) that has an associated probability level of 0.71%. This means that the probability of random error being responsible for the outcome of this experiment was 0.00 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.5% and it could be said that the result was statistically.

This means that difference between experimental group treatment (Mulligan's NAGs along with conventional physiotherapy) and control group treatment (conventional physiotherapy) was significant i. e. improvement occur in the experimental group were more than control group. They differ significantly as experimental group improvement was more than control group.

4.24 Extension of cervical spine within control and Experimental group

Table 16: Statistical outcome of extension (degree) within control and Experimental group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Extension (degree) of cervical spine (control group)	-15.8	7.84	-20.14	-11.45	-7.8	14	0.000
Extension (degree) of cervical spine (Experimental group)	-28.93	8.65	-33.73	-24.14	-12.95	14	0.000

Table 16: showed that within group analysis of cervical extension (degree), the improvement of ROM was highly significant and in fact in control group (p= 0.000) and Experimental group (p= 0.000).

4.25 Right side flexion of cervical spine between control and Experimental group

Table 17: Statistical outcome of right-side flexion (degree) within control and Experimental group

	Unpaired t	df	P	95% Confidence	Interval
				Lower	Upper
Difference between control and Experimental group in Right side flexion (degree)	-3.13	28	0.004***	-4.85	-1.014

The t-value is -3.13 with (df)= 28 and a p-value of 0.004 that t value is smaller than the p-value (0.004) that has an associated probability level of 0.04%. This means that the probability of random error being responsible for the outcome of this experiment was 0.01 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.5% and it could be said that the result was statistically significant.

This means that difference between Experimental group treatment (Mulligan's NAGs along with conventional physiotherapy) and control group treatment (conventional physiotherapy) was significant i. e. improvement occur in the Experimental group were more than control group. They differ significantly as experimental group improvement was more than control group.

4.26 Right side flexion of cervical spine within control and Experimental group

Table 18: Statistical outcome Right side flexion of cervical spine within control and Experimental group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Rt side flexion (degree) of cervical spine (control group)	-12.27	6.07	-15.63	-8.90	-7.82	14	0.000
Rt side flexion (degree) of cervical spine (Experimental group)	-13.47	-6.22	-10.02	-16.91	-8.38	14	0.000

Table 18 showed that within group analysis of cervical extension (degree), the improvement of ROM was highly significant and in fact in control group (p= 0.000) and Experimental group (p= 0.000).

4.27 Left side flexion of cervical spine between control and Experimental group

Table 19: Statistical outcome of left side flexion (degree) control and Experimental group

	Unpaired t	df	P	95% Confidence	Interval
				Lower	Upper
Difference between control and Experimental group in Left side flexion (degree)	-3.412	28	0.002***	-5.01	-1.25

The t-value is -3.412 with (df)= 28 and a p-value of 0.002, t value is smaller than the p-value (0.013) that has an associated probability level of 0.01%. This means that the probability of random error being responsible for the outcome of this experiment was 0.02 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.5% and it could be said that the result was statistically significant.

This means that difference between Experimental group treatment (Mulligan's NAGs along with conventional physiotherapy) and control group treatment (conventional physiotherapy) was significant i. e. improvement occur in the Experimental group were more than control group. They differ significantly as experimental group improvement was more than control group.

4.28 Left side flexion of cervical spine within control and Experimental group

Table 20: Statistical outcome left side flexion of cervical spine within control and Experimental group

	Mean	**Std. Deviation**	**95% Confidence Interval**		**Paired t**	**df**	**p**
			Lower	**Upper**			
Lt side flexion (degree) of cervical spine (control group)	-11.46	4.34	-13.87	-9.06	-10.23	14	0.000
Lt side flexion (degree) of cervical spine (Experimental group)	-15.46	6.96	-19.31	-11.61	-8.61	14	0.000

Table 20: showed that within group analysis of cervical extension (degree), the improvement of ROM was highly significant and in fact in control group (p= 0.000) and Experimental group (p= 0.000).

4.29 Right side rotation of cervical spine between control and Experimental group

Table 21: Statistical outcome of Right-side rotation (degree) within Experimental and control group

	Unpaired t	**df**	**P**	**95% Confidence**	**Interval**
				Lower	**Upper**
Difference between Experimental and control group in Rt Rotation (degree)	-8.64	28	0.00	-14.59	-9.00

The t-value is -8.64 with 28 degrees of freedom (df) and a p-value of 0.00, t value is smaller than the p-value (0.00) that has an associated probability level of 0.00%. This means that the probability of random error being responsible for the outcome of this experiment was 0.00 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.5% and it could be said that the result was not statistically significant.

This means that difference between Experimental group treatment (Mulligan's NAGs along with conventional physiotherapy) and control group treatment (conventional physiotherapy) was significant i. e. improvement occur in the Experimental group were more than control group. They differ significantly as experimental group improvement was more than control group.

4.30 Right Rotation of cervical spine within control and Experimental group

Table 22: Statistical outcome Rt Rotation of cervical spine within control and Experimental group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Rt Rotation (degree) (degree) of cervical spine (control group)	-12.00	4.02	-14.22	-9.77	-11.57	14	0.000
Rt Rotation (degree) of cervical spine (Experimental group)	-25.53	5.72	-28.7	-22.36	-17.29	14	0.000

Table 22 showed that within group analysis of cervical extension (degree), the improvement of ROM was highly significant and in fact in control group (p= 0.000) and Experimental group (p= 0.000).

4.27 Left side rotation of cervical spine between control and Experimental group

Table 23: Statistical outcome of Left side rotation (degree) within Experimental and control group

	Unpaired t	**df**	**P**	**95% Confidence**	**Interval**
				Lower	**Upper**
Difference between Experimental and control group in Left side rotation (degree)	-7.45	28	0.00	-15.72	-8.94

The t-value is -7.45 with 28 degrees of freedom (df) and a p-value of 0.00, t value is smaller than the p-value (0.00) that has an associated probability level of 0.0%. This means that the probability of random error being responsible for the outcome of this experiment was 0.00 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.5% and it could be said that the result was not statistically significant.

This means that difference between Experimental group treatment (Mulligan's NAGs along with conventional physiotherapy) and control group treatment (conventional physiotherapy) was significant i. e. improvement occur in the Experimental group were more than control group. They differ significantly as experimental group improvement was more than control group.

4.28 Left Rotation of cervical spine within control and Experimental group

Table 24: Statistical outcome Rt Rotation of cervical spine within control and Experimental group

Left rotation	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Left Rotation (degree) (degree) of cervical spine (control group)	-12.73	6.87	-16.53	-8.92	-7.17	14	0.000
Left Rotation (degree) of cervical spine (Experimental group)	-27.53	5.93	-24.25	-17.95	-17.95	14	0.000

Table 24 showed that within group analysis of cervical extension (degree), the improvement of ROM was highly significant and in fact in control group (p= 0.000) and Experimental group (p= 0.000).

4.29 Mean Difference of Cervical Spine Muscle Strength (OXFORD GRADE) in Pretest and Posttest Score of Control experimental Group

Table 25: Mean pretest and posttest changes of muscle strength (manual muscle testing score) of cervical spine between control and Experimental group

Cervical muscles	Experimental	group		Control	group	
	Pretest	Posttest	Difference	Pretest	Posttest	Difference
Flexor, mean	4.00	4.87	0.87	4.07	4.87	0.87
Extensor, mean	3.93	4.80	0.87	4.20	4.93	0.73
Side flexor (Right), mean	3.73	4.80	1.07	4.00	4.87	0.87
Side flexor (Left), mean	3.39	4.87	1.48	4.13	4.80	0.67
Rotator (Right), mean	3.73	5.00	1.27	4.07	4.87	0.80
Rotator (Left), mean	4.00	4.93	0.93	4.20	4.87	0.67

Table 23 showed mean differences of cervical muscle strength (manual muscle testing by OXFORD muscle grade scale) between Experimental and control group. In addition, each muscle group showed lower mean difference in Experimental group compared to control group.

4.30 Cervical spine flexor muscle strength between Experimental and control group

Table 26: Rank and test statistics of cervical flexor muscle strength between Experimental and control group

	Category of Participants	N	Mean of post-test Muscle grade flexion	Mean Rank	Mann-Whitney *U* Score	p
Difference between Experimental and control group in cervical spine flexor muscle strength	Control	15	0.73	14.93	104	0.586
	Experimental	15	0.87	16.07		

Table 26 described that the calculated value of *U* is 104 for flexor muscle strength and the table value of *U* for n1= 15 and n2= 15 is 104 for 0.586 in one tailed hypothesis. From the calculated value (*U*= 104), it is clear that *U* value between Experimental and control groups did not have an associated probability level which was more than 0.05. Therefore, the result was not significant for one tailed hypothesis. Since the p value was more than 5% the result was said to be not significant. This means that difference between Experimental group treatment (Mulligan's NAGs along with conventional) and control group treatment (usual care only) was not significant.

4.31 Cervical spine flexor muscle strength within control group

Table 27: Rank and test statistics of cervical flexor muscle strength within control group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Flexor muscle strength (posttest) - Flexor muscle strength (pretest)	15				
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.00	66.00	-3.207	0.001
Ties	4				
Total	15				

Table 27 described the grade on the comparison of participant's pre and post cervical flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of combination of with conventional treatment in control group. In addition, 11 participants had higher muscle strength deficit score before application of conventional treatment compare with after application of conventional treatment. Besides, 4 participants had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks conventional treatment session showed a statistically significant change in cervical flexor muscle strength among individuals with cervical spondylosis patients (Z= -3.207, p= 0.001).

4.32 Cervical spine flexor muscle strength within experimental group

Table 28: Rank and test statistics of cervical flexor muscle strength within experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Flexor muscle strength (posttest) - Flexor muscle strength (pretest)	15				
Negative ranks	0	0.00	0.00		
Positive ranks	10	5.50	55.00	-2.92	0.004
Ties	5				
Total	15				

Table 26 described the grade on the comparison of participant's pre and post cervical flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of Mulligan's NAGs along with conventional treatment in experimental group. In addition, 10 participants had higher muscle strength deficit score before application of Mulligan's NAGs with conventional treatment in experimental group compare with after application of conventional treatment. Besides, 5 participants had equal amount of muscle strength before and after treatment in experimental group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks experimental treatment session showed a statistically significant change in cervical flexor muscle strength among individuals with cervical spondylosis patients (Z= -2.92, p= 0.004).

4.33 Cervical spine extensor muscle strength between Experimental and control group

Table 29: Rank and test statistics of cervical extensor muscle strength between Experimental and control group

	Category of Participants	**N**	**Mean of posttest Muscle grade extension**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
Difference between Experimental and control group in cervical spine extension muscle strength	Control	15	0.73	16	105	0.63
	Experimental	15	0.87	15		

Table 29 described that the calculated value of *U* is 105 for flexor muscle strength and the table value of *U* for n1= 15 and n2= 15 is 105 for 0.63 in one tailed hypothesis. From the calculated value (*U*= 105), it is clear that *U* value between experimental and control groups did not have an associated probability level which was more than 0.05. Therefore, the result was not significant for one tailed hypothesis. Since the p value was more than 5% the result was said to be not significant.

This means that difference between Experimental group treatment (Mulligan's NAGs combined with conventional therapy) and control group treatment (conventional therapy only) was not significant.

4.34 Cervical spine extensor muscle strength within control group

Table 30: Rank and test statistics of cervical extensor muscle strength within Control group

			Test statistics (Wilcoxon	signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Extension muscle strength (posttest) – extension muscle strength (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.00	66.00	-3.32	0.001
Ties	4				
Total	15				

Table 30 described the grade on the comparison of participant's pre and post cervical extensor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of usual care. In addition, 11 participants had higher muscle strength deficit score before application of conventional compare with after usual care. Besides, 4 participants had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks conventional treatment session showed a statistically significant change in cervical extensor muscle strength among individual patient with cervical spondylosis (Z= -3.32, p= 0.001).

4. 35 Cervical spine extensor muscle strength within experimental group.

Table 31: Rank and test statistics of cervical extensor muscle strength experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Extension muscle strength (posttest) extension muscle strength (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.00	66.00	-3.13	0.002
Ties	4				
Total	15				

Table 31 described the grade on the comparison of participant's pre and post cervical extensor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of Mulligan's NAGs mobilization combined with conventional therapy. In addition, 11 participants had higher muscle strength deficit score before application of Mulligan's NAGs mobilization combined with conventional therapy compare with after conventional therapy. Besides, 4 participants had equal amount of muscle strength before and after treatment in experimental group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (Mulligan NAGs mobilization combined with conventional) treatment session showed a statistically significant change in cervical extensor muscle strength among individual patient with cervical spondylosis ($Z= -3.12$, $p= 0.002$).

