Faculty of Medicine

University of Dhaka

Effectiveness of upper and mid thoracic spine mobilization in individuals with mechanical neck pain: a randomized trial

By:

Md. Nazmul Hassan
Master of Science in Physiotherapy
Class Roll No: 03
Registration No: 801
Session: 2018-2019

Department of Physiotherapy

Bangladesh Health Professions Institute (BHPI)

January 2021

Faculty of Medicine

University of Dhaka

Effectiveness of upper and mid thoracic spine mobilization in individuals with mechanical neck pain: a randomized trial

By:

Md. Nazmul Hassan
Master of Science in Physiotherapy
Class Roll No: 03
Registration No: 801
Session: 2018-2019

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

Department of Physiotherapy

Bangladesh Health Professions Institute (BHPI)

January 2021

We the under signed certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled "**Effectiveness of upper & mid thoracic spine mobilization in individuals with non-specific neck pain: a randomized clinical trial"** submitted by **Md. Nazmul Hassan,** for the partial fulfillment of the requirements for the degree of Masters of Science in Physiotherapy (M.Sc. in PT).

……..……..
Assoc. Professor Mohammad Anwar Hossain
M.Sc. PT, B.Sc. PT (Hons.), MPH
Dip. Ortho. Med.,
Senior Consultant & Head,
Department of Physiotherapy,
CRP, Savar, Dhaka
Supervisor

……..
Professor Dr. Md. Forhad Hossain
M.Sc. (DU), PhD (Canada),
Department of Statistics,
Jahangirnagar University,
Savar, Dhaka

……..
Assoc. Professor Md. Shafiqul Islam
Head of the Department,
Department of Physiotherapy,
BHPI, CRP, Savar, Dhaka

…….
Assist. Professor Muhammad Millat Hossain
Department of Physiotherapy,
BHPI, CRP, Savar, Dhaka

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.

- I confirm that if anything identified in my work that I have done plagiarism or any form of cheating that will directly awarded me fail and I am subject to disciplinary actions of authority.

- I confirm that the electronic copy is identical to the bound copy of the Thesis.

- In case of dissemination the finding of this project for future publication, research supervisor will highly concern and it will be duly acknowledged as graduate thesis.

Signature: ……

Name: …….

Date: .....

ACKNOWLEDGEMENT

First of all, I am grateful to almighty Allah for enabling me to complete this thesis and then thanks to my parents to assist me in all aspect of my life. I would like to express deepest appreciation to my supervisor Mohammad Anwar Hossain, Associate Professor of BHPI, Senior Consultant & Head of the Physiotherapy Department, CRP for his keen supervision without which I could not able to complete this thesis.

In addition, I would like to thank Md. Obaidul Haque, Vice-Principal & Professor of BHPI; Md. Shafiqul Islam, Associate Professor & Head, Department of Physiotherapy, BHPI; BHPI; Muhammad Millat Hossain, Assistant Professor, Department of Physiotherapy, BHPI for giving their valuable opinion throughout the thesis period.

I would also like to express my gratitude to Dr. Md. Forhad Hossain, Professor, Department of statistics, Jahangirnagar University who guided me throughout data management and analysis. I am also grateful to Ganesh Dey, Internee Physiotherapist to help me in data collection procedure and handed over raw data. I am obliged to all Physiotherapists of Musculoskeletal Unit, CRP, Savar for their cordial support. I would like to thank also librarians of BHPI as they helped me to find out related books, journals and also access to internet. I would like to appreciate Parvin Akter, Clinical Physiotherapist for her direct and indirect support during the thesis. Finally, I am lucky to have meaningful suggestions from Ehsanur Rahman, Associate Professor & Coordinator, M. Sc. in Physiotherapy Program, BHPI, CRP.

CONTENTS

List of Tables

List of Figures

List of Abbreviations

ADL	Activity of Daily Living
BHPI	Bangladesh Health Professions Institute
CRP	Centre for the Rehabilitation of the Paralysed
PT	Physiotherapy
USA	United States of America
WHO	World Health Organization
BMI	Body Mass Index
PCID	Prolapse Cervical Intervertebral Disc
MNP	Mechanical Neck Pain
CMNP	Chronic Mechanical Neck Pain
TS	Thoracic Spine
HIVD	Herniated Inter-vertebral Disc Disease
MRI	Magnetic Resonance Imaging
CT	Computed Tomography
ROM	Range of Motion

ABSTRACT

Background: Neck pain is the fourth leading cause of disability, with an annual prevalence rate exceeding 30%. Most episodes of acute neck pain will resolve with or without treatment, but nearly 50% of individuals will continue to experience some degree of pain or frequent occurrences. Although cervical mobilization plus therapeutic exercises are common interventions for the management of mechanical neck pain, no study has directly compared the effectiveness of upper thoracic spine mobilization and conventional care with that of conventional care alone in individuals with Mechanical Neck Pain. **Objective: Methods**: Seventy-Nine participants with Mechanical Neck Pain were randomized into the cervical group or the thoracic group. The treatment period was 4 weeks comprising 12 sessions pre & post assessment. Outcome measures including the pain (VAS- Visual Analogue Scale), cervical range of motion (Goniometer), McGill Pain Questionnaire & neck disability index (NDI) were collected. Data were analyzed with Independent 't' test, Paired 't' test as parametric test; Mann-Whitney 'U' test and Wilcoxon Sign Ranked Test as non-parametric test. **Results**: Participants in the trial group demonstrated significant improvements ($p < .05$) in Pain, cervical extension, and NDI at the unpaired 't' test compared with those in the control group. In addition, control group participants in the trial group compared with the control group showed a significant improvement in McGill Pain Characteristics. **Conclusions**: The combination of upper thoracic spine mobilization and conventional physiotherapy demonstrated better overall short-term outcomes in Pain, cervical extension, McGill Pain Characteristics, and NDI compared with the control.

Trial registration: CTRI/2020/06/026090 [Registered on: 24/06/2020] - Trial Registered Retrospectively

Keywords: *Mobilization, Upper & mid-thoracic spine mobilization, Conventional Care, Mechanical Neck pain.*

CHAPTER-I: INTRODUCTION

Background

Mechanical neck pain is worldwide health problem. Most often, it is the result of a compression or inflammatory pathology from a space occupying lesion such as disc herniation, spondylitic spur, or cervical osteophyte (Rai, Ajith, Bhagavan, & Pinto, 2013). The average annual incidence rate of cervical radiculopathy is 85 per 100,000 for the population in its entirety, with an increased prevalence occurring in the fifth decade of life, 203 per 100,000 (Fuller, 2018). The most frequently involved nerve roots are the cervical 6 (C6) and cervical 7 (C7) cervical roots which are typically caused by C5-C6 or C6-C7 disc herniation or spondylosis (Eguchi et al., 2020). It's estimated that 50% of the population experienced neck and upper extremity pain at some time in their lifetime (Hoy, Protani, De, & Buchbinder, 2010).

Prevalence of neck pain and its burden varies worldwide. Among the general population, overall prevalence of neck pain ranges from 0.4% to 86.8% around the world (Carlesso, MacDermid, Gross, Walton, & Santaguida, 2014). Vos et al. (2016) stated that the prevalence of neck pain is increasingly yearly as well as creating disability globally. Beside this, Disability-adjusted life years increased from 23.9 million in 1990 to 33.6 million in 2010 (May et al., 2015). Among the 291 conditions those were studied in the Global Burden of Disease 2010, 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 (Vos et al., 2012).

In United States of America, the annual prevalence was 41.5% in which individuals with mechanical neck pain were middle-aged (mean age 48.9 years) and the majority of subjects were women (Rahman, 2017) and it was the eight leading cause of disability in United States of America (Mokdad et al., 2018). In United Kingdom, the

annual incidence was 34%. Incidence of neck pain is increasing and approximately 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, Davis, Dolan, & Clark, 2014). In Australia, the prevalence of neck pain was 27.1% (Rahmani, Amiri, Ali, Mohsenifar, & Pourahmadi, 2013) whereas Frutiger, Taylor, and Borotkanics (2019) 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 (Lin, Shen, Chung, & Chiu, 2013) 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 Pradhan (2013) showed that the prevalence of mechanical 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 (Westergren et al., 2012). 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, Olsén, Eriksson, Svensson, & Carlsson, 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 (Rahman, 2017). 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% (Hoy, Protani, & Buchbinder, 2010). In Hong Kong, the prevalence of neck pain among desk workers was 25.2% (Dunning, et al., 2012). In India, the prevalence of neck pain among computer operators was found 47%. Majority of the participants were in between the age of 30- 50 years (Darivemula et al., 2016). In contrast, Radhakrishnan, Senthil, Rathnamala, & Gandhi (2015) showed that female was more commonly to develop and suffered from persistent neck pain. In Pakistan, one study (Umar et al., 2019) 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, Milosavljevic, Bagheri, Vasiljev, Mcbride, & Rehn (2012) showed that mechanical 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 (Senarath et al., 2014) and no relevant study was found on neck pain prevalence among Bangladeshi people till date.

One study Masum, Haqe, Haque, & Islam (2014) 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 (Altug, Büker, Kavlak, Kitiş, & Cavlak, 2013). Another study (Gore, Sadosky, Stacey, Tai, & Leslie, 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. Chou, Qaseem, Owens, & Shekelle, 2011) 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 (Dieleman, et al., 2016).

Given the situation in recent years, Australian population showed tremendous days of sick leave which ultimately affects the country's economy. One study by Kennedy, Roll, Schraudner, Murphy, & McPherson (2014) 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 (Centeno, 2020).

The position and arrangement of symptoms could be vary, depending on the nerve root level exaggerated (Takagi, Eliyas, & Stadlan, 2011) and can include sensory and motor alterations if the dorsal and ventral nerve root is complicated (Woods & Hilibrand, 2015). Although, patients with mechanical neck pain often seeking for medical assistance to reduce arm pain (Ganesh, Mohanty, Pattnaik, & Mishra, 2015). Patients frequently complain of pain, numbness, tingling, and weakness in the upper extremity, which often result in significant functional restrictions and incapacity

(Hakimi & Spanier, 2013). Physical therapy programs play a significant role in the treatment and improvement of symptoms in patients with cervical spine syndromes (Todd, 2011). Conservative treatment for radiating neck pain includes short-term use of a soft, cervical collar, traction, medications. Manipulation, physical therapy (Eubanks, 2010) and steroid injections are also part of a conservative plan of management of physical therapy interventions.

There are some recognized questionnaires that 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 (Misailidou, Malliou, Beneka, Karagiannidis, & Godolias, 2010). 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 (Blanpied, et al., 2017). Pain usually measured by using pain scales in different form such as numerical rating scale (NRS), visual analogue scale (VAS) etc. (Aicher, Peil, Peil, & Diener, 2012). 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, Mian, Kendzerska, & French, 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 (Psaltis et al., 2014). 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 (Alemanno, et al., 2019).

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 (Brosseau et al., 2012) study addressed to assess pain with neck pain functional limitation scale (Silva & Cruz, 2013) to measure the disability for neck pain in Asian context and concluding good reliability but it lacks concurrent and criterion validity which is essential for using the scale confidently in Asian context.

Rationale

Mechanical neck pain is one of the worldwide health related complaints. In order to prevent mechanical neck pain, it is not enough to identify risk factors or to rely on the conventional care accordingly. During the past decades, numerous factors, such as physical characteristics, psychological characteristics, lifestyle factors, employment, social factors and genetic components have been considered as factors for developing neck pain. Despite considerable research efforts, no clear picture has developed. Even though, different factors are found to be dominant in different studies that they may be complicating factors or confounders of varying importance. Some factors might enhance each other while some might suppress the effect of others. Furthermore, the same factor may have various influences on different body types, personalities, genetic make-up or subgroups of mechanical neck pain.

In our country, socio-economic conditions of many patients are not so favorable to take long time physiotherapy treatment. Therefore, patient's suffering is more throughout their life & patient's satisfaction is not remaining same during the treatment regime. The study will try to explore which treatment is more effective considering the others or relevant treatment and I hope the standardized treatment protocol will be established which will provide maximum benefit considering time consuming, suffering from pain & cost-effective, therefore the individual will be more productive and huge amount of currency will be saved.

The purpose of the study is to find out efficacy of upper & mid-thoracic mobilization along with conventional physiotherapy and only conventional physiotherapy in patients with mechanical neck pain, which was essential to compare the efficacy of treatment approach for the best interest of the patients.

To date, few attempts have been made to describe the intervention protocol which is most effective to mechanical neck pain and still regarded as a puzzle.

The disorder has a mysterious and intriguing appeal with an apparently spontaneous onset and resolution, inflicting a great deal of suffering on patients over a prolonged period. The high costs and work absenteeism are related with productivity losses as a result socio economic impacts are increasing day by day in Bangladesh.

Identifying an effective treatment procedure for a disease is one of the methods to strengthen the health care system along with rehabilitation sector in perspective of our country & there were very few studies to explore the relationship between thoracic spine and neck pain. By conducting this study, researcher wishes to describe the protocol in an effective way & this study may form a foundation to use upper & mid-thoracic mobilization along with conventional care considering special dose and repetitions. However, research is essential to improve the knowledge of health professionals, as well as to develop the profession.

1.3 Aim

To evaluate the effectiveness of upper & mid-thoracic mobilization combined with conventional care among patients with mechanical neck pain.

1.4 Objectives

1.4.1 General objective

To determine and compare the effectiveness of upper & mid-thoracic mobilization combined with conventional care among patients with mechanical neck pain.

1.4.2 Specific Objectives

- To find out the demographic characteristics and pain related information of participants.
- To find out the effectiveness of upper & mid-thoracic mobilization combined with conventional care in within and between groups at patient rated general pain.
- To determine the effectiveness of upper & mid-thoracic mobilization combined with conventional care in within and between groups among patients with mechanical neck pain at cervical range of motion.
- To explore the effectiveness of upper & mid-thoracic mobilization combined with conventional care at within and between groups among patients with mechanical neck pain at cervical spine disability by 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 etc.

1.5 Research Hypothesis

1.5.1 Null Hypothesis (H_o)

H_o: μ_1-μ_2 = 0 or μ_1=μ_2, where the experimental group and control group initial and final mean difference is same.

Upper & mid-thoracic mobilization combined with conventional care is no more effective than usual care for the treatment of patients with mechanical neck pain.

1.5.2 Alternative hypothesis (H_a)

- H_a: μ_1- $\mu_2 \neq 0$ or $\mu_1 \neq \mu_2$, where the experimental group and control group initial and final mean difference is not same.

