Faculty of Medicine

University of Dhaka

EFFECTIVENESS OF CRANIO-CERVICAL EXERCISE COMBINED WITH USUAL CARE AMONG PATIENTS WITH CHRONIC NECK PAIN

By

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Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Physiotherapy

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance of this thesis entitled, **"Effectiveness of Cranio-cervical Exercise Combined with Usual Care among Patients with Chronic Neck Pain",** submitted by Mohammad Habibur Rahman, for the partial fulfillment of the requirements for the degree of Master of Science in Physiotherapy.

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Declaration Form

- This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidature for any degree.

- This dissertation is being submitted in partial fulfillment of the requirements for the degree of M.Sc. in Physiotherapy.

- This dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A Bibliography is appended.

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List of Abbreviations

BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical & Research Council
CCE	Cranio-cervical Exercise
CRP	Centre for the Rehabilitation of the Paralysed
DNF	Deep Neck Flexor
ICF	International Classification of Functioning, Disability and Health
IRB	Institutional Review Board
MMT	Manual Muscle Testing
MPQ	Mcgill Pain Questionnaire
NAGs	Natural Appophyseal Gliding
NDI	Neck Disability Index
NPDS	Neck Pain & Disability Index
NPQ	Northwick Park Neck Pain Questionnaire
NRS	Numerical Rating Scale
ROM	Range of Motion
SNAGs	Sustained Natural Appophyseal Gliding
SPSS	Statistical Package for Social Science
US	United States
VAS	Visual Analogue Scale
WHO	World Health Organization
YLDs	Years Lived with Disability

Abstract

Background*:** Chronic neck pain (CNP) is defined as pain in the neck with or without pain referred into one or both upper limbs that last for at least 3 months. The prevalence neck pain in the general population ranges from 0.4% to 86.8% worldwide. However, neck pain triggered by imbalance between superficial and deep neck muscles was regarded as important factors for this increased prevalence. Cranio-cervical exercise (CCE) maintains balance between these muscles. ***Objectives*:** To determine and compare patient rated general neck pain, neck ROM, neck muscle strength and disability before and after application CCE combined with usual care among patients with CNP. ***Methodology*:** Classic experimental study design was used in this study. 28 patients with CNP were randomly assigned into two groups from outdoor musculo-skeletal unit, CRP. Among them 14 patients were assigned into trial group received CCE with usual care and another 14 into control group received only usual care. Total treatment sessions were six comprising of 2 sessions per week for 3 weeks. Single blinding procedure was used during data collection. ***Outcome measurement tools*:** Numerical pain rating scale (NPRS) was used to measure pain and universal goniometer to measure ROM, manual muscle testing to measure muscle strength and NDI to measure neck disability. ***Analysis of data: Inferential statistics such as Mann-Whitney U test, Unpaired t, Paired t and Wilcoxon test was done using SPSS version 20. ***Results*:** It was observed that pain and neck disability had reduced and ROM and muscle strength improved both between and within group results except flexion and activation of cervical flexor muscle (P>.05). ***Conclusion:*** This research showed that CCE combined with usual care was more effective than only usual care for patients with chronic neck pain.

Key words: Chronic neck pain, Cranio-cervical exercise and Usual care.

CHAPTER- I INTRODUCTION

1.1. Background

Musculoskeletal disorders remain one of the important causes of activity limitation and participation restriction in daily activities. Within the musculoskeletal disorder, neck pain is increasing throughout the world (Rubinstein and van Tulder, 2008). Chronic neck pain is defined as pain in the neck with or without pain referred into one or both upper limbs that lasts for at least 3 months (Hoy, et al., 2014). The prevalence and burden of neck pain varies worldwide. Overall prevalence of neck pain in the general population ranges from 0.4% to 86.8% worldwide (Breivik, et al., 2013). Conversely Hoy, et al. (2014) stated that the prevalence of neck pain is increasingly yearly and creating disability globally. In addition, Disability-adjusted life years increased from 23.9 million in 1990 to 33.6 million in 2010. Out of all 291 conditions studied in the Global Burden of Disease 2010 Study neck pain ranked as the 4th highest in terms of disability as measured by years lived with disability (YLDs) and 21st in terms of overall burden.

In United States of America, the annual prevalence was 41.5% in which individuals with chronic neck pain were middle-aged (mean age 48.9 years) and the majority of subjects were women (Driessen, et al., 2012) and it was the eight leading cause of disability in United States of America (Sberman, et al., 2014). In United Kingdom, the annual incidence was 34%. Incidence of neck pain is increasing and it is estimated that up to 50% of the population experienced neck pain in last 1 year in which majority of the participants were middle age and female gender were associated with risk factors for the development and reporting of neck pain (Joslin, et al., 2014). In Australia, the prevalence of neck pain was 27.1% (Hayes, et al., 2013) whereas Hush,

et al. (2009) conducted a one year incidence proportion of neck pain in Australian office workers which estimated to be 0.49 and predictors of neck pain with moderate to large effect sizes were female gender than men. In Canada one population based cohort study (Cote, et al., 2008) showed that the annual incidence of neck pain was 14.6% and each year, 0.6% of the population developed disabling neck pain. Women are more likely than men to develop neck pain more likely to suffer from persistent neck problems and less likely to experience resolution. On the other hand, another study conducted by Schopflocher, et al. (2011) showed that the prevalence of chronic neck pain was 18.9% among patients aged 18 years or older in which before 30 years predominately male suffered from neck pain with prevalence of 16.3% and after 30 years predominately more female reported neck pain compare with male with prevalence of 17.6%. In Sweden, the prevalence of neck pain was 55% in which females were more prevalent to be affected than male. Age specific statistics showed there was variation in age between male and female. Females aged between 35-44 had a higher risk of having long and medium-term neck pain and ≥ 65 aged males had a higher risk of having long and medium term neck pain symptoms (Linder, et al., 2012).

In the terms of the region of Asia, the prevalence of neck pain demonstrated in the peak position in West and the Midwest of the Asia whereas in the South part of Asia showed relatively lower. In this area, the prevalence of neck pain varies among different age range. Age group of 45 to 64 years, 65 to 74 years, and 75 years and older had a similar prevalence of neck pain consisting of 31.1%–32.2%. In contrast, age between 18 to 44 years showed lower prevalence that demonstrated 23.9% (Paul, 2008). In Hong Kong, the prevalence of neck pain among desk workers was 25.2% (Chiu, et al. 2012). In India, the prevalence of chronic neck pain among computer

operators was found 47%. Majority of the participants were in between the age of 30-50 years. In contrast, Radhakrishnan, et al. (2015) showed that female was more commonly to develop and suffered from persistent neck pain. In Pakistan, one study (Sabeen, et al., 2013) categorized work related neck disorders among different employees and the highest prevalence was found among Pakistani computer users (72%) than bank workers (45.7%). Besides, Mansoor, et al. (2013) showed that chronic neck pain was found with highest prevalence of 28.6%. In Sri Lanka, the prevalence was 39.64% in sewing workers in a garments factory (Jahan, et al., 2015) and no relevant study was found on neck pain prevalence among Bangladeshi people till date.

One study (Masum, et al., 2015) found that 22.22% office workers experienced neck pain on regular basis and 52.22% of the respondent sometimes. Along with considerable cost for individual and society, neck pain is a frequent source of disability causing human suffering and affecting wellbeing of individual (Bronfort, et al., 2012). Another study (Driessen, et al., 2012) stated that chronic neck pain was a financial burden for society, since these symptoms result in extended periods of sick-leave from work and high utilization of health care services. Martin, et al. (2009) in the United States (US) showed that in the period from 1997 to 2006, the US health care expenditures had increased 7% per year for persons with spinal problems. In 2007, neck problems accounted for 9% of the total US health care expenditures (Martin, et al., 2008).

Given the situation in recent years, Australian population showed tremendous days of sick leave which ultimately affects the country's economy. One study (Bevan, 2012) showed that 7% of nation's expenditure on health services increased due to neck pain

in Australia. Economic evaluations investigate the value for money of health care interventions. The costs and effects of the health care intervention under study are compared with the costs and effects of an alternative intervention. This comparison gives insight into whether a health care intervention is worth implementing. For policy makers, health care professionals, and patients, this information is important to decide whether or not to reimburse, provide or receive a specific intervention. The precursors for impairing the wellbeing are mechanical irritation of pain sensitive structures due to muscle spasm, degenerative changes in intervertebral bodies, discs, ligament injury and muscular weakness in the cervical spine.

In an upright neutral posture of cervical spine, passive resistance to motion is minimal. Support of the cervical segments is provided by the muscular sleeve formed by the longus colli muscle anteriorly and the semispinalis cervicis and cervical multifidus muscle posteriorly. The importance of deep muscles for the maintenance of cervical posture is known and region of local segmental instability results, if only the large superficial muscles of the neck (sternocleidomastoid and anterior scalene) are stimulated to produce movement. Deep cervical muscle activity is needed in synergy with superficial muscle activity to stabilize the cervical segments, especially in the functional mid-range of cervical spine (Falla, et al., 2013). Cervical muscle impairments have been found in up to 70 percent of subject with neck pain. The cervical impairments which are commonly noted are cervical pain, loss of range of motion, decreased strength, endurance and forward head posture (Rezasoltani, et al., 2010).

There is growing evidence that subjects with neck pain have weakness or motor difficulty in facilitating the deep neck flexor (DNF). The location of deep neck flexor

(longus colli and longus capitis) suggested that they played an important role in stabilizing cervical spine in all position without being influenced by gravity (Gupta, et al., 2013). A poor forward head posture may occur as a result of loss of endurance of deep neck flexors (Falla, et al., 2007). Therefore, coordination between superficial and deep flexors is considered safe progression of exercises in patient with mechanical neck pain. It is well known that sternocleidomastoid and anterior scalene together provide 83% of cervical flexion capacity. If coordination between superficial and deep flexor is not corrected in the first instance, the overwork of superficial flexor might mask or substitute for any impaired performance of deep neck flexor in any premature progression to higher load exercises (Falla, et al., 2013).

Most recently few studies found effectiveness of craniocervical exercise for neck pain patients which was unknown in past and still to be included in usual care for patients with neck pain. Jeyanthi and Arumugam, (2015) stated that the craniocervical training program (CTP) was a new developed program using low-load endurance exercises in order to train and/or to regain muscle control of the cervicoscapular and craniocervical regions. Sowmya (2014) stated that craniocervical exercise maintains balance between cervical superficial and deep groups of muscles.

There is consistent evidence that these questionnaires provide useful information about the impact of neck pain on the patient's psychosomatic status and the effectiveness of treatment intervention for both clinicians and patients (Nordin, et al., 2008). In addition, neck pain and neck related functional disabilities were commonly measured by classifying pain in one category, function another and disability in the final category. Pain was measured by using pain scales in different form such as numerical rating scale (NRS), visual analogue scale (VAS) and verbal rating scale (Walton, et al., 2011). The NRS is a verbal or written determination of a pain level on

a scale from 0 to 10, in which 0 represents no pain and 10 represents excruciating pain (Hawker, et al., 2011). In contrast with VAS, some investigators stated that the NRS was not as sensitive to patient's ability to express distress and therefore, they recommend using the VAS because it is better suited to parametric analysis and it provides a continuous score as well (Tashjian, et al., 2009; Kim, et al., 2015). In verbal rating scale, there is a 4 or 5 point scale based on the patient's selection of a word that best describes current pain intensity. The value of this scale appears to be limited by its lack of sensitivity in detecting small changes in pain intensity (Hawker, et al., 2011). In addition, Mcgill pain questionnaire (MPQ) which is a valid and reliable pain measurement scale demonstrated the actual scenario of patient's pain.

One of the most popular pain scales that uses word lists and has been adopted for many clinical trials is the McGill Pain Questionnaire (MPQ) and especially the short form (SF-MPQ) whereas the VAS measures only pain intensity (Uddin, et al., 2014). On the other hand, different disability scales are commonly used by different researchers in their study. They are Neck Disability Index (NDI), Northwick Park Neck Pain Questionnaire (NPQ) and Cervical Spine Outcome Questionnaire (CSOQ). The NDI, NPQ and CSOQ have the similar prediction to measure patient's pain on cervical region but NPDS uses Million Visual Analogue Scale as a template whereas as CSOQ is mostly used to assess pain associated with whiplash injury of neck (Schellingerhout, et al., 2012).

However, among these disability measurement scales NDI showed acceptable reliability. In addition, it has been used effectively in both clinical and research settings (Neziri, et al., 2010). In contrast Leonard, et al. (2009) study addressed to asses pain with neck pain functional limitation scale (NPFLS) to measure the disability for neck pain in Asian context and concluding that NPFLS showed good

reliability but it lacks concurrent and criterion validity which is essential for using the scale confidently in Asian context.

1.2. Justification of the study

Neck pain due to mechanical origin is most prevalent around the globe. Different studies (O'Leary, et al., 2011; Sowmya, 2014) found positive correlation between influence of neck muscle weakness and chronic neck pain. In particular, general neck and upper limb endurance training, dynamic strengthening programs and cervical stabilization exercises appear to be more favorable exercise options than stretching (Dusunceli, et al., 2009 ; El-Sodany, et al., 2014). However, these exercises primarily focused on superficial neck muscles which have shown least effective for long time pain reduction and minimization of neck disability.

It has already proved that isolated superficial muscle contraction produce movement impairments and instability in the absence of deep neck flexor muscles synergistic action. Therefore, introducing cranio-cervical exercise would deliver more emphasize to minimize neck pain and neck disability. The usual care for neck pain patients are recognized as multimodal treatments such as McKenzie exercises in combination with manual therapy, exercise therapy, superficial and deep heating agents as well as traction.

In past, craniocervical exercise was compared to isometric neck strengthening exercise and found effective to minimize neck pain and disability. The purpose of this study was to find out the effectiveness cranio-cervical exercise combined with usual care among patients with chronic neck pain. There were numerous published articles regarding physiotherapy interventions for patients with chronic neck pain but cranio-cervical exercise was not combined with usual care for chronic neck pain patients

earlier by any author. In reality, this study would form a foundation to use cranio-cervical exercise along with usual care considering special dose and repetitions. However, research is essential to improve the knowledge of health professionals, as well as to develop the profession. The results of this study would guide physiotherapists to apply evidence based treatment to patients with chronic neck pain which would be beneficial for patients and develop physiotherapy profession as well.

1.3.Operational Definition

1.3.a Cranio-Cervical Exercise: A method that is applied over deep cervical muscles in order to minimize pain and disability related to chronic neck pain patients.

1.3.b. Neck pain: This is usually associated with a long-term illness and chronic pain can be the result of damaged tissue but very often is attributable to nerve damage.

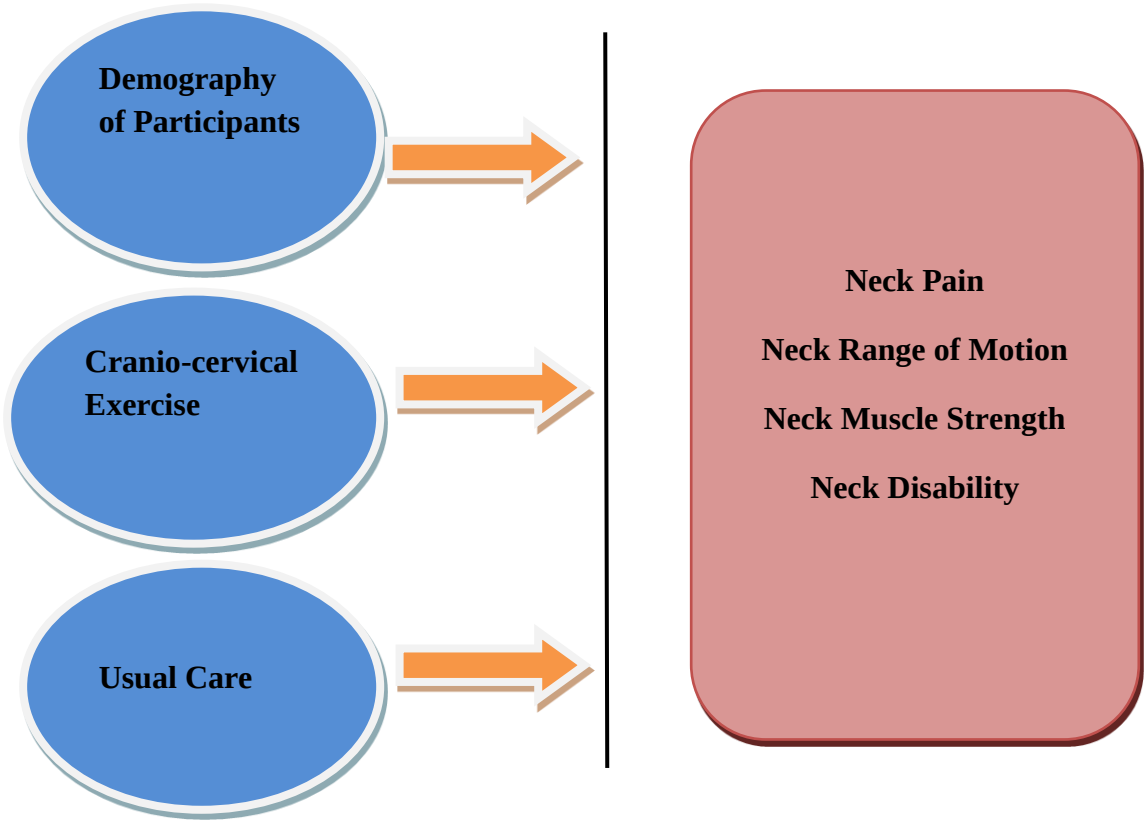
1.3.c. Chronic neck pain: Neck pain sustaining of more than 3 months duration.

1.3.d. Usual care: Treatment techniques that are conventionally preferred by physiotherapist in a particular setting.

1.3. 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.

1.4.List of variables

Independent variables **Dependent variable**



1.5 .Aim

To evaluate the effectiveness of cranio-cervical exercise (CCE) combined with usual care among patients with chronic neck pain.

1.6. Objectives

1.6.1. General Objective

To determine and compare the effectiveness of cranio-cervical exercise (CCE) combined with usual care among patients with chronic neck pain.

1.6.2. Specific objectives:

- To find out the demographic characteristics, pain related and medical information of participants.
- To find out the effectiveness of CCE combined with usual care in within and between groups at patient rated general pain.
- To determine the effectiveness of CCE combined with usual care in within and between groups among patients with chronic neck pain at cervical range of motion and muscle strength.
- To ascertain the effectiveness of CCE combined with usual care in within and between groups among patients with chronic neck pain at cervical spine disability.
- To demonstrate the effectiveness of CCE combined with usual care in within and between groups at each components of neck disability index such as sleeping effects, pain at rest, reading newspaper, headache, travelling, concentration at work, personal car, daily work, lifting objects and recreational activities.

1.7. Hypothesis (H_1)

Cranio-cervical exercise combined with usual care is more effective than usual care for the treatment of patients with chronic neck pain.

1.8. Null hypothesis (H_0)

Cranio-cervical exercise combined with usual care is no more effective than usual care for the treatment of patients with chronic neck pain.

CHAPTER- II LITERATURE REVIEW

Musculoskeletal disorders are consistently threatening the quality of life by having the potential to restrict daily activities, causing absence from work and resulting in a change or discontinuation from employment. Hence disorders are expensive for society and for patients and are responsible for the highest number of healthy years (Damgaard, et al., 2013). Among those loss of days due to musculoskeletal disorders, work related pain is one of the common musculoskeletal disorders that affects millions of workers throughout the world across variant works or sectors of services (Mustafa and Sultan, 2013). Thus, pain is an unpleasant emotional state felt in the mind but identifiable as arising in a part of the body. In other word, it is a subjective sensation. Besides, pain is a defense mechanism designed to protect the subject's injured part from further damage (Wilde, et al., 2007). By any measure, pain is significantly a global health problem. Globally, it has been reported that 1 in 5 adults suffer from pain (Goldberg and McGee, 2011).

2.1. Definition of neck pain

Pain in the neck is an unpleasant sensory and emotional experience in the neck area associated with actual or potential tissue damage or described in terms of such damage and it is an unspecified pain symptom (or syndrome) rather than a clinical sign. Perhaps age, culture, previous pain experiences and emotional factors such as joy, grief, fear, excitement, and the patient's beliefs and attitudes toward pain (Vaajoki, 2013). Although it is not life threatening, it can cause a sense of being unwell and substantial level of disability due to pain and neck stiffness. This disability can affect the physical functioning of the patients leading to sickness behavior and

activity restrictions. In general population, the 12-month prevalence of activity-limiting pain has been reported to vary from 1.7% to 11.5% (Leonard, et al., 2009).

2.2. Types of neck pain

Neck pain can be experienced as acute, chronic or intermittent or a combination of the three. Pain is a multivalent, dynamic and ambiguous phenomenon which is notoriously difficult to quantify. The International Association for the Study of Pain (IASP) in its classification of chronic pain defines cervical spinal pain as pain perceived anywhere in the posterior region of the cervical spine, from the superior nuchal line to the first thoracic spinous process (Misailidou, et al., 2010). The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders describes neck pain as pain the posterior neck region from the superior nuchal line to the spine of the scapula and the side region down to the superior border of the clavicle and the suprasternal notch (Sherman, et al., 2014). In addition, Ylinen (2007) defines typical characteristics of chronic neck pain with differential time duration from other types of neck pain.

2.3. Definition of chronic neck pain

Chronic neck pain is described as an often-widespread sensation with hyperalgesia in the skin, ligaments and muscles on palpation and in both passive and active movements in neck and shoulder area. Acute neck pain usually lasts less than 7 days, sub-acute neck pain lasts more than 7 days but less than 3 months, and chronic neck pain has duration of 3 months or more (Wilde, et al., 2007).

2.4. Consequence of chronic neck pain

One study (Vos, 2012) showed that neck pain affects about 330 million people globally as of 2010 (4.9% of the population) whereas it is more common in women (5.7%) than men (3.9%). However, it is evident to know the estimation of acute or

chronic neck pain prevalence and till date no research clearly mentioned which one is most prevalence. Nonetheless Goode, et al. (2010) stated that approximately 50–85% of individuals with neck pain do not experience complete resolution of symptoms and many of them might go on to experience chronic and impairing pain. In contrast Carroll, et al. (2008) disclaimed that neck pain either acute or chronic depending on the activity level performed by individuals. Thus, the authors concluded that twelve-month prevalence estimates for activity-impairing neck pain range from 3.1–4.5% in the general population. The vast transformation of chronic neck pain from acute largely depends on production of neck pain through pain mechanism.

2.5. Mechanism of chronic neck pain

The sequence of chronic neck pain started from the mechanisms that alter the alignment of the cervical spine include pain, tightness in the soft tissues, imbalances of muscle strength as well as endurance between superficial and deep neck muscles, muscle fatigue and the cervical and thoracic curves. Changes in cervical and thoracic alignment as well as slouched posture are also known to contribute to altered alignment of the scapula. Hence, altered cervical alignment such as head protrusion is considered to be an important mechanism influencing cervical and scapular kinematics (Moayedi and Davis, 2013). Smart, et al. (2010) stated that chronic neck was introduced as a result of dysfunction of pain matrix and ectopic foci. Hence, due to repetitive movements or neck muscles imbalance originates pain impulse that starts from the epidermal free nerve ending of the skin travelling via the first order neuron to the spinal cord and there the first order neuron bonds with the second order neuron in the substantial gelatinosa area. From here, pain impulse enters the first spinothalamic tract and then the brain stem and finally the second order neuron synapse with the third order neuron in the thalamus to create the sensation of pain.

Therefore, production of chronic neck pain largely depends on predisposing or risk factors rather than limited casual factors.

2.6. Causes of chronic neck pain

The causes of chronic neck pain are broadly categorized into mechanical and pathological in which most of the patient came with mechanical neck pain (Ragonese, 2009). The mechanical causes of chronic neck pain directly includes traumatic cervical injury such as whiplash injury, cervical spondylosis, osteoarthritis or rheumatoid arthritis in cervical region, strain of neck muscles, muscles imbalance between cervical superficial and deep muscles, cervical disc bulging or herniation (Jull, et al., 2009; Sabeen, et al., 2015). However, different studies (Loose, et al., 2008; Son, et al., 2013) argued that chronic neck pain was not only confined to relative cause but also moderately depends on risk factors in which some are medical risk factors and others are work related risk factors. Medical risk factors include obesity and diabetes mellitus (Pai, et al., 2015), hypertension, sleeping posture (Peng, et al., 2015). In recent years, work load have increased among different professionals as well as students. Hence, the prevalence of work related chronic neck pain has increased among computer users, dentist, nurses, surgeons, bankers and teachers (Hagag, et al., 2011; Mustafa and Sultan, 2013). This high prevalence has reflected by work related musculoskeletal disorders due to functional anatomy of cervical spine.

2.7. Clinical features of chronic neck pain

The clinical features of neck pain exhibits in accordance with the level of involved cervical spine. Misailidou, et al. (2010) suggested that neck pain was subdivided into upper cervical spinal pain and lower cervical spinal pain, above or below an imaginary transverse line through C4. From upper cervical segments, pain can usually be referred to the head, whereas from lower cervical segments, pain can be referred to

the scapular region, anterior chest wall, shoulder, or upper limb. They also define suboccipital pain as the pain located between the superior nuchal line and C2, an area that appears to be the source of cervicogenic headache. In that aspect, the division of neck pain into suboccipital and upper and lower cervical pain may be important for clinicians and researchers in recognizing the area of the source of pain and trying to determine the possible causes. It is recognized that neck pain is a symptom following conditions in neck which are of degenerative conditions, inflammatory conditions, soft tissues injury or abnormalities of upper thoracic level. In contrast, when pathoanatomical conditions of neck pain cannot be made, Cheng, et al. (2015) recommended the term idiopathic chronic neck pain.

Guzman, et al. (2008) recommended a clinical classification of chronic neck pain in 4 grades according to severity of pain: grade I is neck pain with no signs or symptoms of major structural pathology and no or minor interference with activities of daily living, grade II is neck pain with no signs or symptoms of major structural pathology but major interference with activities of daily living, grade III is neck pain with no signs or symptoms of major structural pathology but with neurologic signs of nerve compression and grade IV is neck pain with signs of major structural pathology.

Major structural pathologies include, but are not limited to, fractures, spinal cord injuries, infections, neoplasm, or systemic diseases. Including this features discogenic pain causing forward head protrusion, weakness of cervical spine muscles and imbalance in strength and endurance between cervical superficial and deep flexor muscle (O' Leary, et al., 2011). All these symptoms were described on the basis of hypo mobility of the cervical spine facet joint or intervertebral joint. Steilen, et al. (2014) argued that chronic neck occurred due to capsular laxity and instability.

Chronic neck pain often reflects a state of instability in the cervical spine and is a symptom common to a number of conditions described herein, including disc herniation, cervical spondylosis and whiplash associated disorder and vertebrobasilar insufficiency. Consequently, the influence of laxity and instability caused excessive movement of the cervical vertebrae. In the upper cervical spine (C_0-C_2), this can cause a number of other symptoms including, but not limited to, nerve irritation and vertebrobasilar insufficiency with associated vertigo, tinnitus, dizziness, facial pain, arm pain, and migraine headaches. In the lower cervical spine (C_3-C_7), this can cause muscle spasms, crepitation, and/or in addition to chronic neck pain. Another study (Childs, et al., 2008) disclaimed that chronic neck pain symptoms should be adhered with International Classification of Functioning, Disability and Health (ICF) scale. Thus, the sign and symptoms incorporating ICF reflecting as neck pain with mobility deficit, neck pain with headaches, neck pain with movement coordination impairments and neck pain with radiating pain. Despite of having such enormous features from person to person the authors finally recommended that a clear and accurate diagnosis of chronic neck pain is essential.

2.8. Diagnosis

Diagnosis was regarded as the first tool for successful management of patient's problems (Guzman, et al., 2008). In case of chronic neck pain Mintken and Cleland (2012) stated that during history taking the duration of symptoms, behavior of pain, deformity of cervical spine and presence of neck disability was urgent to be included. In addition, McColl (2013) advised to exclude vascular headache from cervical headache which usually originated from cervical spine.

2.8.1. Physical examination

Johnson and Cordett (2014) stated that physical examination of the cervical spine infrequently contributes to general observation, palpation, active, passive, resisted movements and special test for cervical spine. General observation examining posture, symmetry, muscle bulk and previous scars should be part of the observation. Palpation of the cervical spine may elicit focal tenderness which is the appropriate clinical context may increase the clinician's suspicion for threatening pathology.

2.8.2. Neurological examination

A neurological examination most commonly emphasis on any upper (example: cord compression) or lower (nerve root) motor neuron involvement and potential myotomal or dermatomal involvement to localize an anatomical level. Provocative maneuvers such as neck compression and upper limb tension tests did not have adequate sensitivity or specificity to be recommended as routine practice (Nee, et al., 2012).

2.8.3. Radiological examination

In emergency case, a plain x ray of cervical spine was recommended for the early diagnosis of the source of neck pain. Conversely, Pompan (2011) stated that magnetic resonance imaging (MRI) was found highly effective for the diagnosis of neck pain. There is no urgency about the use of laboratory test for the diagnosis of mechanical chronic neck pain. However Hooten, et al. (2013) recommended that accurate diagnosis was named as the key to make successful treatment plan for patient with chronic neck pain.

2.9. Management

Management of chronic neck pain attributed to the causative conditions thus the principles of pharmacological and physiotherapy management varied in response to different symptoms. Southerst, et al. (2014) conducted a systematic review which focused on effectiveness of exercise for chronic neck pain patients. The authors concluded that exercise is superior to any other means for patients with chronic neck pain. The review found seven different types of exercise such as cranio-cervical flexion exercises, cervical range of motion exercises, cervical isometric strengthening exercises, cervical dynamic resistance strengthening exercises, shoulder range of motion or strengthening exercises, stretching and general exercise programs. The majority of randomized control trials (RCTs) combined different types of exercises within one exercise program. The duration of the exercise programs ranged from 6 weeks to 12 months. In contrast Bronfort, et al. (2012) found superior effects of cervical spinal manipulation compared with medication among acute and sub-acute neck pain patients.