4.36 Cervical spine right side flexor muscle strength between Experimental and control group

Table 32: Rank and test statistics of cervical extensor muscle strength between Experimental and control group

	Category of Participants	**N**	**Mean of posttest Right Side flexion muscle grade**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
Difference between Experimental and control group in cervical spine	**Control**	15	0.87	16.50	97.50	0.291
Right Side flexion muscle strength	**Experimental**	15	1.07	14.50		

Table described that the calculated value of *U* is 97.50 for flexor muscle strength and the table value of *U* for n1= 15 and n2= 15 is 97.50 for 0.291 in one tailed hypothesis. From the calculated value (*U*= 97.5), it is clear that *U* value between experimental and control groups did not have an associated probability level which was more than 0.05. Therefore, the result was not significant for one tailed hypothesis. Since the p value was more than 5% the result was said to be not significant.

This means that difference between Experimental group treatment (Mulligan's NAGs combined with conventional therapy) and control group treatment (conventional therapy only) was not significant.

4.37 Cervical spine right side flexor muscle strength within control group

Table 33: Rank and test statistics of Right-Side flexion muscle strength within Control group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Right Side flexion (MS) (posttest) - Right Side flexion (MS) (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.00	66.00	-3.13	0.002
Ties	4				
Total	15				

Table 33 described the grade on the comparison of participant's pre and post Right-Side flexion muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application conventional therapy. In addition, 11 participants had higher muscle strength deficit score before application of conventional therapy compare with after conventional therapy. Besides, 4 participants had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (conventional) treatment session showed a statistically significant change in cervical Right-Side flexion muscle strength among individual patient with cervical spondylosis (Z= -3.13, p= 0.002).

4.38 Cervical spine right side flexor muscle strength within experimental group.

Table 34: Rank and test statistics of cervical extensor muscle strength experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Right Side flexion MS (posttest) - Right Side flexion MS (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	13	7.00	91.00	-3.36	0.001
Ties	2				
Total	15				

Table described the grade on the comparison of participant's pre and post cervical extensor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of Mulligan's NAGs mobilization combined with conventional therapy. In addition, 13 participants had higher muscle strength deficit score before application of Mulligan's NAGs mobilization combined with conventional therapy compare with after conventional therapy. Besides, 2 participants had equal amount of muscle strength before and after treatment in experimental group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (Mulligan's NAGs mobilization combined with conventional) treatment session showed a statistically significant change in cervical Right Side flexion muscle strength among individual patient with cervical spondylosis (Z= -3.36, p= 0.001).

4.39 Cervical spine Left side flexion muscle strength between Experimental and control group

Table 35: Rank and test statistics of cervical extensor muscle strength between Experimental and control group

	Category of Participants	N	Mean of posttest flexor	Mean Rank	Mann-Whitney *U* Score	p
Difference between Experimental and control group in cervical spine Left Side flexion muscle strength	**Control**	15	0.67	16.00	105.00	0.630
	Experimental	15	1.48	15.00		

Table described that the calculated value of *U* is 105.0 for flexor muscle strength and the table value of *U* for n1= 15 and n2= 15 is 105 for 0.630 in one tailed hypothesis. From the calculated value (*U*= 105), it is clear that *U* value between experimental and control groups did not have an associated probability level which was more than 0.05. Therefore, the result was not significant for one tailed hypothesis. Since the p value was more than 5% the result was said to be not significant.

This means that difference between Experimental group treatment (Mulligan's NAGs combined with conventional therapy) and control group treatment (conventional therapy only) was not significant.

4. 40 Left side flexion muscle strength within control group

Table 36: Rank and test statistics of cervical extensor muscle strength within Control group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Left side flexion muscle strength (posttest) – Left side flexion muscle strength (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.00	66.00	-3.36	0.001
Ties	4				
Total	15				

Table 36 described the grade on the comparison of participant's pre and post cervical Left side flexion muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application conventional therapy. In addition, 11 participants had higher muscle strength deficit score before application of conventional therapy compare with after conventional therapy. Besides, 4 participants had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (conventional) treatment session showed a statistically significant change in cervical Left side flexion muscle strength among individual patient with cervical spondylosis (Z= -3.36, p= 0.001).

4.31 Cervical Left side flexor muscle strength within experimental group.

Table 37: Rank and test statistics of Left side flexor muscle strength experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Left side flexion MS (posttest) – Left side flexion MS (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	12	6.50	78.00	-3.28	0.001
Ties	3				
Total	15				

Table 37 described the grade on the comparison of participant's pre and post cervical left Side flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of Mulligan's NAGs mobilization combined with conventional therapy. In addition, 13 participants had higher muscle strength deficit score before application of Mulligan's NAGs mobilization combined with conventional therapy compare with after conventional therapy. Besides, 2 participants had equal amount of muscle strength before and after treatment in experimental group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (Mulligan's NAGs mobilization combined with conventional) treatment session showed a statistically significant change in cervical left Side flexion muscle strength among individual patient with cervical spondylosis (Z= -3.28, p= 0.001).

4.32 Cervical spine Rt side rotator muscle strength between Experimental and control group

Table 38: Rank and test statistics of cervical Rt side rotator muscle strength between Experimental and control group

	Category of Participants	**N**	**Mean of posttest flexor**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
Difference between Experimental and control group in cervical spine Rt side rotation muscle strength	Control	15	0.80	14.00	90.00	0.073
	Experimental	15	1.27	17.00		

Table described that the calculated value of *U* is 90.0 for flexor muscle strength and the table value of *U* for n1= 15 and n2= 15 is 90 for 0.073 in one tailed hypothesis. From the calculated value (*U*= 90), it is clear that *U* value between experimental and control groups did not have an associated probability level which was more than 0.05. Therefore, the result was not significant for one tailed hypothesis. Since the p value was more than 5% the result was said to be not significant.

This means that difference between Experimental group treatment (Mulligan's NAGs combined with conventional therapy) and control group treatment (conventional therapy only) was not significant.

4.33 Cervical spine Rt side rotator muscle strength within control group

Table 39: Rank and test statistics of cervical Rt side rotator muscle strength within Control_group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Rt side rotation muscle strength (posttest) - rotation muscle strength (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.0	66.00	-3.32	0.001
Ties	4				
Total	15				

Table 39 described the grade on the comparison of participant's pre and post cervical Rt side rotation muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application conventional therapy. In addition, 11 participants had higher muscle strength deficit score before application of conventional therapy compare with after conventional therapy. Besides, 4 participants had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (conventional) treatment session showed a statistically significant change in cervical Rt side rotation strength among individual patient with cervical spondylosis (Z= -3.32, p= 0.001).

4.35 Cervical spine Right side rotation strength within experimental group.

Table 40: Rank and test statistics of cervical Right side rotation strength experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	Mean rank	Sum of Ranks	Based on negative ranks Z	p
Rt side rotation muscle strength (posttest) - Rt side rotation muscle strength (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	14	7.50	105.0	-3.42	0.001
Ties	1				
Total	15				

Table 40 described the grade on the comparison of participant's pre and post cervical Rt side rotation muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application conventional therapy. In addition, 14 participants had higher muscle strength deficit score before application of conventional therapy compare with after conventional therapy. Besides, 1 participant had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (conventional) treatment session showed a statistically significant change in cervical Rt side rotation strength among individual patient with cervical spondylosis ($Z= -3.42$, $p= 0.001$).

4.36 Cervical spine Left side flexor muscle strength between Experimental and control group

Table 41: Rank and test statistics of Left side flexor muscle strength between Experimental and control group

	Category of Participants	N	Mean of posttest flexor	Mean Rank	Mann-Whitney *U* Score	p
Difference between Experimental and control group in cervical spine Left side rotation muscle strength	Control	15	0.67	16.60	96.00	0.073
	Experimental	15	0.93	14.40		

Table 41 described that the calculated value of *U* is 96.0 for flexor muscle strength and the table value of *U* for n1= 15 and n2= 15 is 96 for 0.073 in one tailed hypothesis. From the calculated value (*U*= 105), it is clear that *U* value between experimental and control groups did not have an associated probability level which was more than 0.05. Therefore, the result was not significant for one tailed hypothesis. Since the p value was more than 5% the result was said to be not significant.

This means that difference between Experimental group treatment (Mulligan's NAGs combined with conventional therapy) and control group treatment (conventional therapy only) was not significant.

4.37 Cervical spine Left side rotator muscle strength within control group

Table 42: Rank and test statistics of cervical Left side rotator muscle strength within Control_group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Left side rotation muscle strength (posttest) – Lt side rotation muscle strength (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	8	4.5	36.0	-2.64	0.008
Ties	7				
Total	15				

Table 42 described the grade on the comparison of participant's pre and post cervical Rt side rotation muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application conventional therapy. In addition, 8 participants had higher muscle strength deficit score before application of conventional therapy compare with after conventional therapy. Besides, 7 participants had equal amount of muscle strength before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (conventional) treatment session showed a statistically significant change in cervical Left side rotation strength among individual patient with cervical spondylosis (Z= -2.64, p= 0.008).

4.38 Cervical spine Left side rotator muscle strength within experimental group.

Table 43: Rank and test statistics of cervical Left side rotator muscle strength within experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	Mean rank	Sum of Ranks	Based on negative ranks Z	p
Left side rotation MS (posttest) – Left side rotation MS (pretest)					
Negative ranks	0	0.00	0.00		
Positive ranks	11	6.00	66.0	-3.07	0.002
Ties	4				
Total	15				

Table 43 described the grade on the comparison of participant's pre and post cervical left Side rotation MS score. The table's legend showed that any participants did not have decreased muscle strength after application of Mulligan's NAGs mobilization combined with conventional therapy. In addition, 11 participants had higher muscle strength deficit score before application of Mulligan's NAGs mobilization combined with conventional therapy compare with after conventional therapy. Besides, 4 participants had equal amount of muscle strength before and after treatment in experimental group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks (Mulligan's NAGs mobilization combined with conventional) treatment session showed a statistically significant change in cervical left Side rotation muscle strength among individual patient with cervical spondylosis (Z= -3.07, p= 0.008).

4.39. Neck disability index (NDI) between Experimental and control group

Table 44: Rank and test statistics of neck disability index between Experimental and control group

NDI	Category of Participants	N	Mean of Neck disability index (posttest)	Mean Rank	Mann-Whitney *U* Score	p
Neck disability index (pretest) –	Control	15	11.0	20.63	105	0.009
Neck disability index (posttest)	Experimental	15	7.27	10.37		

Table 44 described that the calculated value of *U* is 105.0 for neck disability index and the table value of *U* for n1= 15 and n2= 15 is 105 for 0.009 in one tailed hypothesis. From the calculated value (*U*= 105), it is clear that *U* value between experimental and control groups have an associated probability level which was less 0.05. Therefore, the result was significant for one tailed hypothesis. Since the p value was less than 5% the result was said to be significant.

This means that difference between Experimental group treatment (Mulligan's NAGs combined with conventional therapy) was more effective than control group treatment (conventional therapy only).

4.40. Neck disability index (NDI) within control group

Table 45: Rank and test statistics of neck disability index within control group

				Test statistics (Wilcoxon signed-rank test)	
	N	Mean rank	Sum of Ranks	Based on negative ranks Z	p
Neck disability index (pretest) – Neck disability index (posttest					
Negative ranks	0	0.00	0.00		
Positive ranks	15	8.00	120.0	-3.41	0.001
Ties	0				
Total	15				

Table 45 described the comparison of participant's before (pre) and after (post) neck disability index score. The table's legend showed that any participants did not have increased disability after application of conventional physiotherapy. In addition, 15 participants had higher disability score before application of conventional physiotherapy compare with after application of conventional physiotherapy. Besides, no participants had equal amount of neck disability before and after treatment in control group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 4 weeks, 4 days weekly conventional physiotherapy treatment course showed a statistically significant change in neck disability among individual patient with cervical spondylosis (Z= -3.41, p= 0.001).

4.41 Neck disability index (NDI) within Experimental group

Table 46: Rank and test statistics of neck disability index within Experimental group

				Test statistics (Wilcoxon signed-rank test)	
	N	**Mean rank**	**Sum of Ranks**	**Based on negative ranks Z**	**p**
Neck disability index (pretest) – Neck disability index (posttest					
Negative ranks	0	0.00	0.00		
Positive ranks	15	8.00	120.0	-3.41	0.001
Ties	0				
Total	15				

Table described the comparison of participant's before (pre) and after (post) neck disability index score. The table's legend showed that any participants did not have increased disability after application of conventional physiotherapy. In addition, 15 participants had higher disability score before application of conventional physiotherapy compare with after application of conventional physiotherapy. Besides, no participants had equal amount of neck disability before and after treatment in control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the experimental group for 4 weeks, 4 days weekly Mulligan NAGs mobilization treatment session showed a statistically significant change in neck disability among individual patient with cervical spondylosis (Z= -3.41, p= 0.001).