Upper & mid-thoracic mobilization combined with conventional care is no more effective than usual care for the treatment of patients with mechanical neck pain.

Here,

Ho= Null hypothesis

Ha= Alternative hypothesis

μ_1= Mean difference in initial assessment

μ_2= Mean difference in final assessment

1.6 Operational definition

Upper & Mid-thoracic Mobilization: Spinal mobilization from 1st thoracic vertebrae to 7th Thoracic vertebrae in order to minimize pain and disability related to mechanical neck pain patients.

Mechanical neck pain: Mechanical pain is the general term that refers to any type of neck pain caused by placing abnormal stress and strain on muscles of the vertebral column. Typically, mechanical pain results from bad habits, such as poor posture, poorly designed seating, and incorrect bending and lifting motions.

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

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.

Reliability is the extent to which a particular measurement is repeatable. Test-retest reliability is the ability of a questionnaire to repeatedly capture similar scores on two separate occasions of test administration, over which time the patient has not exhibited a change in their condition (Cleland et al., 2006).

Validity is the extent to which an instrument measures exactly what it is intended to measure. Construct validity is the determination of how the scores on a questionnaire compare with scores obtained with a reference standard (Cleland et al., 2006).

CHAPTER-II: LITERATURE REVIEW

Extensive research has been done to explore the efficacy of manual therapy in managing neck pain. Most of the studies were randomized controlled trials (RCTs) and thus showed high levels of hierarchy. Due to a variety of treatment options available for the mechanical neck pain, this part of the review has been divided into various sections:

Gemmell and Miller (2010) reviewed the comparative efficacy of mobilizations, manipulations. Five studies came under inclusion criteria out of 217 non-specific citations on efficacy of mobilizations and manipulations. Study concluded that no one therapy is more effective than other. Groeneweg et al. (2010) did RCTs to compare the effectiveness of manual therapy (MT; mainly spinal mobilization), physical therapy (PT; mainly exercise therapy), and continued care by the general practitioner (GP; analgesics, counseling and education). Short-term results (at 7 weeks) have shown that MT speeded recovery compared with GP care and, to a lesser extent, also compared with PT. In the long-term, GP treatment and PT caught up with MT, and differences between the three treatment groups decreased and lost any statistical significance at the 13-week and 52-week follow-up. Vincent, Maigne, Fischhoff, Lanlo, & Dagenais, (2013) reported that manual therapy was more effective as well as less costly compared to physiotherapy and care by a general practitioner.

Ganesh et al., (2015) compared manual therapy (mobilizations, manipulations and massage) and stretching and concluded that both have short-term effects on mechanical neck pain. Lau, Chiu, & Lam, (2011) did a RCT to compare the efficacy of the two.

They concluded that both stretching exercise and manual therapy considerably decreased neck pain and disability in women with non-specific neck pain. The difference in effectiveness between the two treatments was minor. Low-cost stretching exercises can be recommended in the first instance as an appropriate therapy intervention to relieve pain, at least in the short-term (Haik, Alburquerque-Sendín, Moreira, Pires, & Camargo, 2016). Lilje, Friberg, Wykman, & Skillgate, (2010) investigated the efficacy of napropathic manual therapy (Napropathy combines manual techniques like spinal manipulation/ mobilization, massage, and stretching to correct the cause being practiced in Sweden, United States, Finland, Norway, and some other countries) and concluded that Combined manual therapy, like napropathy, is effective both in the short and long-term, and might be considered for patients with non-specific back and/or neck pain. Mobilization can produce a hypoalgesic effect to mechanical nociception (La Touche et al., 2013). In conjunction with that, it demonstrates significant decrease in EMG activity of the superficial neck flexor muscles (Edmondston et al., 2011). Another study showed that following mobilization 69% of patients reported pain improvement and increased range of motion immediately after the treatment (Cross, Kuenze, Grindstaff, & Hertel, 2011).

An analysis of the literature on all forms of conservative management of neck pain by Coulter et al. (2019) concluded that there had not been sufficient studies to adequately prove the effectiveness of any treatment approach. When, however, they combined the results of five trials on manual methods of treatment, they noted a positive effect at 1-4 weeks, equivalent to an improvement of 6.9 to 23.1 points on a 100- point scale.

In contrast to most of the work done regarding the efficacy of manual therapy some authors found no additional benefits of manual therapy. McLean, Moffett, Sharp, & Gardiner, 2013) did a pragmatic RCT to determine whether manual therapy or pulsed shortwave diathermy, in addition to advice and exercise, provide better clinical outcome at 6 months than advice and exercise alone in primary care patients with non-specific neck disorders and concluded that the addition of pulsed shortwave or manual therapy to advice and exercise did not provide any additional benefits in the physical therapy treatment of neck disorders.

Significant decreases in neck pain at rest and pain on most painful movement ($P<0.001$) with a significant increase in active cervical ROM after mobilization on most painful movement were reported (Kanlayanaphotporn, Chiradejnant, & Vachalathiti, 2010). At this time, the best interpretation of the literature is that there is some evidence for effectiveness of mobilization procedures for patients with neck pain (Louw et al., 2017).

In the comparative studies by Weerasekara and Madhurangani (2019), patients received either a single rotational manipulation (high-velocity, low-amplitude thrust) or mobilization in the form of muscle energy technique to check short- and long-term benefits for sub-acute/chronic mechanical neck disorders. The results show that both treatments increase range of motion, but manipulation has a significantly greater effect on pain intensity. 85% of the manipulated patients and 69% of the mobilized patients reported pain improvement immediately after treatment (Cross, Kuenze, Grindstaff, & Hertel, 2011). However, the decrease in pain intensity was greater than 1.5 times in the manipulated group ($p = .05$). Whereas Schroeder, Kaplan, Fischer, & Skelly (2013) did a study to compare chiropractic mobilizations and manipulations in chronic neck pain patients. +-

They reported cervical spine manipulation and mobilization yield comparable clinical outcomes (Masaracchio, Cleland, Hellman, & Hagins, 2013). In another randomized controlled trial by Gross et al. (2010), comparison of manipulation and mobilization was done. They reported only short-term effectiveness of manipulation in neck pain patients and proposed that the long-term effects of the intervention in the future trials need to be determined. Cross, Kuenze, Grindstaff and Hertel (2011). Thoracic spine thrust manipulation improves pain, range of motion, and self-reported function in patients with mechanical neck pain: a systematic review (Cross, Kuenze, Grindstaff, & Hertel, 2011). Another randomized clinical trials gave high quality evidence that subjects with mechanical neck pain show clinically important improvements from a course of spinal manipulations or mobilizations (Cross et al., 2011).

Kolberg et al. (2010) did a study to identify effect of manipulations on 22 men with neck pain. They found reduction in pain perception and disability and marked increase in blood catalase activity after high-velocity and low-amplitude thrust in these patients.

In a systematic review comparing various RCTs on efficacy of mobilization and combination of manual therapy with exercises; Carlesso et al. (2010) concluded that manipulation were not effective enough, when given in isolation. A combination of general physical exercises along with manual therapy is recommended to be the most beneficial in neck pain.

Ongoing intensive or light exercise equally improves pain in the long-term, and intensive exercise is better than light exercise for objective outcomes in the medium-term (Goršič, Cikajlo, & Novak, 2017). In other randomized controlled trial studies by Evans et al. (2012), neck pain patients were divided into three different groups.

The first group received only rehabilitation program including strengthening exercises, resistance exercises and cervical extension exercises. The second group was given a combination of spinal manipulative therapy and strengthening exercises. The third group received only spinal manipulative therapy with no exercises. This quality study showed the multimodal treatment approach of SMT and exercise was an effective intervention in chronic mechanical neck pain patients (Akindele-Agbeja, Mbada, & Egwu, 2017).

Llamas-Ramos et al., (2014) did randomized trials using a Cochrane format to determine if manual therapy improves pain, function and patient satisfaction in adults suffering from mechanical neck disorders. They concluded that to be more beneficial, manual therapies should be done with exercise for improving pain and patient satisfaction, (Vincent, Maigne, Fischhoff, Lanlo, & Dagenais, 2013). Furthermore, in a recent randomized controlled trial study by Mintken et al. (2016), it was concluded that manual therapy combined with exercise returned moderately larger improvements, although not statistically significant, improvements in pain, disability and patient perceived recovery than manual therapy alone.

Thoracic spine mobilization technique can possibly be used as a substitute to lessen the cervical pain (Dunning et al., 2012); its effectiveness has been shown in neck pain patients. In their first study, they compared the efficacy of thoracic mobilization with placebo manipulation in neck pain patients. This study showed the effectiveness of thoracic spine mobilization in neck pain patients (Young, Walker, Snyder, & Daly, 2014) and proposed that future trials were needed to compare the effectiveness of mobilization and cervical spine exercise therapy in mechanical neck pain patients.

In their randomized controlled study Salom-Moreno et al. (2014), compared the effectiveness non-thrust mobilization at the thoracic spine in the patients with

mechanical neck pain. The results suggest that thoracic spine mobilization results in significantly greater short-term reductions in pain and disability than thoracic thrust mobilization/manipulation in people with mechanical neck pain.

EFFICACY OF OTHER THERAPIES IN MECHANICAL NECK PAIN

Murray, Lange, Nørnberg, Søgaard, and Sjøgaard, (2017) did a RCT to assess preventive efficacy of a neck/shoulder exercise regimen for neck pain in air force helicopter pilots. They concluded that a supervised neck/shoulder exercise regimen was effective in reducing neck pain cases in air force helicopter pilots. General strength training before the intervention predicted reduction in prevalence of pain at follow-up.

A randomized controlled trial was conducted by Brosseau et al. (2012) to evaluate whether therapeutic massage is more beneficial than a self-care book for patients with chronic mechanical neck pain. They concluded that massage is safe and may have clinical benefits for treating mechanical neck pain at least in the short term but not the mechanical one. Mulimani et al. (2018) did a systematic review to study the effectiveness of physical and organizational ergonomic interventions on neck pain and thoracic pain. There was low quality evidence that a physical ergonomic intervention was significantly more effective for reducing neck pain intensity in the short-term and the long-term than no ergonomic intervention. However, this review provides a solid overview of the high-quality epidemiological evidence on the effectiveness of ergonomic interventions on mechanical neck pain.

Gross et al. (2010) did a Cochrane review to assess whether patient education strategies are of benefit for pain, function/disability, global perceived effect, quality of life, or patient satisfaction, in adults with neck pain with or without radiculopathy.

This review has not shown effectiveness for educational interventions for neck pain of various acuity stages and disorder types and at various follow-up periods, including advice to activate, advice on stress coping skills, and neck school.

Some studies were done to study the efficacy of non-surgical and/ or nonpharmacological treatments in general for neck pain (Cohen & Hooten, 2017). Akhter, Khan, Ali, and Soomro (2014) did a study to identify the best treatment amongst non-steroidal anti-inflammatory drugs (NSAIDs), exercise, and manual therapy for non-specific neck pain. When the objective is to maximize life expectancy and quality-adjusted life expectancy, none of the treatments were found superior (Collins, 2017).

Haldeman, Carroll, and Cassidy, (2010) reviewed literature to identify, critically appraise, and synthesize literature from 1980 through 2006 on non-invasive interventions for neck pain and its associated disorders. They concluded that therapies involving manual therapy and exercise were more effective than alternative strategies for patients with neck pain; this was also true of therapies, which include educational interventions addressing self-efficacy.

Apart from the above-mentioned text studies with regard to efficacy of Mulligan techniques, some on mechanical neck pain were also found out. Anandkumar (2015) stated that the cervical SNAG is a popular manual therapy technique used widely in the treatment of painful and restricted neck movement. Its clinical application has been based almost exclusively on convention with little attempt to provide a biological basis and little, if any, empirical evidence as yet to support its efficacy.

Reid, Rivett, Katekar, and Callister (2014) investigated the efficacy of SNAGs in the treatment of cervicogenic dizziness.

Compared to placebo group, SNAG treatment had an immediate clinically and statistically significant sustained effect in decreasing dizziness, cervical pain and disability caused by cervical dysfunction. Improvement in balance and range motion was observed in SNAGs group. Furthermore, Kumar, Sandhu, and Broota, (2011) summarized that the core of Mulligan's work in symptom free joint mobilization added to muscular activity. He explained that Mulligan techniques are used to correct minor joint derangements that often display a disproportionate array of effects (Rhinehart & Buonopane, 2016).

OUTCOME MEASURES AND THEIR APPLICATIONS

An increasing number of clinicians and clinical researchers are considering and incorporating the functional measures, as functional scales measure the impact of a disease on the performance of common daily activities. They also stressed that it is essential for the self-report measures to possess the characteristics of reliability and validity and are responsive enough to identify changes in function when a true change has occurred.

Reliability is the extent to which a measurement is repeatable. Test-retest reliability is the ability of a questionnaire to repeatedly capture similar scores on two separate occasions of test administration, over which time the patient has not exhibited a change in their condition (Young, Cleland, Michener, & Brown, 2010).

Validity is the extent to which an instrument measures exactly what it is intended to measure. Construct validity is the determination of how the scores on a questionnaire compare with scores obtained with a reference standard (Young, Dunning, Butts, Mourad, & Cleland, 2019).

Range of Motion (ROM)

Range of motion (ROM) of the cervical spine is an integral component of clinical assessment (Quek et al., 2014) and it is well correlated with cervical pain (Smania et al., 2010). It has also been used as an outcome measure for spinal mobilizations and manipulations (Millan, Leboeuf-Yde, Budgell, Descarreaux, & Amorim, 2012).

The advantages of goniometry are the simplicity in assessing ROM, the direct measurement of joint angles without any data reduction process and the low cost of the instrument. The two-arm goniometer is still the most used, economical and portable device for the evaluation of ROM (Nussbaumer et al., 2010). ROM of lower cervical spine is being measured by bubble inclinometer (Salamh, & Kolber, 2014). Bubble inclinometer was first introduced by Schenker in 1956. American Medical Association (AMA) has accepted the inclinometer as "a feasible and potentially accurate method of measuring spine mobility". It consists of a 360-degree scale with a fluid filled circular tube containing a small air bubble. It is a gravity dependent Goniometer, which uses the gravity's effect on fluid level to measure joint position and motion.