2.9.1. Exercise therapy

Exercise therapy primarily focused on neck pain patients are isometric exercise, range of motion exercise, dynamic resistance exercise, cranio-cervical exercise, upper limb strengthening exercise, neck stabilization exercise, proprioceptive exercise and neck endurance exercise (Bertozzi, et al., 2013). Studies revealed that isometric exercise for neck muscle is performed using manual resistance or theraband. However, manual resistance varied from person to person rather rubber theraband provide good static resistance which was in similar with the outcome of study conducted by Ludvigsson, et al. (2015). Meanwhile, isometric exercises with rubber (Theraband) targeting neck flexors, extensors, and both side flexors and rotators muscles was regarded as

effective treatment. Each exercise was performed 20 repetitions 3 times a week for 12 weeks (Khan, et al., 2014). In contrast, Sowmya (2014) argued that three weeks dynamic neck strengthening exercise in cervical flexors, extensors and rotators for twelve weeks improves pain and minimizes disability. However, these exercises primarily focused on strengthening superficial neck musculature. Supporting this evidence, Jeyanthi and Arumugam (2015) mentioned that cranio- cervical exercise with the dose of two sets of 12 repetitions of each was performed (20 seconds hold time and 10 seconds rest time). Rest period between each set was 30 seconds and treatment session lasts for 15 minutes. Secondly, participants performed exercise in sitting position while low resistance ball was placed behind occiput. Then 10 repetitions of chin tuck in with 10 second hold were performed in each repetition. In addition Liyanage, et al. (2014) stated that strengthening exercise of neck muscles was effective while combining with stretching exercise of neck muscles with repetition for stretching hold for 10 seconds at a time and gradually increased to 15 to 30 seconds and continued for 3 times per day. Dusunceli, et al. (2009) argued that without stabilizing the neck it is hard to find the efficacy of stretching and strengthening exercise. Cervical and upper limb stabilization exercise sessions included 3 times per week and exercises included 5–6 minutes jogging and 10 minutes stretching (the cervical, shoulder, chest, and scapular muscles) in the standing position and 15 minutes isometric exercises (cervical flexion, extension, rotation and side-bending by resisting the forehead in the seated position) with a total of 30 minutes sessions.

2.9.2. Manual therapy

One randomized clinical trial (Gautam, et al., 2014) compared Maitland and Mulligan mobilization for chronic neck pain patient. In this article, Maitland mobilization was

applied in grade 2 oscillatory movements for 60 seconds with 2-3 hertz. Starting with grade 2, repetitions were subsequently increased in progressive whereas Mulligan mobilizations such as Natural Appophyseal Gliding (NAGS) were given with 2-3 hertz (for less than 6 repetition) and Sustained Natural Appophyseal Gliding (SNAGS) for 6 repetitions in 3 sets. The mobilization was repeated for less than 6 times and then movement was reassessed. Treatment was given 4 times a week for total of 30 days. In addition, Kilinc, et al. (2014) found Cyrix cervical mobilization to be effective to reduce chronic neck pain. The treatment sessions lasted for 10 minutes and scapular mobilization for 10 repetition 10 sets was performed to patients. Another most popular type of mobilization technique was named as Mckenzie mobilization. Kjellman and Oberg (2002) used Mckenzie mobilization technique in repeated retraction and retraction extension. The author continued 2 sessions per week for 8 weeks with additional home exercise for patients with chronic neck pain.

In contrast, manipulation has proven to improve pain and range of motion and minimize disability among patients with chronic neck pain. One systematic review by Gross, et al. (2010) found moderate quality evidence which concluded that cervical manipulation and mobilization produced similar effects on pain, function and patient satisfaction at intermediate term to follow up. Low quality evidence suggested cervical manipulation might provide greater short term pain relief and low quality evidence also supported thoracic manipulation for pain reduction and increased function (immediate pain reduction in chronic neck pain but optimal technique and dose need to be determined). Besides Martel, et al. (2011) suggested including manipulation in cervical spine with selected criteria for patient with chronic neck pain. This ended up with inconclusive finding that was manipulation with home exercise program eventually relief pain for shorter time but additional investigation is

also required to identify the best strategies for secondary and tertiary prevention of chronic neck pain. Saha and Haque (2015) argued that manipulation for cervical spine with specific dose and repetitions found effective among patients with chronic neck pain. This study described that manipulation such as straight pull and rotation manipulation was found effective when combined with home exercises. Manipulation was done 3 to 4 times in each direction and 3-4 times per day. Quite the opposite, Kim, et al. (2015) proved that myofascial release technique was found effective than joint mobilization where chronic neck pain was due to tightness of neck musculature. In this study, release technique was performed 2 times in a week for 20 minutes. In release technique group, myofascial release was used to treat the muscles that showed shortened and soft tissue mobilization was performed in Grade II B in accordance with Granter King Scale with active or passive stretching in order to lengthen the soft tissues. On the other hand, Kaur and Singh (2015) found muscle energy technique to be effective in reducing neck pain and reduce disability. In case of cervical radiculopathy, the long term persists of arm and hand pain alters the plasticity of nervous system. One study (Sambyal and Kumar, 2013) found that neuro mobilization of median, radial and ulnar nerve reduces pain among patients with chronic neck pain. The total duration of the treatment program was 4 weeks with 4 sittings per week.

2.9.3. Electrotherapy

Varieties of electro physical agents were used conventionally for the management of chronic neck pain including arm and hand pain since their invention. In recent past, majority of the studies showed low quality evidence to draw conclusion to use electrophysical agents for neck pain. However one study Kroeling, et al., (2013) conducted a systematic review to find the efficacy of electrotherapy for neck pain. The study found very low quality evidence to determine that pulsed electromagnetic

field therapy (PEMF) and repetitive magnetic stimulation (rMS) were more effective than placebo, while transcutaneous electrical nerve stimulation (TENS) showed inconsistent results.

One recent study (Sharma and Patel, 2014) showed that TENS is more effective while combined with isometric neck muscle exercises. The dose of TENS was 5 HZ frequency, high pulse intensity, 300 Micro second duration and 20 minutes duration with 4 sessions per week.

Cervical traction was found to be effective in different studies. The mechanism of relief of pain by cervical traction was the reduction of compression on the pain sensitive structure of cervical spine such as a central disc bulge or spondylotic changes in cervical spine (Umar, et al., 2012). However, Sambyal and Kumar (2013) also found effectiveness of traction for chronic neck pain patients. But it had to be under specific dose and duration. The authors recommended to apply cervical traction for 20 minutes on 7% of body weight with 7 seconds hold time and 5 seconds rest time and 4 sessions per week. In contrast, there was debate in application of cervical traction for chronic neck pain patients. In recent past Chiu, et al. (2011) used intermittent cervical traction over baseline, 6 weeks and 12 weeks period for chronic neck pain patient and found no significant difference in VAS and Modified Northwick park neck pain questionnaires while compared with control group. Conversely Childs, et al. (2008) stated based on moderate evidence that clinicians should consider the use of mechanical intermittent cervical traction, combined with other interventions such as manual therapy and strengthening exercises for reducing pain and disability in patients with neck and neck-related arm pain.

2.9.4. Medication

Medication is the second choice of treatment for long time pain control. Different studies (Cho, et al., 2013; Seo, et al., 2014) suggested that allopathic medicine showed to demonstrate short term benefits and consequently can create long term systemic complications such as kidney failure or ulcer. The most common drugs in case of chronic neck pain were non-steroidal anti-inflammatory drugs, muscle relaxant, acetaminophen, anti-depressant, steroid injection and narcotics.

2.9.5. Home advice

One study (Martel, et al., 2011) discovered home exercise program for chronic neck pain which includes general range of motion (ROM) exercises that served for warm-up and cool down purposes, followed by four stretching/mobilization and four strengthening exercises (concentric and isometric contractions) of the cervical and upper thoracic spine, principally flexion/extension, lateral flexion and rotation of the cervical spine. Three series of each exercise were performed during a training session, with a 30 to 60 second rest period between each series. A complete training session lasted between 20 to 30 minutes.

2.10. Outcome measurement tools for chronic neck pain

In order to find the effectiveness of study, outcome measurement is mandatory to introduce for objective findings. The neck disability index (NDI) is a commonly used outcome measure to demonstrate the actual level of disability among patients with chronic neck pain. This consists of 10 items in which 7 items are related to activities of daily livings, 2 items related to pain and 1 item related to concentration. There are total 50 scores in this scale and each item starts with 0 and end up with 5. The highest number of score revealed to greatest disability (Macdermid, et al., 2009). In addition

Jun and Kim (2013) stated that the NDI has demonstrated moderate test re-test reliability (0.68). Pain intensity was measured by numerical pain rating scale (NRS) in which a segmented numeric version of the VAS demonstrated greatest intensity of pain. The common format is a horizontal bar or line. Similar to the pain VAS, the NRS is anchored by terms describing pain severity extremes. In this scale patients are asked to mark the last 24 hours of pain. The reliability of NRS is 0.95 whereas the reliability of VAS is 0.94 (Hawker, et al., 2011). In addition, Sowmya (2014) proved manual muscle testing in an isometric muscle contraction that is best suited assessment procedure to assess muscle strength among patients with chronic neck pain. The authors suggested the testing procedure three times and counting the strongest one in physiotherapist point of view. However, the reliability of manual muscle testing ranged from 0.63 to 0.98 for individual muscle and from 0.57 to 1.0 for a total manual muscle testing.

Different studies (Fletcher and Bandy, 2008; Florencio, et al., 2010) suggested that Goniometer was the best tools to measure cervical range of motion (CROM). The CROM device stands out as a reliable, non-invasive and easy to use method, but it is a very expensive tool. However, the agreement between the tools was considered moderate for flexion and left rotation (0.71; 0.58) and excellent for all of the other movements (0.76-0.87). The intra examiner reliability for the CROM device was moderate for flexion and right rotation (0.70; 0.69) and excellent for all of the other movements (0.79-0.88).

CHAPTER –III METHODOLOGY

This thesis was designed to evaluate the efficacy of cranio-cervical exercise combined with usual care among patients with chronic neck pain. To identify the effectiveness of this treatment regime, numeric pain rating scale, goniometer, manual muscle testing and neck disability index were used as measurement tools for measuring pain, range of motion, muscle strength and neck disability.

3.1. Study Design

The study was a quantitative evaluation of classic experimental research design. Depoy and Gitlin (2015) stated that classic experimental research find out the casual relationship between independent and dependent variables and infer the findings for generalization. In fact, the study was an experiment between different subject designs. Cranio-cervical exercise combined with usual 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 Area

Musculoskeletal Outpatient Unit, Department of Physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka.

3.3. Study Period

September 2015 to May 2016.

3.4. Study Population

The study population was the patients diagnosed as chronic neck pain attended in the musculoskeletal outpatient unit of physiotherapy department at CRP, Savar, Dhaka.

3.5. Sample Size

Sample size for this thesis was 30. Among them 15 participants were in trial group and 15 participants in control group.

3.6. Sampling Technique

30 patients with chronic neck pain who met the inclusion criteria selected conveniently from outpatient musculoskeletal unit of physiotherapy department of CRP, Savar, Dhaka. All the participants had an equal probability of assigning to any of two groups and then 15 patients were randomly assigned to trial group comprising of treatment approaches of Cranio-cervical exercise combined with usual physiotherapy techniques and 15 patients to the control group treated by usual physiotherapy techniques for this study. Single blinding procedure was followed in this study. After completion of sampling technique, the researcher randomly assigned the participants into trial group and control group, because it improves internal validity of the thesis. The participants were assigned into trial and control group by using computer generated random number from 1 to 30. An initial randomization was done by computer to identify the participants of trial and control group and the first participants came out in the control group. The samples was given numerical number C_1, C_2, C_3 etc. for the control group and T_1, T_2, T_3 etc. for trial group. The random numbers of samples in the control group was 1, 2 ,3 ,9 ,10 ,12 ,14 ,15 ,16 ,17 ,18 ,20, 24 ,28 ,30 and trial group 4, 5, 6, 7 ,8, 11, 13, 19, 21, 22, 23, 25, 26, 27, 29. Meanwhile, the sample became 28 as 2 participants (participants number 20 from control group and participants number 29 from trial group) were dropped out before completion of 6 sessions of treatment. Finally, the sample size was 28 in number consisting of 14 participants in the control group and 14 in the trial group.

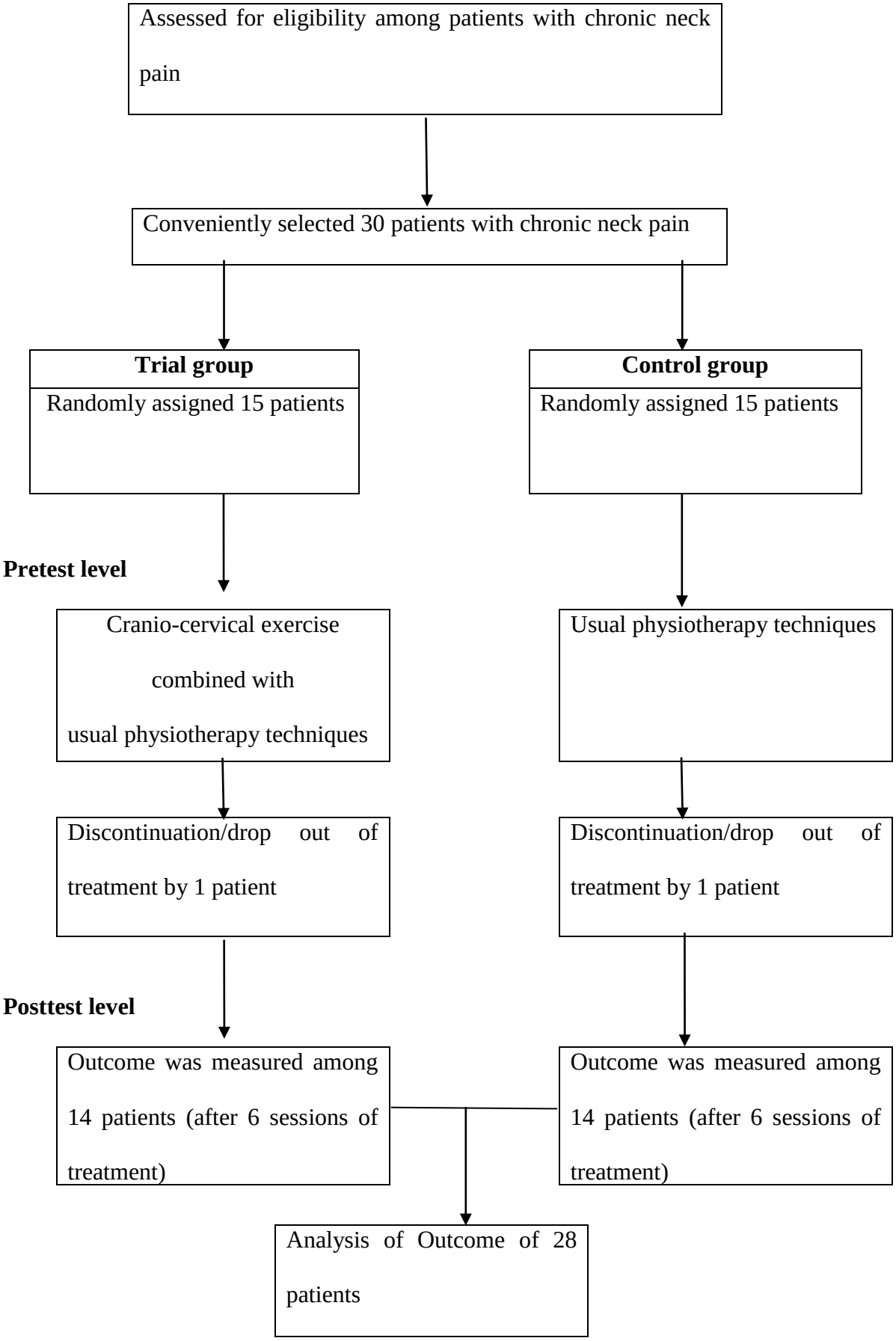


Figure 1: Flow-chart of the phases of classic experimental research

3.7. Inclusion criteria

- **Age range between 20 to 45 years:** This age range was selected because most of the people around the age range showed most prevalent time of neck pain in their life (Chiu, et al., 2012; Gautam, et al., 2014).
- **Male and female both were included:** Both male and female were included because one study conducted by Schopflocher, et al. (2011) showed that chronic neck pain affects male before 30 years and predominately male suffered from neck pain with prevalence of 16.3% and after 30 years predominately more female reported neck pain with prevalence of 17.6%.
- **Patient suffering from neck pain for at least 3 months:** Chronic neck pain patients were included in this thesis. By definition, participants who suffered from neck pain for at least 3 months were included (Hoy, et al., 2014).
- **Patient diagnosed as nonspecific mechanical chronic neck pain:** This type of patients were included because physiotherapy favors most in terms of mechanical neck pain due to cervical spondylois, neck muscle spasm, neck muscle imbalance and central disc bulging (El-Sodany, et al., 2014).
- **Pain around cervical region and above shoulder region:** The researcher included this type of patients as cranio- cervical exercise have shown effective in previous studies (Naz and Sarfraz, 2012; Jeyanthi and Arumugam, 2015).
- **Willingness to adhere to treatment and measurement regimes:** Included these patients because they provided written consent form and might be helpful or might not leave treatment during the study (Gautam, et al., 2014).
- **Subjects who did not receive drug or other therapies for their neck pain:** The half-lives of Diclofenac sodium, Indomethacin, Naproxen sodium, Allopurinol are 12 hours, 1-2 days, 1 hour and 2 hours. Therefore, subjects

who did not take these drugs before starting of physiotherapy on the given time were included (Hinz, et al., 2008; Warden, 2010). In addition, subjects who did not receive physiotherapy previously were included as they might not show any influence of previous experience with the current physiotherapy treatment.

3.8. Exclusion criteria

- **Age below 20 years and above 45 years:** This age range participants were excluded as chronic neck pain due to mechanical origin is less prevalent (Ummar, et al., 2012)
- **Acute or sub-acute neck pain:** In this state of pain, cranio-cervical exercise was not recommended as it might increase irritability in cervical spine (Jull, et al., 2009).
- **Sustaining red flags of neck pain:** Subjects were excluded when they showed red flags such as weight loss, fever, malignancy, inflammatory arthritis, vascular headache, cervical cord compression, vertibro- basillary insufficiency and referred pain from myocardial ischemia (McColl, 2013).
- **Associated pathology of the upper cervical region or upper limb:** Participants were excluded if they showed any overlapping with other clinical findings as referred pain from costo-transverse joint, rotator cuff tendonitis, and cervical rib syndrome (El-Sodany, et al., 2014).
- **Participants who were unwilling to participate or continue medication for neck pain:** These types of patients were excluded as they have the chance to drop out during the itinerary of thesis or wanted to take medicine like pain killer which would actually hide the outcome of dependent variables or potentially influence the results of the study (Halvorsen, et al., 2014).

3.9. Data Processing

3.9.1. Data Collection Tools

Data collection tools were data collection form, informed consent form, structured questionnaire, papers, pen and pencil.

3.9.2. Measurement Tools

- 10 cm numeric pain rating 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 chronic neck pain.

3.9.3. Ethical Issues

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. The proposal of the dissertation including methodology was presented to the Institutional Review Board (IRB) of Bangladesh Health Professions Institute (BHPI) (Appendix- A). Again before starting data collection, researcher obtained permission (Appendix- B) from the head of physiotherapy department to access patient data based management and allow full involvement of physiotherapist who have been working in musculoskeletal physiotherapy department, CRP, Savar. The researcher strictly maintained the confidentiality regarding participant's condition and treatments. The researcher obtained consent from each participant to take part in this study. A signed informed consent form (Appendix- C) was received from each participant. The participants they decline answering any

question during the study and were free to withdraw their consent and terminate participation at any time. Withdrawal of participation from the study did not affect their treatment in the physiotherapy department and they still had the chance to receive same facilities. Every subject had the opportunity to discuss their problems with the senior authority or administration of CRP and had any questioned answer to their satisfaction.

3.9.4. Data Collection Procedure

The data collection procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening at the department, patients were assessed by a graduate physiotherapist. 6 sessions of treatment was provided for each participant. Data was gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form (Appendix- D) which was formulated by the researcher. Pre-test was performed before beginning the treatment and the intensity of pain was noted with numeric pain rating scale, range of motion (ROM) was measured by universal goniometer, muscle strength was measured by manual muscle testing (MMT) and disability by Neck disability index. The same procedure was performed to take post-test at the end of 6 sessions of treatment. A data collector provided the assessment form to each subject before starting treatment and after 6 sessions of treatment and patient was instructed to put mark on the subjective portion and in objective portion like ROM, MMT was completed by Physiotherapist.

The data collector collected the data of both trial and control group in front of the Physiotherapist in order to minimize the bias.

3.10. Data Analysis

Statistical analysis was performed by using statistical package for social science (SPSS) version 20.

3.10.1 Statistical Test

Statistical analysis refers to the well-defined organization and interpretations of the data by systemic and mathematical procedure and rules (DePoy and Gitlin, 2015). Between groups analysis of pain, muscle strength and neck disability was calculated by Mann-Whitney *U*-test and range of motion (ROM) by Unpaired *t* test. In addition, within group analysis of ROM was carried by Paired *t* test and within group analysis of pain, muscle strength and neck disability index was analyzed by Wilcoxon signed rank test (Hicks, 2009).

3.10.2. 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 (DePoy and Gitlin, 2015).

3.11. Treatment Regime

Three physiotherapists who were expert in treatment of musculoskeletal patient were involved in treatment of patients. All the physiotherapists have the experience of more than three years in the aspect of musculoskeletal physiotherapy. Among them, two were male and one was female physiotherapist. Protocol for usual physiotherapy care was obtained from head of physiotherapy department, Centre for the rehabilitation of the paralysed (CRP) (Appendix- E). An in-service training was arranged to share the information with practical demonstration regarding cranio-cervical exercise including patient position, types of exercise, dose and repetition (Appendix- F) with usual care.

Table I: Comparison of baseline characteristic of participants

Variable(s)	**Trial group (n=14)**	**Control group (n=14)**	**p**
Age, mean (SD), years	41.78 ± 11.19	43.93 ± 9.75	0.59
Gender	Male= 06 (42.85%), Female=08 (57.15%)	Male= 06 (42.85%), Female= 08 (57.15%)	1.00
Duration of pain (month), SD	10.85 ± 4.89	10.64 ± 4.45	0.89
Weight (kg), mean (SD)	61.78 ± 6.78	61.57 ± 6.02	0.93
Height (cm), mean (SD)	156.5 ± 4.14	155.9 ± 5.07	0.87
BMI (kg/m^2), SD	25 ± 3.61	25 ± 4.17	0.38
NDI mean (SD), Pretest	26.50 (± 3.27)	25.79 ± 2.57	0.52

Table I compares the baseline characteristics of participants between trial and control group. In addition, two groups did not show significant differences at baseline regarding demographic characteristics and disease-related parameters. In trial group, the mean age (± SD) of the participants was 41.78 (± 11.19) years and in control group 43.93 (± 9.75) years. In trial group and control group, male and female ratio was similar (male: female= 1:1.3). The mean duration of pain (± SD) was 10.85 (± 4.89) months in trial group and 10.64 (± 4.45) in control group. In addition, mean weight (± SD) in trial group was 61.78 (± 6.78) kg and 61.57 (±6.02) kg. Mean height (± SD) was 156.5 (± 4.14) cm in trial group and in contrast 155.9 (± 5.07) in control group participants. Mean (± SD) pretest NDI score in trial group was 26.50 (± 3.27) and in contrast mean (± SD) in control was 25.79 ± 2.57.

4.1. Socio-demographic Information

4.1.1. Gender distribution among participants

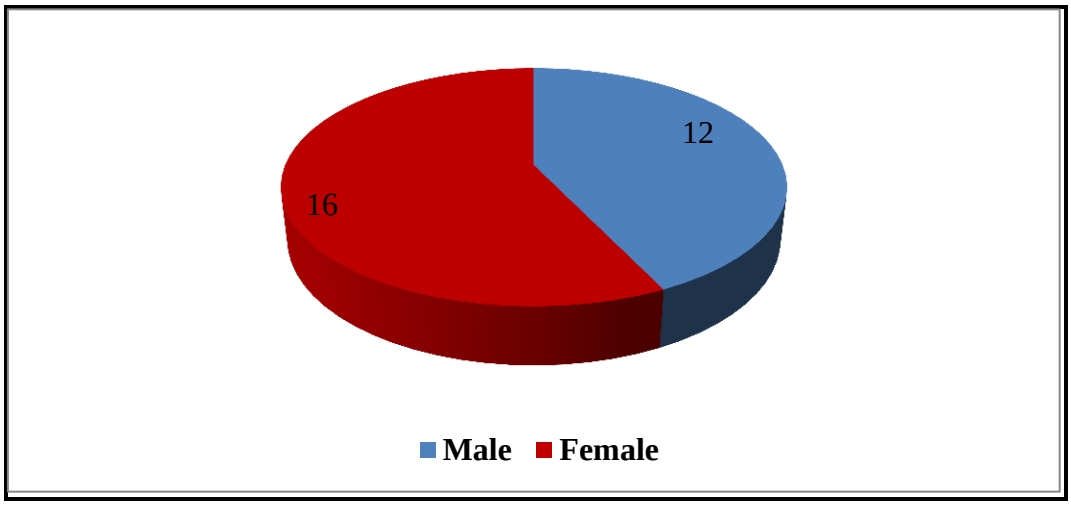


Figure 2: Gender distribution among participants

Figure 2 described that among the 28 participants, 12 participants were male and 16 participants were female.

4.1.1.a: Cross tabulation between sex and category of participants:

Table II: Gender distribution of participants in trial and control group

		Category of Participants	
		Trial	**Control**
Sex of the Participants	Male	42.85%	42.85%
	Female	57.15%	57.15%
Total		100%	100%

Table II showed cross tabulation between sex and category of participants (Percentages) and found that among all participants, there was equal number of male (42.85%) and female (57.15%) participants in both trial and control group.

4.1.2. Occupation of Participants

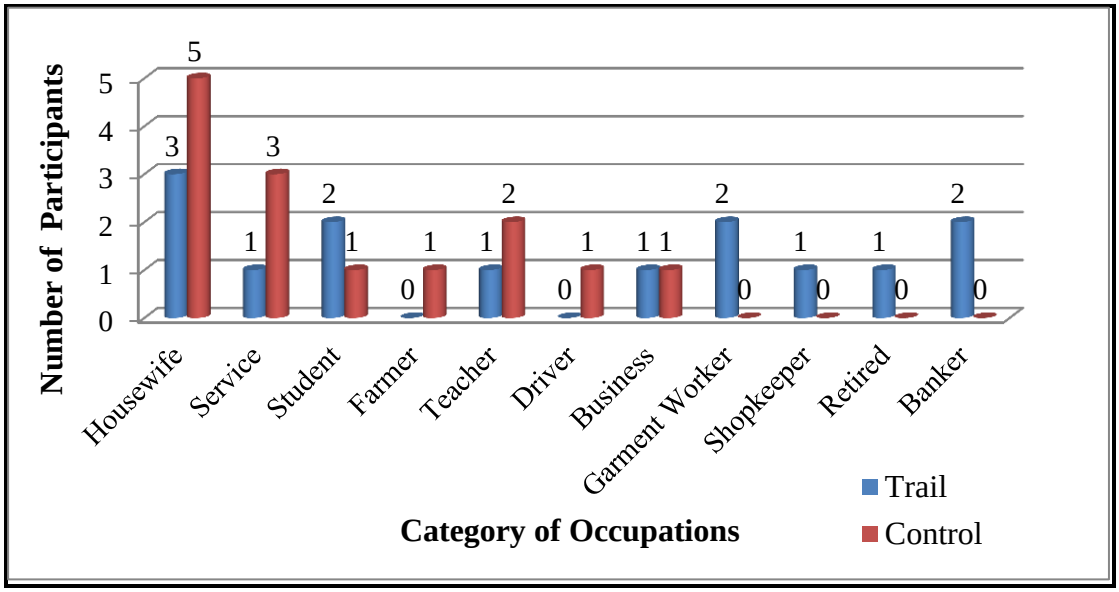


Figure 3: Occupations of participants

Figure 3 showed, among the 28 participants, housewife was 8 (28.6%), service 4 (14.3%), student 3 (10.7%), farmer 1 (3.6%), teacher 3 (10.7%), driver 1 (3.6%), business 2 (7.1%), garment worker 2 (7.1%), shopkeeper 1 (3.6%), retired from service 1 (3.6%) and banker 2 (7.1%).