Chapter-v	Discussion

In this study found different characteristics on baseline in age, gender, duration of neck pain, mean weight, mean height, body mass index (BMI) and neck disability index (NDI) pretest score between both Experimental and control groups of participants. Similarities in baseline characteristics between both groups confirmed successful randomization.

In this study, involved, Among the 30 participants, 60% were men (18 participants), and 40% were women (12 participants). In both the control and experimental groups, the gender distribution was identical, with each group comprising 9 men (50%) and 6 women (50%). In Experimental group, the mean age (± SD) of the participants was 50.06 (± 9.4) years and in control group 43.87 ± 8.1 years.

In terms of BMI, majority of the participants in the Experimental group were normal, the 15 participants in the experimental group, 13.33% (n=2) were underweight, 53.33%(n=8) had a healthy weight, 20% (n= 3)were overweight, and 13.33% (n=2) had obesity. In the control group, similarly, 13.33% (n=2) were underweight, while a slightly higher percentage, 60% (n=9) had a healthy weight. Additionally, 26.67% (n=4) of the control group participants were overweight, and 13.33% (n=2) had obesity.

The study also found that patient rate pain was not associated with BMI (p= 0.215), Hypertension (p=0.264), Diabetic militias (DM) (p= 0.477). The association between body mass index (BMI) and chronic neck pain is significant, particularly among overweight and obese individuals. Research indicates that higher BMI correlates with an increased risk of chronic musculoskeletal pain, including neck pain, due to factors such as biomechanical load and inflammation (Malfliet et al., 2021) (Sengar et al., 2023). However, the study in question found no significant relationship between pain ratings and BMI, hypertension, or diabetes mellitus, suggesting that while obesity may predispose individuals to chronic pain, it does not necessarily correlate with the severity of pain experienced (Morozova et al., 2023).

According to a study Hussain et al., 2016 Mulligan's NAGs mobilization were performed at 2-3 hertz (for fewer than 6 repetitions) in 3 sets. The treatment was given 4 times a week. A physiotherapist with 2-3 years of clinical experience or additional training or knowledge about the Mulligan's NAGs mobilization applied the treatment.

Moreover, combining Mulligan's NAGs mobilization with conventional physiotherapy has been shown to improve overall quality of life metrics, increase neck range of motion (ROM), and reduce scores on the Neck Pain and Disability Scale (NPDS) (Ozlu and Sahin, 2024). In this study, after completed the treatment the rating pain both control and experimental group ($p= 0.002$) where significant reduction in pain intensity measured by the VAS scale (cm). Additionally, a study also found Mulligan NAGs had a significant decrease in pain intensity measured by the Numeric Pain Rating Scale (NPRS) (Waqas et al., 2017).

Patient rated general pain was measured in the pre-test part and posttest was taken after completing of 16 sessions of treatment. Nevertheless, patient rated general pain intensity between group was highly significant ($p=0.002$). Though, exercise significantly decreased pain in Experimental group ($p= 0.000$) and control group ($p = 0.000$). Although Mulligan's NAGs mobilization exercise along with conventional physiotherapy has significant effect than only conventional physiotherapy since each exercise has significant effect in decreasing pain. Moreover, a study showed compare the amounts at the baseline and immediately after treatment. Statistically significant improvements were found in the post-treatment ROM, VAS, NPDS values in both groups ($p < 0.05$). When the differences were compared, the results of the Mulligan group were significantly better than the conventional physiotherapy group ($p < 0.05$) (Ozlu and Sahin, 2024). In cervical range of motion variable, between group analyses was significant in both group such as flexion ($p=0.001$), extension ($p=0.00$), right-side flexion ($p=0.004$), left side flexion ($p=0.002$) and also right-side rotation ($p=0.00$), left side rotation ($p=0.00$) where p value is less than 0.005. Additionally, a study found that Mulligan's NAGs technique significantly improved in chronic neck pain patients, indicating its effectiveness in enhancing cervical pain management and overall range of motion (ROM) (Sania et al., 2023).

In this study, the analysis of muscle strength between the experimental and control groups showed no significant differences in several muscle groups: flexors (p = 0.586), extensors (p = 0.63), right-side flexors (p = 0.291), and left-side rotators (p = 0.630). However, there was a notable association in the strength of left-side and right-side rotators, with both showing a significance level of p = 0.073. A study Waqas et al., 2017, Mulligan's Natural Apophyseal Glides (NAGs) significantly improve cervical muscle strength and overall neck function compared to other interventions, one study demonstrated that participants receiving NAGs exhibited a significant improved in strength and cervical mobility.

In the present thesis, significant improvement was observed in the cervical spine muscles including flexor, extensor, right side flexor, left side flexor, right rotator and left rotator muscles during between group analyses and within group analysis and showed significant improvement in both groups. Although several studies found that loss of muscle strength can be happened by neck pain. According to Jamil et al., 2022, Mulligan's Mobilization was more effective as compared to METs in progressing NPRS and NDI scales.

In this study, after completing treatment, there was significant difference in improvement between the control and experimental groups (p = 0.009), which is less than 0.05. However, Mulligan's NAGs also showed to significantly improve the Neck Disability Index (NDI) and reduce pain in patients with chronic neck pain. Additionally, other studies have also found that NAGs, especially when combined with SNAGs, are more effective than methods like McKenzie exercises in enhancing function and reducing discomfort. The experimental group showed significant reductions in pain and disability following NAGs intervention, with notable decreases in NDI scores (Naz et al., 2023; Zemadanis, 2018; Aggarwal & Verma, 2018).

Mulligan's mobilization techniques, particularly Natural Apophyseal Glides (NAGs), have been shown to be effective in reducing pain and improving range of motion in patients with chronic neck pain. Studies indicate that combining Mulligan techniques with conventional physiotherapy yields better outcomes than conventional methods alone. However, Natural Apophyseal Glides (NAGs) along with conventional

physiotherapy. Physiotherapy shown effective than only conventional physiotherapy and statistical test was conducted between the groups to identify which intervention was more effective than others. Data was also analyzed within Experimental and control group and found both Experimental and control had reduced pain, increase ROM, muscle strength.

Limitation

Despite of the effectiveness of Mulligan's NAGs with conventional physiotherapy for patients with cervical spondylosis on dependent variables in this study, there were some limitations. The main limitation was unable to develop a sampling frame to which the study lacks external validity. Physiotherapists could not be blinded to the interventions. The other main limitation of the study was that the Experimental therapists were not blinded to the treatment allocation. The researcher tried to minimize the effect of unbinding by training the Experimental therapists as samples were collected only from CRP- Savar, it could not represent the wider patients with cervical spondylosis population and the study lacks in generalize ability of results to wider population. In addition, the study was conducted with 30 patients of patients with cervical spondylosis, which was a very small size of samples in compare with the real-world prevalence. Also, patient get 16 sessions of treatment, it can be more effective and accurate if they get treatment sessions timely and regularly. Some patients didn't continue treatment for long duration and distance. Data were collected only two times during study and it created study limitation as there is no follow up session. The study did not offer any follow up for participants which was essential component to find out effectiveness of treatment for longer period of time. However, participants were only blinded and it lacks the absolute minimization of physiotherapist's bias during delivering treatment. There were no available researches representing effectiveness of this intervention before this one in Bangladesh. So, timeline comparison of the particular exercise's effectiveness couldn't be possible.

Chapter –vi Conclusion and recommendation

Patients with cervical spondylosis regarded as the source of impairments within the structure of cervical spine for middle-older age due to degenerative changes. After this study it has come out that the Experimental group treatment Mulligan's NAGs with conventional physiotherapy along with conventional physiotherapy is more effective to minimize pain than only conventional physiotherapy. This treatment is also slightly effective in increase range of motion and muscle strength and in minimize disability rate. In clinical practice the usual treatment for an example manual therapy, exercise therapy electrotherapy is used frequently. After doing this study a new treatment approach is introduced to everyone which is effective and can be applicable for the benefit of the patients. Conversely, the aim and objectives of this study has been not fulfilled and the null hypothesis was rejected favoring the Mulligan's NAGs along with conventional physiotherapy for patients with cervical spondylosis. In contrast, the techniques and procedures of Mulligan's NAGs with conventional physiotherapy along with conventional physiotherapy involving patients actively as the resistance of muscle force can be progressed in accordance with patient's ability for patients with cervical spondylosis. Pain affects the body system as well as the entire personnel daily activities. Since Mulligan's NAGs has been practicing by physiotherapist in limiting manner outside of this study setting, the outcomes of thesis would help practitioners outside the study setting to formulate a management guideline to treat patients with patients with cervical spondylosis.

In this study, the patient was benefited by 16 sessions of treatment in 4 sessions per week for experimental group. It is recommended to give to sessions of Mulligan's NAGs for further research. Here 30 participants were taken for completing this thesis project. More participants were recommended for the future study to get more effective result. Future study should include large sample size and should follow the randomization process while selecting sample from population.

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Annexure 1: IRB approval from BHPI

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)

Bangladesh Health Professions Institute (BHPI)

(The Academic Institute of CRP)

Ref: CRP-BHPI/IRB/03/2024/877

Date: 14.03.2024

To
Konok Chandra Barman
B.Sc. in Physiotherapy
Session: 2015-16, Student ID: 112150272
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Outcome of Mulligan's NAGs mobilization technique along with conventional physiotherapy management for cervical spondylosis patients"** by ethics committee.

Dear Konok Chandra Barman,
Congratulations!
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the principal investigator. The Following documents have been reviewed and approved

Sl. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English & / or Bangali version)
3	Information sheet & consent form

The purpose of the study is to explore, understand, and evaluate the effectiveness and outcomes of integrating Mulligan's NAGs mobilization technique in treating patients with cervical spondylosis. This study use of Dali questionnaire and face to face interview to find out the potential benefits of treatment modalities in terms of pain reduction, improvement in cervical range of motion, functional outcomes, and overall patients' satisfaction. The study seeks to provide evidence-based recommendations for optimizing treatment options for cervical spondylosis patients, thereby improving clinical practice and enhancing patient outcome. The study involves use of a questionnaire to explore that may take 20 to 30 minutes to answer the specimen and there is no likelihood of any harm to the participants. Data collectors will receive informed consents from all participants any data collected will be kept confidential. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 9AM on 29 February, 2024 at BHPI (23 IRB Meeting).

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of 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 accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964-2013 and other applicable regulation.

Best regards,

Muhammad Millat Hossain
Associate Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB),
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

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Annexure 2: Data collection permission

24th March 2024

Head
Department of Physiotherapy
Centre for the Rehabilitation of the Paralysed (CRP)
Chapain, Savar, Dhaka-1343

Through: Head, Department of Physiotherapy, BHPI.

Subject: Prayer for seeking permission to collect data for conducting research project.

Sir,

With due to respect and humble submission to state that I am Konok Chandra Barman, a student of 4th year B.Sc. in physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: - **"Outcome of Mulligan's NAGs mobilization technique along with conventional physiotherapy for patients with cervical spondylosis''** under the supervision of Dr. Mohammad Habibur Rahman, Assistant Professor Physiotherapy, MDMR program, Bangladesh Open University, Dhaka. I want to collect data for my research project from the Department of Physiotherapy at CRP. So, I need permission for data collection from the Musculoskeletal Unit of Physiotherapy Department at both CRP-Savar & Mirpur-14 branch, Dhaka-1343. I would like to assure that anything of the study will not be harmful for the participants and the Department itself.

I, therefore pray and hope that you would be kind enough to grant my application and give me permission for data collection and oblige thereby.

Yours faithfully,

Konok Chandra Barman

Konok Chandra Barman
4th Year, B.Sc. in Physiotherapy
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Forwarded

Dr. Shazal Kumar Das, PhD
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Approved
22/3/24

Prof. Dr. Mohammad Anwar Hossain, PhD
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Annexure 3: Conventional treatment

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Ref: CRP/PT/2102/134/27.03.24 Date: 27/03/24

Physiotherapy Department of the center for the rehabilitation of the paralysed (CRP) most commonly used latest McKenzie Institution Assessment for Mechanical Spine problems. Conversely, most commonly prescribed and used treatment concepts are McKenzie, Cyriax, Maitland and Mulligan.

<u>Treatment For (Control group)</u> Usual/Conventional Physiotherapy for cervical Spondylosis patient.