Neck Disability Index (NDI)

The Neck Disability Index (NDl) is a commonly used neck pain questionnaire. It is modelled after the Oswestry Back Disability questionnaire (Howell, 2011). The NDI contains 10 items, seven related to activities of daily living, two related to pain, and one item related to concentration. Each item is scored ranging from 0 (no pain or disability) to 5 (severe pain and disability); and the total score is expressed as a percentage, with higher scores corresponding to greater disability. The NDI has shown to be reliable and valid for patients with neck pain (Juul, Søgaard, Davis, &

Roos, 2016) and has excellent test-retest properties. Burneikiene, Nelson, Mason, Rajpal and Villavicencio (2015) examined the validity of NDI on 100 neck pain patients to draw a comparison of the NDI with Short form 36 (SF36). The test-retest reliability and the concurrent validity between the two questionnaire scores were assessed using Pearson correlation. The individual scores for each of the ten items of the NDI were correlated to the total disability score categories. Both questionnaires showed robust internal consistency and the NDI had significant correlation to all eight domains of the SF36 ($p<0.001$). The individual scores for each of the ten items had significant correlation with the total disability score ($p<0.001$). The test-retest reliability of the NDI was acceptable. The study concluded that NDI has good reliability and validity and it stands up well to the SF36.

Young, Cleland, Michener, & Brown (2010) in a cohort study on patients with cervical radiculopathy undergoing physical therapy examined the test-retest reliability; construct validity, and minimum levels of detectable and clinically important change for the Neck Disability Index (NDI). They concluded that NDI exhibits fair to moderate test-retest reliability in patients with mechanical neck pain, whereas PSFS exhibits superior reliability and construct validity in cervical radiculopathy patients.

Ferreira et al. (2010) compared the sensitivity to change of the Neck Disability Index (NDI) and the Neck Bournemouth Questionnaire (NBQ) in patients with chronic mechanical neck pain. This study concluded that the NDI and the NBQ have similar responsiveness and internal validity, and thus, can appropriately be used in patients with mechanical neck pain.

Juul, Søgaard, avis, and Roos, (2016), in there study, examined the psychometric properties like test-retest reliability, construct validity, and minimum levels of detectable and clinically important change for the Neck Disability Index (NDI) for pain in a cohort of patients with neck pain. They reported that both NDI and NRS exhibit fair to moderate test-retest reliability and showed adequate responsiveness in patients with mechanical neck pain.

McGill Pain Questionnaire

Melzack developed the McGill Pain Questionnaire (MPQ) that has become one of the most widely used pain measurement tools that provides sensory, affective, site, pain pattern, and intensity information. It is both useful and valid for acute, chronic, musculoskeletal, post-surgical and neuropathic pain (Katz & Melzack, 2011). In a comparison of the psychometric properties of the McGill Pain Questionnaire (MPQ) with the 17-item Short Pain Inventory (SPI) in 60 outpatients with osteoarthritic knee pain (Boyle, Boerresen, & Jang, 2015). The SPI measures the emotional aspects of pain well and the McGill assesses the physical or sensory aspects of pain better than any other available method.

Visual Analogue Scale (VAS)

VAS is a subjective outcome measurement where patients judge the intensity of their pain on a scale of 0-10, which is in the form of a 10cm straight line (Jamison & Edwards, 2012). On this 0-10 scale, zero denotes no pain and ten denotes severe pain intensity (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). The validity and reliability of VAS measures has previously been established (Brokelman et al., 2012).

Chiarotto et al. (2019) carried out their study to determine the reliability and concurrent validity of a visual analogue scale (VAS) as a single-item instrument measuring disability in chronic pain patients. For the reliability study a test-retest design and for the validity study a cross-sectional design was used. The conclusion of the study was that the reliability of the VAS for disability is moderate to good. Because of a weak correlation with other disability instruments and a strong correlation with the VAS for pain, however, its validity is questionable. Parazza et al. (2014) in their study compared the validity & reliability of VAS with neck pain and disability scale. They found these instruments equally reliable in neck pain patients.

CHAPTER-III: METHODOLOGY

This thesis was designed to evaluate the efficacy of upper and mid-thoracic mobilization combined with usual care among patients with mechanical neck pain. To identify the effectiveness of this treatment regime, visual analogue scale, goniometer, McGill pain questionnaire and neck disability index were used as measurement tools for measuring pain, range of motion, intensity of pain and neck disability.

3.1. Study Design

The study was a quantitative type of classic experimental research design. Depoy and Gitlin (2019) stated that classic experimental research finds 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. Upper and mid-thoracic mobilization 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, pain characteristics and neck disability.

3.2. Study Area

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

3.3. Study Period

The mentioned study duration was September 2019 to November 2020.

3.4. Study Population

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

3.5. Inclusion criteria

- **Age range between 20 to 55 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 diagnosed as mechanical neck pain:** This type of patients was included because physiotherapy favors most in terms of mechanical neck pain due to cervical spondylosis, neck muscle spasm, neck muscle imbalance and central disc bulging (El-Sodany, et al., 2014).

3.6. Exclusion Criteria

- **Age below 20 years and above 55 years:** This age range participants were excluded as chronic neck pain due to mechanical origin is less prevalent (Ummar, et al., 2012)
- **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).
- **Post-operative subjects**

3.7. Sample Size

Data is collecting from December 2019 to February 2020. During this period, those Who matched with the criteria and give their consent to participate in this study were this study subjects.

$$n = \frac{z^2 p(1-p)}{e^2}$$

Here,

n= number of samples

p= sample proportion or percentage of incidence and prevalence /Power of the study

q= 1-p

z= 1.96 for a 95% CI

e= margin of error 5%= .05

3.8. Sampling Technique

All the patients with mechanical neck pain who have met the inclusion criteria have created the sampling frame from outpatient musculoskeletal unit of physiotherapy department, CRP, Savar, Dhaka. All the participants have an equal probability of assigning to any of two groups, because they are choosing by 'Therapist Randomization' which are assigning them either to trial group or to control group. By thus, randomly assigning into trial group and control group, internal validity of the thesis will improve. Patients those who were randomly assigned to trial group was received treatment approaches of upper & mid-thoracic mobilization combined with usual physiotherapy techniques and the control group treated by usual physiotherapy techniques in this study. Double blinding procedure was followed in this study. Finally, the sample size was 79 in number consisting of 39 participants in the control group and 40 in the trial group.

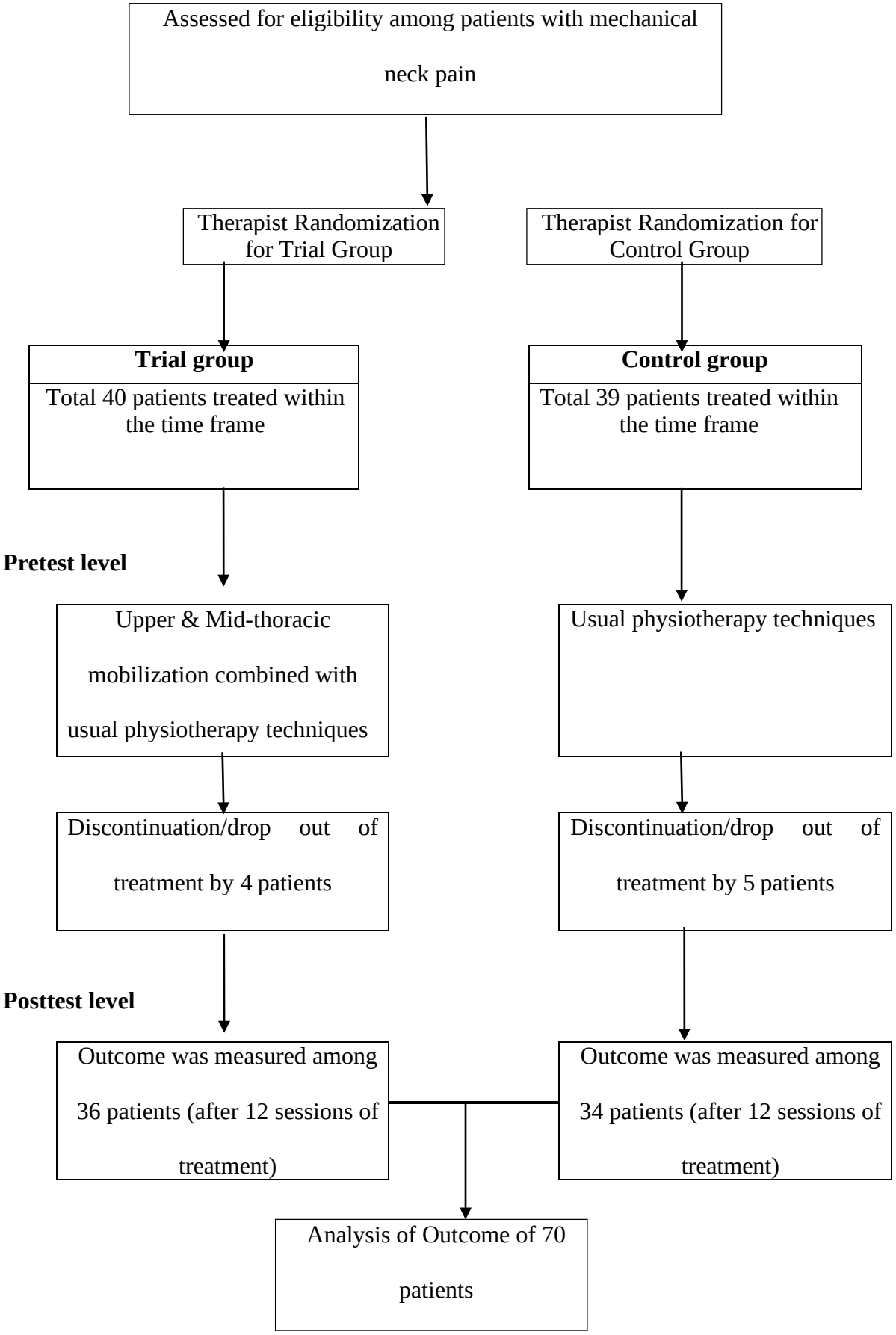


Figure 1: Flow-chart of the phases of classic experimental research

3.9. Data Collection Proceedings

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. Research Instrument

- 10 cm visual analogue scale for measuring pain intensity in resting position.

  VAS is a subjective outcome measurement where patients judge the intensity of their pain on a scale of 0-10, which is in the form of a 10cm straight line (Jamison & Edwards, 2012). On this 0-10 scale, zero denotes no pain and ten denotes severe pain intensity (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). The validity and reliability of VAS measures has previously been established (Brokelman et al., 2012).

- Universal Goniometer to measure range of motion in cervical spine.

  Range of motion (ROM) of the cervical spine is an integral component of clinical assessment (Quek et al., 2014) and it is well correlated with cervical pain (Smania et al., 2010). It has also been used as an outcome measure for spinal mobilizations and manipulations (Millan, Leboeuf-Yde, Budgell, Descarreaux, & Amorim, 2012). The advantages of goniometry are the simplicity in assessing ROM, the direct meas -urement of joint angles without any data reduction process and the low cost of the instrument. The two-arm goniometer is still the most used, economical and portable device for the evaluation of ROM (Nussbaumer et al., 2010)

- McGill Questionnaire to measure the characteristics & intensity of pain.

  Melzack developed the McGill Pain Questionnaire (MPQ) that has become one of the most widely used pain measurement tools that provides sensory, affective, site, pain pattern, and intensity information. It is both useful and valid for acute,

chronic, musculoskeletal, post-surgical and neuropathic pain (Katz & Melzack, 2011). In a comparison of the psychometric properties of the McGill Pain Questionnaire (MPQ) with the 17-item Short Pain Inventory (SPI) in 60 outpatients with osteoarthritic knee pain (Boyle, Boerresen, & Jang, 2015).

- Neck disability Index to measure the disability status among patients with mechanical neck pain.

The Neck Disability Index (NDl) is a commonly used neck pain questionnaire. It is modelled after the Oswestry Back Disability questionnaire (Howell, 2011). The NDI contains 10 items, seven related to activities of daily living, two related to pain, and one item related to concentration. Each item is scored ranging from 0 (no pain or disability) to 5 (severe pain and disability); and the total score is expressed as a percentage, with higher scores corresponding to greater disability. The NDI has shown to be reliable and valid for patients with neck pain (Juul, Søgaard, Davis, & Roos, 2016) and has excellent test-retest properties.

3.9.3. 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. 8 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- B) which was formulated by the researcher. Pre-test was performed before beginning the treatment and the intensity of pain was noted with visual-analogue scale & Short-form McGill questionnaire, range of motion (ROM) was measured by universal goniometer and disability by Neck disability index. The same procedure was performed to take

post-test at the end of 12 sessions of treatment. A data collector provided the assessment form to each subject before starting treatment and after 12 sessions of treatment and patient was instructed to put mark on the subjective portion and in objective portion like ROM, MPQ was completed by the collector. The data collector collected the data of both trial and control group in front of the Physiotherapist in order to minimize the bias.

3.9.4 Data Analysis

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

Formula: Paired **"t'** test statistic t is follows:

$$t = \frac{\bar{d}}{SE(\bar{d})} = \frac{\bar{d}}{\frac{SD}{\sqrt{n}}}$$

Where,
$\bar{d}$= mean of difference (d) between paired values,
SE ($\bar{d}$)= Standard Error of the mean difference
SD= standard deviation of the differences *d* and
n= number of paired observations.

Formula: Independent '**t**' test statistic t is follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where,

$\bar{x}_1$ = Mean of the Experimental Group,
$\bar{x}_2$ = Mean of the Control Group,
n_1 = Number of participants in the Experimental Group,
n_2 = Number of participants in the Control Group
S = Combined standard deviation of both groups

3.10.1 Statistical Analysis

Statistical analysis refers to the well-defined organization and interpretations of the data by systemic and mathematical procedure and rules (DePoy and Gitlin, 2019). At first descriptive statistics was done. Parametric tests were done for VAS pain, ROM and neck disability such as paired 't' test and independent 't' test. Also, performed non-parametric test for McGill Pain characteristics such as Mann-Whitney *U*-test & Wilcoxon sign ranked test (Sung et al., 2019).

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, 2019).

3.11. Treatment Regime

Ten physiotherapists who are expert in treatment of musculoskeletal patient were involved in treatment of patients. All the physiotherapists have the experience of more than two years in aspect of musculoskeletal physiotherapy. Among them, 5 were male and 5 were female physiotherapist. Protocol for usual physiotherapy care was obtained from head of physiotherapy department, Centre for the rehabilitation of the paralysed (CRP) (Appendix- C). An in-service training was arranged to share the information with practical demonstration regarding upper and mid-thoracic

mobilization including patient position, types of exercise, dose and repetition (Appendix- D) with conventional care.