4.1.3. Exertion during work

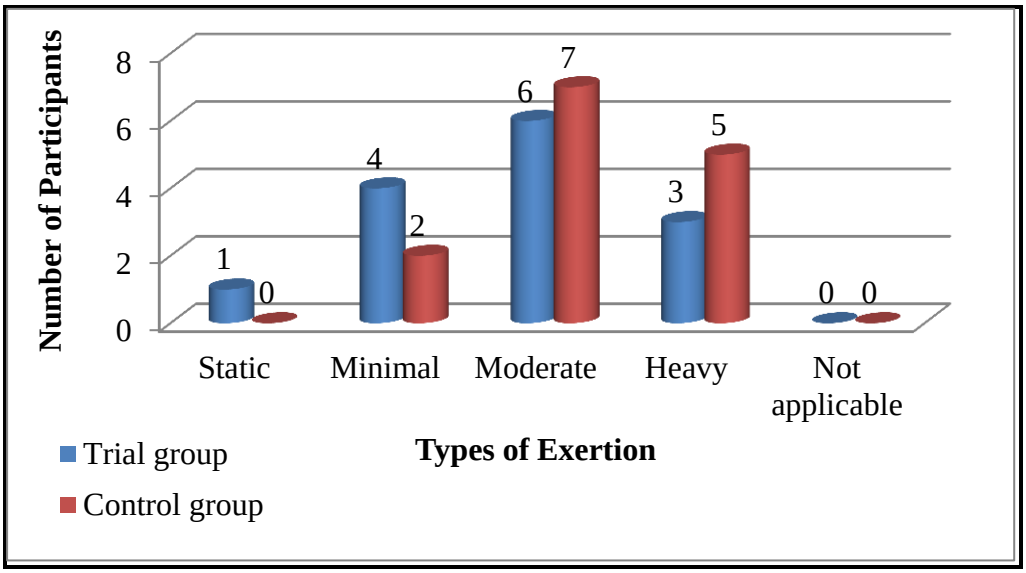


Figure 4: Characteristics of exertion during work

Figure 4 described that among 14 participants in the trial group 1 (7.15%) participant performed static work, 4 (28.57%) performed minimal work, 06 (42.85%) involved in moderate type of exertion at work, 3 (21.43%) performed heavy work. Among the 14 participants of control group, 2 (14.28%) participants performed minimal work, 7 (50%) performed moderate intensity work, 5 (35.72%) involved in heavy type of exertion.

4.1.4. Dominant hand

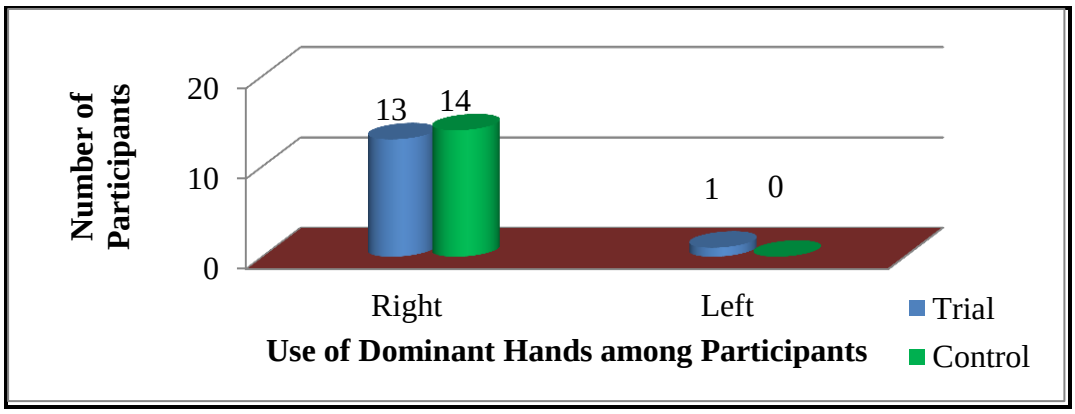


Figure 5: Involvement of dominant hand during work

Figure 5 demonstrated that among 14 participants in the trial group 13 (92.85%) was right hand dominant and 1 (7.15) was left hand dominant whereas in the control group all 14 (100%) participants was right hand dominant.

4.1.5. BMI of the participants

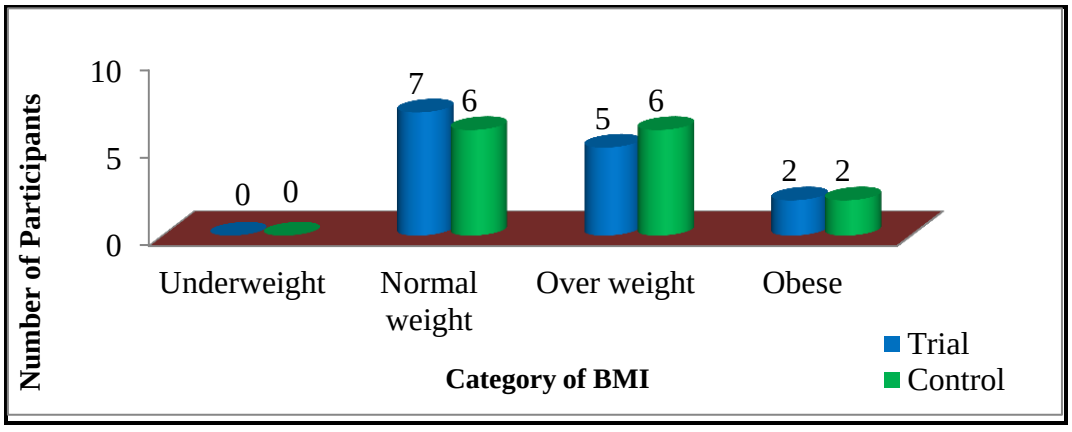


Figure 6: BMI among participants in trial and control group

Figure 6 narrated that among 14 participants in the trial group, no participant (0%) was underweight, 7 (50%) in normal weight, 5 (35.72%) overweight and 2 (14.28%) was obese. In contrast, among 14 participants in the control group, no participant (0%) was underweight, 6 (42.85%) was in normal weight as well as overweight range and 2 (14.3%) was obese.

4.1.6. Educational level of both group's participants with frequencies

Table III: Educational level of participants

Educational level	**Trial group**	**Percent**	**Control group**	**Percent**
	Frequency of participants		Frequency of participants	
Illiterate	0	0	1	7.1
Class I- Class V	3	21.4	4	28.6
Class VI- Class X	4	28.6	3	21.4
S. S. C.	0	0	1	7.1
H. S. C.	4	28.6	1	7.1
Degree/Honors	2	14.3	4	28.6
Masters	1	7.1	0	0
Total	14	100.0	14	100.0

Table III showed that among 28 participants, no participant was illiterate in the trial group and 1 was in control group, 3 participants of trial group was in class I- Class V and 4 was in control group. Only 1 participant passed S. S. C examination in control group whereas no one in trial group. There were 4 participants who passed H. S. C. level in trial group and 1 was in control group. At degree/Honors level, there were 2 in trial and 4 in control group and in Masters Level 1 was from trial and no participant from control group.

4.1.7. Cross tabulation between sleeping posture and category of participants:

Table IV: Sleeping posture and percentages of preference between trial and control group

		Category of Participants	
		Control	**Trial**
Sleeping posture	Side lying (Left)	14.28%	21.42%
	Side lying (Right)	35.71%	42.85%
	Prone lying	21.42%	21.42%
	Supine lying	28.57%	14.28%
Total		**100%**	**100%**

Table IV showed that among 14 patients of control group, 28.57% (n=4) preferred to sleep in supine lying, 21.42% (n=3) in prone lying, 35.71% (n=5) in side lying (right) and 14.28% (n=2) in side lying (left). In contrast, among 14 patients of trial group, 14.28% (n=2) to sleep in supine lying, 21.42% (n=3) in prone lying, 42.85% (n=6) in side lying (right) and 21.42% (n=3) in side lying (left).

4.1.8. Numbers of pillow used by participants during sleeping

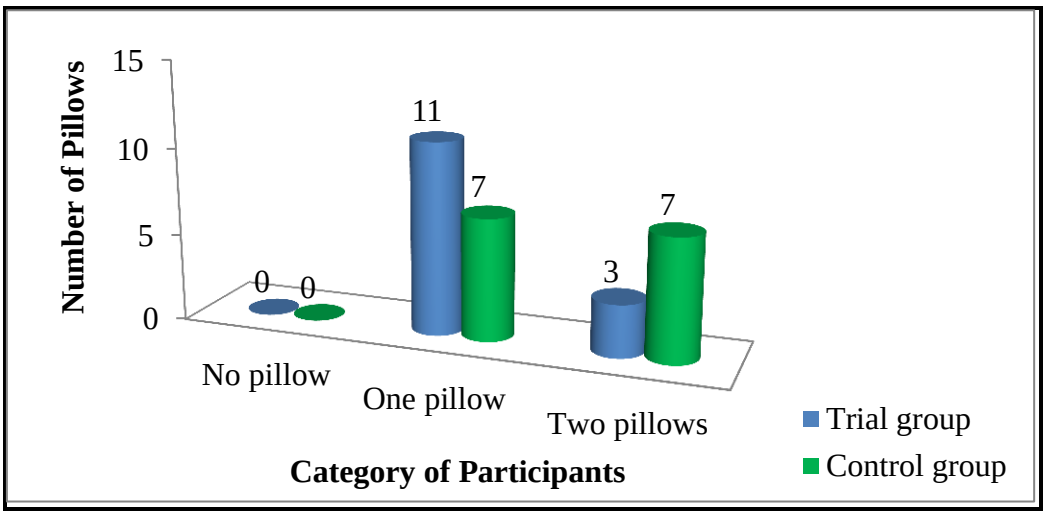


Figure 7: Number of pillows used by both group's participants

Figure 7 showed that among 14 patients of trial group, 0% (n=0) did not use pillow, 78.57% (n=11) used one pillow and 21.43% (n=3) used two pillows at the time of sleeping. On the other hand, among 14 participants of control group, 0% (n=0) did not use pillow, 50% (n=07) used one pillow and 50% (n=07) used two pillows at the time of sleeping.

4.2. Medical Information

4.2.1. Diabetes mellitus among participants

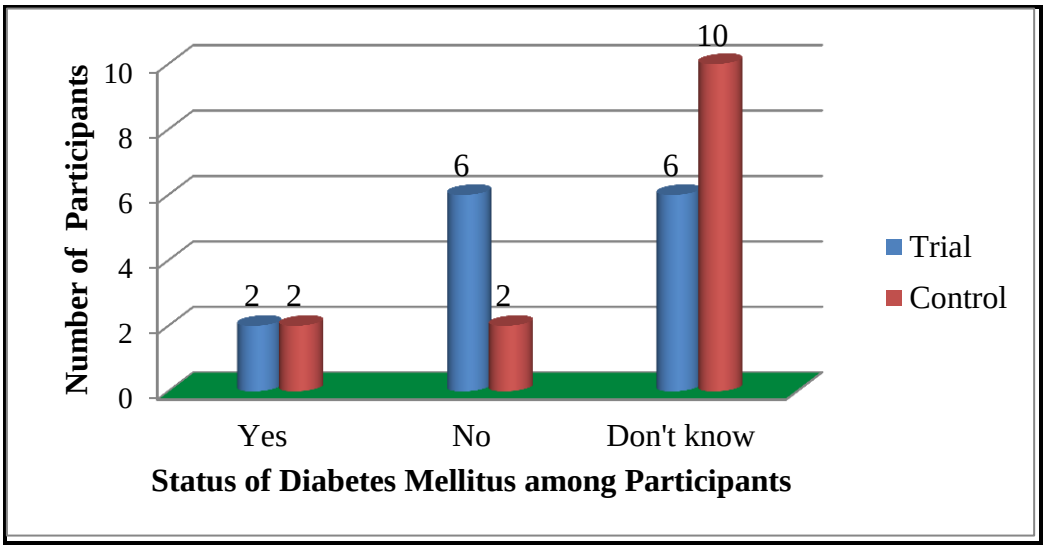


Figure 8: Status of diabetes mellitus among trial and control group participants

Figure 8 showed that among 14 participants of trial group, 14.28% (n=2) knew that they had been suffering from diabetes, 42.85% (n=6) did not have diabetes and 42.85% (n=6) don't have the knowledge of existence diabetes at themselves. On the other hand, among 14 participants of control group, 14.28% (n=2) were aware about their diabetes, 14.28% (n=2) did not have prior knowledge diabetes and 71.42% (n=10) don't have the knowledge of existence diabetes at themselves.

4.2.2. Status of hypertension among participants

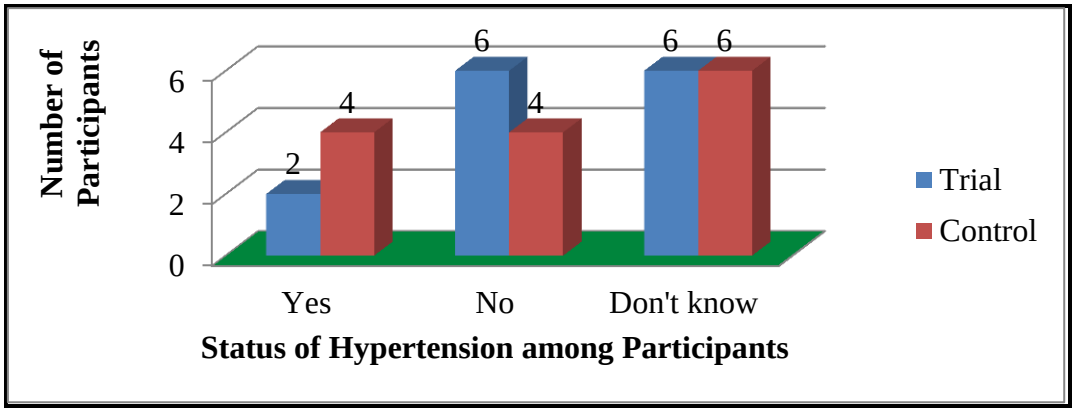


Figure 9: Status of hypertension among trial and control group participants

Figure 9 disclaimed that among 14 participants of trial group, 14.28% (n=2) knew that they had been suffering from hypertension, 42.85% (n=6) did not have hypertension and 42.85% (n=6) did not have the knowledge of existence diabetes at themselves. On the other hand, among 14 participants of control group, 28.57% (n=4) were aware about their hypertension, 28.57% (n=4) did not have prior knowledge of hypertension and 42.85% (n=6) did not have the knowledge of existence hypertension at themselves.

4.3. Pain related Information

4.3.1. Causes of pain among category of participants

Table V: Cross tabulation between causes of pain within trial and control group

		Category of Participants		Total
		Control	Trial	
Causes of pain	Others	1	2	3
	Bad sleeping posture	0	1	1
	Due to bad working	5	9	14
	Due to lifting heavy	6	1	7
	Due to trauma	1	0	1
Total		**14**	**14**	**28**

Table V showed that trauma was the cause of pain which constituted 1 person in control and no person in trial group. 7 participants had history of lifting heavy weight in which control was 6 and trial was 1 in number. The most contributing cause was bad working posture. There were 14 (5 in control and 9 in trials) participants out of 28 who showed increased of neck pain due to bad working posture. Minor contributing factor was bad sleeping posture which constituted 1 participant in trial and no participants in control group. In addition, others causes including unknown and coughing or sneezing totaling 3 in numbers in which there was 2 participants in trial and 1 in control group.

4.3.2. Dominant side of neck pain among category of participants

Table VI: Cross tabulation between dominant side of pain within trial and control group

		Category of Participants		**Total**
		Control	**Trial**	
Dominant side of neck pain	Right	1	2	3
	Left	4	6	10
	Middle	5	4	9
	Both	4	2	6
Total		**14**	**14**	**28**

Table VI conceptualized that among 28 participants, 3 (1 control and 2 trial) had right sided neck pain, 10 (4 control and 6 trial) had left sided pain, 9 (5 control and 4 trial) had middle area and 6 (4 control and 2 trial) participants had both sided neck pain.

4.3.3. Dominant side of shoulder pain

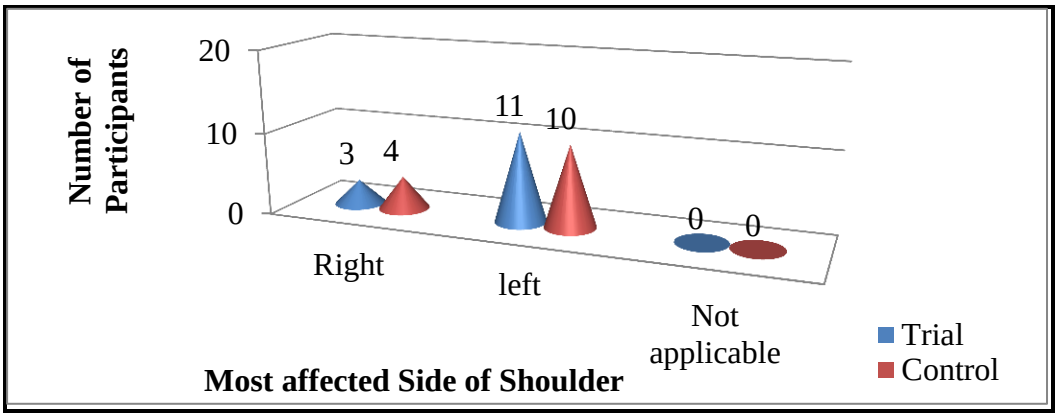


Figure 10: Most affected side of shoulder pain

Figure 10 showed that among 14 participants of trial group, 21.42% (n=3) showed right side shoulder pain and 78.58% (n=11) in left sided shoulder pain. In contrast, among 14 participants of control group, 28.57% (n=4) showed right side and 71.43% (n=10) showed left sided shoulder pain as well.

4.3.4 Dominant pain area between neck and shoulder

Table VII: Cross tabulation between dominant side of pain between neck and shoulder within trial and control group

		Category of Participants		Total
		Control	Trial	
Dominant pain area between neck and shoulder	Neck pain is more than shoulder	4	0	4
	Shoulder pain is more than neck	3	3	6
	Neck pain and shoulder pain is equal	7	11	18
Total		**14**	**14**	**28**

Table VII showed that among 28 participants, 4 participants (control 4 and trial 0) neck pain is more than shoulder, 6 participants (3 of each in both groups) shoulder pain is more than neck and 18 participants (7 in control and 11 in trial) showed equal amount of pain in neck and shoulder.

4.3.5. Time of worse pain

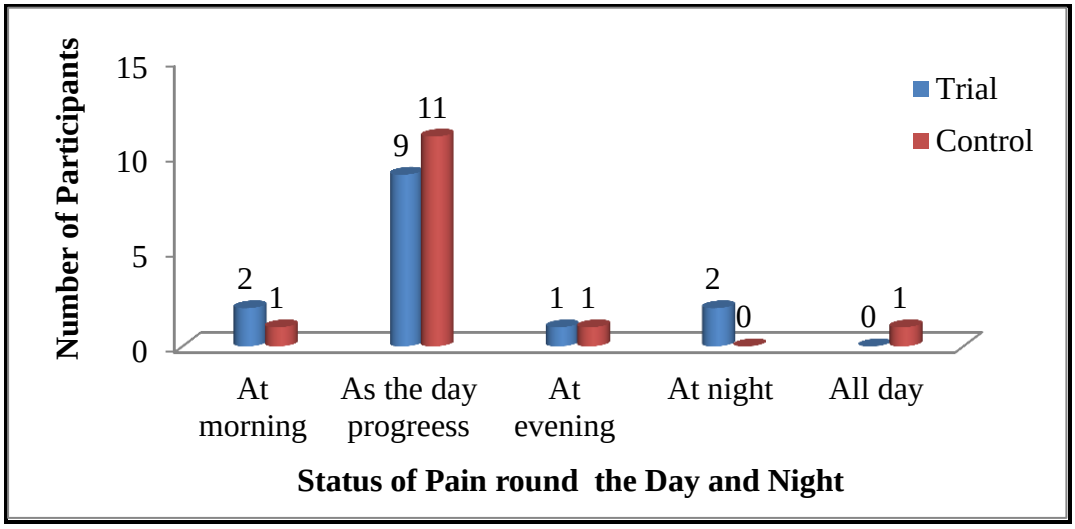


Figure 11: Most consistent time of pain

Figure 11 showed that among 14 participants in trial group 14.3% (n=2) had worse pain at morning, 64.3% (n=9) had as the day progress, 7.1% (n=1) at evening, 14.3% (n=2) at night and no one (0%) had worse pain all the day. Besides, among 14 participants in control group, 7.1 (n=1) at morning, 78.6% (n=11) had as the day progress, 7.1% (n=1) at evening, no one (0%) at night and 7.1% (n=1) had worse pain all day.

4.3.6. Pain exaggerated by direction of neck movement

Table VIII: Cross tabulation between neck movements and category of participants

		Category of Participants		Total
		Control	Trial	
Direction of movement exaggerated pain	Neck forward bending	10	9	19
	Neck backward bending	1	1	2
	Neck turning to right	1	0	1
	Neck turning to left	1	2	3
	Raising from lying	1	2	3
Total		**14**	**14**	**28**

Table VIII described that among 28 participants, 19 participants (10 in control and 9 in trial) neck forward bending movement exaggerated pain, 2 participants (1 in trial and 1 in control) neck backward bending, 1 participant (1 in control and 0 in trial) neck turning to right, 3 participants (1 in control and 2 in trial) neck turning to left and 3 participants (1 in control and 2 in trial) raising from lying exaggerated pain.

4.3.7. History of proceeding pain from onset

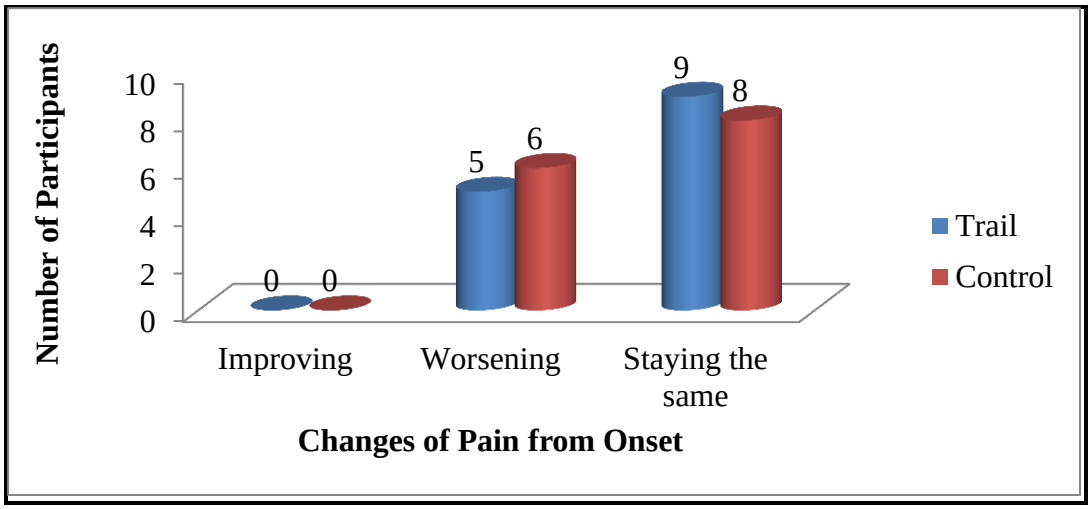


Figure 12: Progression of pain from the onset

Figure 12 showed that among 28 participants, 0% participants in both groups were improved from the onset at baseline prior to group allocation for treatment. 39.28% (11 participants in which 5 was in trial group and 6 was in control group) became worse and 60.72% (17 participants in which 9 was in trial group and 8 was in control group) remained the same from the initial period of pain prior to assessment and treatment by group allocation.

4.4. Pretest and posttest score of patient rated pain (cm) in general

Table IX: Comparison of pretest and posttest patient rated pain in trial and control group

Serial No.	Trial group			Serial No.	Control group		
	Pre-test score	Posttest score	Difference		Pre-test score	Posttest score	Difference
T1	6	2	4	C1	5	3	3
T2	6	3	3	C2	6	3	3
T3	7	3	4	C3	5	3	2
T4	4	2	2	C4	4	2	2
T5	5	2	3	C5	5	3	2
T6	7	2	5	C6	5	3	2
T7	6	3	3	C7	6	3	3
T8	6	2	4	C8	6	3	3
T9	5	2	3	C9	5	3	2
T10	4	2	2	C10	7	4	3
T11	4	2	2	C11	6	3	3
T12	6	2	4	C12	7	4	3
T13	5	3	2	C13	6	4	2
T14	5	2	3	C14	4	2	2
Total	76	32	44	**Total**	77	43	34
Mean	10.13	4.26	5.86	**Mean**	10.26	5.73	4.53

Table IX demonstrated the level of pretest and posttest pain score between trial and control group. Mean pretest pain score was 10.13 cm and posttest was 4.26 cm with a mean difference of 5.86 cm in the trial group. In contrast, the mean pretest pain score

in the control group was 10.26 cm and posttest was 5.73 cm with a mean difference of 4.53 cm. In this part, data analysis was done using *U* test as numerical pain rating scale was regarded as non-parametric scale and there was two different groups (one was cranio-cervical exercise combined with usual care as trial group and other was only usual care as control group). Conversely, the effectiveness of trial group treatment as well as control group treatment was analyzed by Wilcoxon signed- rank test (within group analysis).

4.4.1. Association between patient's rated pain (cm) and BMI, number of usable pillows, diabetes mellitus and hypertension

Table X: Cross tabulation between patient rated general pain (cm) and BMI, number of usable pillows, diabetes mellitus and hypertension.

Variable 1	Variable 2	p value	Comments
Patient rated general pain (cm)	BMI	0.56	No significant association
	Number of pillows	0.25	No significant association
	Diabetes mellitus	0.78	No significant association
	Hypertension	0.80	No significant association

Table X showed that there was no statistically significant association between patient rated general pretest pain (cm) and BMI (p=0.56), number of usable pillows (p=0.25), diabetes mellitus (p=0.78) and hypertension (0.80).

4.4.2. Patient rated general pain (cm) between groups (control and trial)

Table XI: Rank and test statistics of patient rated general pain (cm) between trial and control group

	Category of Participants	**N**	**Mean of posttest pain (cm)**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
Patient rated general pain (cm)	Control	14	3.07	18.93	36.00	.004
	Trial	14	2.20	10.07		
	Total	28				

Table XI showed that the calculated value of *U* is 36 for pain in resting position and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 42 for 0.005 in one tailed hypothesis. From the calculated value (*U*= 36), it is clear that *U* value between trial and control groups have an associated probability level which is equal to .004 (0.4%). Therefore, the result is significant for one tailed hypothesis. Since the p value is equal to 0.4%, the result is said to be significant and the null hypothesis (no relationship) is now can be rejected and the experimental hypothesis is supported.

This means that difference between trial group treatment (cranio-cervical exercise combined with usual care) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same with control group. They differ significantly as trial group improvement was more than control group.

4.4.3. Patient rated pain in general within control group

Table XII: Rank and test statistics of patient rated general pain in control group

Pain at resting position (cm) (Pretest) - Pain at resting position (cm) (Posttest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	14	7.50	105.00	-3.39	0.001
Ties	0				
Total	14				

Table XII described the comparison of participant's before (pre) and after (post) pain score. The table's legend showed that any participants did not have increased pain after application of usual care. 14 participants had higher pain score before application of usual care compare with after usual care. In addition, no participants had equal amount of pain 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 control group for 3 weeks, twice weekly usual care treatment course showed a statistically significant change in neck pain among individuals with chronic neck pain ($Z= -3.39$, $p= 0.00$).

4.4.4. Patient rated pain in general within trial group

Table XIII: Rank and test statistics of patient rated general pain in trial group

Pain at resting position (cm) (Pretest) - Pain at resting position (cm) (Posttest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	14	7.50	105.00	-3.32	0.000
Ties	0				
Total	14				

Table XIII described the date on the comparison of participants' before (pre) and after (post) pain score. The table's legend showed that any participants did not have increased pain after application of cranio-cervical exercise (CCE) combined with usual care (trial group). 14 participants had higher pain score before application of CCE combined with usual care compare with after same treatment. Conversely, no participants had equal amount of pain before and after treatment in trial group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE combined with usual care (trial group) treatment course showed a statistically significant change in neck pain among individuals with chronic neck pain (Z= -3.32, p= 0.00)

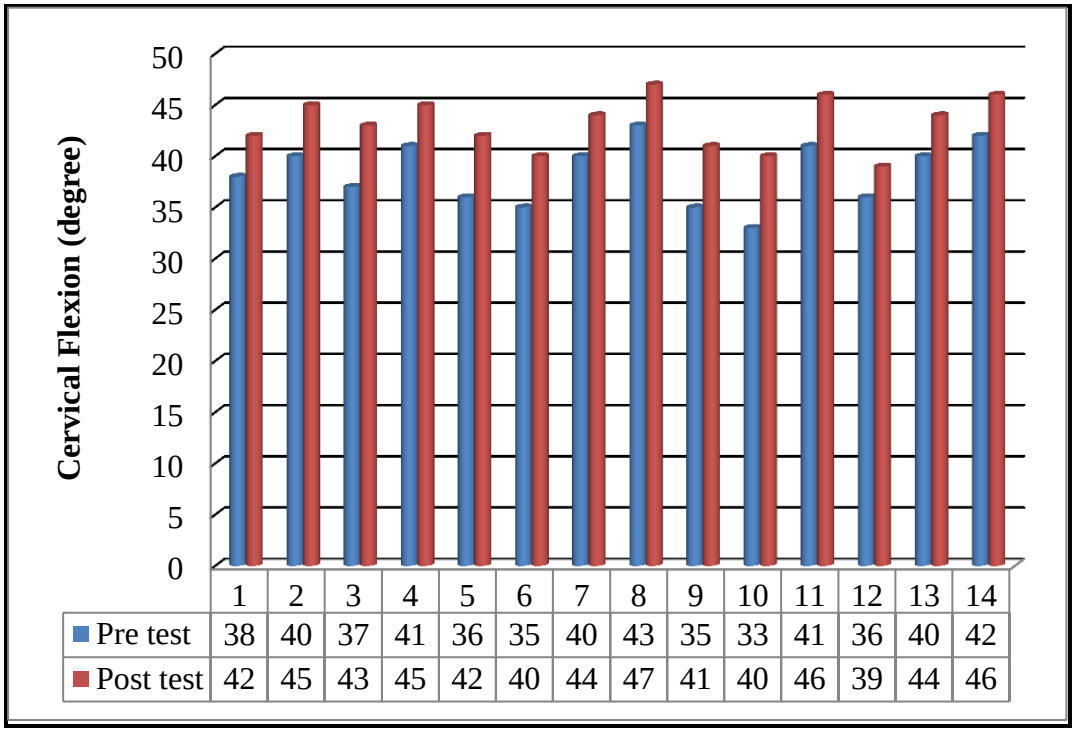
4.5. Cervical Spine Range of Motions (degree) in Pretest and Posttest Score of Trial and Control Group

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

	Trial group			Control group		
	Pretest	**Post test**	**Mean difference**	**Pretest**	**Posttest**	**Mean difference**
Flexion, mean (degree)	39.29	44.71	5.42	38.36	43.14	4.78
Extension, mean (degree)	48.36	54.50	6.14	48.64	51.36	2.71
Right Side flexion, mean (degree)	36.71	43.07	6.35	36.86	40.79	3.92
Left Side flexion, mean (degree)	36.14	42.50	6.35	36.86	40.71	3.85
Right Rotation, mean (degree)	69.64	75.71	6.07	70.00	74.07	4.07
Left Rotation, mean (degree)	69.71	75.21	5.5	70.36	74.00	3.64

Table XIV showed mean differences of cervical range of motion (degree) between trial and control group. In addition, each type of movements showed higher mean difference in trial group compared with control group.