1) **Manual therapy**

   Therapist guided McKenzie of directional exercises for cervical region

   -Repeated retraction

   -Repeated retraction with over pressure

   -Repeated retraction with extension

2) **Cyriax Manipulation**
   - Rotational manipulation or Straight pull
   - DTFM in triggered soft tissue

3) **Maitland Mobilization technique**
   - Grade-I &
   - Grade-II

3) **Exercise Therapy**
   - Soft tissue release technique
   - Neck muscle Stretching exercise
   - Neck muscle strengthening exercise
   - Isometric exercise

   Concentric exercise and Eccentric exercise

4) **Cervical Manual Traction:** intermittent mode with weight of 7% of total body weightfor 10 minutes.

5) **Electrotherapy- Infra-red radiation** over the back of neck for 10-15 minutes.
   - **Transcutaneous electrical nerve stimulation (TENS)** applies with frequency of 5 Hz,high intensity brust mode and pulse duration 300 micro second for 20 minutes.

Prof. Dr. Mohammad Anwar Hossain, PhD
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As a donor to CRP you quality for a tax rebate as the Government of Bangladesh have approved CRP as a Philanthropic Institution from February 2008

Appendix-4: Treatment protocol

Conventional physiotherapy plus Mulligan's NAG's mobilization technique

Technique of Mulligan's NAG's mobilization

Application Process: The patient will be seated, and the and the cradle head and head must be straight. The therapist's hand places the grasp occiput with the 3rd and 4th fingers. The little finger will be placed on the spinous process. Thenar eminence applies pressure and creates a gentle force.

Doses: The treatment will be given 4 times in a week for 4 weeks.

Repetitions at a time & how many time in a day: Mulligan mobilization NAGs with **2-3 sec** (for less than 6 repetitions) in 3 sets.

Who will apply: A physiotherapist will be applied who has 2-3 years of clinical experience or has extra course or knowledge about Mulligan mobilization technique NAG's (Hussain *et al.*, 2016).

How many sessions required: The duration of the treatment will be 4 weeks in both groups (Group A and Group B). Conventional treatment will be given for control group A, and conventional plus mulligan mobilization technique NAGs will be given for group B.

Appendix-5: Information and consent form with questionnaire

মৌখিক সম্মতি পত্র

আসসালামু আলাইকুম/নমস্কার, আমি কনক চন্দ্র বর্মন, ঢাকা বিশ্ববিদ্যালয়ের চিকিৎসা অনুষদের অধিভুক্ত বাংলাদেশ হেল্‌থ প্রফেশন ইনস্টিটিউট (বিএইচপিআই) এর বিএসসি ইন ফিজিওথেরাপি বিভাগের ছাত্র। আমার অধ্যয়নের একটি অংশ হিসেবে আমাকে একটি গবেষণা সম্পাদন করতে হবে এবং এটি আমার প্রাতিষ্ঠানিক শিক্ষার একটি অংশ। নিম্নোক্ত তথ্যাদি পড়ার পর অংশগ্রহণকারীদের অধ্যায়নে অংশগ্রহনের জন্য অনুরোধ করা হল। আমার গবেষণার শিরোনাম হল "সারভাইক্যাল স্পনডাইলোসিস আক্রান্ত রোগীদের জন্য প্রচলিত ফিজিওথেরাপির পাশাপাশি মালিগানের ন্যাগস মোবিলাইজেশন চিকিৎসার কার্যকারিতা"।

আমি আশা করি সাক্ষাৎকারটি ২০-৩০ মিনিট সময় লাগবে। গবেষণার প্রয়োজনে আপনাকে আরও যে কোনও ধরণের প্রশ্ন জিজ্ঞাসা করার প্রয়োজন হতে পারে।

আমি আপনাদের জানাতে চাই যে এটি শুধুমাত্র একাডেমিক অধ্যয়ন এবং অন্য কোনও উদ্দেশ্যে ব্যবহার করা হবে না। আমি আপনাকে আশ্বস্ত করতে চাই যে, সমস্ত তথ্য গোপনীয় রাখা হবে। আপনার অংশগ্রহণ স্বেচ্ছামূলক হবে। আপনার সম্মতি প্রত্যাহার করার এবং যে কোনও সময়ে সাক্ষাৎকারটি বন্ধ করার অধিকার রয়েছে। এই প্রশ্নাবলীতে আপনার পছন্দ না হওয়া অন্য কোনও প্রশ্নের উত্তর না দেওয়ার অধিকারও আপনার রয়েছে।

গবেষণা সম্পর্কে আপনার যদি কোন জিজ্ঞাসা থাকে তবে আপনি অনুগ্রহপূর্বক আমার সাথে (01787899100) অথবা আমার সুপারভাইজার ডাঃ মোহাম্মদ হাবিবুর রহমান, সহকারী অধ্যাপক ফিজিওথেরাপি ও কোর্স কো-অর্ডিনেটর, এমডিএমআর প্রোগ্রাম, স্কুল অব সায়েন্স অ্যান্ড টেকনোলজি, বাংলাদেশ উন্মুক্ত বিশ্ববিদ্যালয়, ঢাকা (drsumonptbou@gmail.com) মাধ্যমে যোগাযোগ করতে পারেন।

সুতরাং, আমি কি সাক্ষাৎকারটি শুরু করতে আপনার সম্মতি পেতে পারি? হ্যাঁ.........., না.......।

অংশগ্রহণের স্বাক্ষর এবং তারিখ...

তথ্য সংগ্রাহকের তারিখ এবং স্বাক্ষর ....

গবেষকের স্বাক্ষর এবং তারিখ...

Verbal Consent Form

I am **Konok Chandra Barman**, student of the **B.Sc. in physiotherapy**, **Bangladesh Health Professions Institute (BHPI), affiliated with Faculty of Medicine, University of Dhaka**. For the partial fulfilment of my Bachelor degree, I have a conduct a research project and it is a part of my study. My research title is **"Outcome of the mulligan's NAG's mobilization technique along with conventional physiotherapy for the patients with cervical spondylosis".**

I do expect that the interview will take 20-30 minutes. I also offer you to ask any sort of questions when fell it is necessary to get insight.

I would like to inform you that this is a purely academic study and will not be any used for any other purposes. I assure you that all the data will be kept confidential. Your participation will be voluntary. You may have the rights to withdraw your consent and discontinue from the study at any point of the time. You also have the right not to answer any other question that you don't like of this questionnaire.

If you have any query about the study, you may conduct with me (01787899100) or my supervisor **Dr. Mohammad Habibur Rahman, Assistant Professor Physiotherapy and Course Coordinator, MDMR program, School of Science and Technology, Bangladesh Open University, Dhaka** (drsumonptbou@gmail.com).

So, may I have your consent to proceed with the interview? Yes………., No…….

Signature of the participation & Date ……………………………………………….

Signature of the data collector & Date …………………………………………………

Signature of the Researcher & Date ……………………………………………………

Questionnaire Bangla (বাংলা প্রশ্নপত্র)

আমি আপনাকে জানাতে চাই যে আমার গবেষণায় আপনাকে অন্তর্ভুক্ত এবং আপনার কাছ থেকে কিছু তথ্য প্রয়োজন। সারভাইক্যাল স্পনডাইলোসিসে আক্রান্ত রোগীর ব্যথা, মাংসপেশীর সক্ষমতা , ঘাড়ের জয়েন্টের গতিরপরিসীমা (ROM) এবং ঘাড়ের অক্ষমতা সূচক (NDI) পরিমাপ করার জন্য এই প্রশ্নাবলী তৈরি করা হয়েছে এবং এই অংশটি একটি কালো কলম ব্যবহার করে তথ্য সংগ্রাহক দ্বারা পূরণ করুন। অনুগ্রহ করে প্রতিটি বিভাগের উত্তর দিন এবং প্রতিটি বিভাগে আপনার জন্য প্রযোজ্য শুধুমাত্র একটি বাক্সে (টিক/✓) চিহ্ন দিয়ে চিহ্নিত করুন। আপনার কাছে প্রতিটি প্রশ্নের এক বা একাধিক বিকল্প উত্তর মনে হতে পারে, তবে আপনি যে উত্তরটিকে আরও উপযুক্ত বলে মনে করেন তা চিহ্নিত করুন।

রোগীর কোড নংঃ...... তারিখঃ.............

রোগীর নামঃ.................................... রোগীর আইডি নংঃ....................

মোবাইল নম্বরঃ................................... ঠিকানা- গ্রামঃ...................... পোস্টঃ..........................।

উপজেলাঃ......................... জেলাঃ..........................।

পর্বঃ-১ সামাজিক-বৈষয়িক তথ্য	
প্রশ্ন সমূহ	**উত্তর**
১.১। রোগীর বয়স	...............বছর
১.২। লিঙ্গ	☐ পুরুষ ☐ মহিলা
১.৩। পেশা	....
১.৪। শিক্ষাগত যোগ্যতা	....

১.৫। আপনার কাজের ক্ষেত্রে ঘাড়ের কোন ধরনের কাজ করতে হয়?	☐ পুনরাবৃত্তিমূলক কাজ ☐ বলপ্রয়োগমূলক কাজ ☐ দীর্ঘক্ষণ স্থির সংকোচনমূলক কাজ ☐ দীর্ঘদিন বোঝা বহনের কাজ ☐ অসামঞ্জস্য অঙ্গবিন্যাসে কাজ করা
১.৬। আপনি কতদিন ধরে ঘাড়ের ব্যথায় ভুগছেন?	.... মাস
১.৭। শরীরের ওজন	.... (কেজি)
১.৮। শরীরের উচ্চতা	.... সেন্টিমিটার
১.৯। শরীরের বিএমআই	.... (কেজি/ মিটার২)

পর্বঃ-২ চিকিৎসা সংক্রান্ত তথ্য

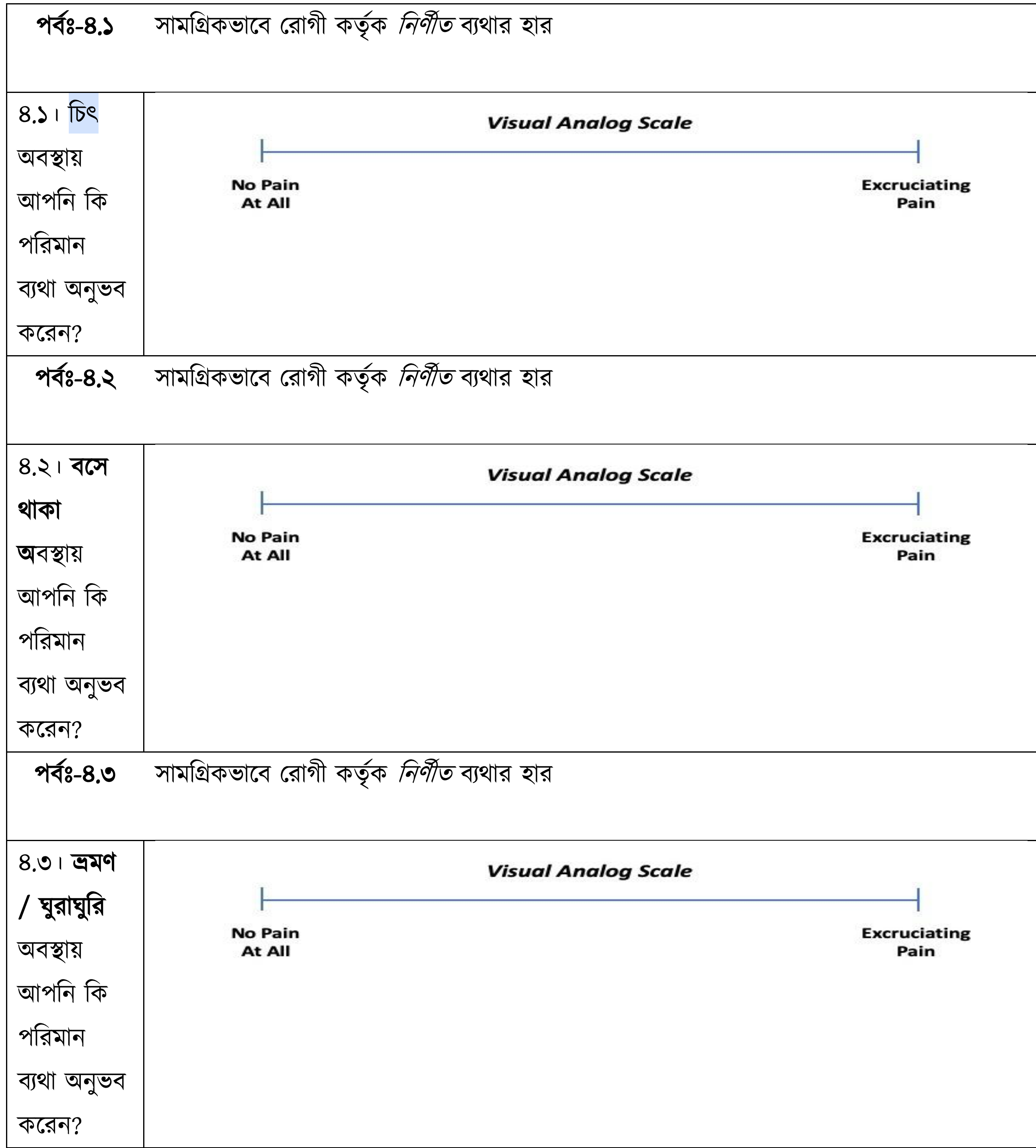
২.১০। আপনার কি উচ্চরক্তচাপ রোগে ভুগছেন?	☐ হ্যাঁ ☐ না
২.১১। আপনার কি ডায়াবেটিস আছে?	☐ হ্যাঁ ☐ না