3.12. 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- E). After completion of IRB, the researcher obtained trial registration from CTRI (Central Trial Registry of India) under WHO (World Health Organization) and taken permission of the data collection questionnaire from respective authors. Again, before starting data collection, researcher obtained permission (Appendix- E) 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- A) was received from each participant. The participants were free to decline answering any questions 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.

CHAPTER- IV: RESULT

Table I: Result of Descriptive Statistics

Variable(s)	Trial Group		Control Group	
	Mean with SD	Min.-Max. Or %	Mean with SD	Min.-Max. Or %
Age (yr.)	38.53 (±10.0)	20-55	42.54 (±9.53)	23-55
Gender	Male=15	37.5%	Male=12	30.8%
	Female=25	62.5%	Female=27	69.2%
Living place	Urban=24	60%	Urban=20	51.3%
	Female=16	40%	Female=19	48.7%
	Initial	Final	Initial	Final
Pain (VAS)	8.78 (±1.16)	0.80 (±0.92)	7.93 (±1.51)	1.32 (±1.05)
NDI	40.18 (±4.92)	11.72 (±4.43)	39.51 (±9.84)	15.03 (±5.82)

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 38.53 (±10.00) years and in control group 42.54 (±9.53) years. The mean intensity of pain (± SD) was 8.78 (±1.16) at pre-test & 0.80 (±0.92) at post-test in trial group and 7.93 (±1.51) at pre-test & 1.32 (±1.05) at post-test in control group. In addition, Mean (± SD) pretest NDI score in trial group was 40.18 (±4.92) & post-test 11.72 (±4.43) and in contrast mean (± SD) in control pretest was 39.51 (±9.84) & 15.03 (±5.82).

Occupation of Participants

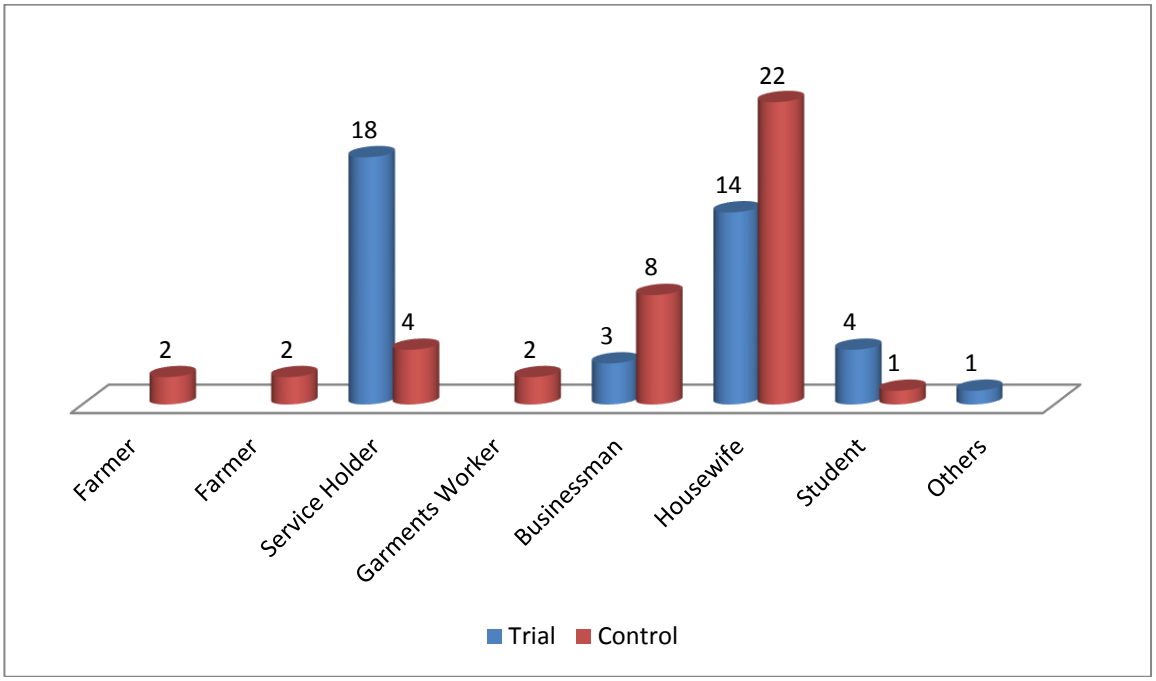


Figure I: Occupations of participants

Figure 3 showed, among the 79 participants, housewife were 36 (45.6%), service holder were 22 (27.8%).

Educational level of both group's participants with frequencies

Table II: Educational level of participants

Educational level	Trial group	Percent	Control group	Percent
	Frequency		Frequency	
Illiterate	1	2.5%	1	2.6%
Primary	3	7.5%	13	33.3%
SSC	9	22.5%	10	25.6%
HSC	11	27.5%	7	17.9%
Graduate & Masters	16	40%	8	20.5%

Table II showed that among 79 participants, 19 participants (24.1%) were completed secondary level (9 in trial group and 10 in control group); besides, 24 participants (30.4%) were Graduated (16 in the trial group and 8 were in control group).

Result of Parametric Tests

Result of pain

The Unrelated/independent t test in between group at 5% level of significant and 68 degrees of freedom standard table value was 1.995 and at the same significant level and same degree of freedom observed t value was 2.221. The observed t value was greater than the table value that meant null hypothesis was rejected and alternative hypothesis was accepted which Upper & Mid-thoracic spine mobilization for mechanical neck pain patients were was statistically significant. So, Upper & Mid-thoracic spine mobilization was very much effective for reducing pain than usual physiotherapy in between group comparison.

This study found that in the general pain intensity, observed t value was 35.48(8.1±1.4) in the experimental group at two tailed paired t test while this same variable for control group observed value was 21.302 (6.69±1.83) in within group. 5% level of significant at 38 (thirty five) degrees of freedom standard t value was 2.031 and observed t value in general pain intensity in both groups which were greater than standard t value that meant null hypothesis was rejected and alternative hypothesis was accepted in the within group. Both groups in aspect of general pain intensity were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for reducing general pain.

Result of ROM- Neck Flexion

The Unrelated/independent t test in between group at 5% level of significant and 68 degrees of freedom standard table value was 1.995 and at the same significant level and same degree of freedom observed t value was 2.277. The observed t value was greater than the table value that meant null hypothesis was rejected and alternative hypothesis was accepted which Upper & Mid-thoracic spine mobilization for mechanical neck pain patients were was statistically significant. So, Upper & Mid-thoracic spine mobilization was very much effective for regaining ROM than usual physiotherapy in between group comparison.

This study found that in the Neck flexion ROM, observed t value was 9.3(12.2±7.9) in the experimental group at two tailed paired t test while this same variable for control group observed value was 10.5 (9.9±5.5) in within group. 5% level of significant at 35 (thirty five) degrees of freedom standard t value was 2.031 and observed t value in Neck flexion ROM in both groups which were greater than standard t value that meant null hypothesis was rejected and alternative hypothesis was accepted in the within group. Both groups in aspect of general pain intensity were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for regaining ROM.

Result of ROM- Neck Extension

This study found that in the Neck extension ROM, the Unrelated/independent t test in between group at 5% level of significant and 35 degrees of freedom standard table value was 1.995 and observed t value was 0.082. The observed t value was less than the table value that means null hypothesis was accepted and alternative hypothesis was rejected which there was no difference Upper & Mid-thoracic spine mobilization and conventional physiotherapy for mechanical neck pain patients in the between group.

Beside this, Observed t value was 9.229 (17.64±11.47) in the experimental group at two tailed paired t test while this same variable for control group observed value was 9.332 (14.32±8.95). 5% level of significant at 35 (thirty five) degrees of freedom standard t value is 2.031 and observed t value in neck extension in both groups which were greater than standard t value in both group that means null hypothesis had rejected in both group; and alternative hypothesis was accepted. Both groups in aspect of general neck extension ROM were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for regaining extension ROM.

Result of ROM- Neck side bend (right)

This study found that in the Neck extension ROM, the Unrelated/independent t test in between group at 5% level of significant and 35 degrees of freedom standard table value was 1.995 and observed t value was 1.818. The observed t value was less than the table value that means null hypothesis was accepted and alternative hypothesis was rejected which there was no difference Upper & Mid-thoracic spine mobilization and conventional physiotherapy for mechanical neck pain patients in the between group.

Beside this, Observed t value was 13.29 (15.75±7.1) in the experimental group at two tailed paired t test while this same variable for control group observed value was 11.53 (10.44±5.28). 5% level of significant at 35 (thirty five) degrees of freedom standard t value is 2.031 and observed t value in neck extension in both groups which were greater than standard t value in both group that means null hypothesis had rejected in both group; and alternative hypothesis was accepted. Both groups in aspect of general neck side bending right ROM were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for regaining side bending right ROM.

Result of ROM- Neck side bend (left)

This study found that in the Neck extension ROM, the Unrelated/independent t test in between group at 5% level of significant and 35 degrees of freedom standard table value was 1.995 and observed t value was 1.419. The observed t value was less than the table value that means null hypothesis was accepted and alternative hypothesis was rejected which there was no difference Upper & Mid-thoracic spine mobilization and conventional physiotherapy for mechanical neck pain patients in the between group.

Beside this, Observed t value was 16.01 (16.17±6.01) in the experimental group at two tailed paired t test while this same variable for control group observed value was 12.45 (11.76±5.5). 5% level of significant at 35 (thirty five) degrees of freedom standard t value is 2.031 and observed t value in neck extension in both groups which were greater than standard t value in both group that means null hypothesis had rejected in both group; and alternative hypothesis was accepted. Both groups in aspect of general neck side bending left ROM were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for regaining side bending left ROM.

Result of ROM- Neck Rotation (right)

This study found that in the Neck extension ROM, the Unrelated/independent t test in between group at 5% level of significant and 35 degrees of freedom standard table value was 1.995 and observed t value was 1.797. The observed t value was less than the table value that means null hypothesis was accepted and alternative hypothesis was rejected which there was no difference Upper & Mid-thoracic spine mobilization and conventional physiotherapy for mechanical neck pain patients in the between group.

Beside this, Observed t value was 12.26 (26.39±12.91) in the experimental group at two tailed paired t test while this same variable for control group observed value was 10.46 (15.15±8.44). 5% level of significant at 35 (thirty five) degrees of freedom standard t value is 2.031 and observed t value in neck extension in both groups which were greater than standard t value in both group that means null hypothesis had rejected in both group; and alternative hypothesis was accepted. Both groups in aspect of general neck rotation right ROM were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for regaining neck rotation right ROM.

Result of ROM- Neck rotation (left)

This study found that in the Neck extension ROM, the Unrelated/independent t test in between group at 5% level of significant and 35 degrees of freedom standard table value was 1.995 and observed t value was 1.177. The observed t value was less than the table value that means null hypothesis was accepted and alternative hypothesis was rejected which there was no difference Upper & Mid-thoracic spine mobilization and conventional physiotherapy for mechanical neck pain patients in the between group.

Beside this, Obseved t value was 11.32 (26.33±13.96) in the experimental group at two tailed paired t test while this same variable for control group observed value was 10.197 (16.35±9.35). 5% level of significant at 35 (thirty five) degrees of freedom standard t value is 2.031 and observed t value in neck extension in both groups which were greater than standard t value in both group that means null hypothesis had rejected in both group; and alternative hypothesis was accepted. Both groups in aspect of neck rotation left ROM were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for regaining neck rotation left ROM.

Result of Neck Disability Index

The Unrelated/independent t test in between group at 5% level of significant and 68 degrees of freedom standard table value was 1.995 and at the same significant level and same degree of freedom observed t value was 2.683. The observed t value was greater than the table value that meant null hypothesis was rejected and alternative hypothesis was accepted which Upper & Mid-thoracic spine mobilization for mechanical neck pain patients were was statistically significant. So, Upper & Mid-thoracic spine mobilization was very much effective for regaining ROM than usual physiotherapy in between group comparison.

This study found that in the neck disability index, observed t value was 26.99 (2.81±.624) in the experimental group at two tailed paired t test while this same variable for control group observed value was 18.24 (24.32±7.77) in within group. 5% level of significant at 35 (thirty five) degrees of freedom standard t value was 2.031 and observed t value in Neck disability index in both groups which were greater than standard t value that meant null hypothesis was rejected and alternative hypothesis was accepted in the within group. Both groups in aspect of general pain intensity were significant at 0.001% level, but the mean difference of the experimental group was greater than the control group mean that means Upper & Mid-thoracic spine mobilization for mechanical neck pain patients was more effective than conventional physiotherapy treatment for reducing neck disability.

Table III: Independent 't' test

Variables	***t***	**P value**
Pain Intensity	2.221	.030
Neck_Flexion	-2.277	.026
Neck_Extension	-.082	.935
Neck_Side_Bend_Right	-1.818-	.073
Neck Side_bend_Left	-1.419	.160
Neck_Rotation_Right	-1.797	.077
Neck Rotation_Left	-1.177	.243
NDI Raw- Post	2.683	.009

Table IV: Paired 't' test

Variables	**Control group**		**Experimental group**	
	t	**P value**	***t***	**P value**
Pain Intensity	21.302	.000	35.480	.001
Neck_Flexion	-10.458	.001	-9.239	.001
Neck_Extension	-9.332	.001	-9.229	.001
Neck_Side_Bend_Right	-11.528	.001	-13.293	.001
Neck Side_bend_Left	-12.449	.001	-16.009	.001
Neck_Rotation_Right	-10.461	.001	-12.267	.001
Neck Rotation_Left	-10.197	.001	-11.319	.001
NDI Raw- Post	18.239	.001	26.966	.001

RESULT OF NON-PARAMETRIC TESTS

1. Pounding – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (pounding) between trial and control group

Table V: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (pounding)	Control	34	43.76	331.000	.001
	Trial	36	27.69		
	Total	70			

Table V showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 43.76, compared to 27.69 for the trial. Calculated value of *U* is 331.000 for pain characteristics pounding in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that means that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table VI: Wilcoxon Signed Rank test

	McGill pain questionnaire (pounding)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	30	16.03	481.00	5.089	0.001
	Positive ranks	1	15.00	15.00		
	Ties	3				
	Total	34				
TRIAL	Negative ranks	32	16.50	528.00	5.12	0.001
	Positive ranks	0	.00	.00		
	Ties	4				
	Total	36				

Table VI described the comparison of participant's before (pre) and after (post) pain characteristics (pounding) at within group analysis calculated z value are 5.089 (p=0.001) for control group and 5.12 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (pounding) is statistically significant for pounding in within group analysis.