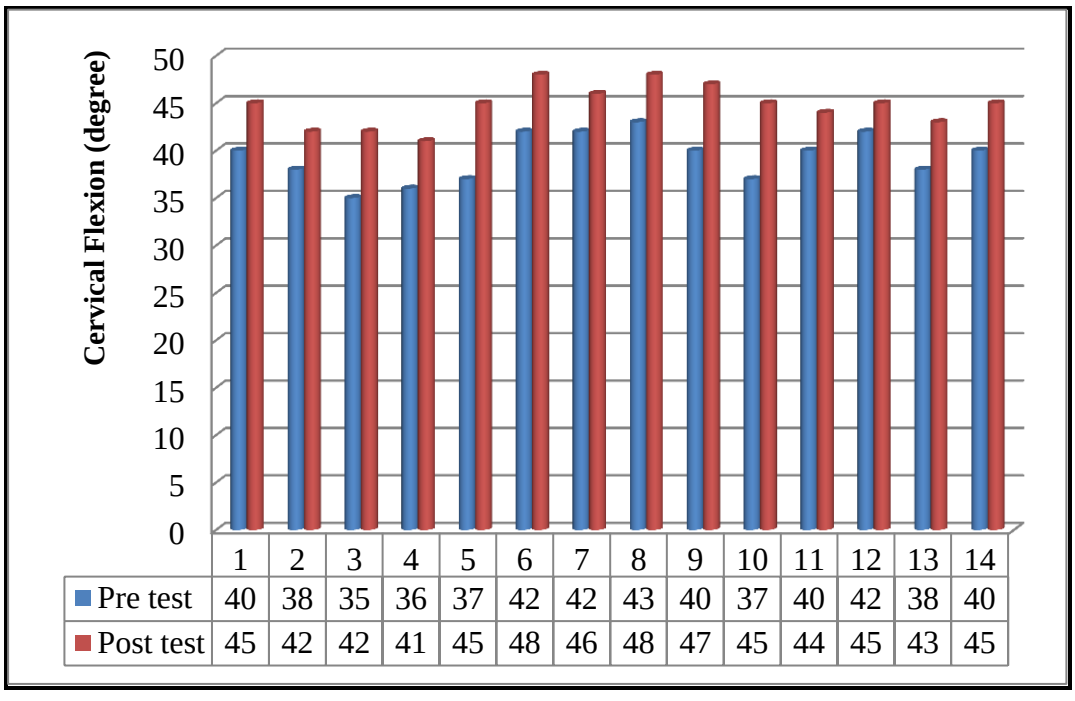
4.6. Pretest and posttest flexion (degree) in control group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pre test	38	40	37	41	36	35	40	43	35	33	41	36	40	42
Post test	42	45	43	45	42	40	44	47	41	40	46	39	44	46

Figure 13: Pretest and posttest score comparison of flexion (degree) in control group

4.7. Pretest and posttest flexion (degree) in trial group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pre test	40	38	35	36	37	42	42	43	40	37	40	42	38	40
Post test	45	42	42	41	45	48	46	48	47	45	44	45	43	45

Figure 14: Pretest and posttest score comparison of flexion (degree) in trial group

4.8. Flexion of cervical spine between trial and control group

Table XV: Statistical outcome of flexion (degree) between trial and control group

	Unpaired t	df	p	95% Confidence Interval	
				Lower	Upper
Difference between trial and control group in flexion (degree)	1.255	26	0.11	-1.696	0.410

Table XV described that the calculated *t* value is 1.255 and for df= 26, the calculated *t* value is smaller than table value of *t* = 1.315 that has an associated probability level of 11%. This means that the probability of random error being responsible for the outcome of this experiment is 11 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 11% and it could be said that the result was not significant. Thus, cranio-cervical exercise combined with usual care was not more effective than usual care among patients with chronic neck pain.

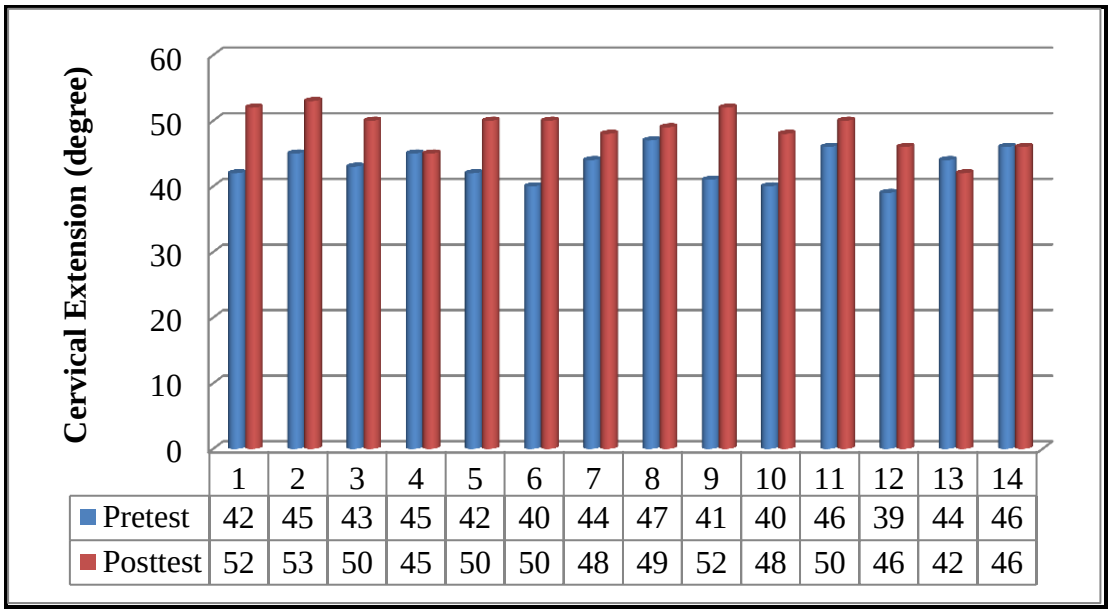
4.8.1. Flexion of cervical spine within control and trial group

Table XVI: Statistical outcome of flexion (degree) within trial and control group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Flexion (degree) of cervical spine (control group)	3.786	1.122	3.138	4.433	12.628	13	0.000
Flexion (degree) of cervical spine (trial group)	3.429	1.555	2.531	4.326	8.251	13	0.000

Table XVI 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 trial group (p= 0.000).

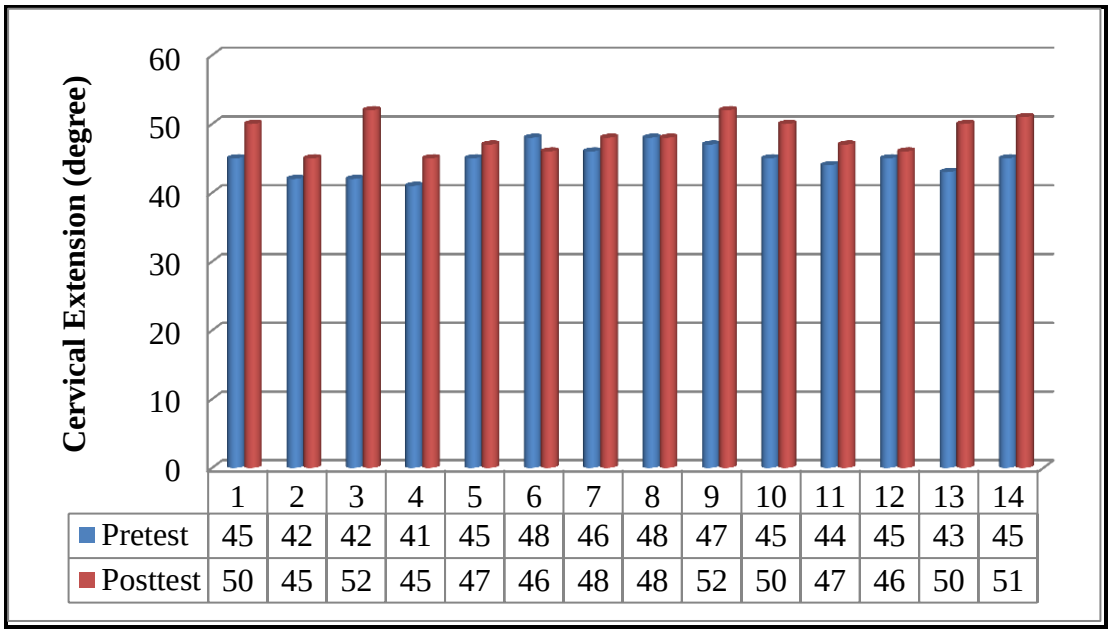
4.9. Pretest and posttest extension (degree) in control group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	42	45	43	45	42	40	44	47	41	40	46	39	44	46
Posttest	52	53	50	45	50	50	48	49	52	48	50	46	42	46

Figure 15: Pretest and posttest score comparison of extension (degree) in control group

4.10. Pretest and posttest extension (degree) in trial group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	45	42	42	41	45	48	46	48	47	45	44	45	43	45
Posttest	50	45	52	45	47	46	48	48	52	50	47	46	50	51

Figure 16: Pretest and posttest score comparison of extension (degree) in trial group

4.11. Extension of cervical spine between trial and control group

Table XVII: Statistical outcome of extension (degree) between trial and control group

	Unpaired t	df	p	95% Confidence Interval	
				Lower	Upper
Difference between trial and control group in extension (degree)	3.695	26	0.005	-5.286	-1.571

Table XVII showed that the calculated *t* value is 3.695 and for df= 26, the calculated *t* value is larger than 2.779 but smaller than 3.707 of table value that has an associated probability level of 0.5%. This means that the probability of random error being responsible for the outcome of this experiment was 0.5 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 significant. Thus, cranio-cervical exercise combined with usual care was effective than usual care among patients with chronic neck pain.

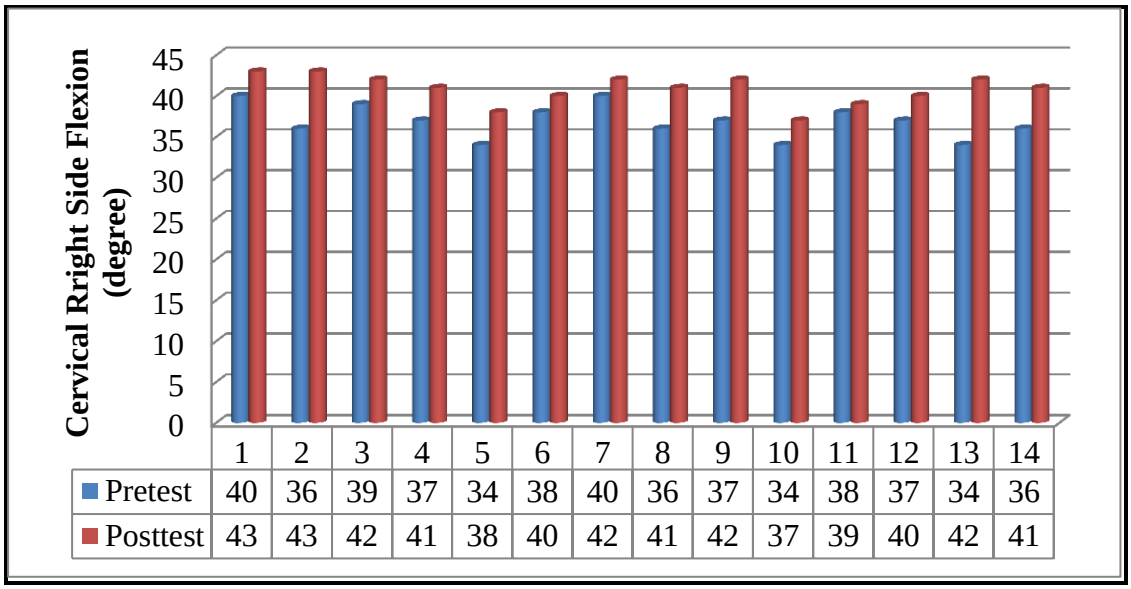
4.11.1. Extension of cervical spine within control and trial group

Table XVIII: Statistical outcome of extension (degree) within trial and control group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Extension (degree) of Cervical Spine (Control group)	2.714	2.431	-4.118	-1.310	4.177	13	0.000
Extension (degree) of Cervical Spine (trial group)	6.143	2.349	-7.499	-4.787	9.786	13	0.000

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

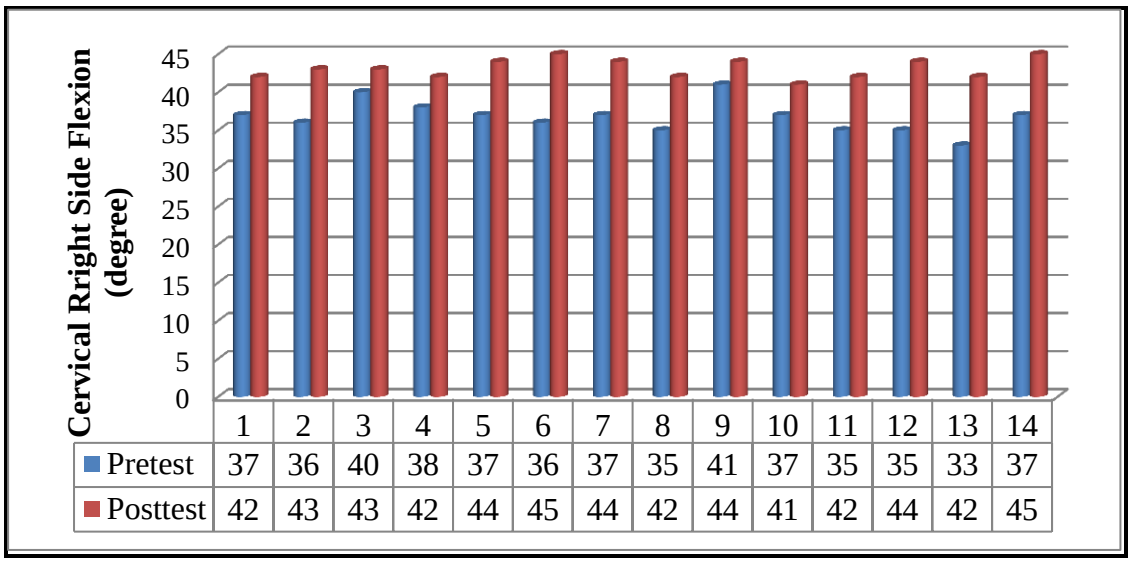
4.12. Pretest and posttest right side flexion (degree) in control group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	40	36	39	37	34	38	40	36	37	34	38	37	34	36
Posttest	43	43	42	41	38	40	42	41	42	37	39	40	42	41

Figure 17: Pretest and posttest score comparison of right side flexion (degree) in control group

4.13. Pretest and posttest right side flexion (degree) in trial group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	37	36	40	38	37	36	37	35	41	37	35	35	33	37
Posttest	42	43	43	42	44	45	44	42	44	41	42	44	42	45

Figure 18: Pretest and posttest score comparison of right side flexion (degree) in trial group

4.14. Right Side flexion of cervical spine between trial and control group

Table XIX: Statistical outcome of right side flexion (degree) between trial and control group

	Unpaired t	df	p	95% Confidence Interval	
				Lower	Upper
Difference between trial and control group in right side flexion (degree)	3.876	26	.0005	-3.498	-1.074

Table XIX showed that the calculated *t* value is 3.876 and for df= 26, has an associated probability level of 0.05%. This means that the probability of random error being responsible for the outcome of this experiment was 0.05 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.05% and it could be said that the result was significant. Thus, cranio-cervical exercise combined with usual care was effective than usual care among patients with chronic neck pain.

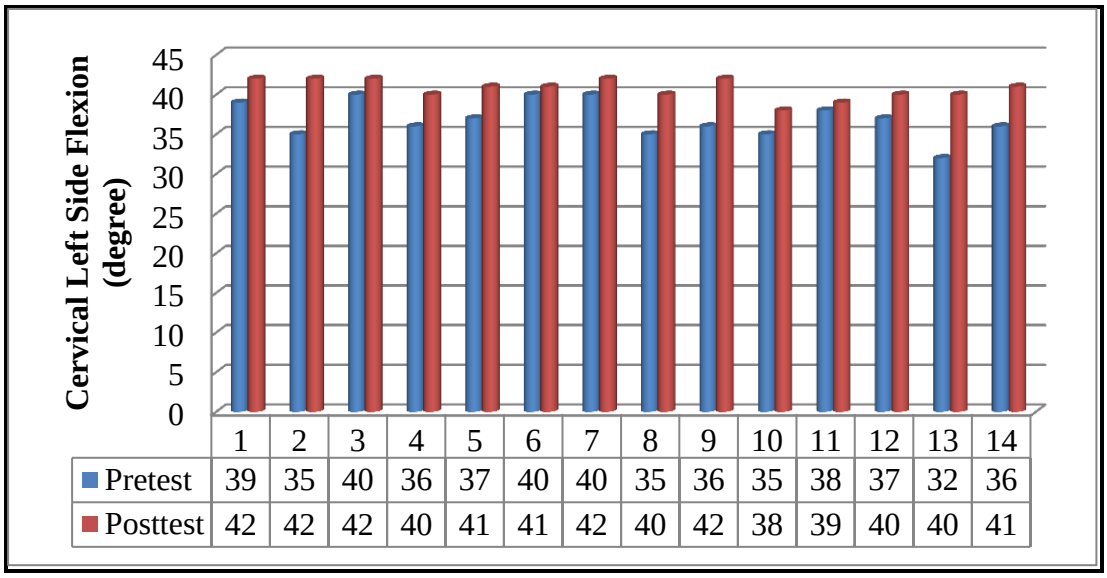
4.14.1. Right Side flexion of cervical spine within control and trial group

Table XX: Statistical outcome of right side flexion (degree) within trial and control group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Right Side flexion (degree) of cervical spine (control group)	3.929	1.940	-5.049	-2.808	7.577	13	0.000
Right Side flexion (degree) of cervical spine (trial group)	6.357	2.170	-7.610	-5.104	10.962	13	0.000

Table XX showed that within group analysis of right side flexion (degree) of cervical spine, the improvement of ROM was highly significant and in fact control group (p= 0.000) and trial group (p= 0.000).

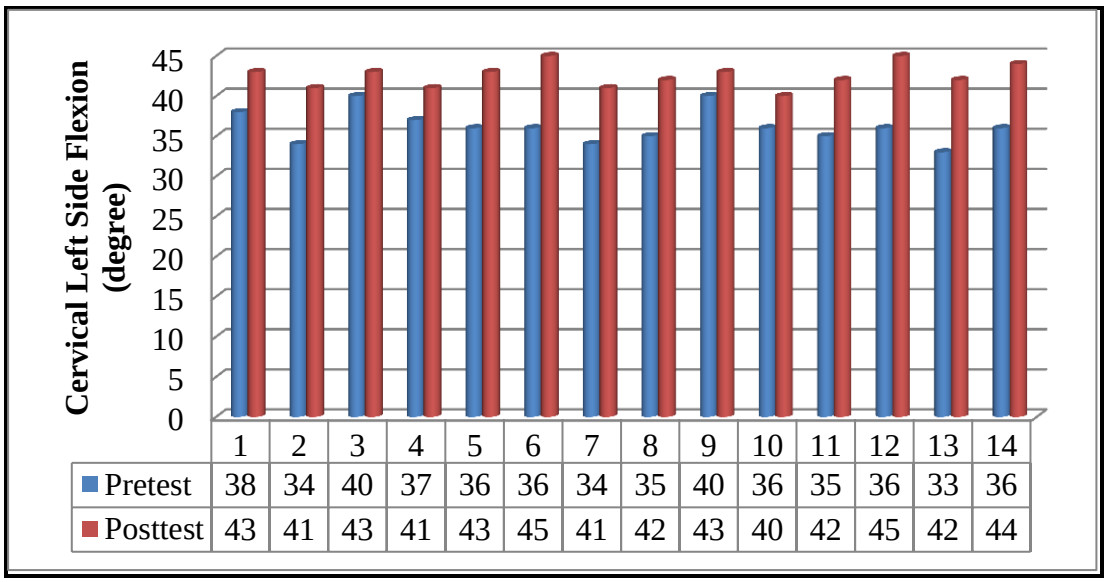
4.15. Pretest and posttest left side flexion (degree) in control group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	39	35	40	36	37	40	40	35	36	35	38	37	32	36
Posttest	42	42	42	40	41	41	42	40	42	38	39	40	40	41

Figure 19: Pretest and posttest score comparison of left side flexion (degree) in control group

4.16. Pretest and posttest left side flexion (degree) in trial group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	38	34	40	37	36	36	34	35	40	36	35	36	33	36
Posttest	43	41	43	41	43	45	41	42	43	40	42	45	42	44

Figure 20: Pretest and posttest score comparison left side flexion (degree) in trial group

4.17. Left Side flexion of cervical spine between trial and control group

Table XXI: Statistical outcome of left side flexion (degree) between trial and control group

	Unpaired t	df	p	95% Confidence Interval	
				Lower	Upper
Difference between trail and control group in left side flexion (degree)	3.395	26	0.005	-2.867	-.704

Table XXI described that the calculated *t* value is 3.395 and for df= 26, has an associated probability level of 0.05%. This means that the probability of random error being responsible for the outcome of this experiment was 0.05 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.05% and it could be said that the result was significant. Thus, cranio-cervical exercise combined with usual care was effective than usual care among patients with chronic neck pain.

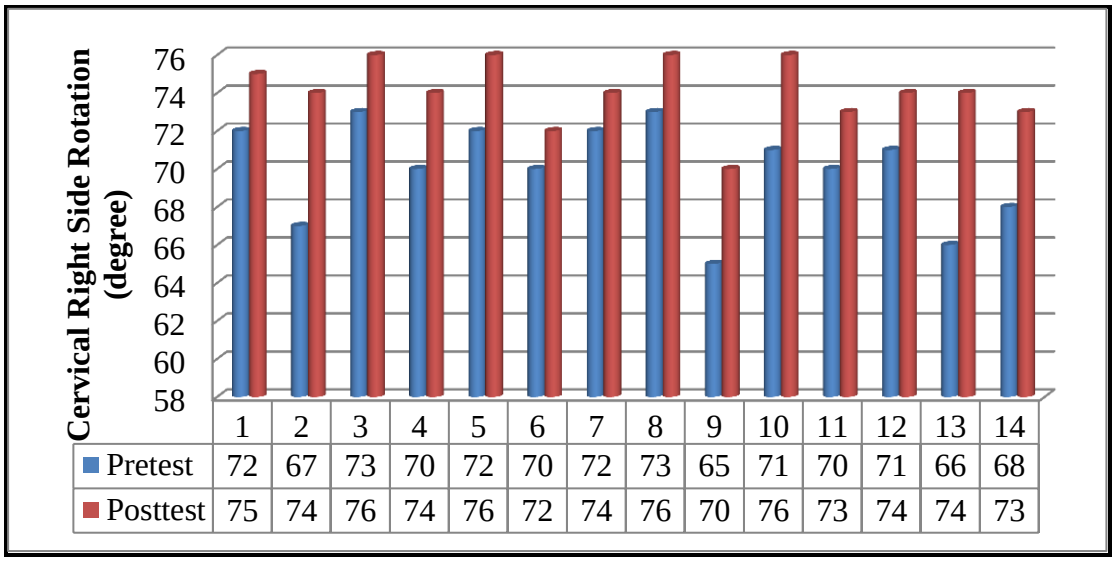
4.17.1. Left side flexion of cervical spine within control and trial group

Table XXII: Statistical outcome of left side flexion (degree) within trial and control group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Left Side flexion (degree) of cervical spine (control group)	3.857	2.143	-5.095	-2.620	6.734	13	0.000
Left Side flexion (degree) of cervical spine (trial group)	6.357	2.170	-7.610	-5.104	10.962	13	0.000

Table XXII proved that within group analysis of left side flexion (degree), the improvement was highly significant and in fact control group (p= 0.000) and trial group (p= 0.000).

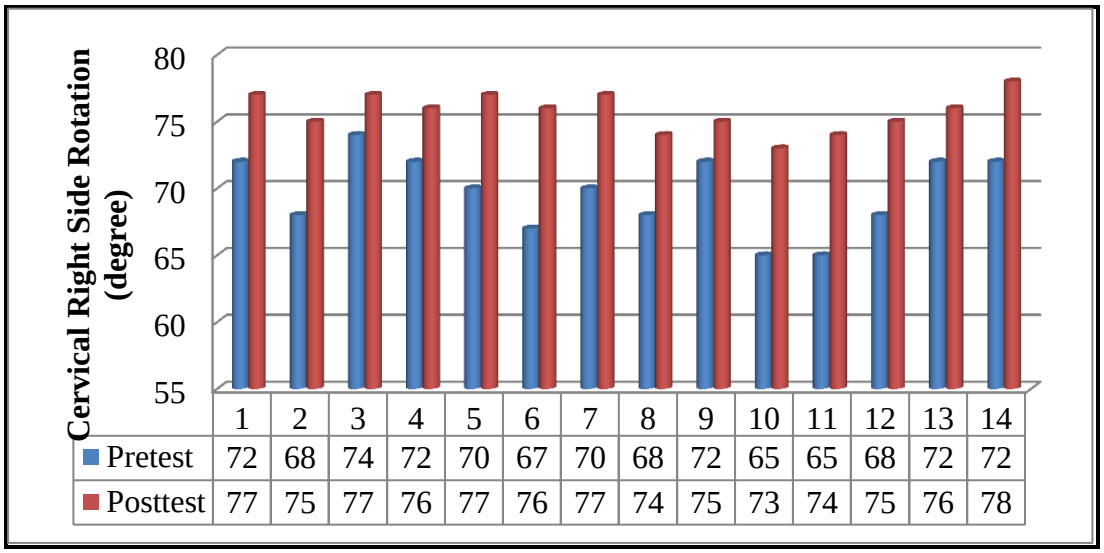
4.18. Pretest and posttest right side rotation (degree) in control group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	72	67	73	70	72	70	72	73	65	71	70	71	66	68
Posttest	75	74	76	74	76	72	74	76	70	76	73	74	74	73

Figure 21: Pretest and posttest score comparison of right side rotation (degree) in control group

4.19. Pretest and posttest right side rotation (degree) in trial group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	72	68	74	72	70	67	70	68	72	65	65	68	72	72
Posttest	77	75	77	76	77	76	77	74	75	73	74	75	76	78

Figure 22: Pretest and posttest score comparison of right side rotation (degree) in trial group

4.20. Right side rotation of cervical spine between trial and control group

Table XXIII: Statistical outcome of right side rotation (degree) between trial and control group

	Unpaired t	df	p	95% Confidence Interval	
				Lower	Upper
Difference between trial and control group in right side rotation (degree)	2.733	26	0.005	-2.879	-.407

Table XXIII showed that the calculated *t* value is 2.733 and for df= 26, has an associated probability level of 0.05%. This means that the probability of random error being responsible for the outcome of this experiment was 0.05 in 100. As the usual cut- off point for claiming support for the experimental hypothesis was 0.05% and it could be said that the result was significant. Thus, cranio-cervical exercise combined with usual care was effective than usual care among patients with chronic neck pain.

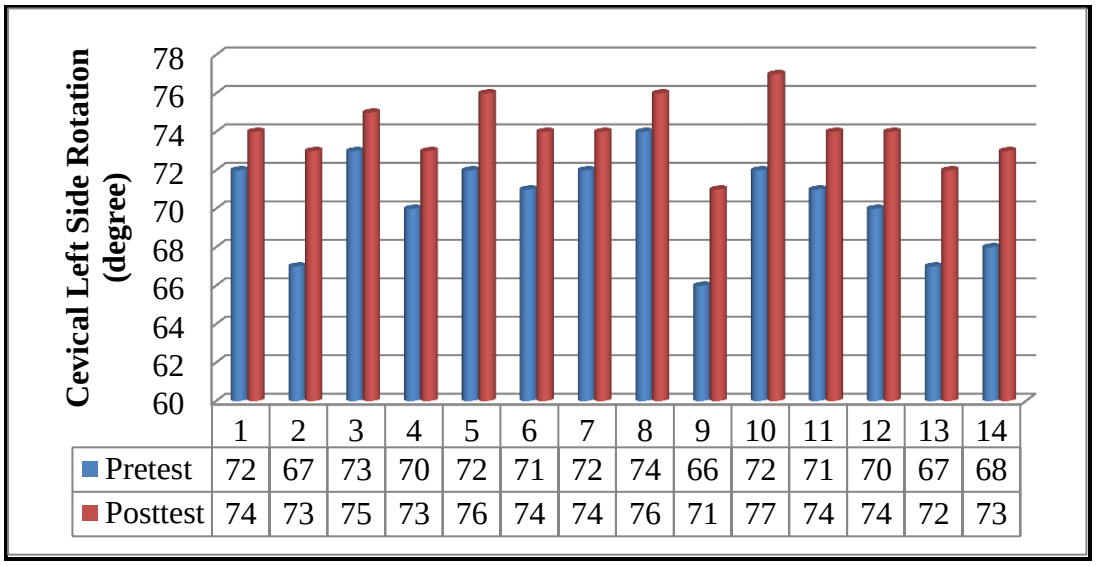
4.20.1. Right rotation of cervical spine within control and trial group

Table XXIV: Statistical outcome of right rotation (degree) within trial and control group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Right Rotation (degree) of cervical spine (control group)	4.071	1.774	-5.096	-3.047	8.586	13	0.000
Right Rotation (degree) of cervical spine (trial group)	6.071	2.018	-7.236	-4.906	11.259	13	0.000

Table XXIV showed that within group analysis of right side rotation (degree) of cervical spine, the improvement was highly significant and in fact, control group (p= 0.000) and trial group (p= 0.000).