পর্বঃ-৩ ব্যথা সম্পর্কিত তথ্য

প্রশ্ন	উত্তর
৩.১২। আপনার ঘাড়ের ব্যথার কারণ কী?	☐ আঘাতের কারণে ☐ ভারি ওজন বহনের কারণে ☐ কাজের সময় শরীরের অবস্থান সঠিক না রাখার জন্য ☐ ঘুমানোর সময় শরীরে অবস্থান সঠিক না রাখার জন্য ☐ বয়সজনিত ক্ষয়ের কারনে ☐ অন্যান্য

৩.১৩। ঘাড়ের কোন পাশে আপনার ব্যথা সবচেয়ে বেশি?	☐ ডান ☐ বাম
৩.১৪। আপনার ব্যথা কি কাঁধে ছড়িয়ে পরে?	☐ হ্যাঁ ☐ না
৩.১৫। আপনার ব্যথা কোন দিকে বেশি ছড়িয়ে পরে? (যদি না হয়, তাহলে এই প্রশ্নটির উত্তর দেওয়া থেকে বিরত থাকুন) ।	☐ ডান দিকে ☐ বাম দিকে
৩.১৬। আপনি কোথায় তুলনামূলকভাবে বেশি ব্যথা অনুভব করেন?	☐ ঘাড়ের ব্যথা কাঁধের চেয়ে বেশি ☐ কাঁধের ব্যথা ঘাড়ের চেয়ে বেশি ☐ ঘাড়ের ব্যথা এবং কাঁধের ব্যথা সমান
৩.১৭। আপনি কখন আরও বেশি ব্যথা অনুভব করেন?	☐ সকালে ☐ দিন বাড়ার সাথে সাথে ☐ সন্ধ্যায় ☐ রাতে ☐ সারাদিন
৩.১৮। কোন দিকে ঘাড়ের নড়াচড়া করলে আপনার ব্যথা বেশি অনুভব হয়?	☐ ঘাড় সামনের দিকে ঝুঁকলে ☐ ঘাড় পিছন দিকে ঝুঁকলে ☐ ঘাড় ডান দিকে ঘুরালে ☐ ঘাড় বাঁ দিকে ঘুরালে ☐ শোয়া থেকে উঠতে গেলে ☐ বসা থেকে উঠতে গেলে
৩.১৯। কোন দিকে ঘাড়ের নড়াচড়া করলে আপনার ব্যথা কম অনুভব হয়?	☐ ঘাড় সামনের দিকে ঝুঁকলে ☐ ঘাড় পিছন দিকে ঝুঁকলে ☐ ঘাড় ডান দিকে ঘুরালে ☐ ঘাড় বাঁ দিকে ঘুরালে ☐ শোয়া থেকে উঠতে গেলে ☐ বসা থেকে উঠতে গেলে

চিকিৎসা পূর্ববতী তথ্য সমূহঃ-



পর্বঃ-৪.১	সামগ্রিকভাবে রোগী কর্তৃক *নির্ণীত* ব্যথার হার
৪.১। চিৎ অবস্থায় আপনি কি পরিমান ব্যথা অনুভব করেন?	**Visual Analog Scale** No Pain At All — Excruciating Pain
পর্বঃ-৪.২	সামগ্রিকভাবে রোগী কর্তৃক *নির্ণীত* ব্যথার হার
৪.২। **বসে থাকা অবস্থায়** আপনি কি পরিমান ব্যথা অনুভব করেন?	**Visual Analog Scale** No Pain At All — Excruciating Pain
পর্বঃ-৪.৩	সামগ্রিকভাবে রোগী কর্তৃক *নির্ণীত* ব্যথার হার
৪.৩। **ভ্রমণ / ঘুরাঘুরি** অবস্থায় আপনি কি পরিমান ব্যথা অনুভব করেন?	**Visual Analog Scale** No Pain At All — Excruciating Pain

পর্বঃ-৫ ঘাড়ের জয়েন্টের গতিরপরিসীমা তথ্যবলী

প্রশ্ন	উত্তর
৫.১। ঘাড়ের গতি বর্তমানে কতটুকু আছে? (দয়া করে ডিগ্রী দিয়ে লিখবেন)	☐ ফ্লেক্সসন.............. ☐ এক্সটেন্সান............... ☐ সাইড ফ্লেক্সিয়ন (ডানদিকে)........... ☐ সাইড ফ্লেক্সিয়ন (বামে)........... ☐ রোটেসন (ডানদিকে).............. ☐ রোটেসন (বামে).........

পর্বঃ-৬ মাংসপেশীর সক্ষমতার তথ্যবলী

প্রশ্ন	উত্তর
৬.১। ঘাড়ের মাস পেশীর সক্ষমতা বর্তমানে কতটুকু রয়েছে? (OXFORD Grade Scale)	☐ ফ্লেক্সর.............. ☐ এক্সটেনসর............... ☐ সাইড ফ্লেক্সিয়ন (ডানদিকে)........... ☐ সাইড ফ্লেক্সিয়ন (বামে)........... ☐ রোটেসন (ডানদিকে).............. ☐ রোটেসন (বামে).........

পর্বঃ-৭ ঘাড়ের প্রতিবন্ধকতা সম্পর্কিত

এই প্রশ্নাবলীটি আপনার ঘাড়ের ব্যথা কীভাবে আপনার দৈনন্দিন জীবনে পরিচালনা করার ক্ষমতাকে প্রভাবিত করেছে সে সম্পর্কে আমাদের তথ্য দেওয়ার জন্য তৈরি করা হয়েছে) নেক ডিসেবিলিটি ইনডেক্সের (এনডিআই) প্রতিটি বিভাগে সর্বনিম্ন ০ পয়েন্ট এবং সর্বোচ্চ ৫ পয়েন্ট রয়েছে। মোট স্কোর = ৫০ (প্রাপ্ত স্কোর)= ....।

প্রশ্নসমূহ	উত্তর
প্রশ্ন নং ১ আজ আপনার ব্যথার তীব্রতা কি পরিমান?	☐ আমার এই মুহূর্তে কোন ব্যথা নেই
	☐ আমার এই মুহূর্তে খুব হালকা ব্যথা আছে
	☐ আমার এই মুহূর্তে মাঝারি ব্যথা আছে
	☐ আমার এই মুহূর্তে ব্যথা মোটামুটি গুরুতর
	☐ আমার এই মুহূর্তে ব্যথা খুব গুরুতর
	☐ আমার এই মুহূর্তে ব্যথা সবচেয়ে বেশি

প্রশ্ন-২	উত্তর
ব্যক্তিগত কাজে (পোশাক পরিচ্ছন্নতা, জামাকাপড় পরিধান ইত্যাদি) ক্ষেত্রে আপনি কতটা স্বাধীন?	☐ আমি সাধারণত অতিরিক্ত ব্যথা ছাড়াই নিজেকে স্বাভাবিকভাবে নিজের যত্ন নিতে পারি।
	☐ আমি স্বাভাবিকভাবে নিজের যত্ন নিতে পারি কিন্তু এর ফলে অতিরিক্ত ব্যথা হয়।
	☐ আমার নিজের যত্ন নেওয়া বেদনাদায়ক এবং আমি ধীরগতি এবং সতর্কতা অবলম্বন করি
	☐ আমার কিছু সাহায্য দরকার কিন্তু আমি আমার বেশিরভাগ ব্যক্তিগত যত্ন নিতে পারি।
	☐ আমার ব্যক্তিগত যত্নে বেশিরভাগ ক্ষেত্রে আমার প্রতিদিন সাহায্যের প্রয়োজন।
	☐ আমি পোশাক পরিধান করতে পরি না, আমার কাপড় ধুয়ে কষ্ট হয় এবং বিছানায় শুয়ে থাকতে হয়
প্রশ্ন-৩	**উত্তর**
কোন বস্তু উঠানর ক্ষেত্রে আপনি কতটা স্বাবলম্বী?	☐ আমি অতিরিক্ত ব্যথা ছাড়াই ভারী ওজন উত্তোলন করতে পারি
	☐ আমি ভারী ওজন উত্তোলন করতে পারি কিন্তু অতিরিক্ত ব্যথা হয়
	☐ ব্যথা আমাকে মেঝে থেকে ভারী ওজন তুলতে বাধা দেয়, তবে সেগুলি সুবিধামত স্থাপন করা হলে আমি পরিচালনা করতে পারি, উদাহরণস্বরূপ কোন একটি টেবিলের উপর থেকে
	☐ ব্যথা আমাকে ভারী ওজন তুলতে বাধা দেয় তবে আমি হালকা থেকে মাঝারি ওজন উত্তোলন করতে পারি যদি সেগুলি সুবিধাজনকভাবে স্থাপন করা হয়
	☐ আমি শুধু খুব হালকা ওজন উত্তোলন পারি
	☐ আমি কোন কিছু উত্তোলন বা বহন করতে পারি না
প্রশ্ন-৪	**উত্তর**
সংবাদপত্র বা বই পড়ার সময় আপনার কেমন লাগে?	☐ ঘাড়ে ব্যথা ছাড়াই আমি যতটা চাই ততটাই পড়তে পারি।
	☐ ঘাড়ে সামান্য ব্যথা নিয়ে যত ইচ্ছে পড়তে পারি।
	☐ ঘাড়ে মাঝারি ব্যথা সহ আমি যত খুশি পড়তে পারি। ☐ ঘাড়ে মাঝারি ব্যথার কারণে আমি যতটা চাই ততটা পড়তে পারি না।
	☐ ঘাড়ে তীব্র ব্যথার কারণে আমি খুব কমই পড়তে পারি।
	☐ আমি পড়তে পারি না।
প্রশ্ন-৫	**উত্তর**
আপনি কোন অবস্থায় মাথাব্যথা অনুভব	☐ আমার কোনও মাথাব্যথা নেই

করেন?	□ আমার সামান্য মাথাব্যথা আছে, যা কদাচিৎ আসে
	□ আমার মাঝারি মাথাব্যথা আছে, যা কদাচিৎ আসে
	□ আমার মাঝারি মাথাব্যথা আছে, যা প্রায়শই হয়
	□ আমার গুরুতর মাথাব্যথা আছে, যা প্রায়শই আসে
	□ আমার প্রায় সব সময়ই মাথা ব্যথা হয়।
প্রশ্ন-৬	**উত্তর**
ঘাড়ে ব্যথা থাকা সত্ত্বেও কাজ করার সময় আপনি কোন মাত্রায় মনোনিবেশ করেন?	□ আমি যখন চাই তখন কোনও অসুবিধা ছাড়াই পুরোপুরি মনোনিবেশ করতে পারি
	□ আমি যখন চাই তখন সামান্য অসুবিধা সহ সম্পূর্ণরূপে মনোনিবেশ করতে পারি
	□ আমি যখন মনোনিবেশ করতে চাই তখন আমার যথেষ্ট অসুবিধা হয়
	□ আমি যখন মনোনিবেশ করতে চাই তখন আমার অনেক অসুবিধা হয়
	□ আমি যখন মনোনিবেশ করতে চাই তখন আমার অনেক অসুবিধা হয়
	□ আমি একেবারেই মনোনিবেশ করতে পারি না।