2. Shooting – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (shooting) between trial and control group

Table VII: Mann-Whitney U test

	Category of Participants	N	Mean Rank	Mann-Whitney *U* Score	p
McGill pain questionnaire (shooting)	Control	34	43.32	346.000	.001
	Trial	36	28.11		
	Total	70			

Table VII showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 43.32, compared to 28.11 for the trial. Calculated value of *U* is 346.000 for pain characteristics shooting in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table VIII: Wilcoxon Signed Rank test

	McGill pain questionnaire (shooting)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	30	15.5	465.00	5.151	0.001
	Positive ranks	0	.00	00		
	Ties	4				
	Total	34				
TRIAL	Negative ranks	35	18.00	630.00	5.35	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table VIII described the comparison of participant's before (pre) and after (post) pain characteristics (shooting) at within group analysis calculated z value are 5.151 (p=0.001) for control group and 5.35 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (shooting) is statistically significant for shooting in within group analysis.

3. Stabbing – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (stabbing) between trial and control group

Table IX: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (stabbing)	Control	34	46.10	251.50	.001
	Trial	36	25.49		
	Total	70			

Table IX showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 46.10, compared to 25.49 for the trial. Calculated value of *U* is 251.000 for pain characteristics stabbing in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table X: Wilcoxon Signed Rank test

	McGill pain questionnaire (stabbing)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	30	15.50	465.00	4.940	0.001
	Positive ranks	0	.00	.00		
	Ties	4				
	Total	34				
TRIAL	Negative ranks	32	16.50	528.00	5.076	0.001
	Positive ranks	0	.00	.00		
	Ties	4				
	Total	36				

Table X described the comparison of participant's before (pre) and after (post) pain characteristics (stabbing) at within group analysis calculated z value are 4.940 (p=0.001) for control group and 5.076 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (stabbing) is statistically significant for stabbing in within group analysis.

4. **Sharp – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (sharp) between trial and control group

Table XI: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (sharp)	Control	34	45.26	280.000	.001
	Trial	36	26.28		
	Total	70			

Table XI showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 45.26, compared to 26.28 for the trial. Calculated value of *U* is 280.000 for pain characteristics sharp in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XII: Wilcoxon Signed Rank test

	McGill pain questionnaire (sharp)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	29	15.00	435.00	5.012	0.001
	Positive ranks	0	.00	.00		
	Ties	5				
	Total	34				
TRIAL	Negative ranks	35	18.00	630.00	5.309	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table XII described the comparison of participant's before (pre) and after (post) pain characteristics (sharp) at within group analysis calculated z value are 5.012 (p=0.001) for control group and 5.309 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (sharp) is statistically significant for sharp in within group analysis.

5. Cramping – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (cramping) between trial and control group

Table XIII: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (cramping)	Control	34	43.51	339.500	.001
	Trial	36	27.93		
	Total	70			

Table XIII showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 43.51, compared to 27.93 for the trial. Calculated value of *U* is 339.500 for pain characteristics cramping in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XIV: Wilcoxon Signed Rank test

	McGill pain questionnaire (cramping)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	25	13.00	325.00	4.714	0.001
	Positive ranks	0	.00	.00		
	Ties	9				
	Total	34				
TRIAL	Negative ranks	35	18.00	630.00	5.311	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table XIV described the comparison of participant's before (pre) and after (post) pain characteristics (cramping) at within group analysis calculated z value are 4.714 (p=0.001) for control group and 5.311 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (cramping) is statistically significant for cramping in within group analysis.

6. **Gnawing – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (gnawing) between trial and control group

Table XV: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (Gnawing)	Control	34	45.12	285.500	.001
	Trial	36	26.42		
	Total	70			

Table XV showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 45.12, compared to 26.42 for the trial. Calculated value of *U* is 285.500 for pain characteristics Gnawing in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XVI: Wilcoxon Signed Rank test

	McGill pain questionnaire (gnawing)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	28	14.50	406.00	4.917	0.001
	Positive ranks	0	.00	.00		
	Ties	6				
	Total	34				
TRIAL	Negative ranks	33	17.00	561.00	5.233	0.001
	Positive ranks	0	.00	.00		
	Ties	3				
	Total	36				

Table XVI described the comparison of participant's before (pre) and after (post) pain characteristics (gnawing) at within group analysis calculated z value are 4.917 (p=0.001) for control group and 5.233 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (gnawing) is statistically significant for gnawing in within group analysis.

7. **Hot & Burning – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (hot & burning) between trial and control group

Table XVII: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (Hot-Burning)	Control	34	46.51	237.500	.001
	Trial	36	25.10		
	Total	70			

Table XVII showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 46.51, compared to 25.10 for the trial. Calculated value of *U* is 237.500 for pain characteristics hot & burning in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XVIII: Wilcoxon Signed Rank test

	McGill pain questionnaire (hot & burning)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	31	16.00	496.00	5.122	0.001
	Positive ranks	0	.00	.00		
	Ties	3				
	Total	34				
TRIAL	Negative ranks	35	18.00	630.00	5.351	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table XVIII described the comparison of participant's before (pre) and after (post) pain characteristics (hot & burning) at within group analysis calculated z value are 5.122 (p=0.001) for control group and 5.351 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (hot & burning) is statistically significant for hot & burning in within group analysis.

8. **Aching – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (aching) between trial and control group

Table XIX: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (Aching)	Control	34	45.38	276.000	.001
	Trial	36	26.17		
	Total	70			

Table XIX showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 45.38, compared to 26.17 for the trial. Calculated value of *U* is 276.000 for pain characteristics stabbing in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XX: Wilcoxon Signed Rank test

	McGill pain questionnaire (aching)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	28	14.50	406.00	4.882	0.001
	Positive ranks	0	.00	.00		
	Ties	6				
	Total	34				
TRIAL	Negative ranks	35	18.00	630.00	5.405	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table XX described the comparison of participant's before (pre) and after (post) pain characteristics (aching) at within group analysis calculated z value are 4.882 (p=0.001) for control group and 5.405 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (aching) is statistically significant for aching in within group analysis.

9. **Heavy – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (heavy) between trial and control group

Table XXI: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (heavy)	Control	34	47.15	216.000	.001
	Trial	36	24.50		
	Total	70			

Table XXI showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 47.15, compared to 24.50 for the trial. Calculated value of *U* is 216.000 for pain characteristics stabbing in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXII: Wilcoxon Signed Rank test

	McGill pain questionnaire (heavy)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	25	13.00	325.00	4.716	0.001
	Positive ranks	1	.00	15.00		
	Ties	9				
	Total	34				
TRIAL	Negative ranks	36	18.50	666.00	5.373	0.001
	Positive ranks	0	.00	.00		
	Ties	0				
	Total	36				

Table XXII described the comparison of participant's before (pre) and after (post) pain characteristics (heavy) at within group analysis calculated z value are 4.716 (p=0.001) for control group and 5.373 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (heavy) is statistically significant for heavy in within group analysis.

10. **Tender – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (tender) between trial and control group

Table XXIII: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (tender)	Control	34	41.94	393.000	.006
	Trial	36	29.42		
	Total	70			

Table XXIII showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 41.94, compared to 29.42 for the trial. Calculated value of *U* is 393.000 for pain characteristics tender in McGill Pain Questionnaire and the p value is 0.006 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXIV: Wilcoxon Signed Rank test

	McGill pain questionnaire (tender)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	29	15.00	435.00	5.108	0.001
	Positive ranks	0	.00	.00		
	Ties	5				
	Total	34				
TRIAL	Negative ranks	33	17.00	561.00	5.187	0.001
	Positive ranks	0	.00	.00		
	Ties	3				
	Total	36				

Table XXIV described the comparison of participant's before (pre) and after (post) pain characteristics (tender) at within group analysis calculated z value are 5.108 (p=0.001) for control group and 5.187 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (tender) is statistically significant for tender in within group analysis.

11. Splitting – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (splitting) between trial and control group

Table XXV: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (splitting)	Control	34	43.57	251.50	.001
	Trial	36	27.88		
	Total	70			

Table XXV showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 43.57, compared to 27.88 for the trial. Calculated value of *U* is 337.500 for pain characteristics splitting in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXVI: Wilcoxon Signed Rank test

	McGill pain questionnaire (splitting)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	28	15.09	422.50	4.765	0.001
	Positive ranks	1	12.50	12.50		
	Ties	5				
	Total	34				
TRIAL	Negative ranks	36	18.50	666.00	5.324	0.001
	Positive ranks	0	.00	.00		
	Ties	0				
	Total	36				

Table XXVI described the comparison of participant's before (pre) and after (post) pain characteristics (splitting) at within group analysis calculated z value are 4.765 (p=0.001) for control group and 5.324 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (splitting) is statistically significant for splitting in within group analysis.

12. Tiring-Exhausting – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (tiring-exhausting) between trial and control group

Table XXVII: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (tiring-exhausting)	Control	34	43.85	328.000	.001
	Trial	36	27.61		
	Total	70			

Table XXVII showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 43.85, compared to 27.61 for the trial. Calculated value of *U* is 328.000 for pain characteristics tiring-exhausting in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXVIII: Wilcoxon Signed Rank test

	McGill pain questionnaire (tiring-exhausting)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	31	16.00	496.00	5.196	0.001
	Positive ranks	0	.00	.00		
	Ties	3				
	Total	34				
TRIAL	Negative ranks	35	18.00	630.00	5.239	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table XXVIII described the comparison of participant's before (pre) and after (post) pain characteristics (tiring-exhausting) at within group analysis calculated z value are 5.196 (p=0.001) for control group and 5.239 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (tiring-exhausting) is statistically significant for tiring-exhausting in within group analysis.

13. Causing-Nausea – Result of McGill Questionnaire

Rank and test statistics of patient rated pain characteristics (causing-nausea) between trial and control group

Table XXIX: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (Causing-nausea)	Control	34	42.09	388.000	.004
	Trial	36	29.28		
	Total	70			

Table XXIX showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 42.09, compared to 29.28 for the trial. Calculated value of *U* is 388.000 for pain characteristics stabbing in McGill Pain Questionnaire and the p value is 0.004 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXX: Wilcoxon Signed Rank test

	McGill pain questionnaire (causing-nausea)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	27	14.00	378.00	4.972	0.001
	Positive ranks	0	.00	.00		
	Ties	7				
	Total	34				
TRIAL	Negative ranks	30	15.50	465.00	4.863	0.001
	Positive ranks	0	.00	.00		
	Ties	6				
	Total	36				

Table XXX described the comparison of participant's before (pre) and after (post) pain characteristics (causing-nausea) at within group analysis calculated z value are 4.972 (p=0.001) for control group and 4.863 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (causing-nausea) is statistically significant for causing-nausea in within group analysis.

14. **Fearful – Result of McGill questionnaire**

Rank and test statistics of patient rated pain characteristics (fearful) between trial and control group

Table XXXI: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (fearful)	Control	34	42.65	369.000	.001
	Trial	36	28.75		
	Total	70			

Table XXXI showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 42.65, compared to 28.75 for the trial. Calculated value of *U* is 369.000 for pain characteristics stabbing in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXXII: Wilcoxon Signed Rank test

	McGill pain questionnaire (fearful)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	29	15.62	453.00	4.804	0.001
	Positive ranks	1	12.00	12.00		
	Ties	4				
	Total	34				
TRIAL	Negative ranks	33	17.00	561.00	5.127	0.001
	Positive ranks	0	.00	.00		
	Ties	3				
	Total	36				

Table XXXII described the comparison of participant's before (pre) and after (post) pain characteristics (fearful) at within group analysis calculated z value are 4.804 (p=0.001) for control group and 5.127 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (fearful) is statistically significant for fearful in within group analysis.

15. **Punishing-Cruel – Result of McGill Questionnaire**

Rank and test statistics of patient rated pain characteristics (punishing-cruel) between trial and control group

Table XXXIII: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (punishing-cruel)	Control	34	44.09	320.000	.001
	Trial	36	27.39		
	Total	70			

Table XXXIII showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 44.09, compared to 27.39 for the trial. Calculated value of *U* is 320.000 for pain characteristics punishing-cruel in McGill Pain Questionnaire and the p value is 0.001 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial pain characteristics that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXXIV: Wilcoxon Signed Rank test

	McGill pain questionnaire (punishing-cruel)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	Negative ranks	32	16.50	528.00	5.144	0.001
	Positive ranks	0	.00	.00		
	Ties	2				
	Total	34				
TRIAL	Negative ranks	36	18.50	666.00	5.336	0.001
	Positive ranks	0	.00	.00		
	Ties	0				
	Total	36				

Table XXXIV described the comparison of participant's before (pre) and after (post) pain characteristics (punishing-cruel) at within group analysis calculated z value are 5.144 (p=0.001) for control group and 5.336 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of pain characteristics (punishing-cruel) is statistically significant for punishing-cruel in within group analysis.

Result of Present Pain Intensity (PPI)

Rank and test statistics of patient rated pain characteristics (PPI) between trial and control group

Table XXXV: Mann-Whitney U test

	Category of Participants	**N**	**Mean Rank**	**Mann-Whitney *U* Score**	**p**
McGill pain questionnaire (PPI)	Control	34	39.82	431.000	.028
	Trial	35	30.31		
	Total	69			

Table XXXV showed the mean ranking of the control and trial groups. The control group shows a higher mean rank of 39.82, compared to 30.31 for the trial. Calculated value of *U* is 431.000 for present pain intensity and the p value is 0.028 which is less than 0.05. So, the test is significant and we conclude that there is a significant difference between the distribution of ranking the control and trial present pain intensity that difference between trial group treatment (upper & mid-thoracic spine mobilization combined with conventional care) and control group treatment (usual care only) 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.

Table XXXVI: Wilcoxon Signed Rank test

	Present pain intensity (McGill Questionnaire)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on positive ranks Z	p
CONTROL	**Negative ranks**	34	17.50	495.00	5.138	0.001
	Positive ranks	0	.00	.00		
	Ties	0				
	Total	34				
TRIAL	**Negative ranks**	35	18.00	630.00	5.292	0.001
	Positive ranks	0	.00	.00		
	Ties	1				
	Total	36				

Table XXXVI described the comparison of participant's before (pre) and after (post) present pain intensity (McGill Questionnaire) at within group analysis calculated z value are 5.138 (p=0.001) for control group and 5.292 (p=0.001) for experimental group. Both the z score greater than the standard z value 1.96 at 5% level of significance. So, we reject the null hypothesis of equality of two phase at $\alpha = 0.05$ which means the reducing of present pain intensity (McGill Questionnaire) is statistically significant for present pain intensity in within group analysis.