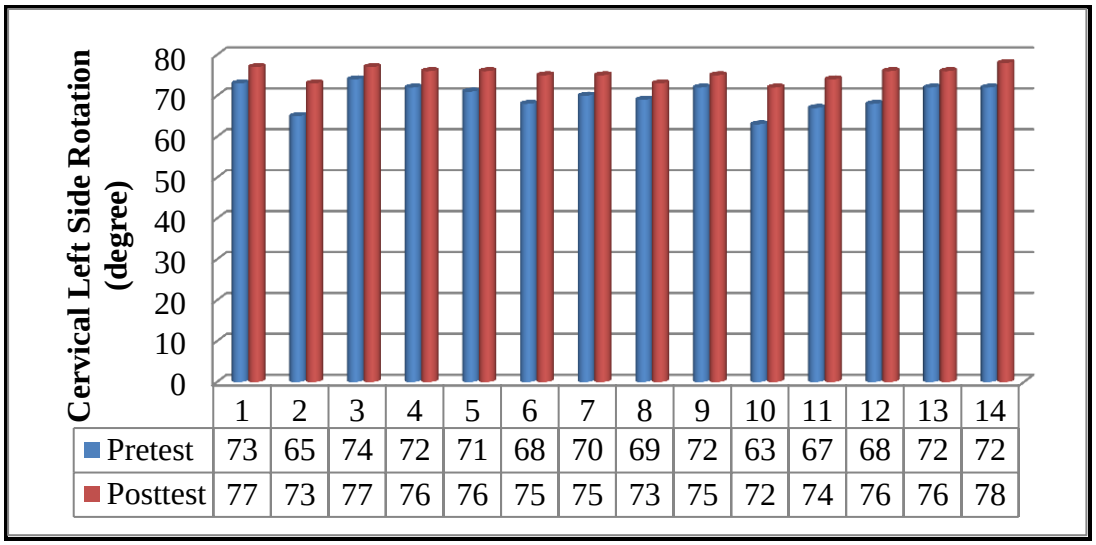
4.21. Pretest and posttest left side rotation (degree) in control group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	72	67	73	70	72	71	72	74	66	72	71	70	67	68
Posttest	74	73	75	73	76	74	74	76	71	77	74	74	72	73

Figure 23: Pretest and posttest score comparison of left side rotation (degree) in control group

4.22. Pretest and posttest left side rotation (degree) in trial group



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pretest	73	65	74	72	71	68	70	69	72	63	67	68	72	72
Posttest	77	73	77	76	76	75	75	73	75	72	74	76	76	78

Figure 24: Pretest and posttest score comparison of left side rotation (degree) in trial group

4.23.Left side rotation of cervical spine between trial and control group

Table XXV: Statistical outcome of left side rotation (degree) between trial and control group

	Unpaired t	df	p	95% Confidence Interval	
				Lower	Upper
Difference between trail and control group in left side rotation (degree)	1.926	26	0.05	-2.510	.082

Table XXV showed that the calculated *t* value is 1.926 and for df= 26, has an associated probability level of 5%. This means that the probability of random error being responsible for the outcome of this experiment was 5 in 100. As the usual cut-off point for claiming support for the experimental hypothesis was 5% and it could be said that the result was significant. Thus, cranio-cervical exercise combined with usual care was effective than usual care among patients with chronic neck pain.

4.23.1. Left side rotation of cervical spine within control and trial group

Table XXVI: Statistical outcome of left side rotation (degree) within trial and control group

	Mean	Std. Deviation	95% Confidence Interval		Paired t	df	p
			Lower	Upper			
Left side Rotation (degree) of cervical spine (control group)	3.643	1.393	-4.447	-2.839	9.787	13	0.000
Left side Rotation (degree) of cervical spine (trial group)	5.500	1.990	-6.649	-4.351	10.339	13	0.000

Table XXVI showed that within group analysis of left side rotation (degree), the improvement was highly significant and in fact, control group (p= 0.000) and trial group (p= 0.000).

4.24. Mean Difference of Cervical Spine Muscle Strength (OXFORD GRADE) in Pretest and Posttest Score of Trial and Control Group

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

Cervical muscles	**Trial group**			**Control group**		
	Pretest	**Posttest**	**Mean difference**	**Pretest**	**Posttest**	**Mean difference**
Flexor, mean	3.92	4.71	0.78	3.92	4.42	0.5
Extensor, mean	4.07	4.85	0.78	3.85	4.42	0.57
Side flexor (Right), mean	4.14	4.92	0.78	4	4.5	0.5
Side flexor (Left), mean	4.21	4.78	0.57	3.92	4.35	0.42
Rotator (Right), mean	4.07	4.78	0.71	3.78	4.28	0.5
Rotator (Left), mean	4.06	4.66	0.6	3.85	4.28	0.42

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

4.25. Pretest and posttest muscle strength of cervical flexor in control group

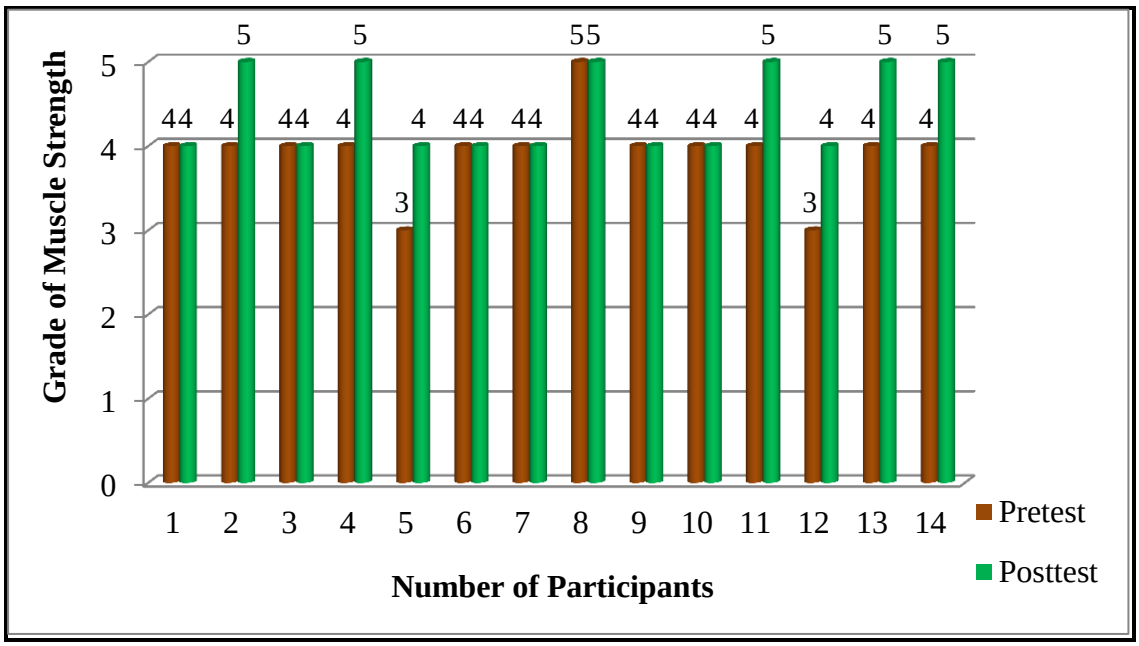


Figure 25: Pretest and posttest score comparison of cervical flexor muscle strength in control group

4.26. Pretest and posttest muscle strength of cervical flexor in trial group

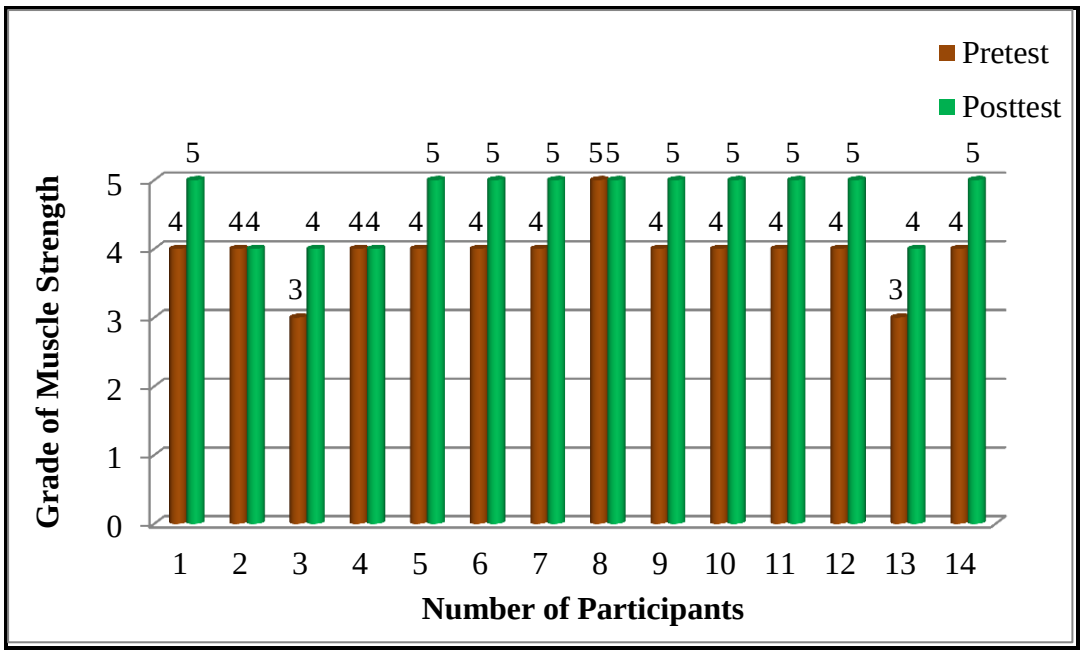


Figure 26: Pretest and posttest score comparison of cervical flexor muscle strength in trial group.

4.27.Cervical spine flexor muscle strength between trial and control group

Table XXVIII: Rank and test statistics of cervical flexor muscle strength between trial and control group

	Category of Participants	N	Mean of posttest flexor	Mean Rank	Mann-Whitney *U* Score	p
Difference between trial and control group in cervical spine flexor muscle strength	Control	14	4.42	12.50	70.00	0.10
	Trial	14	4.71	16.50		

Table XXVIII described that the calculated value of *U* is 70 for flexor muscle strength and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 61 for 0.05 in one tailed hypothesis. From the calculated value (*U*= 70), it is clear that *U* value between trial 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 trial group treatment (cranio-cervical exercise combined with usual) and control group treatment (usual care only) was not significant.

4.27.1. Cervical spine flexor muscle strength within control group

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

Flexor muscle strength (posttest) - Flexor muscle strength (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	7	4.00	28.00	-2.64	0.008
Ties	7				
Total	14				

Table XXXIX described the grade on the comparison of participant's before (pre) and after (post) cervical flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of usual care. In addition, 7 participants had higher muscle strength deficit score before application of usual care compare with after usual care. 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in cervical flexor muscle strength among individuals with chronic neck pain (Z= -2.64, p= 0.008).

4.27.2. Cervical spine flexor muscle strength within trial group

Table XXX: Rank and test statistics of cervical flexor muscle strength within trial group

Flexor muscle strength (posttest) - Flexor muscle strength (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	11	6.00	66.00	-3.31	0.001
Ties	3				
Total	14				

Table XXX described the grade on the comparison of participant's before (pre) and after (post) cervical flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of CCE combined with usual care in trial group. In addition, 11 participants had higher muscle strength deficit score before application of CCE combined with usual care compare with after application of CCE combined with usual care. Besides, 7 participants had equal amount of muscle strength before and after treatment in trial group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the control group for 3 weeks, twice weekly CCE combiner with usual care treatment course showed a statistically significant change in cervical flexor muscle strength among individuals with chronic neck pain (Z= -3.31, p= 0.001).

4.28.Pretest and posttest muscle strength of cervical extensor in control group

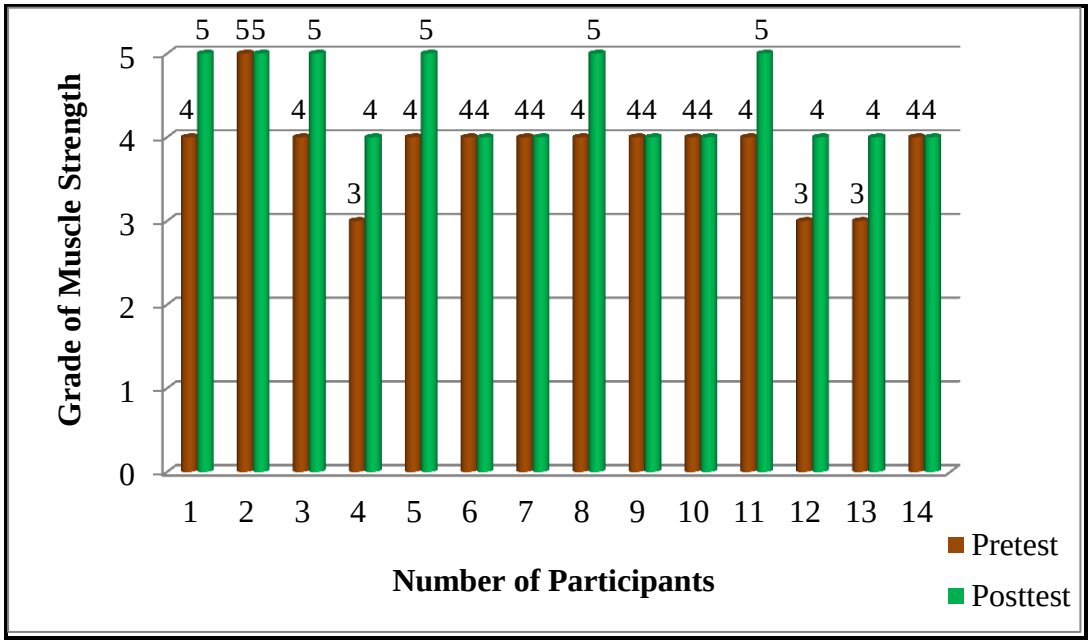


Figure 27: Pretest and posttest score comparison of cervical extensor muscle strength in control group

4.29.Pretest and posttest muscle strength of cervical extensor in trial group

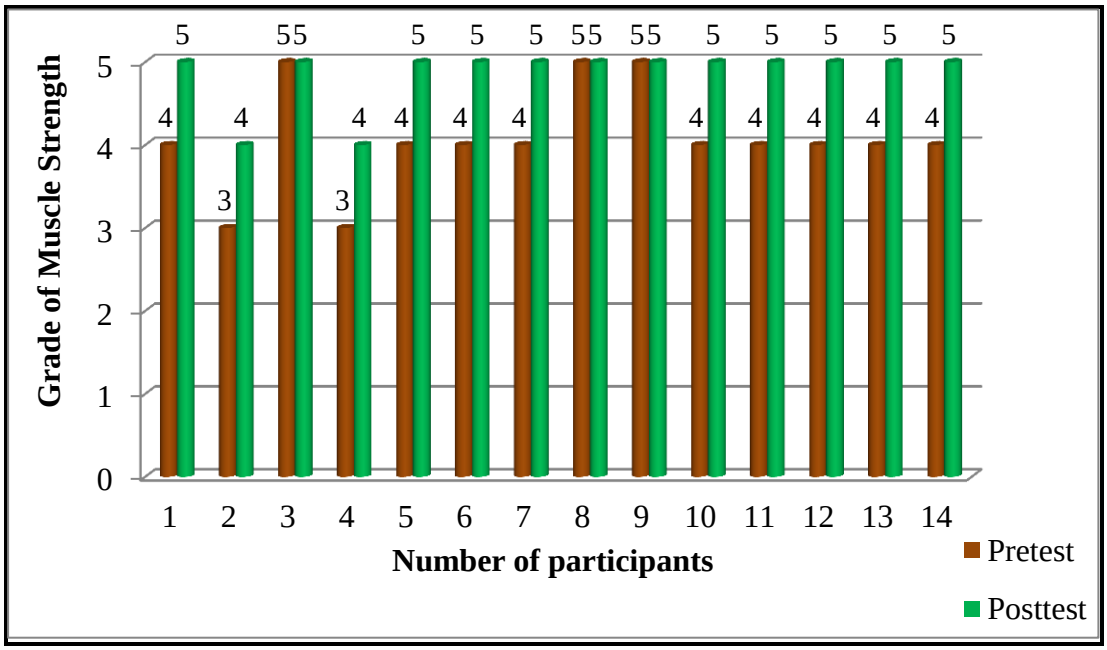


Figure 28: Pretest and posttest score comparison of cervical extensor muscle strength in trial group

4.30.Cervical spine extensor muscle strength between trial and control group

Table XXXI: Rank and test statistics of cervical extensor muscle strength between trial and control group

	Category of Participants	N	Mean of posttest extensor strength	Mean Rank	Mann-Whitney *U* Score	p
Difference between trial and control group in cervical spine extensor muscle strength	Control	14	4.42	11.50	56.00	0.05
	Trial	14	4.85	17.50		

Table XXXI showed that the calculated value of *U* is 56 for extensor muscle strength and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 61 for 0.05 in one tailed hypothesis. From the calculated value (*U*= 56), it was clear that *U* value between trial and control groups had an associated probability level which was less than 0.05 (5%). Therefore, the result was significant for one tailed hypothesis.

This means that difference between trial group treatment (cranio-cervical exercise combined with usual) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same. They differ significantly as trial group improvement was more than control group.

4.30.1. Cervical spine extensor muscle strength within control group

Table XXXII: Rank and test statistics of cervical extensor muscle strength within control group

Extensor of cervical spine (posttest) - Extensor of cervical spine (pretest)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
				Based on negative ranks Z	p
Negative ranks	0	.00	.00		
Positive ranks	8	4.50	36.00	-2.82	0.005
Ties	6				
Total	14				

Table XXXII described the grade on the comparison of participant's before (pre) and after (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, 8 participants had higher muscle strength deficit score before application of usual care compare with after usual care. Besides, 6 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in cervical extensor muscle strength among individuals with chronic neck pain (Z= -2.82, p= 0.005).

4.30.2. Cervical spine extensor muscle strength within trial group

Table XXXIII: Rank and test statistics of cervical extensor muscle strength within trial group

Extensor of cervical spine (posttest) - Extensor of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	11	6.00	66.00	-3.31	0.001
Ties	3				
Total	14				

Table XXXIII described the grade on the comparison of participant's before (pre) and after (post) cervical extensor muscle strength score in trial group. The table's legend showed that any participants did not have decreased muscle strength after application of CCE combined with usual care. In addition, 11 participants had higher muscle strength deficit score before application of CCE combined usual care. Besides, 3 participants had equal amount of muscle strength before and after treatment in trial group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE combined with usual care treatment course showed a statistically significant change in cervical extensor muscle strength among individuals with chronic neck pain (Z= -3.31, p= 0.001).

4.31.Pretest and posttest muscle strength of right side flexor strength in control group

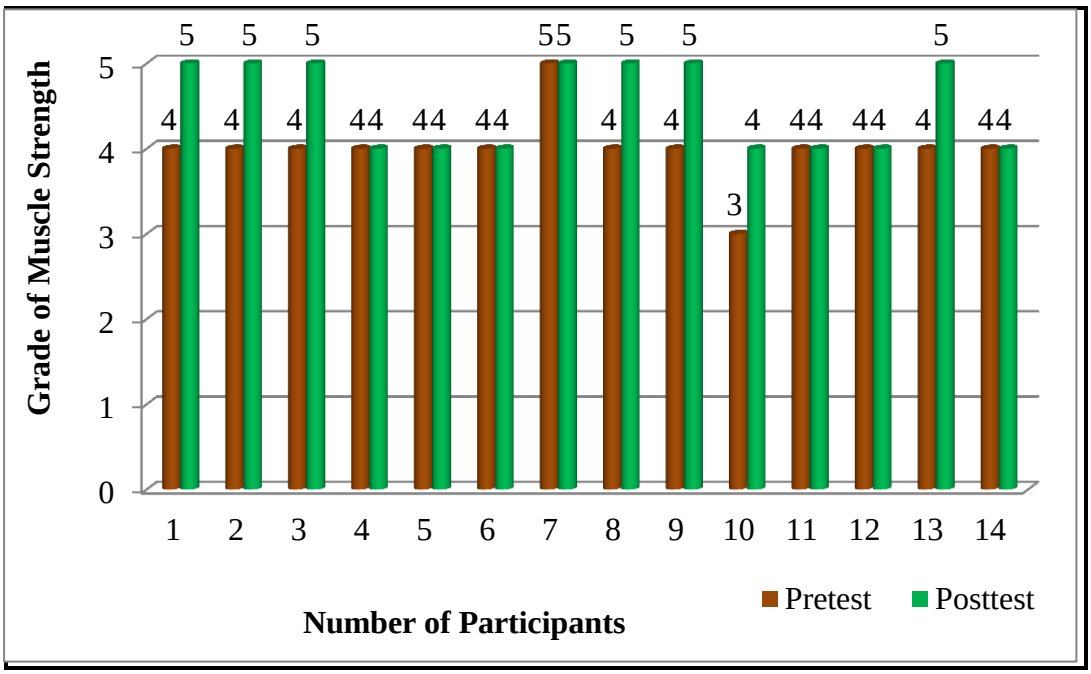


Figure 29: Pretest and posttest score comparison of right side flexor strength in control group

4.32.Pretest and posttest muscle strength of right side flexor strength in trial group

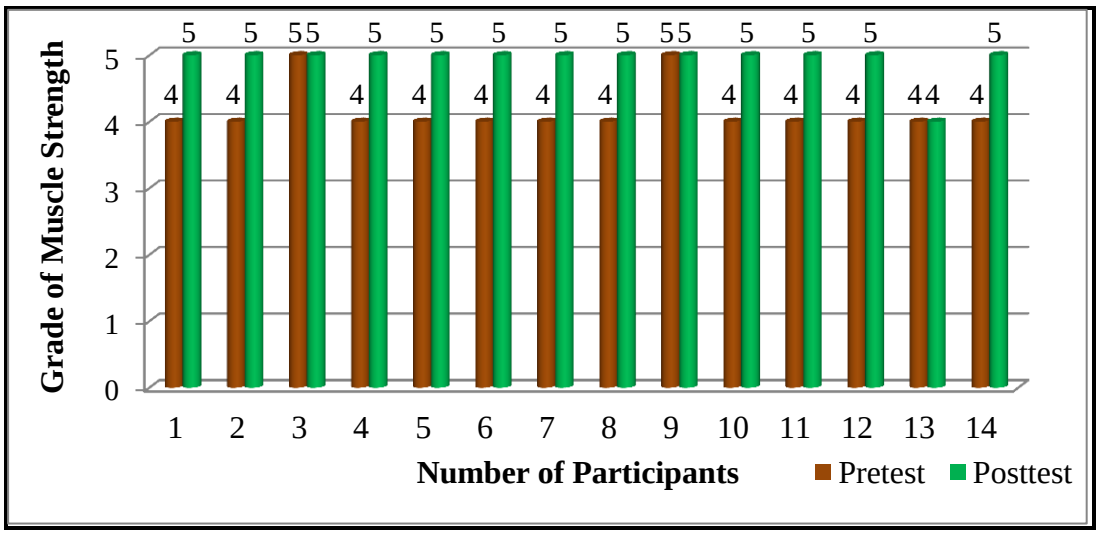


Figure 30: Pretest and posttest score comparison of right side flexor strength in trial group

4.33.Cervical spine right side flexor muscle strength between trial and control group

Table XXXIV: Rank and test statistics of cervical right side flexor muscle strength between trial and control group

	Category of Participants	N	Mean of posttest Side flexor	Mean Rank	Mann-Whitney *U* Score	p
Difference between trial and control group in right Side flexor muscle strength	Control	14	4.46	11.50	56.00	0.05
	Trial	14	4.92	17.50		

Table XXXIV described that the calculated value of *U* is 56 for side flexor (right) muscle strength and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 61 for 0.05 in one tailed hypothesis. From the calculated value (*U*= 56), it was clear that *U* value between trial and control groups had an associated probability level which was less than 0.05 (5%). Therefore, the result was significant for one tailed hypothesis. This means that difference between trial group treatment (cranio-cervical exercise combined with usual) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same. They differ significantly as trial group improvement was more than control group.

4.33.1. Cervical spine right side flexor muscle strength within control group

Table XXXV: Rank and test statistics of cervical right side flexor muscle strength within control group

Right side flexor of cervical spine (posttest) - Right side flexor of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	7	4.00	28.00	-2.64	0.008
Ties	7				
Total	14				

Table XXXV described the grade on the comparison of participant's before (pre) and after (post) cervical right side flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of usual care. In addition, 7 participants had higher muscle strength deficit score before application of usual care compare with after usual care. 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in cervical right side flexor muscle strength among individuals with chronic neck pain (Z= -2.64, p= 0.008).

4.33.2. Cervical spine right side flexor muscle strength within trial group

Table XXXVI: Rank and test statistics of cervical right side flexor muscle strength within trial group

Right side flexor of cervical spine (posttest) - Right side flexor of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	11	6.00	66.00	-3.31	0.001
Ties	3				
Total	14				

Table XXXVI described the grade on the comparison of participant's before (pre) and after (post) cervical right side flexor muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of CCE combined with usual care. In addition, 11 participants had higher muscle strength deficit score before application of CCE combined with usual care compare with after application of CCE combined with usual care. Besides, 3 participants had equal amount of muscle strength before and after treatment in trial group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE combined with usual care treatment course showed a statistically significant change in cervical right side flexor muscle strength in individuals with chronic neck pain (Z= -3.31, p= 0.001).

4.34.Pretest and posttest muscle strength of left side flexor in control group

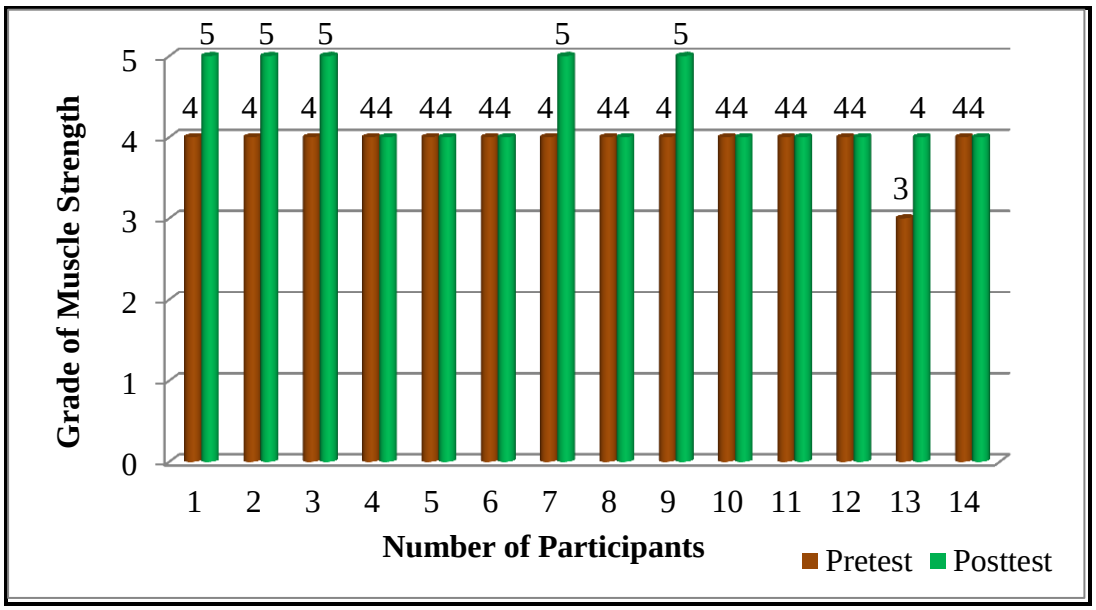


Figure 31: Pretest and posttest score comparison of left side flexor strength in control group

4.35.Pretest and posttest muscle strength of left side flexor in trial group

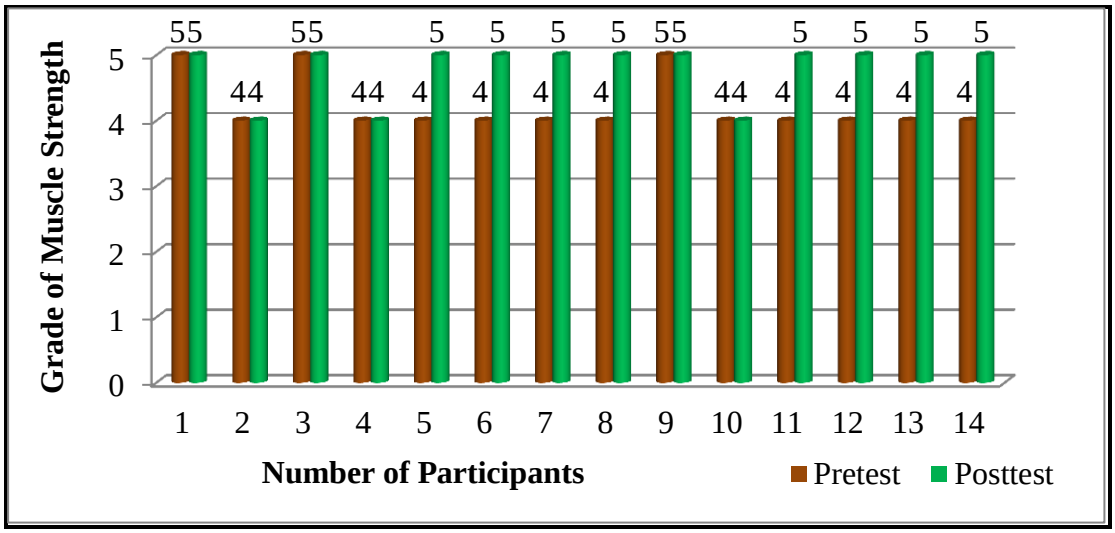


Figure 32: Pretest and posttest score comparison of left side flexor strength in trial group

4.36.Cervical spine left side flexor muscle strength between trial and control group

Table XXXVII: Rank and test statistics of left side flexor muscle strength between trial and control group

	Category of Participants	N	Mean of posttest left Side flexor strength	Mean Rank	Mann-Whitney *U* Score	p
Difference between trial and control group in cervical spine left side flexor muscle strength	Control	14	4.35	11.50	56.00	0.05
	Trial	14	4.78	17.50		

Table XXXVII demonstrated that the calculated value of *U* is 56 for side flexor (left) muscle strength and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 61 for 0.05 in one tailed hypothesis. From the calculated value (*U*= 56), it was clear that *U* value between trial and control groups had an associated probability level which was less than 0.05 (5%). Therefore, the result was significant for one tailed hypothesis. This means that difference between trial group treatment (cranio-cervical exercise combined with usual) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same. They differ significantly as trial group improvement was more than control group.