প্রশ্ন-৭	**উত্তর**
ঘাড়ের ব্যথা কোন অবস্থায় আপনার দৈনন্দিন কাজকে প্রভাবিত করে?	□ আমি যত ইচ্ছে তত কাজ করতে পারি
	□ আমি কেবল আমার স্বাভাবিক কাজ করতে পারি, কিন্তু আর করতে পারি না
	□ আমি আমার স্বাভাবিক কাজের বেশিরভাগই করতে পারি, কিন্তু আর পারি না
	□ আমি আমার স্বাভাবিক কাজ করতে পারি না
	□ আমি খুব কমই কোনও কাজ করতে পারি।
	□ আমি কোন কাজই করতে পারি না
প্রশ্ন-৮	**উত্তর**
ভ্রমণের সময় আপনার ঘাড়ের ব্যথা কেমন লাগে?	□ আমি কোনও ঘাড়ের ব্যথা ছাড়াই ভ্রমণ করতে পারি
	□ ঘাড়ে সামান্য ব্যথা সহ আমি যতদিন চাই ভ্রমণ করতে পারি
	□ ঘাড়ে মাঝারি ব্যথা সহ আমি যতদিন চাই ভ্রমণ করতে পারি
	□ ঘাড়ে মাঝারি ব্যথার কারণে আমি যতক্ষণ চাই ততক্ষণ ভ্রমণ করতে পারি না
	□ ঘাড়ে তীব্র ব্যথার কারণে আমি খুব কমই ভ্রমণ করতে পারি
	□ আমি ভ্রমণ করতে পারি না
প্রশ্ন-৯	**উত্তর**

ঘাড়ের ব্যথা আপনার ঘুমকে কোন অবস্থায় প্রভাবিত করে?	☐ আমার ঘুমানোর কোনও সমস্যা নেই
	☐ আমার ঘুম কিছুটা বিঘ্নিত হয় (১ ঘন্টারও কম ঘুমহীন)
	☐ আমার ঘুমের ব্যাঘাত ঘটে (১-২ ঘন্টা ঘুমহীন)
	☐ আমার ঘুম মাঝারিভাবে বিঘ্নিত হয় (২-৩ ঘন্টা নিদ্রাহীন)
	☐ আমার ঘুম খুব বিরক্তিকর (৩-৫ ঘন্টা ঘুমহীন)
	☐ আমার ঘুম পুরোপুরি বিঘ্নিত হয় (৫-৭ ঘন্টা ঘুমহীন)
প্রশ্ন-১০	**উত্তর**
কোন অবস্থায় আপনার ঘাড়ের ব্যথা আপনার বিনোদনমূলক ক্রিয়াকলাপকে প্রভাবিত করে?	☐ আমি ঘাড়ের ব্যথা ছাড়াই আমার সমস্ত বিনোদনমূলক ক্রিয়াকলাপে জড়িত থাকতে সক্ষম।
	☐ ঘাড়ে কিছুটা ব্যথা সহ আমি আমার সমস্ত বিনোদনমূলক ক্রিয়াকলাপে জড়িত হতে সক্ষম।
	☐ ঘাড়ে ব্যথার কারণে আমি বেশিরভাগ ক্ষেত্রেই ব্যস্ত থাকতে পারি, তবে আমার সমস্ত স্বাভাবিক বিনোদনমূলক ক্রিয়াকলাপে জড়িত হতে পারি না
	☐ ঘাড়ে ব্যথার কারণে আমি আমার কিছু স্বাভাবিক বিনোদনমূলক কাজে অংশ নিতে পারি
	☐ ঘাড়ে ব্যথার কারণে আমি খুব কমই কোনও বিনোদনমূলক কাজ করতে পারি।
	☐ আমি কোনও বিনোদনমূলক কাজই করতে পারি না।

মোট উৎস = এসইউএম (সমস্ত ১০ ফলাফলের জন্য পয়েন্ট) শতাংশে অক্ষমতা = মোট স্কোর.......) / ৫০ * ১০০

ব্যাখ্যাঃ

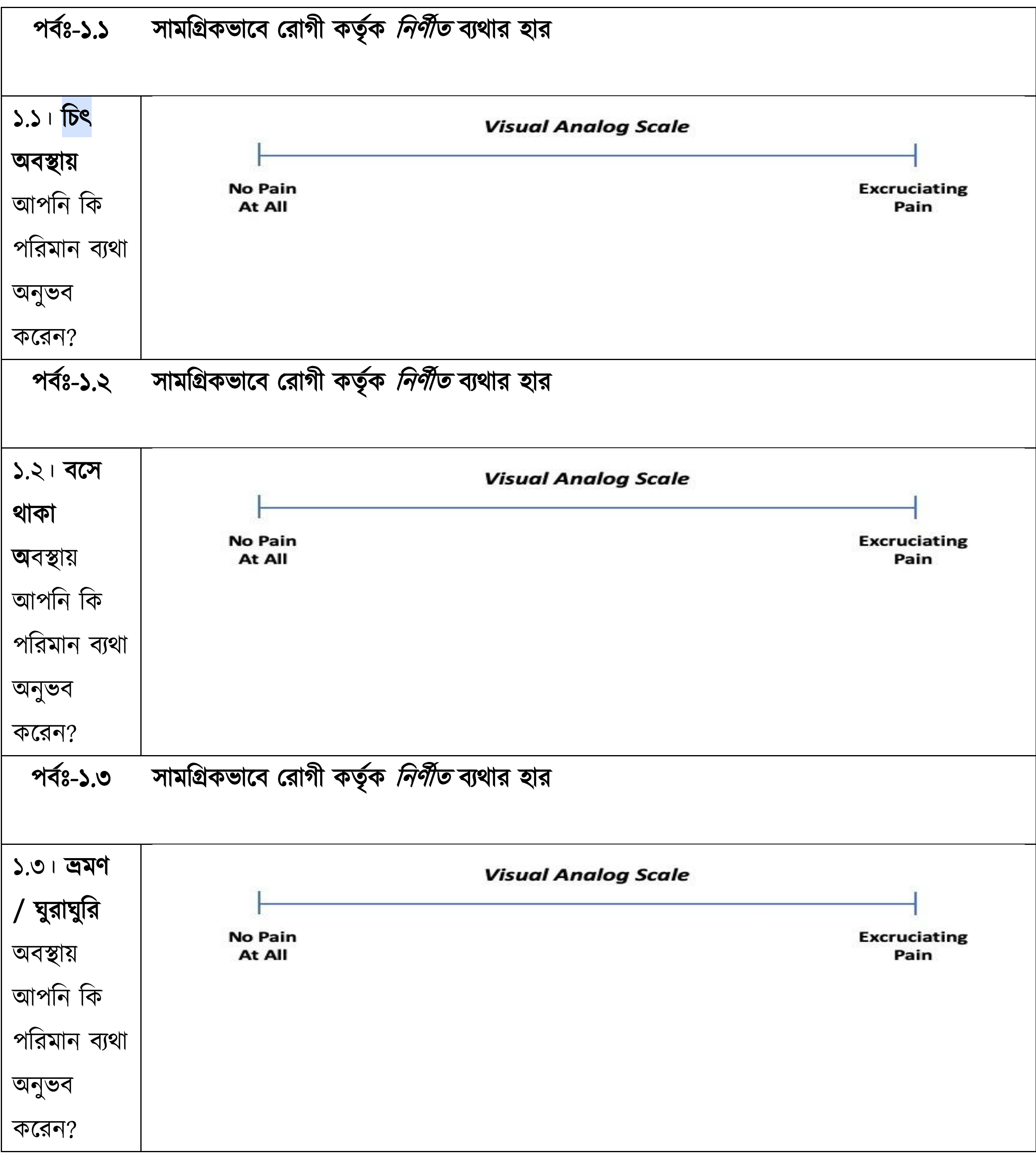
• ন্যূনতম স্কোরঃ ০% ন্যূনতম অক্ষমতা সহ

• সর্বোচ্চ স্কোরঃ ১০০% এর সর্বোচ্চ অক্ষমতা সহ ৫০

অক্ষমতা স্কোর	**ব্যাখ্যা**
০ থেকে ৪	কোনও অক্ষমতা নেই
৫ থেকে ১৪	হালকা
১৫ থেকে ২৪	মাঝারি
২৫ থেকে ৩৪	গুরুতর
৩৪-এর উপরে	সম্পূর্ণ

অনুগ্রহ করে মনে রাখবেনঃ এর অর্থ ৫০ এর মধ্যে ১৫-২৪ (RAW SCORE) মাঝারি অক্ষমতার সাথে সমান

চিকিৎসা পরবর্তী তথ্য সমূহঃ-



পর্বঃ-১.১	**সামগ্রিকভাবে রোগী কর্তৃক *নির্ণীত* ব্যথার হার**
১.১। **চিৎ অবস্থায়** আপনি কি পরিমান ব্যথা অনুভব করেন?	***Visual Analog Scale*** **No Pain At All** — **Excruciating Pain**
পর্বঃ-১.২	**সামগ্রিকভাবে রোগী কর্তৃক *নির্ণীত* ব্যথার হার**
১.২। **বসে থাকা অবস্থায়** আপনি কি পরিমান ব্যথা অনুভব করেন?	***Visual Analog Scale*** **No Pain At All** — **Excruciating Pain**
পর্বঃ-১.৩	**সামগ্রিকভাবে রোগী কর্তৃক *নির্ণীত* ব্যথার হার**
১.৩। **ভ্রমণ / ঘুরাঘুরি** অবস্থায় আপনি কি পরিমান ব্যথা অনুভব করেন?	***Visual Analog Scale*** **No Pain At All** — **Excruciating Pain**

পর্বঃ-২ ঘাড়ের জয়েন্টের গতিরপরিসীমা তথ্যবলী (গনিওমিটার ব্যবহার করে)

প্রশ্ন	উত্তর
২.১। ঘাড়ের গতি বর্তমানে কতটুকু আছে? (দয়া করে ডিগ্রী দিয়ে লিখবেন)	☐ ফ্লেক্সসন.............. ☐ এক্সটেন্সান............... ☐ সাইড ফ্লেক্সিয়ন (ডানদিকে)........... ☐ সাইড ফ্লেক্সিয়ন (বামে)........... ☐ রোটেসন (ডানদিকে).............. ☐ রোটেসন (বামে).........

পর্বঃ-৩ মাংসপেশীর সক্ষমতার তথ্যবলী

প্রশ্ন	উত্তর
৩.১। ঘাড়ের মাস পেশীর সক্ষমতা বর্তমানে কতটুকু রয়েছে? (OXFORD Grade Scale)	☐ ফ্লেক্সর.............. ☐ এক্সটেনসর............... ☐ সাইড ফ্লেক্সিয়ন (ডানদিকে)........... ☐ সাইড ফ্লেক্সিয়ন (বামে)........... ☐ রোটেসন (ডানদিকে).............. ☐ রোটেসন (বামে).........

পর্বঃ-4 ঘাড়ের প্রতিবন্ধকতা সম্পর্কিত

এই প্রশ্নাবলীটি আপনার ঘাড়ের ব্যথা কীভাবে আপনার দৈনন্দিন জীবনে পরিচালনা করার ক্ষমতাকে প্রভাবিত করেছে সে সম্পর্কে আমাদের তথ্য দেওয়ার জন্য তৈরি করা হয়েছে) নেক ডিসেবিলিটি ইনডেক্সের (এনডিআই) প্রতিটি বিভাগে সর্বনিম্ন ০ পয়েন্ট এবং সর্বোচ্চ ৫ পয়েন্ট রয়েছে। মোট স্কোর = ৫০ (প্রাপ্ত স্কোর)।

প্রশ্নসমূহ	উত্তর
প্রশ্ন নং ১ আজ আপনার ব্যথার তীব্রতা কি পরিমান?	☐ আমার এই মুহূর্তে কোন ব্যথা নেই
	☐ আমার এই মুহূর্তে খুব হালকা ব্যথা আছে
	☐ আমার এই মুহূর্তে মাঝারি ব্যথা আছে
	☐ আমার এই মুহূর্তে ব্যথা মোটামুটি গুরুতর
	☐ আমার এই মুহূর্তে ব্যথা খুব গুরুতর
	☐ আমার এই মুহূর্তে ব্যথা সবচেয়ে বেশি