CHAPTER-V: DISCUSSION

The study attempted to find out the effectiveness of upper & mid-thoracic spine mobilization along with conventional physiotherapy in reducing pain, disability and regaining ROM in patients with mechanical neck pain.

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. Henriques et al. (2016) 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 study was carried out on 27 male and 57 female subjects, age group between 20-55 years. The subjects were randomized into 2 groups i.e. Group A (upper & mid-thoracic spine mobilization along with conventional care) and Group B (Conventional care) with 79 patients in total. Group A had 15 males and 25 females, Group B had 12 males and 27 females. The mean age between the groups A and B was 38.53 and 42.54 respectively. 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.

Thus, it is likely that neck alignments seen in this population could be related to the mechanical cause of their work circumstances. However, this assumption lacks evidence since the patients' occupations were not crossed link with the pain intensity. In this study, the mean intensity of pain (± SD) was 8.78 (±1.16) at pre-test & 0.80

(±0.92) at post-test in trial group and 7.93 (±1.51) at pre-test & 1.32 (±1.05) at post-test in control group. So, it is obvious that the mean difference is higher in the trial group in comparison to the control group. Mechanical causes of the neck pain is very important variable to be considered not only in research process, but also in daily practice as it can influence decision making in the management options. It is difficult to find reasons why more females than males attended for physiotherapy treatment although similar trends regarding gender, age and attendance for treatment were found (Nordin, Leonard, & Thye, 2011).

According to the purpose of the mobilization, this study showed improvement of the ROM in both groups; however, there was a significant difference between the two groups in cervical spine extension. Previous studies also showed the increase of the range of motion by improving joint hypo-mobility and the adhesion between soft tissues when the joint mobilization technique was applied to patients with mechanical neck pain (Young, Walker, Snyder, & Daly, 2014). Particularly, it was reported that there were more improvements of movement limitation in patients with the most serious pain. In case of therapeutic exercise, stabilization exercise was conducted in the lower cervical spine and the mobility exercise was performed in the upper thoracic spine (Cho, Lee, & Lee, 2017). The stabilization exercise for the cervical spine was a low-intensity isometric exercise, and the mobility exercise for the thoracic spine was a high intensity exercise against gravity (Gross et al., 2016). Thus, better results were obtained in the thoracic spine owing to the difference in intensity despite performing both exercises at the same time. A previous study reported that, thoracic spine mobilization with continuous passive stimulus increased joint mobility and helped in improving the somatosensory system (Cho, Lee, & Lee, 2017). However, the reason why there was no interaction in the sitting position was because the curve of the

thoracic and lumbar spines consisted of slight flexion in a comfortable sitting position. Depending on the posture, the difference of spine alignment might be affected in the cervical spine (De Carvalho, Soave, Ross, & Callaghan, 2010).

In this study, participants in the trial and control group received 3 sessions per week and totaling 12 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 mechanical 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.

In the study both the groups showed a marked improvement in NDI, VAS, McGill pain and Goniometer scores. And there was a significant difference in the scores observed between the two groups. The study also showed a statistically significant improvement in intervention group in reducing pain, disability and increase in range of motion when compared with the scores of control group at a p value of <0.001 which gives an implication that the patients in the group that received upper & mid-thoracic spine mobilization along with conventional care had improved better than the group which received only conventional care.

This improvement possibly may be attributed to the fact that the improved ROM of the upper & mid-thoracic spine as well as flexibility of the surrounding muscles (Moezy, Sepehrifar, & Dodaran, 2014) could normalize any of these problems by separating the facet surfaces and releasing the entrapped facet joints or by allowing the entrapped meniscoid to return to its intra articular position, or perhaps by

stretching adhesions (Kumar, D., Sandhu, J. S., & Broota, A. (2011). The effectiveness of cervical spinal manipulation in reducing neck pain has been demonstrated in various studies (Bronfort et al., 2012).

The neurophysiologic mechanism by which spinal manipulative therapy is effective in reducing pain is not completely understood in many of the previous studies (Bialosky, Simon, Bishop, & George, 2012). One possible mechanism for improvement in the intervention group in the present study could be that the manipulative procedure may induce a reflex inhibition of pain or reflex muscle relaxation by modifying the discharge of proprioceptive group I and II afferents (Puntumetakul et al., 2015). A second possible mechanism for the improvement in the intervention group might be a presynaptic inhibition of segmental pain pathways and possibly activation of the endogenous opiate system (Martínez-Segura et al., 2012).

Upper & mid-thoracic spine mobilization re-enforced the conventional care that seems likely their underlying mechanism is either purely mechanical, reflexogenic or a combination of the two, and this mechanism can also be a possible reason for the improvement. Some studies have found that spinal manual procedures can activate descending inhibitory mechanisms resulting in hypo-algesic effects in adjacent areas (Vigotsky & Bruhns, 2015). It is suggested that upper & mid-thoracic spine mobilization along with conventional care may help to restore the normal biomechanics of this region potentially lowering the mechanical stress and improving the distribution of joint forces in the cervical spine (Izzo, Guarnieri, Guglielmi, & Muto, 2013).

It is also possible that the experienced symptomatic improvement after a manipulative procedure influence the range of motion improvement in the entire spine (Millan, M., Leboeuf-Yde, Budgell, Descarreaux, & Amorim, 2012).

Another study explored that upper thoracic muscles become dysfunctional in the presence of neck pain and demonstrated that there is reduction in the strength and endurance capabilities of cervical muscles in mechanical neck pain patients (Lau, Cheung, Chan, Lo, & Chiu, 2010).

Calixtre et al. (2019) stated that the upper and mid thoracic flexors contraction is important to stabilize the cervical spine by creating a tension over the cervical fascia. In turn this stabilizes the cervical spine and forms stable base for the movement and functional activities (Landry, Khoo, Wagner, Forton, & Jones, 2011). The current study was focused on generalized neck pain, mechanical in origin. Frank, Kobesova, and Kolar, (2013), stated that thoracic extensors are the key muscle for the stabilization of the cervical spine. There is a significant dysfunction of this muscle has also been implicated in mechanical neck pain patients. Gupta et al. (2013) stated that the anatomical interrelated action of the deep neck muscles are to support and stabilize the cervical. Upper & mid-thoracic spine mobilization might have altered the biomechanics of the joint there by equally distributing the forces and reducing the strain on the adjacent neck muscles and helped in relaxation of the muscles in reduction of pain disability and increased range of motion. As patients experienced pain relief, they were able to perform their day to day activities easily thereby, which reduced their disability.

The significant factor associated with reduction in both neck related disability and neck pain at both trial and control groups, was following the treatment protocol intensively. The hypothesis testing was very much definitive, and it would become an protocol along with usual type of exercise approach with evidence supported. This also suggests that baseline factors revealed as important as the intervention progressed.

And, the disability reduction with pain reduction compared to both groups was statistically significant in the between group analysis and within group analysis. The fact that, usual care was supposed to be non-pain provoking in the control group as much as trial group. The mean difference of disability reduction at were highest for the trial group with an compared to the control group, even though the reduction happened gradually. This may be due to the different approach encouraging participants despite any effect. It should be noted that to maximize the clinical applicability of the analyses in this thesis, only outcome measures which are possible for clinicians to implement in everyday practice were included. Therefore, it cannot be ruled out that there may be other factors, not measured in this study, associated with treatment outcome as well. This analysis also does not include other mediators (that identify possible mechanisms through which a treatment might achieve its effects) or moderators (for whom or under what conditions the treatment works). The effective interventions were both based on upper thoracic spine interventions and improvement in neck ROM may be a mediator. It was thus surprising that baseline neck ROM was strongly regained associated with other outcomes. To analyze the mean difference was not part of the scope of this thesis but has been analyzed elsewhere. Compared with participants in the control group, participants in the Trial groups exhibited greater gains in pain, ROM, Pain characteristics and neck disability index.

The results of this study corresponded with those of a previous research that shows the efficacy of manipulation and mobilization of the cervical and thoracic spine in patients with neck pain (Huisman, peksnijder, & de Wijer, 2013). Mobilization as treatment was conducted to improve the flexion of the upper cervical spine and to enhance the extension of the upper thoracic spine (Malo-Urriés et al., 2017).

Different studies found conventional physiotherapy as an effective treatment for patients with mechanical neck pain (Mahajan, Kataria, & Bansal, 2012). In contrast, few numbers of studies established upper & mid-thoracic spine mobilization combined with conventional care was an effective treatment to reduce pain and improve ROM among patients with mechanical neck pain (Muralidharan, Selvi, Kalaivani, Nandhakumar, & Sivakumar, 2018). The current study demonstrated that upper & mid-thoracic spine mobilization combined with conventional care showed significant effects on neck pain, ROM, McGill Pain Characteristics and NDI score. The exercise program was carried out for 12 sessions in both groups. However, upper & mid-thoracic spine mobilization combined with conventional 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, reduced pain characteristics and NDI scores but in most of the variables trial group outcomes were highly significant.

General pain was measured in the pre-test level and after completing of 12 sessions of treatment. However, general pain intensity between group was highly significant ($p=0.001$) . In addition, exercise significantly decreased pain in trail group ($p= 0.000$) and control group ($p = 0.001$). This means that upper & mid-thoracic spine mobilization combined with conventional 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, cervical spine mobilization 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 Driessen et al.,

(2011) 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 selected participants with age range of 20-40 years (Andersen et al., 2012) and in this study the participant's age range was 20-55 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 (Lindstroem, Graven-Nielsen, & Falla, 2012).

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 extension of range of motion among all the direction ($p>0.05$) in between group analysis. In another study, randomized control trial compared among active release technique (ART), joint mobilization (JM) and control group (did not receive any treatment) among patient with mechanical neck pain. The study found significant outcomes on dependent variables such as visual analog scale (VAS) and cervical ROM. However, the authors concluded with significant improvement in VAS and cervical ROM within and between group analyses. Joshi, Balthillaya, and Neelapala, (2019) found forward bending working posture caused increased high thoracic angles which were positively correlated with the presence of mechanical neck pain ($p < 0.05$).

One study by Jesus-Moraleida, Ferreira, Pereira, Vasconcelos and Ferreira (2011) suggested that mechanical neck pain patients showed significant ($p<0.01$) 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=.001), cervical extensor (p=0.001), cervical right side flexor (0.001), cervical left side flexor (p= 0.011), cervical right rotator (p= 0.001), cervical left rotator (p= 0.01) 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=0.001), cervical right rotator (p= 0.001) cervical left rotator (p= 0.001). There was variation of results in this study in compare with Salo and his colleagues study because they measured ROM with an electrical goniometer. However, one systematic review (Thoomes-de Graaf et al., 2016) evaluated clinometric methods to measure muscle functioning among patients with non-specific neck pain.

Based on the results of the study, disability has reduced significantly after application of upper & mid-thoracic spine mobilization combined with conventional care. In addition, only upper & mid-thoracic spine mobilization was also found effective. Between groups results in terms of neck disability index (NDI) showed significant (p=0.009) improvement of disability. 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). 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 problem in reading because in this function neck tends to bend forwardly which ultimately exaggerated pain and stretching posterior neck structures (O'Leary, Cagnie, Reeve, Jull, & Elliott, 2011). In addition, 21%

participants in the control group was housewife and 71% of them performed their household activities by forward bending of neck. Gupta, Aggarwal, Gupta, Gupta and Gupta, (2013) in their study found positive correlation between forward bending of neck and higher level of neck disability. Muñoz-García et al. (2016) did not find any correlation between headache and neck pain due to lower cervical dysfunction or derangement.

Participant's dropout rate was relatively minor. 9 participants 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 upper & mid-thoracic spine mobilization combined with conventional care on dependent variables in this study, there were some limitations. The main limitation was unable to develop a sampling frame or sampling pool to which the study lacks external validity. As samples were collected only from CRP- Savar, it could not represent the wider mechanical neck pain population and the study lacks in generalizability of results to wider population. In addition, the study was conducted with 79 patients of mechanical neck pain, which was a 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.

CHAPTER- VII: RECOMMENDATION AND CONCLUSION

Mechanical 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 mechanical pain, range of motion, pain characteristics and neck disability. However, the current study has proved that upper & mid-thoracic spine mobilization combined with conventional care was more effective than only usual care among patients with mechanical neck pain. In clinical practice, physiotherapists preferred to apply manual therapy, exercise therapy, electrotherapy and formal education program only regarding the cervical spine. But in the long run, there has been a chance of recurrence of neck symptoms if the muscles and spinal structure of the upper thoracic spine are not conditioned properly.

The outcome of this study would denote physiotherapists to imply upper & mid-thoracic spine mobilization for mechanical 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 upper & mid-thoracic spine mobilization combined with conventional care for mechanical neck pain patients. In the last decade of study, physiotherapists relied on traditional cervical spine mobilization exercise which lacks consistency of outcome as the objectivity solely based on the physiotherapists skills. In contrast, the techniques and procedures of upper & mid-thoracic spine mobilization encouraged involving patients actively as it can be progressed in accordance with patient's cervical structure. Mechanical 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.

Recommendation

Randomized control trial is recommended in future with more larger sample size. Since upper & mid-thoracic spine mobilization 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 mechanical neck pain.

BIBILOGRAPHY

Aicher, B., Peil, H., Peil, B., & Diener, H. C. (2012). Pain measurement: Visual Analogue Scale (VAS) and Verbal Rating Scale (VRS) in clinical trials with OTC analgesics in headache. *Cephalalgia, 32*(3), 185-197.

Akhter, S., Khan, M., Ali, S. S., & Soomro, R. R. (2014). Role of manual therapy with exercise regime versus exercise regime alone in the management of non-specific chronic neck pain. *Pakistan Journal of Pharmaceuticals Sciences, 27*(6 Suppl), 2125-8.

Akindele-Agbeja, O., Mbada, C. E., & Egwu, M. O. (2017). Does the inclusion of spinal manipulative therapy in multimodal treatment regimens result in better outcomes in chronic low back pain? A systematic review. *Proceedings of Singapore Healthcare, 26*(2), 114-120.

Alemanno, F., Houdayer, E., Emedoli, D., Locatelli, M., Mortini, P., Mandelli, C., ... & Iannaccone, S. (2019). Efficacy of virtual reality to reduce chronic low back pain: Proof-of-concept of a non-pharmacological approach on pain, quality of life, neuropsychological and functional outcome. *PloS one, 14*(5), e0216858.

Altug, F., Büker, N., Kavlak, E., Kitiş, A., & Cavlak, U. (2013). RELATIONSHIP BETWEEN DISABILITY, PAIN INTENSITY AND QUALITY OF LIFE IN PATIENTS WITH CHRONIC NECK PAIN. Romanian *Journal of Physical Therapy/Revista Romana de Kinetoterapie, 19*(31).