4.36.1. Cervical spine left side flexor muscle strength within control group

Table XXXVIII: Rank and test statistics of left side flexor strength in control group

Left side flexor of cervical spine (posttest) - Left side flexor of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	6	3.50	21.00	-2.44	0.014
Ties	8				
Total	14				

Table XXXVIII described the grade on the comparison of participant's before (pre) and after (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 usual care. In addition, all the 6 participants had higher muscle strength deficit score before application of usual care compare with after usual care. Besides, 8 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in left side flexor muscle strength among individuals with chronic neck pain ($Z= -2.44$, $p= 0.014$).

4.36.2. Cervical spine left side flexor muscle strength within trial group

Table XXXIX: Rank and test statistics of left side flexor muscle strength within trial group

left side flexor of cervical spine (posttest) - left side flexor of cervical spine (pretest)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
				Based on negative ranks Z	p
Negative ranks	0	.00	.00		
Positive ranks	8	4.50	36.00	-2.82	0.005
Ties	6				
Total	14				

Table XXXIX described the grade on the comparison of participant's before (pre) and after (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 CCE combined with usual care. In addition, 8 participants had higher muscle strength deficit score before application of CCE combined with usual care compare with after application of CCE combined with usual care. Besides, 6 participants had equal amount of muscle strength before and after treatment in trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE exercise combined with usual care treatment course showed a statistically significant change in cervical left side flexor muscle strength among individuals with chronic neck pain (Z= -2.82, p= 0.005).

4.37.Pretest and posttest strength of right rotator in control group

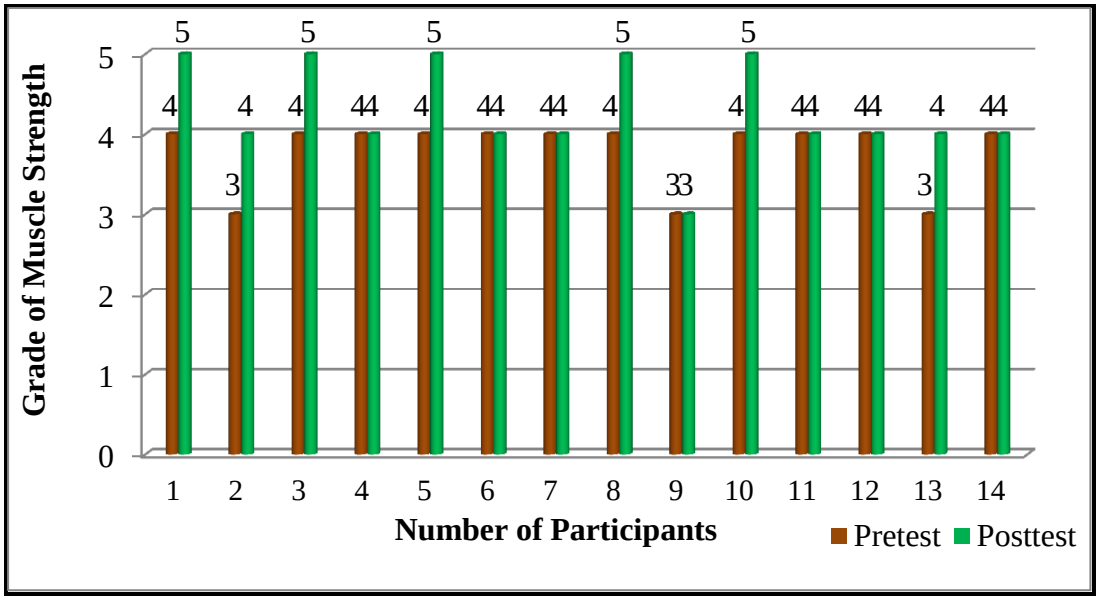


Figure 33: Pretest and posttest score comparison of right rotator strength in control group

4.38.Pretest and posttest strength of right rotator in trial group

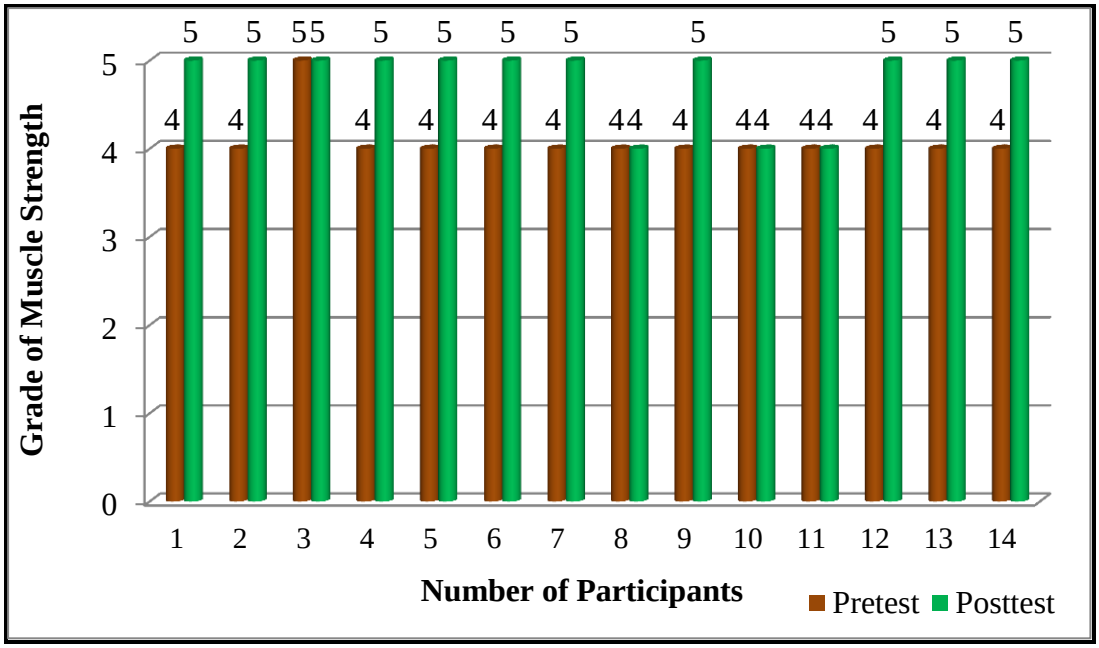


Figure 34: Pretest and posttest score comparison of right rotator strength in trial group

4.39.Cervical spine right rotator muscle strength between trial and control group

Table XXXX: Rank and test statistics of cervical right rotator muscle strength between trial and control group

	Category of Participants	N	Mean of posttest of right rotator strength	Mean Rank	Mann-Whitney *U* Score	p
Difference between trial and control group in cervical spine rotator (right) muscle strength	Control	14	4.28	11.39	54.00	0.05
	Trial	14	4.78	17.61		

Table XXXX showed that the calculated value of *U* is 54 for rotator (right) muscle strength and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 61 for 0.05 in one tailed hypothesis. From the calculated value (*U*= 54), it was clear that *U* value between trial and control groups have an associated probability level which was less than 0.05 (5%). Therefore, the result was significant for one tailed hypothesis. This means that difference between trial group treatment (cranio-cervical exercise combined with usual) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same. They differ significantly as trial group improvement was more than control group.

4.39.1. Cervical spine right rotator muscle strength within control group

Table XXXXI: Rank and test statistics of right rotator muscle strength within control group

Right side rotator of cervical spine (posttest) – Right side rotator of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	7	4.50	28.00	-2.64	0.008
Ties	7				
Total	14				

Table XXXXI described the grade on the comparison of participant's before (pre) and after (post) cervical right side rotator muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of usual care. In addition, 7 participants had higher muscle strength deficit score before application of usual care compare with after application of usual care. 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in right rotator muscle strength among individuals with chronic neck pain (Z= -2.64, p= 0.008).

4.39.2. Cervical spine right rotator muscle strength within trial group

Table XXXXII: Rank and test statistics of right rotator muscle strength in trial group

Right side rotator of cervical spine (posttest) – Right side rotator of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	10	5.50	55.00	-3.16	0.002
Ties	4				
Total	14				

Table XXXXII described the grade on the comparison of participants' before (pre) and after (post) cervical right rotator muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of CCE combined with usual care. In addition, 10 participants had higher muscle strength deficit score before application of CCE combined with usual care compare with after application of CCE combined with usual care. Besides, 4 participants had equal amount of muscle strength before and after treatment in trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE exercise combined with usual care treatment course showed a statistically significant change in cervical right rotator muscle strength in individuals with chronic neck pain (Z= -3.16, p= 0.002).

4.40.Pretest and posttest left rotator muscle strength in control group

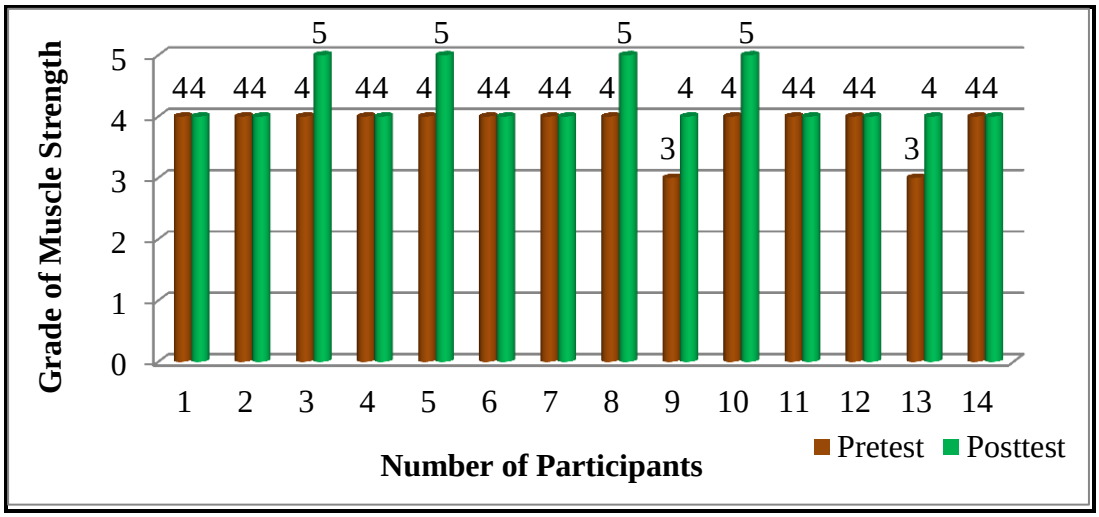


Figure 35: Pretest and posttest score comparison of left rotator strength in control group

4.41.Pretest and posttest left rotator muscle strength in trial group

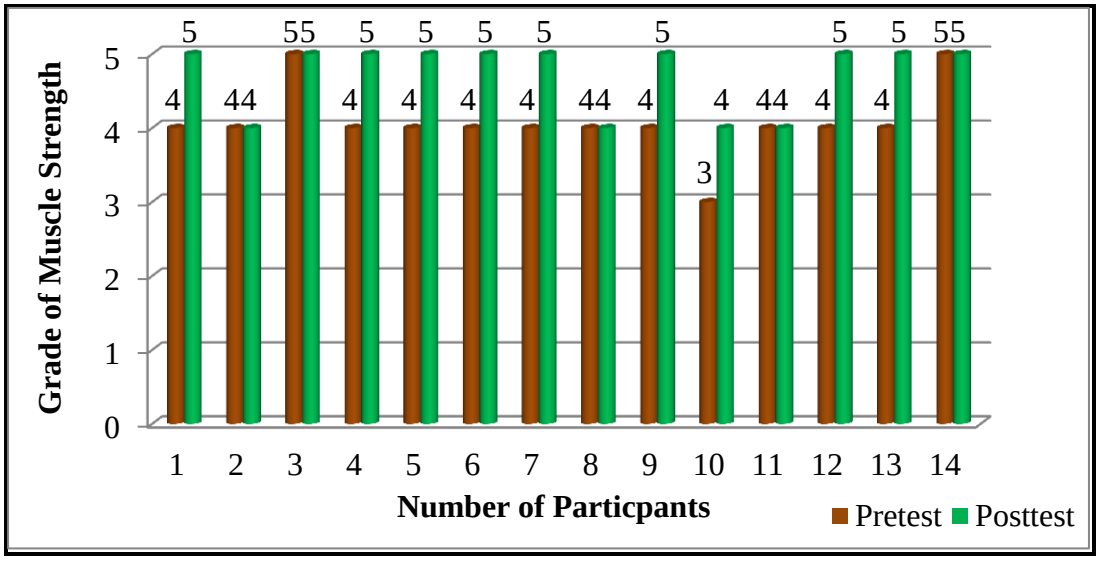


Figure 36: Pretest and posttest score comparison of left rotator strength in trial group

4.42.Cervical spine left rotator muscle strength between trial and control group

Table XXXXIII: Rank and test statistics of cervical left rotator muscle strength between trial and control group

	Category of Participants	N	Mean of posttest rotator (left) strength	Mean Rank	Mann-Whitney *U* Score	p
Difference between trial and control group in cervical spine rotator (left) muscle strength	Control	14	4.28	11.50	56.00	0.05
	Trial	14	4.71	17.50		

Table XXXXIII described that the calculated value of *U* is 56 for rotator (left) muscle strength and the table value of *U* for $n_{1=}$ 14 and n_2= 14 is 61 for 0.05 in one tailed hypothesis. From the calculated value (*U*= 56), it was clear that *U* value between trial and control groups had an associated probability level which was less than 0.05 (5%). Therefore, the result was significant for one tailed hypothesis. This means that difference between trial group treatment (cranio-cervical exercise combined with usual) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same. They differ significantly as trial group improvement was more than control group.

4.42.1. Cervical spine left rotator muscle strength within control group

Table XXXXIV: Rank and test statistics of left side rotator muscle strength within control group

Left side rotator of cervical spine (posttest) – left side rotator of cervical spine (pretest)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
				Based on negative ranks Z	p
Negative ranks	0	.00	.00		
Positive ranks	6	3.50	21.00	-2.44	0.014
Ties	8				
Total	14				

Table XXXXIV described the grade on the comparison of participant's before (pre) and after (post) cervical left side rotator muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of usual care. In addition, 6 participants had higher muscle strength deficit score before application of usual care compare with after application of usual care. Besides, 8 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in right rotator muscle strength among individuals with chronic neck pain (Z= -2.44, p= 0.014).

4.42.2. Cervical spine left rotator muscle strength within trial group

Table XXXXV: Rank and test statistics of left side rotator muscle strength within trial group

Left side rotator of cervical spine (posttest) – Left side rotator of cervical spine (pretest)	**N**	**Mean rank**	**Sum of Ranks**	**Test statistics (Wilcoxon signed-rank test)**	
				Based on negative ranks Z	**p**
Negative ranks	0	.00	.00		
Positive ranks	9	5.00	45.00	-3.00	0.003
Ties	5				
Total	14				

Table XXXXV described the grade on the comparison of participants' before (pre) and after (post) cervical left rotator muscle strength score. The table's legend showed that any participants did not have decreased muscle strength after application of CCE combined with usual care. In addition, 9 participants had higher muscle strength deficit score before application of CCE combined with usual care compare with after application of CCE combined with usual care. Besides, 5 participants had equal amount of muscle strength before and after treatment in trial group.

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE exercise combined with usual care treatment course showed a statistically significant change in cervical right rotator muscle strength among individuals with chronic neck pain (Z= -3.00, p= 0.003).

4.43.Cervical Spine Disability Information

4.43.1. Pretest and posttest score of neck disability score in trial group

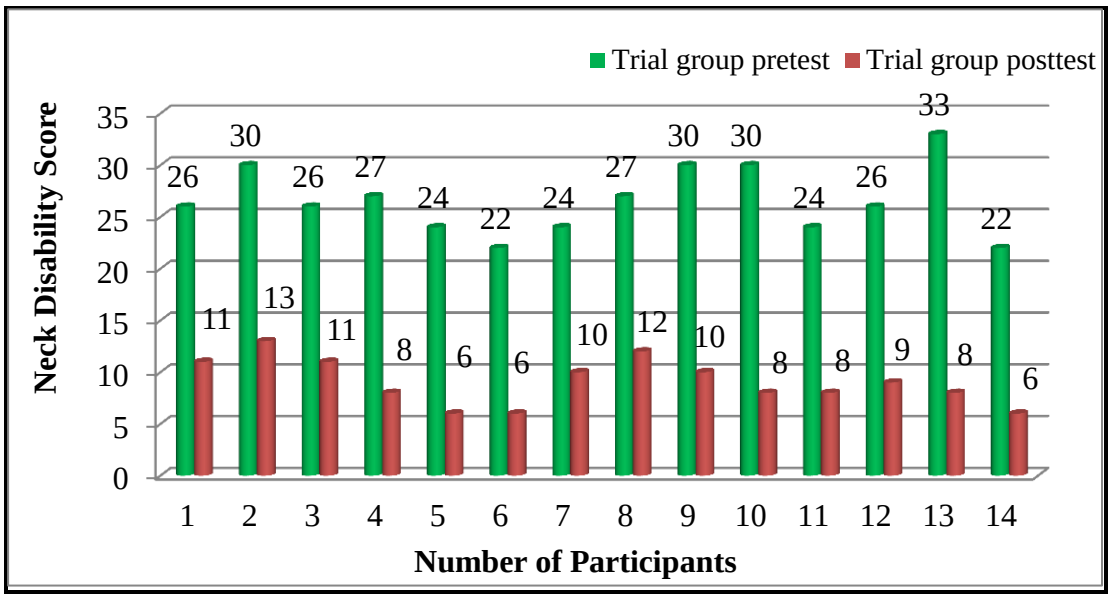


Figure 37: Pretest and posttest score comparison of neck disability in trial group

4.43.2. Pretest and posttest score of neck disability score in control group

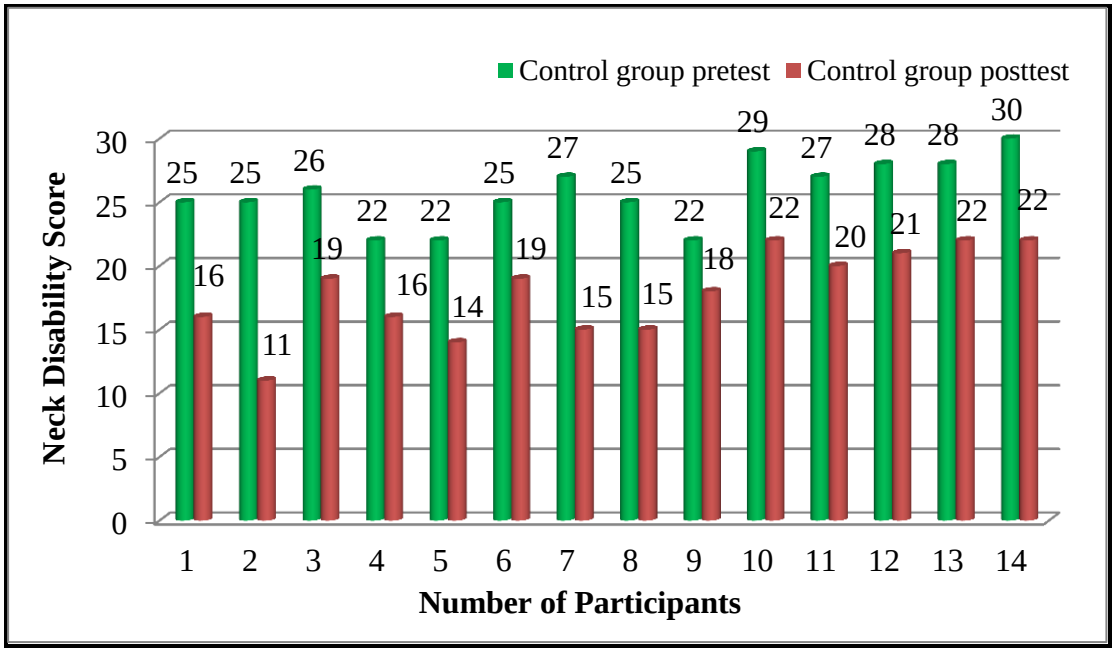


Figure 38: Pretest and posttest score comparison of neck disability in control group

4.44.Neck disability index (NDI) between trial and control group

Table XXXXVI: Rank and test statistics of neck disability index between trial and control group

	Category of Participants	N	Mean of posttest NDI	Mean Rank	Mann-Whitney *U* Score	p
Difference between neck disability index	Control	14	17.85	21.29	03.00	0.00
	Trial	14	09	7.71		
	Total	28				

Table XXXXVI showed that the calculated value of *U* is 03 for neck disability index. From the calculated value (*U*= 03), it was clear that *U* value between trial and control groups had an associated probability of equal to 0.00. Therefore, the result was significant for one tailed hypothesis. This means that difference between trial group treatment (cranio-cervical exercise combined with usual care) and control group treatment (usual care only) was significant i.e. improvement occur in the trial group were not same than control group. They differ significantly as trial group improvement was more than control group. Thus, cranio-cervical exercise combined with usual care was effective than usual care among patients with chronic neck pain.

4.44.1. Neck disability index (NDI) within control group

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

Neck disability index (pretest) – Neck disability index (posttest)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
				Based on negative ranks Z	p
Negative ranks	0	.00	.00		
Positive ranks	14	7.50	105.00	-3.30	0.001
Ties	0				
Total	14				

Table XXXXVII 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 usual care. In addition, 14 participants had higher disability score before application of usual care compare with after application of usual care. 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 3 weeks, twice weekly usual care treatment course showed a statistically significant change in neck disability among individuals with chronic neck pain (Z= -3.30, p= 0.001).

4.44.2. Neck disability index (NDI) within trial group

Table XXXXVIII: Rank and test statistics of neck disability index within trial group

Neck disability index (pretest) – Neck disability index (posttest)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
				Based on negative ranks Z	p
Negative ranks	0	.00	.00		
Positive ranks	14	7.50	105.00	-3.30	0.001
Ties	0				
Total	14				

Table XXXXVIII described the comparison of participants' 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 CCE combined with usual care. In addition, 14 participants had higher neck disability index score before application of CCE combined with usual care compare with after application of CCE combined with usual care. Besides, no participants had equal amount of disability before and after treatment in trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that the trial group for 3 weeks, twice weekly CCE exercise combined with usual care treatment course showed a statistically significant change in nick disability in individuals with chronic neck pain (Z= -3.30, p= 0.001).

Both the results showed equal amount of statistical significant difference within control and trial group but there was variation of median in each group at pretest and posttest score. The pretest median of NDI in the control group was 25.50 in contrast pretest median of in the trial group was 26.00. In addition, the posttest median of NDI in the control group was 18.50 and in contrast posttest median of trial group was 8.50.

4.45.Neck disability index (NDI) between and within group in each variable

Table XXXXIX: Rank and test statistics of NDI in each variable between and within trial and control group

Variable	Mann-Whitney *U* Score	Wilcoxon signed-rank test	
		Within trail group	Within control group
	p	p	p
Pain intensity at rest	0.00	0.000	0.000
Sleeping effects	0.00	0.000	0.001
Reading newspaper	0.00	0.000	0.07
Headache	0.54	0.16	0.040
Travelling	0.00	0.000	0.000
Concentration at work	0.00	0.000	0.003
Personal care	0.01	0.000	0.000
Daily work	0.00	0.000	0.002
Lifting objects	0.00	0.000	0.000
Recreational activities	0.02	0.000	0.000

Table XXXXIX proved that between groups analysis in each components of NDI showed significant improvement occurred in all variables except headache (p>0.5). Within trial group analysis showed that significant improvement occurred in all variables of NDI after application cranio-cervical exercise combined with usual care except headache (p>.05). In addition, within control group analysis showed significant improvement in all variables of NDI except reading newspaper (p>.07). It indicated that cranio-cervical exercise combined with usual care found effective treatment technique for patient with chronic neck pain in terms of minimizing neck disability.

CHAPTER-V DISCUSSION

The present study found almost similar 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 groups of participants. de Boer, et al. (2015) stated that similarities in baseline characteristics between both groups confirmed successful randomization. In addition, it was also proved that both the groups recorded in dependent variables were equal at pretest and there was hardly any influence on post test scores. The results of the study revealed that 43% participants were male and 57% participants were female. Among 14 participants in the trial group 01 (7.15%) participant performed static work, 4 (28.57%) performed minimal work, 06 (42.85%) involved in moderate type of exertion, 3 (21.43%) performed heavy work. On the other hand, among the 14 participants of control group, 02 (14.28%) participants performed minimal work, 07 (50%) performed moderate intensity work, 05 (35.72%) involved in heavy type of exertion (figure 4). In terms of BMI, majority of the participants in the trial group were normal weight (50%) followed by overweight (35.72%), obese 14.28% and in contrast control group had similar 42.85% normal weight and overweight participants separately and 14.3% obese participants (figure 6). In addition, majority of them (46.42%) were involved in moderate and secondly (28.57%) were in heavy work (figure 4). Gupta, et al. (2013) found significant association between age, BMI and level of physical work, and neck pain significantly.

In this study, participants in the trial and control group received 2 sessions per week and totaling 6 sessions of treatment during the treatment period of study based on Akhter, et al. (2014) study. The authors evaluated efficacy of manual therapy and

exercise therapy among patients with chronic nonspecific neck pain. Akhter and his colleagues included subjects who had nonspecific neck pain for more than three months and excluded them who had spinal instability, whish plash injury or radiculopathy of the cervical spine. Thus, these criteria matched with the current study and the numbers of treatment sessions were appropriate to prove or disprove the hypothesis.

Different studies found (Gupta, et al., 2013; Sambyal and Kumar, 2013) conventional physiotherapy as an effective treatment for patients with chronic neck pain. In contrast, few numbers of studies (Naz and Sarfraz, 2012; Gupta, et al., 2013) established cranio-cervical exercise was an effective treatment to reduce pain and improve ROM among patients with chronic neck pain. The current study demonstrated that cranio-cervical exercise combined with usual care showed significant effects on neck pain, ROM, muscle strength and NDI score. The exercise program was carried out for 6 sessions in both groups. However, cranio-cervical exercise combined with usual care shown effective than usual care and statistical test was conducted between the groups to identify which intervention was more effective than others. Data was also analyzed within trial and control group and found both trial and control had reduced pain, improved ROM, muscle strength and NDI scores but in most of the variables trial group outcomes were highly significant.

The current study also discovered that patient rated pain was not associated with BMI ($p= 0.56$), number of usable pillows ($p= 0.25$), diabetes mellitus ($p= 0.78$) and hypertension ($p= 0.80$) of the participants (Table X). Nevein and Hamid (2013) found similar findings in baseline characteristics in their study but the basic difference between the two studies was mean age of the participants. In Nevein and his colleague study, the participants mean age (± SD) was 20.49 years (± 2.14) and in contrast the

current study participants was 42.86 years (± 10.35). Given that older people did have risk factors for neck pain and neck pain increases with age even though in healthy population (Loose, et al., 2008).

Patient rated general pain was measured in the pre-test level and after completing of 6 sessions of treatment. However, patient rated general pain intensity between group was highly significant (p=0.004) (Table XI). In addition, exercise significantly decreased pain in trail group (p= 0.000) and control group (p = 0.001) (Table XII and XIII). This means that cranio-cervical exercise combined with usual care significantly differ from usual care whereas both exercises also were significantly decreased pain simultaneously. Meanwhile, Gupta, et al. (2013) evaluated the efficacy of pain, deep cervical muscle strength training program and found significant outcome (p=0.001) in between group and within group (trail group, p= 0.000; control group p= 0.000). In contrast, the present study outcomes on patient rated general pain intensity was similar as Gupta and his colleagues study but there was difference in outcome of pain intensity between trial and control group results. The main reason for this difference was that Gupta and his colleagues selected participants with age range of 20-40 years and in this study the participant's age range was 27-65 years. Thereby, age might be a factor for the inequality of outcome. In addition Mustafa and Sutan, (2013) found in their study that age and intensity of neck pain was significantly associated thereby patients with increased age were more prone to have severe symptoms of neck pain.