প্রশ্ন-২	উত্তর
ব্যক্তিগত কাজে (পোশাক পরিছন্নতা, জামাকাপড় পরিধান ইত্যাদি) ক্ষেত্রে আপনি কতটা স্বাধীন?	☐ আমি সাধারণত অতিরিক্ত ব্যথা ছাড়াই নিজেকে স্বাভাবিকভাবে নিজের যত্ন নিতে পারি।
	☐ আমি স্বাভাবিকভাবে নিজের যত্ন নিতে পারি কিন্তু এর ফলে অতিরিক্ত ব্যথা হয়।
	☐ আমার নিজের যত্ন নেওয়া বেদনাদায়ক এবং আমি ধীরগতি এবং সতর্কতা অবলম্বন করি
	☐ আমার কিছু সাহায্য দরকার কিন্তু আমি আমার বেশিরভাগ ব্যক্তিগত যত্ন নিতে পারি।
	☐ আমার ব্যক্তিগত যত্নে বেশিরভাগ ক্ষেত্রে আমার প্রতিদিন সাহায্যের প্রয়োজন।
	☐ আমি পোশাক পরিধান করতে পরি না, আমার কাপড় ধুয়ে কষ্ট হয় এবং বিছানায় শুয়ে থাকতে হয়
প্রশ্ন-৩	**উত্তর**
কোন বস্তু উঠানর ক্ষেত্রে আপনি কতটা স্বাবলম্বী?	☐ আমি অতিরিক্ত ব্যথা ছাড়াই ভারী ওজন উত্তোলন করতে পারি
	☐ আমি ভারী ওজন উত্তোলন করতে পারি কিন্তু অতিরিক্ত ব্যথা হয়
	☐ ব্যথা আমাকে মেঝে থেকে ভারী ওজন তুলতে বাধা দেয়, তবে সেগুলি সুবিধামত স্থাপন করা হলে আমি পরিচালনা করতে পারি, উদাহরণস্বরূপ কোন একটি টেবিলের উপর থেকে
	☐ ব্যথা আমাকে ভারী ওজন তুলতে বাধা দেয় তবে আমি হালকা থেকে মাঝারি ওজন উত্তোলন করতে পারি যদি সেগুলি সুবিধাজনকভাবে স্থাপন করা হয়
	☐ আমি শুধু খুব হালকা ওজন উত্তোলন পারি
	☐ আমি কোন কিছু উত্তোলন বা বহন করতে পারি না
প্রশ্ন-৪	**উত্তর**
সংবাদপত্র বা বই পড়ার সময় আপনার কেমন লাগে?	☐ ঘাড়ে ব্যথা ছাড়াই আমি যতটা চাই ততটাই পড়তে পারি।
	☐ ঘাড়ে সামান্য ব্যথা নিয়ে যত ইচ্ছে পড়তে পারি।
	☐ ঘাড়ে মাঝারি ব্যথা সহ আমি যত খুশি পড়তে পারি। ☐ ঘাড়ে মাঝারি ব্যথার কারণে আমি যতটা চাই ততটা পড়তে পারি না।
	☐ ঘাড়ে তীব্র ব্যথার কারণে আমি খুব কমই পড়তে পারি।
	☐ আমি পড়তে পারি না।
প্রশ্ন-৫	**উত্তর**
আপনি কোন অবস্থায় মাথাব্যথা অনুভব করেন?	☐ আমার কোনও মাথাব্যথা নেই
	☐ আমার সামান্য মাথাব্যথা আছে, যা কদাচিৎ আসে
	☐ আমার মাঝারি মাথাব্যথা আছে, যা কদাচিৎ আসে

	☐ আমার মাঝারি মাথাব্যথা আছে, যা প্রায়শই হয়
	☐ আমার গুরুতর মাথাব্যথা আছে, যা প্রায়শই আসে
	☐ আমার প্রায় সব সময়ই মাথা ব্যথা হয়।
প্রশ্ন-৬	**উত্তর**
ঘাড়ে ব্যথা থাকা সত্ত্বেও কাজ করার সময় আপনি কোন মাত্রায় মনোনিবেশ করেন?	☐ আমি যখন চাই তখন কোনও অসুবিধা ছাড়াই পুরোপুরি মনোনিবেশ করতে পারি
	☐ আমি যখন চাই তখন সামান্য অসুবিধা সহ সম্পূর্ণরূপে মনোনিবেশ করতে পারি
	☐ আমি যখন মনোনিবেশ করতে চাই তখন আমার যথেষ্ট অসুবিধা হয়
	☐ আমি যখন মনোনিবেশ করতে চাই তখন আমার অনেক অসুবিধা হয়
	☐ আমি যখন মনোনিবেশ করতে চাই তখন আমার অনেক অসুবিধা হয়
	☐ আমি একেবারেই মনোনিবেশ করতে পারি না।

প্রশ্ন-৭	**উত্তর**
ঘাড়ের ব্যথা কোন অবস্থায় আপনার দৈনন্দিন কাজকে প্রভাবিত করে?	☐ আমি যত ইচ্ছে তত কাজ করতে পারি
	☐ আমি কেবল আমার স্বাভাবিক কাজ করতে পারি, কিন্তু আর করতে পারি না
	☐ আমি আমার স্বাভাবিক কাজের বেশিরভাগই করতে পারি, কিন্তু আর পারি না
	☐ আমি আমার স্বাভাবিক কাজ করতে পারি না
	☐ আমি খুব কমই কোনও কাজ করতে পারি।
	☐ আমি কোন কাজই করতে পারি না
প্রশ্ন-৮	**উত্তর**
ভ্রমণের সময় আপনার ঘাড়ের ব্যথা কেমন লাগে?	☐ আমি কোনও ঘাড়ের ব্যথা ছাড়াই ভ্রমণ করতে পারি
	☐ ঘাড়ে সামান্য ব্যথা সহ আমি যতদিন চাই ভ্রমণ করতে পারি
	☐ ঘাড়ে মাঝারি ব্যথা সহ আমি যতদিন চাই ভ্রমণ করতে পারি
	☐ ঘাড়ে মাঝারি ব্যথার কারণে আমি যতক্ষণ চাই ততক্ষণ ভ্রমণ করতে পারি না
	☐ ঘাড়ে তীব্র ব্যথার কারণে আমি খুব কমই ভ্রমণ করতে পারি
	☐ আমি ভ্রমণ করতে পারি না
প্রশ্ন-৯	**উত্তর**
ঘাড়ের ব্যথা আপনার ঘুমকে কোন অবস্থায় প্রভাবিত করে	☐ আমার ঘুমানোর কোনও সমস্যা নেই
	☐ আমার ঘুম কিছুটা বিঘ্নিত হয় (১ ঘন্টারও কম ঘুমহীন)

	☐ আমার ঘুমের ব্যাঘাত ঘটে (১-২ ঘন্টা ঘুমহীন)
	☐ আমার ঘুম মাঝারিভাবে বিঘ্নিত হয় (২-৩ ঘন্টা নিদ্রাহীন)
	☐ আমার ঘুম খুব বিরক্তিকর (৩-৫ ঘন্টা ঘুমহীন)
	☐ আমার ঘুম পুরোপুরি বিঘ্নিত হয় (৫-৭ ঘন্টা ঘুমহীন)
প্রশ্ন-১০	**উত্তর**
কোন অবস্থায় আপনার ঘাড়ের ব্যথা আপনার বিনোদনমূলক ক্রিয়াকলাপকে প্রভাবিত করে?	☐ আমি ঘাড়ের ব্যথা ছাড়াই আমার সমস্ত বিনোদনমূলক ক্রিয়াকলাপে জড়িত থাকতে সক্ষম।
	☐ ঘাড়ে কিছুটা ব্যথা সহ আমি আমার সমস্ত বিনোদনমূলক ক্রিয়াকলাপে জড়িত হতে সক্ষম।
	☐ ঘাড়ে ব্যথার কারণে আমি বেশিরভাগ ক্ষেত্রেই ব্যস্ত থাকতে পারি, তবে আমার সমস্ত স্বাভাবিক বিনোদনমূলক ক্রিয়াকলাপে জড়িত হতে পারি না
	☐ ঘাড়ে ব্যথার কারণে আমি আমার কিছু স্বাভাবিক বিনোদনমূলক কাজে অংশ নিতে পারি
	☐ ঘাড়ে ব্যথার কারণে আমি খুব কমই কোনও বিনোদনমূলক কাজ করতে পারি।
	☐ আমি কোনও বিনোদনমূলক কাজই করতে পারি না।

মোট উৎস = এসইউএম (সমস্ত 10 ফলাফলের জন্য পয়েন্ট) শতাংশে অক্ষমতা = মোট স্কোর.......) / ৫০ * ১০০

ব্যাখ্যাঃ

- ন্যূনতম স্কোরঃ ০% ন্যূনতম অক্ষমতা সহ
- সর্বোচ্চ স্কোরঃ ১০০% এর সর্বোচ্চ অক্ষমতা সহ ৫০

অক্ষমতা স্কোর	**ব্যাখ্যা**
০ থেকে ৪	কোনও অক্ষমতা নেই
৫ থেকে ১৪	হালকা
১৫ থেকে ২৪	মাঝারি
২৫ থেকে ৩৪	গুরুতর
৩৪-এর উপরে	সম্পূর্ণ

অনুগ্রহ করে মনে রাখবেনঃ এর অর্থ ৫০ এর মধ্যে ১৫-২৪ (RAW SCORE) মাঝারি অক্ষমতার সাথে সমান

(Questionnaire in English)

I would like to inform you that I need to conduct you in my research and need some information from you. This questionnaire is developed to measure pain, muscle strength, range of motion (ROM) and neck disability index (NDI) of the patient with cervical spondylosis and this portion will be filled by data collector using a black pen. Please answer every section and mark in (***check mark / ✓***) each section only the one box that applies to you. You may have one or more alternative answers to each question, but identify the answer that you think is more appropriate.

Patient's Code No……………. Date…………………

Patient's name………………………… Patient ID No……………………...

Mobile No……………………………. Address…………………………….

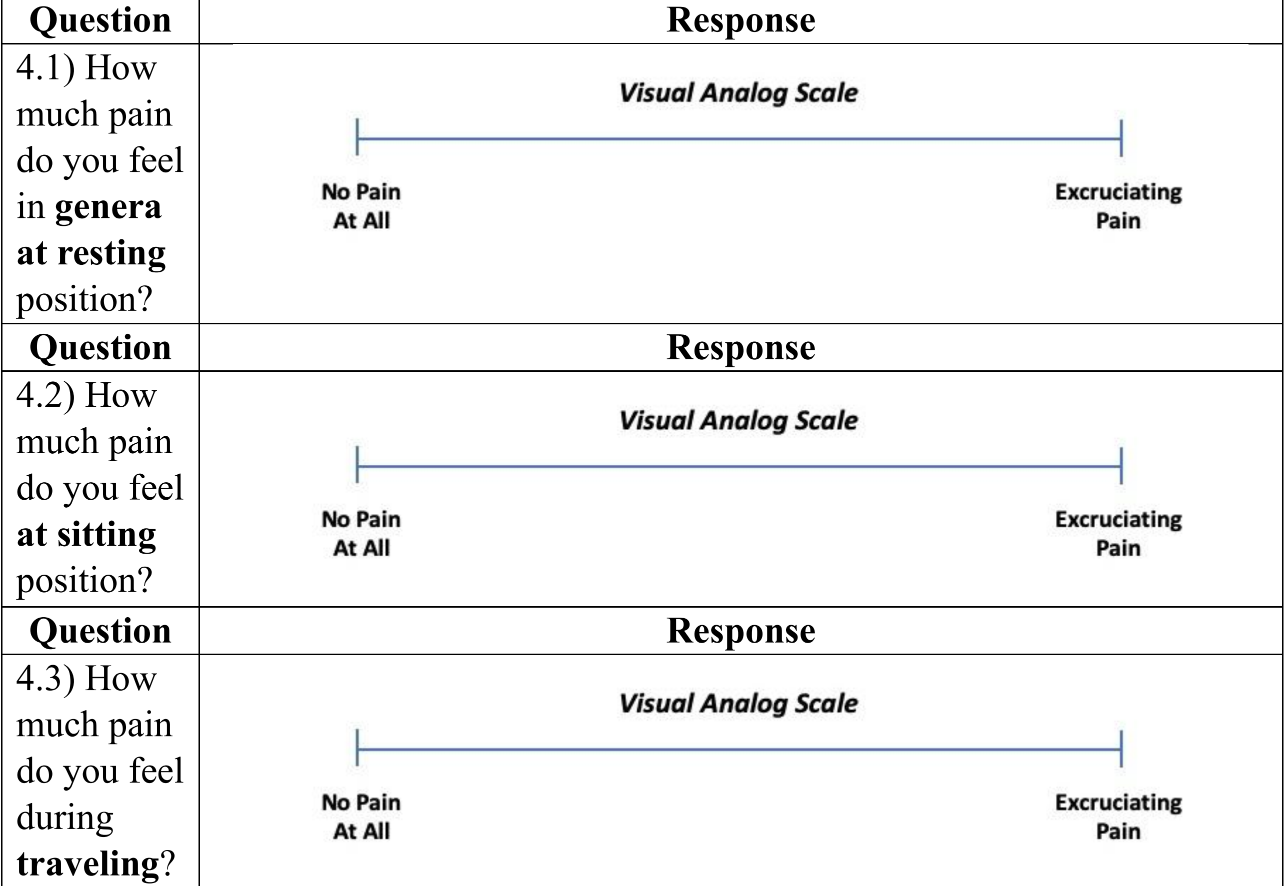
Part-I: Socio-demographic information

Question	**Response**
1.1) Patient's Age (in years)	…………...Years
1.2) Gender	☐ Male ☐ Female
1.3) Occupation	……………………………..
1.4) Education Level	……………………………….
1.5) What type of tasks do you have to perform involving your neck in your work?	☐ Highly repetitive work ☐ Forceful exertions ☐ High level of static contractions ☐ Prolonged static loads ☐ Extreme postures / awkward posture
1.6) How long have you been suffering from neck pain?	…………Months
1.7) Weight	………….. (kg)
1.8) Hight	…………. (cm)
1.9) BMI	…………. (kg/m2)