Anandkumar, S. (2015). The effect of sustained natural apophyseal glide (SNAG) combined with neurodynamics in the management of a patient with cervical radiculopathy: a case report. *Physiotherapy theory and practice, 31*(2), 140-145.

Andersen, C. H., Andersen, L. L., Gram, B., Pedersen, M. T., Mortensen, O. S., Zebis, M. K., & Sjøgaard, G. (2012). Influence of frequency and duration of strength training for effective management of neck and shoulder pain: a randomised controlled trial. *British journal of sports medicine*, *46*(14), 1004-1010.

Bialosky, J. E., Simon, C. B., Bishop, M. D., & George, S. Z. (2012). Basis for spinal manipulative therapy: a physical therapist perspective. *Journal of Electromyography and Kinesiology*, *22*(5), 643-647.

Blanpied, P. R., Gross, A. R., Elliott, J. M., Devaney, L. L., Clewley, D., Walton, D. M., ... & Torburn, L. (2017). Neck pain: revision 2017: clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy*, *47*(7), A1-A83.

Boyle, G. J., Boerresen, B. H., & Jang, D. M. (2015). Factor analyses of the McGill Pain Questionnaire (MPQ) in acute and chronic pain patients. *Psychological reports*, *116*(3), 797-820.

Brokelman, R. B., Haverkamp, D., van Loon, C., Hol, A., van Kampen, A., & Veth, R. (2012). The validation of the visual analogue scale for patient satisfaction after total hip arthroplasty. *European orthopaedics and traumatology*, *3*(2), 101-105.

Bronfort, G., Evans, R., Anderson, A. V., Svendsen, K. H., Bracha, Y., & Grimm, R. H. (2012). Spinal manipulation, medication, or home exercise with advice for acute and subacute neck pain: a randomized trial. *Annals of internal medicine*, *156*(1_Part_1), 1-10.

Brosseau, L., Wells, G. A., Tugwell, P., Casimiro, L., Novikov, M., Loew, L., ... & Cohoon, C. (2012). Ottawa panel evidence-based clinical practice guidelines on therapeutic massage for neck pain. *Journal of Bodywork and Movement Therapies, 16*(3), 300-325.

Burneikiene, S., Nelson, E. L., Mason, A., Rajpal, S., & Villavicencio, A. T. (2015). The duration of symptoms and clinical outcomes in patients undergoing anterior cervical discectomy and fusion for degenerative disc disease and radiculopathy. *The Spine Journal, 15*(3), 427-432.

Calixtre, L. B., Oliveira, A. B., de Sena Rosa, L. R., Armijo-Olivo, S., Visscher, C. M., & Alburquerque-Sendín, F. (2019). Effectiveness of mobilisation of the upper cervical region and craniocervical flexor training on orofacial pain, mandibular function and headache in women with TMD. A randomised, controlled trial. *Journal of oral rehabilitation, 46*(2), 109-119.

Carlesso, L. C., Gross, A. R., Santaguida, P. L., Burnie, S., Voth, S., & Sadi, J. (2010). Adverse events associated with the use of cervical manipulation and mobilization for the treatment of neck pain in adults: a systematic review. *Manual therapy, 15*(5), 434-444.

Carlesso, L. C., MacDermid, J. C., Gross, A. R., Walton, D. M., & Santaguida, P. L. (2014). Treatment preferences amongst physical therapists and chiropractors for the management of neck pain: results of an international survey. *Chiropractic & manual therapies, 22*(1), 11.

Centeno, C. J. (2020). Bone marrow concentrate (BMC) therapy in musculoskeletal disorders: Evidence-based policy position statement of American Society of Interventional Pain Physicians (ASIPP). *Pain Physician, 23*, E85-E131.

Chiarotto, A., Maxwell, L. J., Ostelo, R. W., Boers, M., Tugwell, P., & Terwee, C. B. (2019). Measurement properties of visual analogue scale, numeric rating scale, and pain severity subscale of the brief pain inventory in patients with low back pain: a systematic review. *The Journal of Pain*, *20*(3), 245-263.

Cho, J., Lee, E., & Lee, S. (2017). Upper thoracic spine mobilization and mobility exercise versus upper cervical spine mobilization and stabilization exercise in individuals with forward head posture: a randomized clinical trial. *BMC musculoskeletal disorders*, *18*(1), 1-10.

Chou, R., Qaseem, A., Owens, D. K., & Shekelle, P. (2011). Diagnostic imaging for low back pain: advice for high-value health care from the American College of Physicians. *Annals of internal medicine*, *154*(3), 181-189.

Cleland, J. A., Glynn, P., Whitman, J. M., Eberhart, S. L., MacDonald, C., & Childs, J. D. (2007). Short-term effects of thrust versus nonthrust mobilization/manipulation directed at the thoracic spine in patients with neck pain: a randomized clinical trial. *Physical therapy*, *87*(4), 431-440.

Cohen, S. P., & Hooten, W. M. (2017). Advances in the diagnosis and management of neck pain. *British medical journal*, *358*, j3221.

Collins, B. (2017). Results from a well-being survey in the North West of England: Inequalities in EQ-5D–derived quality-adjusted life expectancy are mainly driven by pain and mental health. *Value in Health*, *20*(1), 174-177.

Coulter, I. D., Crawford, C., Vernon, H., Hurwitz, E. L., Khorsan, R., Booth, M. S., & Herman, P. M. (2019). Manipulation and mobilization for treating chronic nonspecific neck pain: a systematic review and meta-analysis for an appropriateness panel. *Pain physician*, *22*(2), E55.

Cross, K. M., Kuenze, C., Grindstaff, T., & Hertel, J. (2011). Thoracic spine thrust manipulation improves pain, range of motion, and self-reported function in patients with mechanical neck pain: a systematic review. *Journal of orthopaedic & sports physical therapy*, *41*(9), 633-642.

Darivemula, S. B., Goswami, K., Gupta, S. K., Salve, H., Singh, U., & Goswami, A. K. (2016). Work-related neck pain among desk job workers of tertiary care hospital in New Delhi, India: Burden and determinants. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine, 41*(1), 50.

De Carvalho, D. E., Soave, D., Ross, K., & Callaghan, J. P. (2010). Lumbar spine and pelvic posture between standing and sitting: a radiologic investigation including reliability and repeatability of the lumbar lordosis measure. *Journal of Manipulative and Physiological Therapeutics, 33*(1), 48-55.

DePoy, E., & Gitlin, L. N. (2019). Introduction to Research E-Book: Understanding and Applying Multiple Strategies. Elsevier Health Sciences.

Dieleman, J. L., Baral, R., Birger, M., Bui, A. L., Bulchis, A., Chapin, A., ... & Murray, C. J. (2016). US spending on personal health care and public health, 1996-2013. *The Journal of the American Medical Association*, *316*(24), 2627-2646.

Driessen, M. T., Proper, K. I., Anema, J. R., Knol, D. L., Bongers, P. M., & van der Beek, A. J. (2011). The effectiveness of participatory ergonomics to prevent low-back and neck pain—results of a cluster randomized controlled trial. *Scandinavian journal of work, environment & health*, 383-393.

Dunning, J. R., Cleland, J. A., Waldrop, M. A., Arnot, C., Young, I., Turner, M., & Sigurdsson, G. (2012). Upper cervical and upper thoracic thrust manipulation versus nonthrust mobilization in patients with mechanical neck pain: a multicenter randomized clinical trial. *Journal of orthopaedic & sports physical therapy, 42*(1), 5-18.

Edmondston, S., Björnsdóttir, G., Pálsson, T., Solgård, H., Ussing, K., & Allison, G. (2011). Endurance and fatigue characteristics of the neck flexor and extensor muscles during isometric tests in patients with postural neck pain. *Manual therapy, 16*(4), 332-338.

Eguchi, Y., Enomoto, K., Sato, T., Watanabe, A., Sakai, T., Norimoto, M., ... & Ohtori, S. (2020). Simultaneous MR neurography and apparent T2 mapping of cervical nerve roots before microendoscopic surgery to treat patient with radiculopathy due to cervical disc herniation: preliminary results. *Journal of Clinical Neuroscience, 74*, 213-219.

Eubanks, J. D. (2010). Cervical radiculopathy: nonoperative management of neck pain and radicular symptoms. *American family physician, 81*(1), 33-40.

Evans, R., Bronfort, G., Schulz, C., Maiers, M., Bracha, Y., Svendsen, K., ... & Transfeldt, E. (2012). Supervised exercise with and without spinal manipulation performs similarly and better than home exercise for chronic neck pain: a randomized controlled trial. *Spine, 37*(11), 903-914.

Ferreira, M. L., Borges, B. M., Rezende, I. L., Carvalho, L. P., Soares, L. P., Dabes, R. A. I., ... & Ferreira, P. H. (2010). Are neck pain scales and questionnaires compatible with the international classification of functioning, disability and health? A systematic review. *Disability and rehabilitation, 32*(19), 1539-1546.

Ferreira-Valente, M. A., Pais-Ribeiro, J. L., & Jensen, M. P. (2011). Validity of four pain intensity rating scales. *Pain, 152*(10), 2399-2404.

Frank, C., Kobesova, A., & Kolar, P. (2013). Dynamic neuromuscular stabilization & sports rehabilitation. *International journal of sports physical therapy, 8*(1), 62.

Frutiger, M., Taylor, T., & Borotkanics, R. J. (2019). Self-reported Non-Specific Neck Pain (NSNP) is associated with presenteeism and biopsychosocial factors among office workers. *International Journal of Workplace Health Management.*

Fuller, N. (2018). Older patients with odontoid process and cervical spine fractures: evaluating clinical risk factors, clinical pathways and treatment to prevent further fracture.

Ganesh, G. S., Mohanty, P., Pattnaik, M., & Mishra, C. (2015). Effectiveness of mobilization therapy and exercises in mechanical neck pain. *Physiotherapy theory and practice, 31*(2), 99-106.

Gemmell, H., & Miller, P. (2010). Relative effectiveness and adverse effects of cervical manipulation, mobilisation and the activator instrument in patients with sub-acute non-specific neck pain: results from a stopped randomised trial. *Chiropractic & osteopathy, 18*(1), 20.

Gore, M., Sadosky, A., Stacey, B. R., Tai, K. S., & Leslie, D. (2012). The burden of chronic low back pain: clinical comorbidities, treatment patterns, and health care costs in usual care settings. *Spine, 37*(11), E668-E677.

Goršič, M., Cikajlo, I., & Novak, D. (2017). Competitive and cooperative arm rehabilitation games played by a patient and unimpaired person: effects on motivation and exercise intensity. *Journal of neuroengineering and rehabilitation, 14*(1), 1-18.

Groeneweg, R., Kropman, H., Leopold, H., van Assen, L., Mulder, J., van Tulder, M. W., & Oostendorp, R. A. (2010). The effectiveness and cost-evaluation of manual therapy and physical therapy in patients with sub-acute and chronic non specific neck pain. Rationale and design of a Randomized Controlled Trial (RCT). *BMC musculoskeletal disorders, 11*(1), 14.

Gross, A. R., Paquin, J. P., Dupont, G., Blanchette, S., Lalonde, P., Cristie, T., ... & Cervical Overview Group. (2016). Exercises for mechanical neck disorders: A Cochrane review update. *Manual therapy, 24*, 25-45.

Gross, A., Miller, J., D'Sylva, J., Burnie, S. J., Goldsmith, C. H., Graham, N., ... & Hoving, J. L. (2010). Manipulation or mobilisation for neck pain: a Cochrane Review. *Manual therapy, 15*(4), 315-333.

Gupta, B. D., Aggarwal, S., Gupta, B., Gupta, M., & Gupta, N. (2013). Effect of deep cervical flexor training vs. conventional isometric training on forward head posture, pain, neck disability index in dentists suffering from chronic neck pain. *Journal of clinical and diagnostic research: JCDR, 7*(10), 2261.

Haik, M. N., Alburquerque-Sendín, F., Moreira, R. F. C., Pires, E. D., & Camargo, P. R. (2016). Effectiveness of physical therapy treatment of clearly defined subacromial pain: a systematic review of randomised controlled trials. *British journal of sports medicine, 50*(18), 1124-1134.

Hakimi, K., & Spanier, D. (2013). Electrodiagnosis of cervical radiculopathy. *Physical Medicine and Rehabilitation Clinics, 24*(1), 1-12.

Haldeman, S., Carroll, L., & Cassidy, J. D. (2010). Findings from the bone and joint decade 2000 to 2010 task force on neck pain and its associated disorders. *Journal of occupational and environmental medicine, 52*(4), 424-427.

Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain: Visual analog scale for pain (vas pain), numeric rating scale for pain (nrs pain), mcgill pain questionnaire (mpq), short-form mcgill pain questionnaire (sf-mpq), chronic pain grade scale (cpgs), short form-36 bodily pain scale (sf-36 bps), and measure of intermittent and constant osteoarthritis pain (icoap). *Arthritis care & research*, 63(S11), S240-S252.

Henriques, J. P., Hoebers, L. P., Råmunddal, T., Laanmets, P., Eriksen, E., Bax, M., ... & EXPLORE Trial Investigators. (2016). Percutaneous intervention for concurrent chronic total occlusions in patients with STEMI: the EXPLORE trial. *Journal of the American College of Cardiology*, *68*(15), 1622-1632.

Howell, E. R. (2011). The association between neck pain, the Neck Disability Index and cervical ranges of motion: a narrative review. *The Journal of the Canadian Chiropractic Association*, *55*(3), 211.

Hoy, D. G., Protani, M., De, R., & Buchbinder, R. (2010). The epidemiology of neck pain. *Best Practice & Research Clinical Rheumatology*, *24*(6), 783-792.

Huisman, P. A., Speksnijder, C. M., & de Wijer, A. (2013). The effect of thoracic spine manipulation on pain and disability in patients with non-specific neck pain: a systematic review. *Disability and rehabilitation*, *35*(20), 1677-1685.

Izzo, R., Guarnieri, G., Guglielmi, G., & Muto, M. (2013). Biomechanics of the spine. Part I: spinal stability. *European journal of radiology*, *82*(1), 118-126.

Jamison, R. N., & Edwards, R. R. (2012). Integrating pain management in clinical practice. *Journal of clinical psychology in medical settings*, *19*(1), 49-64.

Jesus-Moraleida, F. R., Ferreira, P. H., Pereira, L. S., Vasconcelos, C. M., & Ferreira, M. L. (2011). Ultrasonographic analysis of the neck flexor muscles in patients with chronic neck pain and changes after cervical spine mobilization. *Journal of manipulative and physiological therapeutics*, *34*(8), 514-524.