In cervical range of motion (ROM) variable, both exercises significantly improved (p=0.000) ROM within group analysis. In addition, significant improvement ($p<0.005$) was observed in all directions of range of motion except flexion ($p>0.05$) in between group analysis (Table XV). In addition, there was also significant ($p<0.05$)

results found in the left side rotation (Table XXV). Kim, et al. (2015) conducted a randomized control trial and compared among active release technique (ART), joint mobilization (JM) and control group (did not receive any treatment) among patient with chronic neck pain. The study found significant outcomes on dependent variables such as visual analog scale (VAS), pressure pain threshold (PPT) and cervical ROM. However, the authors concluded with significant improvement in VAS, PPT and cervical ROM within and between group analyses. In ROM component, there was significant ($p<0.05$) difference in cervical flexion between ART and JM group and others ROM were not significant ($p>0.05$). In contrast, the ART and the control group significantly differed in terms of ROM in all directions. Both the study found significant results in cervical ROM section except there was difference in flexion ROM. In this thesis, half of the participants (50%) performed their activities of daily livings in neck forward bending position and 68% of the participant's pain increased by neck forward bending. Therefore, the cranio-cervical angle becomes abnormal. This ultimately predisposed neck pain. Won-Gyu and Duk-Hyun (2009) found positive correlation between active cervical ROM and cranio-cervical angle in flexion. Therefore, an increased in cranio-cervical angle resulting in increased cervical flexion thereby increased the intensity of neck pain. Meanwhile Jeyanthi and Arumugam, (2015) evaluated ROM among patients with chronic neck pain and found significant improvement ($p<0.05$) in both side lateral flexion.

In the present thesis, significant improvement ($p<0.05$) was observed in the cervical spine muscles except flexor muscles during between group analysis (Table XXVIII) and within group analysis showed significant improvement in both groups. Ylinen, et al. (2004) found a wide range of muscle strength loss in their study. The authors stated that pain during trials had a negative correlation with the test results, showing

that pain was associated with decreased force production of the neck muscles. Several studies have shown that maximal isometric neck strength is lower in patients with chronic neck pain compared to matched healthy controls (Mustafa and Sutan, 2013; Kim, et al., 2015). Decreased strength in the neck muscles was thought to be associated with chronic neck pain, because researchers have pinpointed the neck flexor muscles as sites of weakness. Meanwhile, others found weakness in both the flexor and extensor muscles. One study reported (Halvorsen, et al., 2014) weakness of the rotator muscles among subjects with chronic neck pain compared with healthy matched controls. Neck pain might lead to the inability to move and strain the neck normally and might cause the subjects to avoid exercising. At worst, pain can significantly restrict an individual's activities of daily living. The neck is a complicated structure containing several joints with capsules, discs, ligaments, fasciae and muscles, all of which may become hypersensitive to loading in conditions of pain. Pain may arise directly from painful muscles during contraction, or forceful muscle contraction may provoke pain from deep joint structures due to increased mechanical stress. Pain during the strength tests was experienced in different directions by different patients showing that there was wide variation in the structures sensitive to strain. It was somewhat surprising that pain was experienced by so numerous patients during efforts towards flexion, as most patients tend to locate pain in the muscles in the back of the neck. In the clinic, neck pain might think mistakenly to arise from the extensor muscles as their tenderness was easily palpable, unlike in the case of the deep flexor muscles, which could not be examined by manual palpation.

In the present study, pain was felt more often in forward bending of neck than neck turning or raising from lying, although the extensor muscles perform more static work when maintaining the position of the head, as the head's center of the gravity was

situated anterior to the cervical spine. The strength in the flexor muscles was considerably lower compared to strength in the extensor and rotator muscles of neck (Liyanage, et al., 2014). Thus it might be assumed that the flexor muscles become strained more easily. The vast majority of the patients in the present study were right handed. Neck pain was felt more often in rotation towards the left compared to right and pain increased in greater intensity while moving towards left side than right side. The reason might be connected with use of hand as using more the dominant hand might lead to increased strength in the neck and shoulder muscles on the same side. In contrast, the less dominant side muscle found less strength because of inequality in uses during activities of daily livings. In the present thesis, majority of the participants were housewives and service holder where they had to perform moderate types of exertion. Nejati, et al. (2015) found forward bending working posture caused increased high thoracic and craniovertebral angles which were positively correlated with the presence of neck pain ($p < 0.05$).

One study (Salo, et al., 2006) suggested that chronic neck pain patients showed significant ($p<0.01$) isometric neck muscle strength deficits in cervical flexor and extensors. There was still cervical muscle weakness in the side flexors and rotators but they were not statistically significant. In the present study, majority of the participants had almost normal muscle strength in both side flexors and rotators at pretest score. Within control group analysis, significant value was found such as cervical flexor (p=.008), cervical extensor (p=0.005), cervical right side flexor (0.008), cervical left side flexor (p= 0.014), cervical right rotator (p= 0.008), cervical left rotator (p= 0.014) and within trial group cervical flexor (p=0.001), cervical extensor (p=0.001), cervical right side flexor (p=0.001), cervical left side flexor (p=0.005), cervical right rotator (p= 0.002) cervical left rotator (p= 0.003). There was

variation of results in this study in compare with Salo and his colleagues study because they measured muscle strength by isometric neck contraction with a dynamometer. In contrast, muscle strength was measured in similar techniques but the methods were done manually by physiotherapist in this study. However, one systematic review (de Koning, et al., 2008) evaluated clinimetric methods to measure muscle functioning among patients with non-specific neck pain. The study found that several methods were established to measure muscle functioning but there were inconclusive outcomes to support for manual muscle testing or dynamometer. Both the methods lack reproducibility or reliability and that's why de Koning and his colleagues hardly found the superiority of one over another. The current study was conducted in department of physiotherapy, CRP, Bangladesh where dynamometer was not available. Hence, manual muscle testing was selected to measure isometric muscle strength which was graded as 1 (i.e. enable to maintain position against gravity) to 5 (i.e. maintaining position against full manual resistance).

Based on the results of the study disability has reduced significantly after application of cranio-cervical exercise combined with usual care. In addition, only cranio-cervical exercise was also found effective. Between groups results in terms of neck disability index (NDI) showed significant (p=0.000) improvement of disability. In addition, within group analysis (within trial, p=0.001 and within control, p= 0.001) also found significant improvement in disability (Table XXXXVI, XXXXVII and XXXXVIII). In recent past, several studies assessed NDI after application of only cranio-cervical exercise and found improvement of disability (Graaf and Schmitt, 2012; Jeyanthi and Arumugam, 2015). Similar findings emerged in the study conducted by Jeyanthi and his colleague. The authors also focused within and between group's analysis of NDI and found significant changes (p=0.000) between group and within trial (p=0.001)

and control group (p=0.001). Despite of similar results, the average age (26 years) and age range (20-40 years) of their study participant's was far below than the current thesis participant's average age (42.86 years) and age range (26-65 years). Conversely, the researchers did not follow the blinding procedure such as participants or researcher blinded. This point could mimic the changes of variation in a trustworthy way in compare with Jeyanthi and his colleague study. Components of NDI were additionally analyzed between and within group. To the best knowledge of the researcher, there did not have any study which analyzed each components of NDI. Between group and within group analysis in each component such as pain at rest, at sleeping time, reading a newspaper, headache, during travelling, during concentration over a work, personal care, daily work, lifting objects and recreational activities were performed. The main reason for assessing them separately because cumulatively NDI showed an individual effect on disability but studying separately in each component guided which components was superior or ineffective than others. Between group analysis (Table XXXXIX) showed all components significantly strives to minimize disability except headache (p>0.05). In addition, within group results showed that trial group participants showed significant improvement in all variables except headache (p>0.05) and control group participants showed significant improvement in all variables except reading a newspaper or books (p>0.05). The main reason for problem in reading because in this function neck tends to bend forwardly which ultimately exaggerated pain and stretching posterior neck structures (Gross, et al., 2010). In addition, 21% participants in the control group was housewife and 71% of them performed their household activities by forward bending of neck. Graaf and Schmitt, (2012) in their study found positive correlation between forward bending of neck and higher level of neck disability. There was also reason for significantly ineffective for

headache because 75% of the participants did not have headache at pretest level and consequently there was no statistical relationship (p=0.34) between headache and neck disability. For this reason, there was almost no change of headache score during posttest which showed its negative statistical effects on outcome. Ylinen, et al. (2004) did not find any correlation between headache and neck pain due to lower cervical dysfunction or derangement.

Participant's dropout rate was relatively minor. Two participants (6.66%) of this study stop attending in the trial and did not complete treatment sessions. Hence their pretest level of scores was not counted during data analysis.

CHAPTER-VI LIMITATIONS

Despite of the effectiveness of cranio-cervical exercise combined with usual care 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. As samples were collected only from CRP- Savar, it could not represent the wider chronic neck pain population and the study lacks in generalizability of results to wider population. In addition, the study was conducted with 28 patients of chronic neck pain, which was a very small size of samples in compare with the real world prevalence. Data were collected only two times during study and it created study limitation as it lacks follow up daily or weekly basis changes in dependent variables. 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. Dropout rate of participants were relatively minor in percentage but inclusion of their data by adherence might have influence on study results. However, participants were only blinded and it lacks the absolute minimization of physiotherapist's bias during delivering treatment.

CHAPTER- VII RECOMMENDATION AND CONCLUSION

Chronic neck pain regarded as the source of impairments within the structure of cervical spine. This ultimately resulted in activity limitation and participation restriction in daily activity as well as social gatherings. Therefore, appropriate measurement tools were selected to find out the status of cervical pain, range of motion, muscle strength and neck disability. However, the current study has proved that cranio-cervical exercise combined with usual care was more effective than only usual care among patients with chronic neck pain. In clinical practice, physiotherapists preferred to apply manual therapy, exercise therapy, electrotherapy and formal education program. But in the long run, there has been a chance of recurrence of neck symptoms if the muscles acting on cervical spine are not conditioned properly.

The outcome of this study would denote physiotherapists to imply cranio-cervical exercise for selected chronic neck pain patients in their clinical practice. Conversely, the aim and objectives of this study has been fulfilled and the null hypothesis was rejected favouring the cranio-cervical exercise combined with usual care for chronic neck pain patients. In the last decade of study, physiotherapists relied on traditional isometric neck muscle strengthening exercise which lacks consistency of outcome as the objectivity solely based on the physiotherapists skills. In contrast, the techniques and procedures of cranio-cervical exercise encouraged involving patients actively as the resistance of muscle force can be progressed in accordance with patient's ability. Chronic neck pain not only affects the bodily system but also the entire personnel daily activities. Thus, International Classification of Functioning, Disability and Health (ICF) core sets could be applied with this finding from thesis in future time. A

double blinded randomized control trial is recommended in future with large sample size. Since cranio-cervical exercise 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 chronic neck pain.

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Appendix- A

Institutional Review Board (IRB) Letter

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref. CRP/BHPI/IRB/02/16/024 Date: 27.02.2016

To

Mohammad Habibur Rahman
Part – II, Student of M.Sc. in Physiotherapy
Session: 2012-2013, DU Reg. No.: 2242
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal – "Effectiveness of Cranio-cervical Exercise Combined with Usual Care among Patients with Chronic Neck Pain" **by ethics committee.**

Dear Mohammad Habibur Rahman

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your proposal to conduct the above mentioned thesis, with yourself, as the Principal investigator. The Following documents have been reviewed and approved:

Sl. No.	Name of the Documents
1	Thesis Proposal
2	Questionnaire (English and Bengali version)
3	Information sheet & consent form.

Since the study involves answering a questionnaire that takes 15 minutes, have no likelihood of any harm to the participants and have possibility of benefit patients in their chronic neck pain in addition with range of motion, muscle strength and neck disability. However, the members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 8.30 am on February 25, 2016 at BHPI.

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. However, the members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 8.30 am on February 25, 2016 at BHPI.

Best regards,

S. M. Ferdous Alam
Assistant Professor, Dept. of M. Sc. in Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

সিআরপি-চাপাইন, সাভার, ঢাকা-১৩৪৩, বাংলাদেশ, ফোন ঃ ৭৭৪৫৪৬৪-৫, ৭৭৪১৪০৪ ফ্যাক্স ঃ ৭৭৪৫০৬৯
CRP-Chapain, Savar, Dhaka-1343, Tel : 7745464-5, 7741404, Fax : 7745069, E-mail : contact@crp-bangladesh.org, www.crp-bangladesh.org

Appendix- B

Permission Letter

Date: February 17, 2016

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

Through: Coordinator, M. Sc. in Physiotherapy Program, BHPI, CRP, Savar, Dhaka

Subject: **Prayer for permission to collect data in order to conduct a thesis.**

Sir

With due respect, I am Mohammad Habibur Rahman, a student of Part-II M. Sc. in Physiotherapy program at Bangladesh Health Professions Institute (BHPI). As per course curriculum, I shall have to complete a thesis. In this respect, my thesis title is "Effectiveness of cranio-cervical exercise combined with usual care among patients with chronic neck pain". In this thesis, my participants will be patients who are suffering from chronic neck pain. I believe outdoor musculoskeletal unit of physiotherapy department in CRP, Savar is the best place to collect data from participants. In addition, data collector would be graduate physiotherapists who are currently working in this unit. In order to materialization of the thesis, I need your kind permission to collect data and cooperation from those physiotherapists.

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

Forwarded
17/2/2016

Sincerely Yours

Md. Habibur Rahman

Mohammad Habibur Rahman
Student of Part-II M.Sc.in Physiotherapy Program
BHPI, CRP, Savar, Dhaka-1343
Session: 2012-2013.

Approved
20/02/16
Mohammad Anwar Hossain
Associate Professor & Head of Physiotherapy Dept.
CRP, Chapain, Savar, Dhaka-1343

Forwarded
17/2/2016

Appendix- C

সম্মতিপত্র

আসসালামু আলাইকুম/নমস্কার, আমি মোহাম্মাদ হাবিবুর রহমান, ঢাকা বিশ্ববিদ্যালয়ের চিকিৎসা অনুষদের অধীনে বাংলাদেশ হেল্থ প্রফেশন ইনস্টিটিউট (বিএইচপিআই) এর পার্ট-২ এম.এসসি. ইন ফিজিওথেরাপি বিভাগের এর একজন শিক্ষার্থী। অধ্যায়নের অংশ হিসেবে আমাকে একটি গবেষণা সম্পাদন করতে হবে এবং এটা আমার প্রাতিষ্ঠানিক কাজের একটা অংশ। নিম্নোক্ত তথ্যাদি পাঠ করার পর অংশগ্রহণকারীদের অধ্যায়নে অংশগ্রহনের জন্য অনুরোধ করা হলো।

আমার গবেষণা শিরোনাম "ক্রনিক ঘাড়ে ব্যথার রোগীদের জন্য ক্রানিও- সারভিকাল চিকিৎসার কার্যকারিতা"।এই গবেষণায় মাধ্যমে আমি "ক্রনিক ঘাড়ের ব্যাথার চিকিৎসার জন্য ক্রানিও- সারভিকাল চিকিৎসার কার্যকারিতা খুঁজে বের করার চেষ্টা করবো। আমি যদি আমার গবেষণাটি সার্থকভাবেসম্পূর্ণ করতে পারি তবে যেসব রোগীরা ঘাড়ের ব্যাথায় ভুগছেন তারা উপকৃত হবেন এবং এটি হবে একটি পরীক্ষামূলক প্রমাণ।

আমার গবেষণা প্রকল্প বাস্তবায়ন করার জন্য, আমি রোগীদের কাছ থেকে কিছু তথ্য সংগ্রহ করব। সুতরাং, আপনি আমার গবেষণার একজন সম্মানিত অংশগ্রহণকারী হতে পারেন এবং আপনাকে আমার গবেষণার একজন অংশগ্রহণকারী হওয়ার জন্য অনুরোধ করছি। এজন্য আমি আপনার সাথে বেশ কয়েকবার দেখা করব। এই গবেষণায় প্রদত্ত চিকিৎসা সমূহ বাথামুক্ত এবং ঝুকিমুক্ত হবে।

আমি আপনাকে জানাতে চাই যে, ইহা একটি সম্পূর্ণরূপে প্রাতিষ্ঠানিক গবেষণা এবং অন্য কোন উদ্দেশে ব্যবহৃত হবে না।আমি নিশ্চিত করছি সকল উপাত্তসমূহ গোপনীয় রাখা হবে। আপনার অংশগ্রহণ হবে সম্পূর্ণ ঐচ্ছিক। আপনি যে কোনো সময় নিজেকে এ গবেষণা থেকে প্রত্যাহার করতে পারেন।

গবেষণা সম্পর্কে আপনার যদি কোনো জিজ্ঞাসা থাকে তবে আপনি অনুগ্রহপূবক যোগাযোগ করতে পারেন গবেষক মোহাম্মাদ হাবিবুর রহমান অথবা গবেষণার সুপারভাইজার ডাঃ কামাল আহমেদ স্যার এর সাথে।

আমি কি শুরু করতে পারি?

☐ হ্যা ☐ না

অংশগ্রহণকারীর স্বাক্ষর ও তারিখ .....

উপাত্ত সংগ্রহ কারীর স্বাক্ষর ও তারিখ.....

সাক্ষীর স্বাক্ষর ও তারিখ .....

গবেষকের স্বাক্ষর ও তারিখ .....

Consent Form (English)

Assalamualaikum\Namashker, I am Mohammad Habibur Rahman, a student of Part-II M. Sc. in Physiotherapy student of Bangladesh Health Professions Institute (BHPI) under Faculty of Medicine in University of Dhaka. To obtain my Master degree, I shall have to conduct a thesis and it is a part of my study. The participants are requested to participate in the study after reading the following.

My thesis title is "Effectiveness of Cranio-Cervical Exercise combined with usual care among Patients with Chronic Neck Pain". Through this study I will find the effectiveness of cranio-cervical exercise on neck pain, muscle strength, ROM and disability. If I can complete this thesis successfully, patient may get the benefits who have been suffering from this condition and it will be an evidence based treatment.

To fulfill my research project, I need to collect data. So, you can be a respected participant of my research and I would like to request you as a subject of my study. I want to meet you a couple of sessions at the time of your physiotherapy appointment. The exercises that will be given are pain free and safe for you.

I would like to inform you that this is a purely academic study and will not be used for any other purpose. I assure that all data will be kept confidential. Your participation will be voluntary. You have the right to withdraw consent and discontinue participation at any time of the experiment.

If you have any query about the study or your right as a participant, you may contact with me or my thesis supervisor Dr. Md. Kamal Ahmed.
Do you have any questions before I start?

So, may I have your consent to proceed with the interview?

☐ Yes ☐ No

Signature of the participant & Date…….
Signature of data collector & Date……
Signature of the witness & Date……
Signature of the researcher & Date……..

Appendix- D

প্রশ্নাবলী (বাংলা)

এই প্রশ্নাবলী ঘাড়ে ব্যথার রোগীদের জন্য ব্যথা, মাংসপেশির সক্ষমতা, ঘাড়ের জয়েন্টের মোশন এবং ঘাড়ের অক্ষমতা নির্ণয়ের জন্য তৈরি করা হয়েছে এবং এই অংশ কালো কলম দ্বারা তথ্য সংগ্রহকারী পূরণ করবেন। দয়া করে প্রত্যেকটি অংশ পূরণ করবেন এবং বক্সের সেই অংশটুকু পূরণ করবেন যা আপনার জন্য প্রযোজ্য। ইহা অনুমান করা যায় যে, কোন প্রশ্নের একাধিক অংশ আপনার নিকট কাছাকাছি মনে হতে পারে কিন্তু সেই উত্তরটি দিবেন যা আপনার সমস্যার খুব কাছাকাছি অবস্থিত।

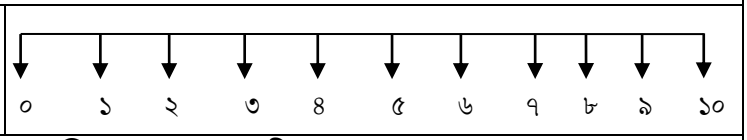
কোডঃ তারিখঃ

রোগীর নামঃ রোগীর আইডিঃ

মোবাইল নং- ঠিকানাঃ

প্রশ্ন সমূহ	উত্তর
পর্ব-১ : সামাজিক- বৈষয়িক তথ্যবলী:	
১। রোগীর বয়স	.....বৎসর .....মাস
২। লিঙ্গ	☐ পুরুষ ☐ মহিলা
৩। পেশা	.....
৪। কাজে কোন ধরনের পরিশ্রম আপনি করেন?	☐ স্বাভাবিক ☐ সামান্য ☐ মাঝামাঝি ☐ ভারি ☐ প্রযোজ্য নহে
৫। কত সময় যাবত আপনি ঘাড়ে বাথায় ভুগছেন?	.....বৎসর .....মাস .....দিন
৬। কাজের জন্য কোন হাত আপনি বেশি ব্যবহার করেন?	☐ ডান ☐ বাম
৭। ওজন	..... (কেজি)
৮। উচ্চতা	..... (সেন্টিমিটার)
৯। বি এম আই	..... (কেজি/মিটার^২)
১০। শিক্ষাগত যোগ্যতা	.....
১১। কি ভাবে ঘুমাতে আপিন পছন্দ করেন?	☐ চিত হয়ে ☐ উপুড় হয়ে ☐ কাত হয়ে- ডানে ☐ কাত হয়ে- বামে
১২। ঘুমানোর সময় আপনি কয়টি বালিশ ব্যবহার করেন?	.....

প্রশ্ন সমূহ	উত্তর
পর্ব- ২: মেডিকেল তথ্যবলী	
১৩। আপনি কি ডায়বেটিস রোগে ভুগছেন?	☐ হাঁ ☐ না ☐ জানি না
১৪। আপনি কি উচ্চরক্তচাপ রোগে ভুগছেন?	☐ হাঁ ☐ না ☐ জানি না
পর্ব- ৩ : ব্যথা সম্পর্কিত তথ্যবলী	
১৫। ব্যথার কারণ সম্পর্কে আপনি কি মনে করেন?	☐ আঘাতের কারনে ☐ ভারি ওজন বহনের কারনে ☐ কাজের সময় শরীরের সঠিক অবস্থান না রাখার জন্য ☐ কাশি অথবা হাঁচি ☐ ঘুমানোর সময় শরীরের সঠিক অবস্থান না রাখার জন্য ☐ অন্যান্য
১৬। ঘাড়ের কোন পাশে আপনার ব্যথা সবচেয়ে বেশি?	☐ ডান ☐ বাম ☐ মাঝামাঝি ☐ উভয় পাশে
১৭। কাঁধের কোন পাশে আপনার ব্যথা সবচেয়ে বেশি?	☐ ডান ☐ বাম ☐ প্রযোজ্য নহে
১৮। কোন স্থানে তুলনামূলকভাবে ব্যথা আপনার কাছে বেশি মনে হয়?	☐ ঘাড়ে ব্যথা কাঁধের চেয়ে বেশি ☐ কাঁধের ব্যথা ঘাড়ের চেয়ে বেশি ☐ ঘাড়ে ব্যথা এবং কাঁধের ব্যথা একইরকম
১৯। কোন সময় আপনি সবচেয়ে বেশি ব্যথা অনুভব করেন?	☐ সকালে ☐ দিন বাড়ার সাথে সাথে ☐ সন্ধায় ☐ রাতে ☐ সারাদিন
২০। কোন দিকে ঘাড়ের নড়াচড়া করলে আপনার ব্যথা বেড়ে যায়?	☐ ঘাড় সামনের দিকে ঝুঁকলে ☐ ঘাড় পিছনের দিকে ঝুঁকলে ☐ ঘাড় ডান দিকে ঘুরালে ☐ ঘাড় বাম দিকে ঘুরালে ☐ শোয়া থেকে উথতেগেলে ☐ বসা থেকে উথতেগেলে
২১। ব্যথার শুরুর অবস্থা থেকে এখনকার ব্যথা কি অবস্থায় আছে?	☐ উন্নতির দিকে ☐ খারাপের দিকে ☐ একই রকম

চিকিৎসা পূর্ববর্তী উপাত্ত সমূহ	
প্রশ্ন সমূহ	**উত্তর**
পর্ব- ৪ :সামগ্রিকভাবে রোগী কর্তৃক নির্ণীত ব্যথার হারঃ	
২২। বিশ্রামরত অবস্থায় (চিত অবস্থায়) আপনি কি পরিমান ব্যথা অনুভব করেন?	
পর্ব- ৫ : ঘাড়ের জয়েন্টের মোশন এবং মাংসপেশির সক্ষমতার তথ্যবলীঃ	
২৩। ঘাড়ের গতি বর্তমানে কতটুকু আছে? (দয়া করে ডিগ্রী দিয়ে লিখবেন)	ফ্লেক্সসন ..... এক্সটেন্সান ..... সাইড ফ্লেক্সসন (ডান) ..... সাইড ফ্লেক্সসন (বাম) ..... রোেটসন (ডান)..... রোেটসন (বাম).....
২৪। ঘাড়ের মাংসপেশির সক্ষমতার বর্তমানে কতটুকু আছে? (OXFORD Grade Scale)	ফ্লেক্সর ..... এক্সটেনসর ..... সাইড ফ্লেক্সর (ডান) ..... সাইড ফ্লেক্সর (বাম) ..... রোটেটর (ডান)..... রোটেটর (বাম).....
পর্ব- ৬ : ঘাড়ের প্রতিবন্ধিতা সম্পর্কিত তথ্যবলী (এই প্রশ্নাবলী তৈরি করা হয়েছে যাতে আমি জানতে পারি যে আপনার ঘাড়ের সমস্যা আপনার প্রতিদিনের কাজে কি পরিমান বাধাগ্রস্ত করে) Neck Disability Index (NDI) – এর প্রতিটি অংশের সর্বনিম্ন নম্বর ০ এবং সর্বোচ্চ নম্বর ৫। মোট নম্বর= 5০। প্রাপ্ত নম্বর= (.....)	
২৫। আজকে 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 ব্যথামোটামুটি গুরুতর ☐ আমার এই মুহূর্তে ব্যথা খুব গুরুতর ☐ আমার এই মুহূর্তে ব্যথা সবচেয়ে খারাপ
২৬। ব্যক্তিগত কাজে (পরিছন্নতা, জামাকাপড় পরিধান ইত্যাদি) আপনি কি পরিমান স্বাবলম্বী?	☐ আমি সাধারণত অতিরিক্ত ব্যথা ছাড়াই নিজেকে দেখাশোনা করার কাজ করতে পারি ☐ আমি সাধারণত নিজেকে দেখাশোনা করতে পারি কিন্তু এতে অতিরিক্ত ব্যথা হয় ☐ আমি নিজেকে দেখাশোনা করার কাজ করতে গেলেব্যাথা অনুভব করি এবং আমি ধীরগতি এবং সতর্কতা অবলম্বন করি ☐ আমাকে সামান্য সাহায্য করলে আমি আমার ব্যক্তিগত যত্নের অধিকাংশ কাজই পরিচালনা করতে পারি ☐ আমার নিজের যত্নের অধিকাংশ ক্ষেত্রেই প্রতিদিনই সাহায্য প্রয়োজন হয় ☐ আমি কাপড় পরিধান করতে পারি না, আমার কাপড় ধৌত করতে অসুবিধা হয় এবং বিছানায় শুয়ে থাকতে হয়

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২৭। কোন বস্তু উঠানর ক্ষেত্রে আপনি কি পরিমান স্বাবলম্বী?	☐ আমি অতিরিক্ত ব্যথা ছাড়াই ভারী ওজন উত্তোলন করতে পারি ☐ আমি ভারী ওজন উত্তোলন করতে পারি কিন্তু এটা অতিরিক্ত ব্যথা দেয় ☐ ব্যথা আমাকে মেঝে থেকে ভারী ওজন উত্তোলন করতে বাধা দেয় , কিন্তু আমিতা পারি যদি সেটা সুবিধামত কোথাও স্থাপন করা থাকে, উদাহরণস্বরূপ, কোন একটি টেবিল এর উপর থেকে ☐ ব্যথা আমাকে মেঝে থেকে ভারী ওজন উত্তোলন করতে বাধা দেয় , কিন্তু আমি মাঝারি থেকে হালকা ওজন উত্তোলন করতে পারি যদি সেটা সুবিধামত কোথাও স্থাপন করা থাকে ☐ আমি শুধুমাত্র খুব হালকা ওজন উত্তোলন করতে পারি ☐ আমি কোন কিছু উত্তোলন বা কিছু বহন করতে পারি ন
২৮। খবরের কাগজ অথবা বই পড়ার সময় আপনি কি রকম অনুভব করেন?	☐ আমি আমার ঘাড়ে কোন ব্যথা ছাড়াই যতটা আমি চাই ততটাই পড়তে পারি ☐ আমি আমার ঘাড়ে সামান্য ব্যথা নিয়ে যতটা আমি চাই পড়তে পারি ☐ আমি আমার ঘাড়ে সহনীয় ব্যথা নিয়ে যতটা আমি চাই পড়তে পারি ☐ আমি আমার ঘাড়ে মাঝারি ব্যথার কারণে আমি যতটা চাই পড়তে পারি না ☐ আমি আমার ঘাড়ে তীব্র ব্যথার কারণেখুব কমই পড়তে পারি ☐ আমি ব্যথার কারণে একদমই পড়তে পারি না
২৯। আপনি ঘাড়ে ব্যথার জন্য কি পরিমান মাথা ব্যথা অনুভব করেন?	☐ আমার কোন মাথাব্যাথাই নেই ☐ আমারসামান্য মাথাব্যথাআছে, যা কদাচিৎ আসে ☐ আমার সহনীয় মাথাব্যাথা আছে, যা কদাচিৎ আসে ☐ আমার সহনীয় মাথাব্যাথা আছে, যা ঘন ঘন আসে ☐ আমার তীব্র মাথাব্যাথা আছে, যা ঘন ঘন আসে ☐ আমার প্রায় সব সময় মাথাব্যাথা হয়
৩০।ঘাড়ে ব্যথা ছাড়া আপনি কাজে কি পরিমান মনোযোগ দিতে পারেন?	☐ আমি কোন অসুবিধা ছাড়াই যখন চাই তখনই আমি সম্পূর্ণরূপে মনোযোগ দিতে পারি ☐ আমি সামান্য অসুবিধার সঙ্গে যখন চাই তখনই আমি সম্পূর্ণরূপে মনোযোগ দিতে পারি ☐ আমি যখন মনোযোগ দিতে চাই তখন চলনসই মাত্রার অসুবিধা হয় ☐ আমি যখনমনোযোগ দিতেচাই তখন অনেক অসুবিধা হয় ☐ আমি যখন মনোযোগ দিতে চাই তখন গুরুতরঅসুবিধা হয় ☐ আমি একদমই মনোযোগ দিতে পারিনা
৩১। ঘাড়ে ব্যথা আপনার প্রতিদিনের কাজে কি পরিমানে প্রভাবিত করে?	☐ আমি যত চাই তত কাজ করতে পারি ☐ আমি শুধুমাত্র আমার স্বাভাবিক কাজ করতে পারি, কিন্তু এর বেশি না ☐ আমি আমার অধিকাংশ স্বাভাবিক কাজ করতে পারি, কিন্তু এর বেশি না ☐ আমি আমার স্বাভাবিক কাজ করতে পারি না ☐ আমি খুব কমই কোন কাজ করতে পারি ☐ আমি একদমই কোন কাজ করতে পারি না