Part-II Medical Information	
2.10) Do you have Hypertension (HTN)?	☐ Yes ☐ No
2.11) Do you have Diabetes Mellitus?	☐ Yes ☐ No
Part-III Pain related information	
3.12) What do you think about the cause of your pain?	☐ Due to Trauma ☐ Due to lifting heavy weight ☐ Due to bad working posture ☐ Bad sleeping posture ☐ Due to Degenerative change ☐ Others
3.13) In which side of your neck pain is more?	☐ Right side ☐ Left side
3.14) Does your pain radiate to your shoulder?	☐ Yes ☐ No
3.15) In which direction does your pain spread the most? (If it doesn't, please refrain from answering this question.)	☐ Right side ☐ Left side
3.16) Where do you feel more pain relatively?	☐ Neck pain is more than shoulder girdle ☐ Shoulder girdle is more than neck ☐ Neck pain and Shoulder girdle pain are equal
3.17) When do you feel worse pain?	☐ At morning ☐ As the day progresses ☐ At evening ☐ At night ☐ All day
3.18) In Which direction of moving exaggerated your pain?	☐ Neck forward bending ☐ Neck backward bending ☐ Neck turning to right ☐ Neck turning to left ☐ Raising from lying ☐ Raising from sitting
3.19) In which direction does moving your neck reduce your pain?"	☐ Neck forward bending ☐ Neck backward bending ☐ Neck turning to right ☐ Neck turning to left ☐ Raising from lying ☐ Raising from sitting

Pre-Test

Part-IV: Visual Analog Scale (VAS)



Question	Response
4.1) How much pain do you feel in **genera at resting** position?	*Visual Analog Scale* No Pain At All — Excruciating Pain
Question	**Response**
4.2) How much pain do you feel **at sitting** position?	*Visual Analog Scale* No Pain At All — Excruciating Pain
Question	**Response**
4.3) How much pain do you feel during **traveling**?	*Visual Analog Scale* No Pain At All — Excruciating Pain

Part-V: Range of Motion using Universal Goniometer by Assessor

Question	Movement (With reference value)	Degree of Range (With finding value)
5.1) How much range of motion cervical spine present? (in degree)	Flexion (50-60)	
	Extension (60-75)	
	Right side flexion (20-45)	
	Left side flexion (20-45)	
	Right side Rotation (60-80)	
	Left Side Rotation (60-80)	

Part-VII: Measurement of Neck Muscle Strength by (OXFORD Grade Scale)

Question	Movement	(OXFORD Grade Scale)
6.1) In which state muscle strength of cervical spine lies at present? (OXFORD Grade Scale)	Flexion	
	Extension	
	Right Side flexion	
	Left Side flexion	
	Rotation (Right)	
	Rotation (Left)	

Part-VIII: NECK DISABILITY INDEX (NDI) Questionnaire

(This questionnaire has been designed to give us information as to how your neck pain has affected your ability to manage in everyday life). Each section of Neck Disability Index (NDI) consists of lowest 0 point and highest 5 points.

Total Score= 50 (Obtained Score……………).

Section 1 Question	Response
PAIN INTENSITY: How much pain do you have right now?	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= The pain is the worst pain imaginable at the moment
Section 2 Question	**Response**
PERSONAL CARE: How independent you at personal care? (e.g. washing, Dressing etc.)	0= I can look after myself normally without causing extra pain
	1= I can look after myself, 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= I do not get dressed; I wash with difficulty and stay in bed
Section 3 Question	**Response**
LIFTING: How independent are you during lifting object?	0= I can look after myself normally without causing extra pain
	1= I can look after myself, but it causes extra pain
	2= It is painful to look after myself and I am slow and careful
	3= The pain is fairly severe at the moment
	4= The pain is very severe at the moment
	5= The pain is the worst pain imaginable at the moment

Section 4 Question	**Response**
READING: How do you feel while reading newspaper or book?	0= I can read as much as I want with no neck pain
	1= I can read as much as I want with slight neck pain
	2= I can read as much as I want with moderate neck pain
	3= I can't read as much as I want because of moderate neck pain
	4= I can hardly read at all because of severe pain
	5= I can't read as much as I want because
Section 5 Question	**Response**
HEADACHES: To which state of headache do you feel?	0= I have no headaches at all
	1= I have slight headaches that come infrequently
	2= I have moderate headaches that come infrequently
	3= I have moderate headaches that come frequently
	4= I have severe headaches that come frequently
	5= I have headaches almost all of the time
Section 6 Question	**Response**
CONCENTRATION: To which level of concentration do you keep during working despite of neck Pain?	0= I can concentrate fully when I want with no difficulty
	1= I can concentrate fully when I want to with slight difficulty
	2= I have a fair degree of difficulty concentrating when I want to
	3= I have a lot of difficulty concentrating when I want to
	4= I have a great deal of difficulty concentrating when I want to
	5= I cannot concentrate at all
Section 7 Question	**Response**
WORK: To which state neck pain affect your daily work?	0= I can do as much work as I want
	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= I cannot do any work at all
Section 8 Question	**Response**
DRIVING: How do you feel your neck pain during travelling?	0= I can drive my car without any neck pain
	1= I can drive my car as long as I want with slight neck pain
	2= I can drive my car as long as I want with moderate neck pain

	3= I can’t drive my car as long as I want because of moderate neck pain
	4= I can hardly drive at all because of severe neck pain
	5= I can’t drive my car at all
Section 9 Question	**Response**
SLEEPING: To which state neck pain affect your sleep?	0= I have no trouble sleeping
	1= My sleep is slightly disturbed (less than 1 hour sleepless)
	2= My sleep is mildly disturbed (1 to 2 hours sleepless)
	3= My sleep is moderately disturbed (2 to 3 hours sleepless)
	4= My sleep is greatly disturbed (3 to 5 hours sleepless)
	5= My sleep is completely disturbed (5 to 7 hours sleepless)
Section 10 Question	**Response**
RECREATION: To which state neck pain affects your recreation activities?	0= I am able to engage in all my recreation activities with no neck pain
	1= I am able to engage in all my recreation activities with some neck pain
	2= I am able to engage in most, but not all, of my usual recreation activities because of neck pain
	3= I am able to engage in a few of my usual recreation activities because of neck pain
	4= I can hardly do any recreation activities because of neck pain
	5= I can’t do any recreation activities at all because of neck pain

Total source = SUM (points for all 10 findings). Disability in percent= total score…….) /50* 100

Interpretation

- Minimum score: 0 with a minimum disability of 0%
- Maximum score: 50 with maximal disability of 100%

Disability Score	Interpretations
0 to 4	No disability
5 to 14	Mild
15 to 24	Moderate
25 to 34	Severe
Above 34	Complete

Please note: the means 15-24 out of 50 (the RAW SCORE) equates with moderate disability.

Post-Test

Part-I: Visual Analog Scale (VAS)

Question	Response
1.1) How much pain do you feel in **genera at resting** position?	***Visual Analog Scale*** **No Pain At All** ——— **Excruciating Pain**
Question	**Response**
1.2) How much pain do you feel **at sitting** position?	***Visual Analog Scale*** **No Pain At All** ——— **Excruciating Pain**
Question	**Response**
1.3) How much pain do you feel during **traveling**?	***Visual Analog Scale*** **No Pain At All** ——— **Excruciating Pain**

Part-II: Range of Motion Using Universal Goniometer by Assessor

Question	Movement (With reference value)	Degree of Range (With finding value)
2.1) How much range of motion of cervical spine present? (in degree)	Flexion (50-60)	
	Extension (60-75)	
	Right side flexion (20-45)	
	Left side flexion (20-45)	
	Right side Rotation (60-80)	
	Left Side Rotation (60-80)	

Part-III: Measurement of Neck Muscle Strength by (OXFORD Grade Scale)

Question	Movement	(OXFORD Grade)
3.1) In which state muscle strength of cervical spine lies at present? (OXFORD Grade)	Flexion	
	Extension	
	Right Side flexion	
	Left Side flexion	
	Rotation (Right)	
	Rotation (Left)	

Part-IV: NECK DISABILITY INDEX (NDI) Questionnaire

(This questionnaire has been designed to give us information as to how your neck pain has affected your ability to manage in everyday life). Each section of Neck Disability Index (NDI) consists of lowest 0 point and highest 5 points.

Total Score= 50 (Obtained Score……………).

Section 1 Question	Response
PAIN INTENSITY: How much pain do you have right now?	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= The pain is the worst pain imaginable at the moment
Section 2 Question	**Response**
PERSONAL CARE: How independent you at personal care? (e.g. washing, Dressing etc.)	0= I can look after myself normally without causing extra pain
	1= I can look after myself, 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= I do not get dressed; I wash with difficulty and stay in bed
Section 3 Question	**Response**
LIFTING: How independent are you during lifting object?	0= I can look after myself normally without causing extra pain
	1= I can look after myself, but it causes extra pain
	2= It is painful to look after myself and I am slow and careful
	3= The pain is fairly severe at the moment

	4= The pain is very severe at the moment
	5= The pain is the worst pain imaginable at the moment
Section 4 Question	**Response**
READING: How do you feel while reading newspaper or book?	0= I can read as much as I want with no neck pain
	1= I can read as much as I want with slight neck pain
	2= I can read as much as I want with moderate neck pain
	3= I can't read as much as I want because of moderate neck pain
	4= I can hardly read at all because of severe pain
	5= I can't read as much as I want because
Section 5 Question	**Response**
HEADACHES: To which state of headache do you feel?	0= I have no headaches at all
	1= I have slight headaches that come infrequently
	2= I have moderate headaches that come infrequently
	3= I have moderate headaches that come frequently
	4= I have severe headaches that come frequently
	5= I have headaches almost all of the time
Section 6 Question	**Response**
CONCENTRATION: To which level of concentration do you keep during working despite of neck Pain?	0= I can concentrate fully when I want with no difficulty
	1= I can concentrate fully when I want to with slight difficulty
	2= I have a fair degree of difficulty concentrating when I want to
	3= I have a lot of difficulty concentrating when I want to
	4= I have a great deal of difficulty concentrating when I want to
	5= I cannot concentrate at all
Section 7 Question	**Response**
WORK: To which state neck pain affect your daily work?	0= I can do as much work as I want
	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= I cannot do any work at all
Section 8 Question	**Response**
DRIVING: How do you feel your neck pain during travelling?	0= I can drive my car without any neck pain
	1= I can drive my car as long as I want with slight neck pain
	2= I can drive my car as long as I want with moderate neck pain

	3= I can't drive my car as long as I want because of moderate neck pain
	4= I can hardly drive at all because of severe neck pain
	5= I can't drive my car at all
Section 9 Question	**Response**
SLEEPING: To which state neck pain affects your sleep?	0= I have no trouble sleeping
	1= My sleep is slightly disturbed (less than 1 hour sleepless)
	2= My sleep is mildly disturbed (1 to 2 hours sleepless)
	3= My sleep is moderately disturbed (2 to 3 hours sleepless)
	4= My sleep is greatly disturbed (3 to 5 hours sleepless)
	5= My sleep is completely disturbed (5 to 7 hours sleepless)
Section 10 Question	**Response**
RECREATION: To which state neck pain affects your recreation activities?	0= I am able to engage in all my recreation activities with no neck pain
	1= I am able to engage in all my recreation activities with some neck pain
	2= I am able to engage in most, but not all, of my usual recreation activities because of neck pain
	3= I am able to engage in a few of my usual recreation activities because of neck pain
	4= I can hardly do any recreation activities because of neck pain
	5= I can't do any recreation activities at all because of neck pain

Total source = SUM (points for all 10 findings). Disability in percent= total score…….) /50* 100

Interpretation

- Minimum score: 0 with a minimum disability of 0%
- Maximum score: 50 with maximal disability of 100%

Disability Score	Interpretations
0 to 4	No disability
5 to 14	Mild
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Above 34	Complete

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