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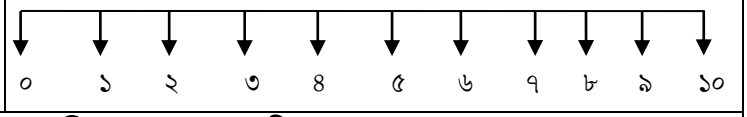
৩২। গাড়িতে ভ্রমনের সময় আপনার ঘাড়ে কি পরিমান ব্যথা অনুভূতুত হয়?	☐ আমি কোনো ঘাড় ব্যথা ছাড়াই আমার গাড়ীতে ভ্রমন করতে পারি ☐ আমি আমার ঘাড়ে সামান্য ব্যথা নিয়ে যতক্ষণ দীর্ঘ খুশি ততক্ষণ ভ্রমন করতে পারি ☐ আমি আমার ঘাড়ে সহনীয় ব্যথা নিয়ে যতক্ষণ দীর্ঘ খুশি ততক্ষণ ভ্রমন করতে পারি ☐ আমি আমার ঘাড়ে মাঝারি ব্যথার কারণে যতক্ষণ দীর্ঘ খুশি ততক্ষণ পারি ☐ আমি আমার ঘাড়ে তীব্র ব্যথার কারণে ভ্রমন করতে পারি না ☐ আমি একদমই আমার গাড়ীতে ভ্রমন করতে পারি না
৩৩। ঘুমানোর সময় ঘাড়ে ব্যথা আপনার ঘুমকে কি পরিমান প্রভাবিত করে?	☐ আমার ঘুম আসতে কোন কষ্ট হয় না ☐ আমার ঘুম আসতে সামান্য সমস্যা হয় (১ ঘন্টার কম সময় নির্ঘুম কাটে) ☐ আমার ঘুম আসতে সমস্যা হয় (১ থেকে ২ ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম পরিমিতরূপে নষ্ট হয় (২ থেকে ৩ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম ব্যাপক ভাবে নষ্ট হয় (৩ থেকে ৫ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম সম্পূর্ণভাবে নষ্ট হয় (৫ থেকে ৭ঘন্টা নির্ঘুম কাটে)
৩৪। ঘাড়ে ব্যথা আপনার চিত্তবিনদনের কার্যক্রমকে কি পরিমান প্রভাবিত করে?	☐ আমি আমার ঘাড়ে কোন ব্যথা ছাড়াই সব চিত্তবিনোদনকার্যক্রমে অংশগ্রহন করতে পারছি ☐ আমি আমার ঘাড়ে কিছু ব্যথা নিয়ে সব চিত্তবিনোদনকার্যক্রমে অংশগ্রহন করতে পারছি ☐ আমি আমার ঘাড়ে ব্যথার কারণে অধিকাংশ কার্যক্রমে অংশগ্রহন করতে পারছি, কিন্তু আমার সকল স্বাভাবিক চিত্তবিনোদনকার্যক্রমে অংশগ্রহন করতে পারছি না ☐ আমি আমার ঘাড়ে ব্যথার কারণে আমার স্বাভাবিক চিত্তবিনোদনকার্যক্রমের কয়েকটি কাজে নিয়োজিত হতে পারছি ☐ আমি আমার ঘাড়ে ব্যথার কারণে আমার স্বাভাবিক চিত্তবিনোদন কার্যক্রমের খুবই কম কাজে নিয়োজিত হতে পারছি ☐ আমি একদমই কোন চিত্তবিনোদন কার্যক্রমে অংশগ্রহন করতে পারছি না

চিকিৎসা পরবর্তী উপাত্ত সমূহ	
প্রশ্ন সমূহ	**উত্তর**
পর্ব- ৪ :সামগ্রিকভাবে রোগী কর্তৃক নির্ণীত ব্যথার হারঃ	
২২। বিশ্রামরত অবস্থায় (চিত অবস্থায়) আপনি কি পরিমান ব্যথা অনুভব করেন?	
পর্ব- ৫ : ঘাড়ের জয়েন্টের মোশন এবং মাংসপেশির সক্ষমতার তথ্যবলীঃ	
২৩। ঘাড়ের গতি বর্তমানে কতটুকু আছে? (দয়া করে ডিগ্রী দিয়ে লিখবেন)	ফ্লেক্সসন ..... এক্সটেন্সান ..... সাইড ফ্লেক্সসন (ডান) ..... সাইড ফ্লেক্সসন (বাম) ..... রোেটসন (ডান)..... রোেটসন (বাম).....
২৪। ঘাড়ের মাংসপেশির সক্ষমতার বর্তমানে কতটুকু আছে? **(OXFORD Grade Scale)**	ফ্লেক্সর ..... এক্সটেনসর ..... সাইড ফ্লেক্সর (ডান) ..... সাইড ফ্লেক্সর (বাম) ..... রোটেটর (ডান)..... রোটেটর (বাম).....
পর্ব- ৬ : ঘাড়ের প্রতিবন্ধিতা সম্পর্কিত তথ্যবলী (এই প্রশ্নাবলী তৈরি করা হয়েছে যাতে আমি জানতে পারি যে আপনার ঘাড়ের সমস্যা আপনার প্রতিদিনের কাজে কি পরিমান বাধাগ্রস্ত করে) Neck Disability Index (NDI) – এর প্রতিটি অংশের সর্বনিম্ন নম্বর ০ এবং সর্বোচ্চ নম্বর ৫। মোট নম্বর= 5০। প্রাপ্ত নম্বর= (.....)	
২৫। আজকে 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 ব্যথামোটামুটি গুরুতর ☐ আমার এই মুহূর্তে ব্যথা খুব গুরুতর ☐ আমার এই মুহূর্তে ব্যথা সবচেয়ে খারাপ
২৬। ব্যক্তিগত কাজে (পরিছন্নতা, জামাকাপড় পরিধান ইত্যাদি) আপনি কি পরিমান স্বাবলম্বী?	☐ আমি সাধারণত অতিরিক্ত ব্যথা ছাড়াই নিজেকে দেখাশোনা করার কাজ করতে পারি ☐ আমি সাধারণত নিজেকে দেখাশোনা করতে পারি কিন্তু এতে অতিরিক্ত ব্যথা হয় ☐ আমি নিজেকে দেখাশোনা করার কাজ করতে গেলেব্যাথা অনুভব করি এবং আমি ধীরগতি এবং সতর্কতা অবলম্বন করি ☐ আমাকে সামান্য সাহায্য করলে আমি আমার ব্যক্তিগত যত্নের অধিকাংশ কাজই পরিচালনা করতে পারি ☐ আমার নিজের যত্নের অধিকাংশ ক্ষেত্রেই প্রতিদিনই সাহায্য প্রয়োজন হয় ☐ আমি কাপড় পরিধান করতে পারি না, আমার কাপড় ধৌত করতে অসুবিধা হয় এবং বিছানায় শুয়ে থাকতে হয়

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২৭। কোন বস্তু উঠানর ক্ষেত্রে আপনি কি পরিমান স্বাবলম্বী?	☐ আমি অতিরিক্ত ব্যথা ছাড়াই ভারী ওজন উত্তোলন করতে পারি ☐ আমি ভারী ওজন উত্তোলন করতে পারি কিন্তু এটা অতিরিক্ত ব্যথা দেয় ☐ ব্যথা আমাকে মেঝে থেকে ভারী ওজন উত্তোলন করতে বাধা দেয় , কিন্তু আমিতা পারি যদি সেটা সুবিধামত কোথাও স্থাপন করা থাকে, উদাহরণস্বরূপ, কোন একটি টেবিল এর উপর থেকে ☐ ব্যথা আমাকে মেঝে থেকে ভারী ওজন উত্তোলন করতে বাধা দেয় , কিন্তু আমি মাঝারি থেকে হালকা ওজন উত্তোলন করতে পারি যদি সেটা সুবিধামত কোথাও স্থাপন করা থাকে ☐ আমি শুধুমাত্র খুব হালকা ওজন উত্তোলন করতে পারি ☐ আমি কোন কিছু উত্তোলন বা কিছু বহন করতে পারি না
২৮। খবরের কাগজ অথবা বই পড়ার সময় আপনি কি রকম অনুভব করেন?	☐ আমি আমার ঘাড়ে কোন ব্যথা ছাড়াই যতটা আমি চাই ততটাই পড়তে পারি ☐ আমি আমার ঘাড়ে সামান্য ব্যথা নিয়ে যতটা আমি চাই পড়তে পারি ☐ আমি আমার ঘাড়ে সহনীয় ব্যথা নিয়ে যতটা আমি চাই পড়তে পারি ☐ আমি আমার ঘাড়ে মাঝারি ব্যথার কারণে আমি যতটা চাই পড়তে পারি না ☐ আমি আমার ঘাড়ে তীব্র ব্যথার কারণেখুব কমই পড়তে পারি ☐ আমি ব্যথার কারণে একদমই পড়তে পারি না
২৯। আপনি ঘাড়ে ব্যথার জন্য কি পরিমান মাথা ব্যথা অনুভব করেন?	☐ আমার কোন মাথাব্যাথাই নেই ☐ আমারসামান্য মাথাব্যথাআছে, যা কদাচিৎ আসে ☐ আমার সহনীয় মাথাব্যাথা আছে, যা কদাচিৎ আসে ☐ আমার সহনীয় মাথাব্যাথা আছে, যা ঘন ঘন আসে ☐ আমার তীব্র মাথাব্যাথা আছে, যা ঘন ঘন আসে ☐ আমার প্রায় সব সময় মাথাব্যাথা হয়
৩০।ঘাড়ে ব্যথা ছাড়া আপনি কাজে কি পরিমান মনোযোগ দিতে পারেন?	☐ আমি কোন অসুবিধা ছাড়াই যখন চাই তখনই আমি সম্পূর্ণরূপে মনোযোগ দিতে পারি ☐ আমি সামান্য অসুবিধার সঙ্গে যখন চাই তখনই আমি সম্পূর্ণরূপে মনোযোগ দিতে পারি ☐ আমি যখন মনোযোগ দিতে চাই তখন চলনসই মাত্রার অসুবিধা হয় ☐ আমি যখনমনোযোগ দিতেচাই তখন অনেক অসুবিধা হয় ☐ আমি যখন মনোযোগ দিতে চাই তখন গুরুতরঅসুবিধা হয় ☐ আমি একদমই মনোযোগ দিতে পারিনা
৩১। ঘাড়ে ব্যথা আপনার প্রতিদিনের কাজে কি পরিমানে প্রভাবিত করে?	☐ আমি যত চাই তত কাজ করতে পারি ☐ আমি শুধুমাত্র আমার স্বাভাবিক কাজ করতে পারি, কিন্তু এর বেশি না ☐ আমি আমার অধিকাংশ স্বাভাবিক কাজ করতে পারি, কিন্তু এর বেশি না ☐ আমি আমার স্বাভাবিক কাজ করতে পারি না ☐ আমি খুব কমই কোন কাজ করতে পারি ☐ আমি একদমই কোন কাজ করতে পারি না

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৩২। গাড়িতে ভ্রমনের সময় আপনার ঘাড়ে কি পরিমান ব্যথা অনুভূতুত হয়?	☐ আমি কোনো ঘাড় ব্যথা ছাড়াই আমার গাড়ীতে ভ্রমন করতে পারি ☐ আমি আমার ঘাড়ে সামান্য ব্যথা নিয়ে যতক্ষণ দীর্ঘ খুশি ততক্ষণ ভ্রমন করতে পারি ☐ আমি আমার ঘাড়ে সহনীয় ব্যথা নিয়ে যতক্ষণ দীর্ঘ খুশি ততক্ষণ ভ্রমন করতে পারি ☐ আমি আমার ঘাড়ে মাঝারি ব্যথার কারণে যতক্ষণ দীর্ঘ খুশি ততক্ষণ পারি ☐ আমি আমার ঘাড়ে তীব্র ব্যথার কারণে ভ্রমন করতে পারি না ☐ আমি একদমই আমার গাড়ীতে ভ্রমন করতে পারি না
৩৩। ঘুমানোর সময় ঘাড়ে ব্যথা আপনার ঘুমকে কি পরিমান প্রভাবিত করে?	☐ আমার ঘুম আসতে কোন কষ্ট হয় না ☐ আমার ঘুম আসতে সামান্য সমস্যা হয় (১ ঘন্টার কম সময় নির্ঘুম কাটে) ☐ আমার ঘুম আসতে সমস্যা হয় (১ থেকে ২ ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম পরিমিতরূপে নষ্ট হয় (২ থেকে ৩ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম ব্যাপক ভাবে নষ্ট হয় (৩ থেকে ৫ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম সম্পূর্ণভাবে নষ্ট হয় (৫ থেকে ৭ঘন্টা নির্ঘুম কাটে)
৩৪। ঘাড়ে ব্যথা আপনার চিত্তবিনদনের কার্যক্রমকে কি পরিমান প্রভাবিত করে?	☐ আমি আমার ঘাড়ে কোন ব্যথা ছাড়াই সব চিত্তবিনোদনকার্যক্রমে অংশগ্রহন করতে পারছি ☐ আমি আমার ঘাড়ে কিছু ব্যথা নিয়ে সব চিত্তবিনোদনকার্যক্রমে অংশগ্রহন করতে পারছি ☐ আমি আমার ঘাড়ে ব্যথার কারণে অধিকাংশ কার্যক্রমে অংশগ্রহন করতে পারছি, কিন্তু আমার সকল স্বাভাবিক চিত্তবিনোদনকার্যক্রমে অংশগ্রহন করতে পারছি না ☐ আমি আমার ঘাড়ে ব্যথার কারণে আমার স্বাভাবিক চিত্তবিনোদনকার্যক্রমের কয়েকটি কাজে নিয়োজিত হতে পারছি ☐ আমি আমার ঘাড়ে ব্যথার কারণে আমার স্বাভাবিক চিত্তবিনোদন কার্যক্রমের খুবই কম কাজে নিয়োজিত হতে পারছি ☐ আমি একদমই কোন চিত্তবিনোদন কার্যক্রমে অংশগ্রহন করতে পারছি না

Questionnaire (English Version)

This questionnaire is developed to measure pain, muscle strength, ROM and neck disability of the patient with chronic neck pain and this portion will be filled by data collector using a black pen. Please answer every section and **mark in each section only the one box that applies to you**. It is realized that you may consider two or more statements in any one section relate to you, but please just mark the box that most closely describes your problem.

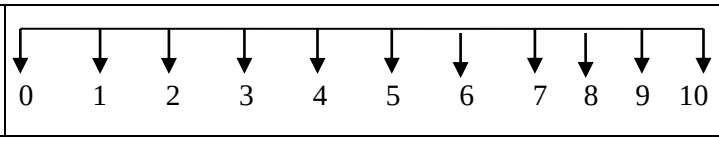
Code No: Date:

Patient's name: Patient ID No:

Mobile No: Address:

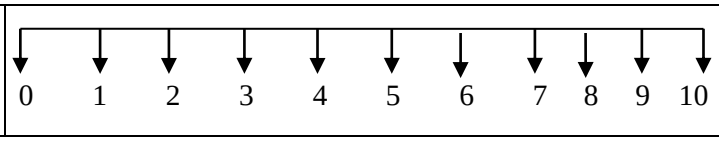
Question	**Response**
Part- I: Socio – demographic Information	
1. Patient's Age	……..Years ……Months
2. Sex	□ Male □ Female
3. Occupation	……
4. Types of Exertion during work	□ Static work □ Minimal □ Moderate □ Heavy □ Not Applicable
5. How long have you been suffering from neck pain?	……Years ……Months
6. Which one is your dominant hand?	□ Right □ Left
7.Weight	…….. (kg)
8. Height	..... (cm)
9. BMI	…… (kg/m^2)
10. Educational Level	……
11. In which posture do you prefer to sleep?	□ Supine lying □ Prone lying □ Side lying- right □ Side lying- left
12. How many pillows do you use during sleeping?	……..

Question	Response
Part- II: Medical Information:	
13. Do you have Diabetes Mellitus?	□ Yes □ No □ Don't Know
14. Do you have Hypertension?	□ Yes □ No □ Don't Know
Part-III: Pain related information	
15. What do you think about the cause of your pain?	□ Due to Trauma □ Due to lifting heavy weight □ Due to bad working posture □ Coughing or sneezing □ Bad sleeping posture □ Others
16. In which side of your neck pain is more?	□ Right □ Left □ Middle □ Both
17. In which side of your shoulder you feel pain most?	□ Right □ Left □ Not applicable
18. 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
19. When do you feel worse pain?	□ At morning □ As the day progresses □ At evening □ At night □ All day
20. Which direction of movement exaggerated your pain?	□ Neck forward bending □ Neck backward bending □ Neck turning to right □ Neck turning to left □ Raising from lying □ Raising from sitting
21. How is your pain now proceeding from onset?	□ Improving □ Worsening □ Staying the same

Pre-test Data:	
Question	**Response**
Part- IV: Patient rated pain in general:	
22. How much pain do you feel in general at resting position?	
Part- V: Range of Motion and Muscle Strength Information:	
23. How much range of motion of cervical spine present? (in degree)	Flexion……. Extension…… Side flexion (Right)……. Side flexion (Left)……. Rotation (Right)……. Rotation (Left)……
24. In which state muscle strength of cervical spine lies at present? (OXFORD Grade Scale)	Flexor……. Extensor…… Side flexor (Right)……. Side flexor (Left)……. Rotator (Right)……. Rotator (Left)……
Part- VI: Disability Information (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……)	
25. How much pain do you have today?	□ I have no pain at the moment □ The pain is very mild at the moment □ The pain is moderate at the moment □ The pain is fairly severe at the moment □ The pain is very severe at the moment □ The pain is the worst imaginable at the moment
26. How independent are you at personal care (washing, dressing etc.)	□ I can look after myself normally without causing extra pain □ I can look after myself normally but it causes extra pain □ It is painful to look after myself and I am slow and careful □ I need some help but can manage most of my personal care □ I need help every day in most aspects of self-care □ I do not get dressed, I wash with difficulty and stay in bed

Question	Response
27. How independent are you during lifting object?	□ I can lift heavy weights without extra pain □ I can lift heavy weights but it gives extra pain □ pain prevents me lifting heavy weights off the floor, but I can manage if they are conveniently placed, for example on a table □ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned □ I can only lift very light weights □ I cannot lift or carry anything
28. How do you feel while reading newspaper or books?	□ I can read as much as I want to with no pain in my neck □ I can read as much as I want to with slight pain in my neck □ I can read as much as I want with moderate pain in my neck □ I can't read as much as I want because of moderate pain in my neck □ I can hardly read at all because of severe pain in my neck □ I cannot read at all
29. To which state of headache do you feel?	□ I have no headaches at all □ I have slight headaches, which come infrequently □ I have moderate headaches, which come infrequently □ I have moderate headaches, which come frequently □ I have severe headaches, which come frequently □ I have headaches almost all the time
30. To which level of concentration do you keep during working despite of neck pain?	□ I can concentrate fully when I want to with no difficulty □ I can concentrate fully when I want to with slight difficulty □ I have a fair degree of difficulty in concentrating when I want to □ I have a lot of difficulty in concentrating when I want to □ I have a great deal of difficulty in concentrating when I want to □ I cannot concentrate at all

Question	**Response**
31. To which state neck pain affect your daily work?	□ I can do as much work as I want to □ I can only do my usual work, but no more □ I can do most of my usual work, but no more □ I cannot do my usual work □ I can hardly do any work at all □ I can't do any work at all
32. How do you feel your neck pain during travelling?	□ I can travel without any neck pain □ I can travel as long as I want with slight pain in my neck □ I can travel as long as I want with moderate pain in my neck □ I can't travel as long as I want because of moderate pain in my neck □ I can hardly travel at all because of severe pain in my neck □ I can't travel at all
33. To which state neck pain affect your sleep?	□ I have no trouble sleeping □ My sleep is slightly disturbed (less than 1 hr sleepless) □ My sleep is mildly disturbed (1-2 hrs sleepless) □ My sleep is moderately disturbed (2-3 hrs sleepless) □ My sleep is greatly disturbed (3-5 hrs sleepless) □ My sleep is completely disturbed (5-7 hrs sleepless)
34. To which state your neck pain affect your recreational activities?	□ I am able to engage in all my recreation activities with no neck pain at all □ I am able to engage in all my recreation activities, with some pain in my neck □ I am able to engage in most, but not all of my usual recreation activities because of pain in my neck □ I am able to engage in a few of my usual recreation activities because of pain in my neck □ I can hardly do any recreation activities because of pain in my neck □ I can't do any recreation activities at all

Post-test Data:	
Question	**Response**
Part- IV: Patient rated pain (in general):	
22. How much pain do you feel in general at resting position?	
Part- V: Range of Motion and Muscle Strength Information:	
23. How much range of motion of cervical spine present? (in degree)	Flexion……. Extension…… Side flexion (Right)……. Side flexion (Left)……. Rotation (Right)……. Rotation (Left)……
24. In which state muscle strength of cervical spine lies at present? (OXFORD Grade Scale)	Flexor……. Extensor…… Side flexor (Right)……. Side flexor (Left)……. Rotator (Right)……. Rotator (Left)……
Part- VI: Disability Information (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……)	
25. How much pain do you have today?	□ I have no pain at the moment □ The pain is very mild at the moment □ The pain is moderate at the moment □ The pain is fairly severe at the moment □ The pain is very severe at the moment □ The pain is the worst imaginable at the moment
26.How independent are you at personal care (washing, dressing etc)	□ I can look after myself normally without causing extra pain □ I can look after myself normally but it causes extra pain □ It is painful to look after myself and I am slow and careful □ I need some help but can manage most of my personal care □ I need help every day in most aspects of self-care □ I do not get dressed, I wash with difficulty and stay in bed

Question	Response
27. How independent are you during lifting object?	□ I can lift heavy weights without extra pain □ I can lift heavy weights but it gives extra pain □ Pain prevents me lifting heavy weights off the floor, but I can manage if they are conveniently placed, for example on a table □ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned □ I can only lift very light weights
28. How do you feel while reading newspaper or books?	□ I can read as much as I want to with no pain in my neck □ I can read as much as I want to with slight pain in my neck □ I can read as much as I want with moderate pain in my neck □ I can't read as much as I want because of moderate pain in my neck □ I can hardly read at all because of severe pain in my neck □ I cannot read at all
29. To which state of headache do you feel?	□ I have no headaches at all □ I have slight headaches, which come infrequently □ I have moderate headaches, which come infrequently □ I have moderate headaches, which come frequently □ I have severe headaches, which come frequently □ I have headaches almost all the time
30. To which level of concentration do you keep during working despite of neck pain?	□ I can concentrate fully when I want to with no difficulty □ I can concentrate fully when I want to with slight difficulty □ I have a fair degree of difficulty in concentrating when I want to □ I have a lot of difficulty in concentrating when I want to □ I have a great deal of difficulty in concentrating when I want to □ I cannot concentrate at all

Question	Response
31. To which state neck pain affect your daily work?	□ I can do as much work as I want to □ I can only do my usual work, but no more □ I can do most of my usual work, but no more □ I cannot do my usual work □ I can hardly do any work at all □ I can't do any work at all
32.How do you feel your neck pain during travelling?	□ I can travel without any neck pain □ I can travel as long as I want with slight pain in my neck □ I can travel as long as I want with moderate pain in my neck □ I can't travel as long as I want because of moderate pain in my neck □ I can hardly travel at all because of severe pain in my neck □ I can't travel at all
33. To which state neck pain affect your sleep?	□ I have no trouble sleeping □ My sleep is slightly disturbed (less than 1 hr sleepless) □ My sleep is mildly disturbed (1-2 hrs sleepless) □ My sleep is moderately disturbed (2-3 hrs sleepless) □ My sleep is greatly disturbed (3-5 hrs sleepless) □ My sleep is completely disturbed (5-7 hrs sleepless)
34. To which state your neck pain affect your recreational activities?	□ I am able to engage in all my recreation activities with no neck pain at all □ I am able to engage in all my recreation activities, with some pain in my neck □ I am able to engage in most, but not all of my usual recreation activities because of pain in my neck □ I am able to engage in a few of my usual recreation activities because of pain in my neck □ I can hardly do any recreation activities because of pain in my neck □ I can't do any recreation activities at all

Appendix- E

Treatment Protocol of Control Group (Usual care/treatment)

Centre for the Rehabilitation of the Paralysed (CRP)
Department of Physiotherapy
CRP, P.O: CRP-Chapain, Savar, Dhaka-1343, Bangladesh
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Ref : CRP/PT/2012/16/17.2.2016 Date : 17.02.2016

Physiotherapy Department of the Centre for the Rehabilitation of the Paralysed (CRP) most commonly uses latest McKenzie Institution Assessment for Mechanical Spinal Problems. Conversely, most commonly prescribed and used treatment concepts are McKenzie, Cyriax, Maitland and Mulligan.

Usual physiotherapy treatment for chronic neck pain patient

1) Manual therapy:

- **Mckenzie Mobilization:**

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

- **Cyriax manipulation:**

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

- **Maitland mobilization:**

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

- **Mulligan mobilization:**

i) Sustained Natural Appophyseal Gliding (SNAGS)
ii) Reverse Sustained Natural Appophyseal Gliding (Reverse SNAGS)
iii) Natural Appophyseal Gliding (NAGS)

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Ref : Date :

- **Neural mobilization:**

i) Median Nerve: Shoulder-Depression and abduction 10 degree. Elbow and wrist is in Extension.

ii) Radial nerve: Shoulder-Depression and abduction 10 degree.Elbow and wrist is in flexion.

iii) Ulnar nerve: Shoulder-Depression and abduction 10 to 90 degree. Elbow is in flexion and wrist is in extension and radial deviation,

iv) In each movements of spine contra lateral side flexion is to be done.

Exercise therapy:

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

Electrotherapy: Physiotherapist most commonly prefers manual therapy for patient with neck pain but in case of needs theyuse selective electrotherapeutic modalities based on patient's requirement.

- Infra-red radiation over the back of neck for 10- 15 minutes.
- Cervical mechanical traction: Intermittent mode with weight of 7% of total body weight for 15 minutes. Upper limit of weight maximum 13 kg and lower limit 5 kg. Force time 5 minutes with 1 minute rest
- Transcutaneous electrical nerve stimulation (TENS) over the greatest intensity of pain with frequency of 5Hz, high intensity burst mode and pulse duration 300 micro seconds for 20 minutes.

Patient education and home advice:

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

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Appendix- F

Treatment Protocol of Trial Group

I) Usual physiotherapy treatment plus

II) Cranio-cervical exercise:

Different studies (Jull, et al., 2009; Naz and Sarfraz, 2012; Jeyanthi and Arumugam, 2015) described the procedure of craniocervical exercise. All the exercises were performed at center 2 sessions per week for 3 weeks and totaling 6 sessions. Each session consists of 30 minutes.

a. Patient will lift head up the chin tucked in from supine lying for neck flexion, lifting head backwards in prone lying for neck extension, lifting head sideways from pillow in side lying position for neck side flexion which is also repeated for the other side and finally lifting head off from the bed and rotating to one side for neck rotation, repeating both ways. These exercises were performed for 8-10 repetitions for duration of three times a week on alternate days.

b. An un inflate pressure was placed behind the neck so that it touch the occiput and it inflate to a stable baseline pressure of 20 mm of Hg. The subject was instructed to put the tip of tongue over upper palate and nod the head into flexion (as in saying YES). The subject was instructed to raise the level of pressure in pressure biofeedback (PBFB) device from 20 mm Hg to 22 mm Hg and hold for a minimum of 10 seconds. One familiarization phase will be included. The trail is considered positive only if the subject is able to hold the target pressure without activating superficial neck muscles and able to sustain without fluctuations. If the subject is able to hold for 10 seconds, the subject shall be instructed to perform the same procedure and hold at 24mmHg for 10 seconds. In similar way increments of 2 mmHg will be added. If the subject meets

the target pressure level and holds for 10 seconds, a rest interval of 30 seconds is given before proceeding to next level.

c. Participants performed exercise in sitting position while low resistance ball was placed behind occiput. Then 10 repetitions of chin tuck in with 10 second hold were performed in each repetition.

d. Craniocervical flexion exercises using a circular thera band with one side positioned at the craniocervical region of the patient's neck and the other side fixed somewhat above the horizontal. The resistance of the band was used in such a way that it facilitated the longus colli muscles. Two sets of 12 repetitions directed forward, obliquely, toward right and left, directed backward were performed. Rest period between each set was 30 seconds and treatment session lasts for 15 minutes.