Joshi, S., Balthillaya, G., & Neelapala, Y. R. (2019). Thoracic posture and mobility in mechanical neck pain population: A review of the literature. *Asian Spine Journal, 13*(5), 849.

Joslin, L. E., Davis, C. R., Dolan, P., & Clark, E. M. (2014). Quality of life and neck pain in nurses. *International journal of occupational medicine and environmental health, 27*(2), 236-242.

Juul, T., Søgaard, K., Davis, A. M., & Roos, E. M. (2016). Psychometric properties of the Neck OutcOme Score, Neck Disability Index, and Short Form–36 were evaluated in patients with neck pain. *Journal of clinical epidemiology, 79*, 31-40.

Kanlayanaphotporn, R., Chiradejnant, A., & Vachalathiti, R. (2010). Immediate effects of the central posteroanterior mobilization technique on pain and range of motion in patients with mechanical neck pain. *Disability and rehabilitation, 32*(8), 622-628.

Katz, J., & Melzack, R. (2011). The McGill Pain Questionnaire: Development, psychometric properties, and usefulness of the long form, short form, and short form-2.

Kennedy, J., Roll, J. M., Schraudner, T., Murphy, S., & McPherson, S. (2014). Prevalence of persistent pain in the US adult population: new data from the 2010 national health interview survey. *The Journal of Pain, 15*(10), 979-984.

Kolberg, C., Horst, A., Kolberg, A., Belló-Klein, A., & Partata, W. A. (2010). Effects of high-velocity, low-amplitude manipulation on catalase activity in men with neck pain. *Journal of manipulative and physiological therapeutics, 33*(4), 300-307.

Kumar, D., Sandhu, J. S., & Broota, A. (2011). Efficacy of Mulligan Concept (NAGs) on Pain at available end range in Cervical Spine: A Randomised Controlled Trial. *Indian Journal of Physiotherapy & Occupational Therapy, 5*(1).

La Touche, R., París-Alemany, A., Mannheimer, J. S., Angulo-Díaz-Parreño, S., Bishop, M. D., Lopéz-Valverde-Centeno, A., ... & Fernández-Carnero, J. (2013). Does mobilization of the upper cervical spine affect pain sensitivity and autonomic nervous system function in patients with cervico-craniofacial pain?: a randomized-controlled trial. *The Clinical journal of pain*, *29*(3), 205-215.

Landry, M. E., Khoo, L. T., Wagner, E. J., Forton, C. R., & Jones, R. J. (2011). U.S. Patent No. 8,034,084. Washington, DC: U.S. Patent and Trademark Office.

Lau, H. M. C., Chiu, T. T. W., & Lam, T. H. (2011). The effectiveness of thoracic manipulation on patients with chronic mechanical neck pain–a randomized controlled trial. *Manual therapy*, *16*(2), 141-147.

Lau, K. T., Cheung, K. Y., Chan, M. H., Lo, K. Y., & Chiu, T. T. W. (2010). Relationships between sagittal postures of thoracic and cervical spine, presence of neck pain, neck pain severity and disability. *Manual therapy*, *15*(5), 457-462.

Lilje, S., Friberg, H., Wykman, A., & Skillgate, E. (2010). Naprapathic manual therapy or conventional orthopedic care for outpatients on orthopedic waiting lists?: A pragmatic randomized controlled trial. *The Clinical journal of pain, 26*(7), 602-610.

Lin, J. H., Shen, T., Chung, R. C. K., & Chiu, T. T. W. (2013). The effectiveness of Long's manipulation on patients with chronic mechanical neck pain: a randomized controlled trial. *Manual therapy, 18*(4), 308-315.

Linder, A., Olsén, S., Eriksson, J., Svensson, M. Y., & Carlsson, A. (2012). Influence of gender, height, weight, age, seated position and collision site related to neck pain symptoms in rear end impacts. In Proceedings: IRCOBI Conference (pp. 12-14).

Lindstroem, R., Graven-Nielsen, T., & Falla, D. (2012). Current pain and fear of pain contribute to reduced maximum voluntary contraction of neck muscles in patients with chronic neck pain. *Archives of physical medicine and rehabilitation, 93*(11), 2042-2048.

Llamas-Ramos, R., Pecos-Martín, D., Gallego-Izquierdo, T., Llamas-Ramos, I., Plaza-Manzano, G., Ortega-Santiago, R., ... & Fernandez-De-Las-Penas, C. (2014). Comparison of the short-term outcomes between trigger point dry needling and trigger point manual therapy for the management of chronic mechanical neck pain: a randomized clinical trial. *Journal of orthopaedic & sports physical therapy, 44*(11), 852-861.

Louw, S., Makwela, S., Manas, L., Meyer, L., Terblanche, D., & Brink, Y. (2017). Effectiveness of exercise in office workers with neck pain: A systematic review and meta-analysis. *The South African journal of physiotherapy, 73*(1).

Mahajan, R., Kataria, C., & Bansal, K. (2012). Comparative effectiveness of muscle energy technique and static stretching for treatment of subacute mechanical neck pain. *International Journal of Health Rehabilitation Sciences, 1*(1), 16-21.

Malo-Urriés, M., Tricás-Moreno, J. M., Estébanez-de-Miguel, E., Hidalgo-García, C., Carrasco-Uribarren, A., & Cabanillas-Barea, S. (2017). Immediate effects of upper cervical Translatoric mobilization on cervical mobility and pressure pain threshold in patients with Cervicogenic headache: a randomized controlled trial. *Journal of Manipulative and Physiological Therapeutics, 40*(9), 649-658.

Martínez-Segura, R., De-la-Llave-Rincón, A. I., Ortega-Santiago, R., Cleland, J. A., & Fernandez-De-Las-Penas, C. (2012). Immediate changes in widespread pressure pain sensitivity, neck pain, and cervical range of motion after cervical or thoracic thrust manipulation in patients with bilateral chronic mechanical neck pain: a randomized clinical trial. *Journal of orthopaedic & sports physical therapy, 42*(9), 806-814.

Masaracchio, M., Cleland, J., Hellman, M., & Hagins, M. (2013). Short-term combined effects of thoracic spine thrust manipulation and cervical spine nonthrust manipulation in individuals with mechanical neck pain: a randomized clinical trial. *Journal of orthopaedic & sports physical therapy, 43*(3), 118-127.

Masum, S. B., Haqe, M., Haque, M., & Islam, M. S. (2014). Prevalence of neck pain and associated factors among office workers. *The American Journals of Innovative Research and Applied Sciences, 1*, 4.

May, A. M., Struijk, E. A., Fransen, H. P., Onland-Moret, N. C., de Wit, G. A., Boer, J. M., ... & Beulens, J. W. (2015). The impact of a healthy lifestyle on Disability-Adjusted Life Years: a prospective cohort study. BMC medicine, 13(1), 39.

McLean, S. M., Moffett, J. A. K., Sharp, D. M., & Gardiner, E. (2013). A randomised controlled trial comparing graded exercise treatment and usual physiotherapy for patients with non-specific neck pain (the GET UP neck pain trial). *Manual therapy, 18(*3), 199-205.

Millan, M., Leboeuf-Yde, C., Budgell, B., Descarreaux, M., & Amorim, M. A. (2012). The effect of spinal manipulative therapy on spinal range of motion: a systematic literature review. *Chiropractic & manual therapies, 20*(1), 23.

Milosavljevic, S., Bagheri, N., Vasiljev, R. M., Mcbride, D. I., & Rehn, B. (2012). Does daily exposure to whole-body vibration and mechanical shock relate to the prevalence of low back and neck pain in a rural workforce?. *Annals of occupational hygiene*, *56*(1), 10-17.

Mintken, P. E., McDevitt, A. W., Cleland, J. A., Boyles, R. E., Beardslee, A. R., Burns, S. A., ... & Michener, L. A. (2016). Cervicothoracic manual therapy plus exercise therapy versus exercise therapy alone in the management of individuals with shoulder pain: a multicenter randomized controlled trial. *Journal of orthopaedic & sports physical therapy*, *46*(8), 617-628.

Misailidou, V., Malliou, P., Beneka, A., Karagiannidis, A., & Godolias, G. (2010). Assessment of patients with neck pain: a review of definitions, selection criteria, and measurement tools. *Journal of chiropractic medicine*, *9*(2), 49-59.

Moezy, A., Sepehrifar, S., & Dodaran, M. S. (2014). The effects of scapular stabilization based exercise therapy on pain, posture, flexibility and shoulder mobility in patients with shoulder impingement syndrome: a controlled randomized clinical trial. *Medical journal of the Islamic Republic of Iran*, *28*, 87.

Mokdad, A. H., Ballestros, K., Echko, M., Glenn, S., Olsen, H. E., Mullany, E., ... & Kasaeian, A. (2018). The state of US health, 1990-2016: burden of diseases, injuries, and risk factors among US states. *The Journal of the American Medical Association*, *319*(14), 1444-1472.

Mulimani, P., Hoe, V. C., Hayes, M. J., Idiculla, J. J., Abas, A. B., & Karanth, L. (2018). Ergonomic interventions for preventing musculoskeletal disorders in dental care practitioners. *Cochrane Database of Systematic Reviews*, (10).

Muñoz-García, D., Gil-Martínez, A., López-López, A., Lopez-de-Uralde-Villanueva, I., La Touche, R., & Fernández-Carnero, J. (2016). Chronic neck pain and cervico-craniofacial pain patients express similar levels of neck pain-related disability, pain catastrophizing, and cervical range of motion. *Pain research and treatment*, 2016.

Muralidharan, C. K., Selvi, P., Kalaivani, T., Nandhakumar, R., & Sivakumar, C. (2018). The effectiveness of thoracic manipulation combined with conventional therapy for mechanical neck pain. *International Journal of Research in Pharmaceutical Sciences*, *9*(4), 1524-1532.

Murray, M., Lange, B., Nørnberg, B. R., Søgaard, K., & Sjøgaard, G. (2017). Self-administered physical exercise training as treatment of neck and shoulder pain among military helicopter pilots and crew: a randomized controlled trial. *BMC musculoskeletal disorders*, *18*(1), 147.

Neziri, A. Y., Haesler, S., Petersen-Felix, S., Müller, M., Arendt-Nielsen, L., Manresa, J. B., ... & Curatolo, M. (2010). Generalized expansion of nociceptive reflex receptive fields in chronic pain patients. *PAIN®*, *151*(3), 798-805.

Nordin, N. A. M., Leonard, J. H., & Thye, N. C. (2011). Work-related injuries among physiotherapists in public hospitals: a Southeast Asian picture. *Clinics*, *66*(3), 373-378.

Nussbaumer, S., Leunig, M., Glatthorn, J. F., Stauffacher, S., Gerber, H., & Maffiuletti, N. A. (2010). Validity and test-retest reliability of manual goniometers for measuring passive hip range of motion in femoroacetabular impingement patients. *BMC musculoskeletal disorders*, *11*(1), 194.

O'Leary, S., Cagnie, B., Reeve, A., Jull, G., & Elliott, J. M. (2011). Is there altered activity of the extensor muscles in chronic mechanical neck pain? A functional magnetic resonance imaging study. *Archives of physical medicine and rehabilitation, 92*(6), 929-934.

Parazza, S., Vanti, C., O'Reilly, C., Villafañe, J. H., Moreno, J. M. T., & De Miguel, E. E. (2014). The relationship between cervical flexor endurance, cervical extensor endurance, VAS, and disability in subjects with neck pain. *Chiropractic & manual therapies, 22*(1), 10.

Pradhan, N. H. (2013). Characteristics of neck pain among the patients attended at musculoskeletal unit, CRP (Doctoral dissertation).

Psaltis, A. J., Li, G., Vaezeafshar, R., Cho, K. S., & Hwang, P. H. (2014). Modification of the Lund-Kennedy endoscopic scoring system improves its reliability and correlation with patient-reported outcome measures. *The Laryngoscope, 124*(10), 2216-2223.

Puntumetakul, R., Suvarnnato, T., Werasirirat, P., Uthaikhup, S., Yamauchi, J., & Boucaut, R. (2015). Acute effects of single and multiple level thoracic manipulations on chronic mechanical neck pain: a randomized controlled trial. *Neuropsychiatric disease and treatment, 11*, 137.

Quek, J., Brauer, S. G., Treleaven, J., Pua, Y. H., Mentiplay, B., & Clark, R. A. (2014). Validity and intra-rater reliability of an Android phone application to measure cervical range-of-motion. *Journal of neuroengineering and rehabilitation, 11*(1), 1-6.

Radhakrishnan, R., Senthil, P., Rathnamala, D., & Gandhi, P. S. (2015). Effectiveness of global posture re-education on pain and improving quality of life in women with chronic neck pain. *International Journal Physical Education Sports Health, 1*, 7-9.

Rahman, M. H. (2017). Cranio-Cervical Exercise Combined with Usual Care: An Effective Physiotherapy Treatment to Minimize Pain and Increase Range of Motion among Patients with Chronic Neck Pain. *EC Orthopaedics*, *8*, 37-45.

Rahmani, N., Amiri, M., Ali Mohseni-Bandpei, M., Mohsenifar, H., & Pourahmadi, M. R. (2013). Work related neck pain in Iranian dentists: an epidemiological study. *Journal of back and musculoskeletal rehabilitation*, *26*(1), 9-15.

Rai, S. C., Ajith, S., Bhagavan, K. R., & Pinto, D. (2013). Cervical traction reduces pain and disability in patients with unilateral cervical radiculopathy. *International Journal of Current Research and Review*, *5*(7), 33.

Reid, S. A., Rivett, D. A., Katekar, M. G., & Callister, R. (2014). Comparison of mulligan sustained natural apophyseal glides and maitland mobilizations for treatment of cervicogenic dizziness: a randomized controlled trial. *Physical therapy*, *94*(4), 466-476.

Rhinehart, A., & Buonopane, M. (2016). Use of the Mulligan Concept and Positional Release Therapy in the Treatment of a Moderate Grade Acromioclavicular Injury: A Case Review. *Athletic Training and Sports Health Care*, *8*(2), 82-88.

Salamh, P. A., & Kolber, M. (2014). The reliability, minimal detectable change and concurrent validity of a gravity-based bubble inclinometer and iphone application for measuring standing lumbar lordosis. *Physiotherapy theory and practice*, *30*(1), 62-67.

Salom-Moreno, J., Ortega-Santiago, R., Cleland, J. A., Palacios-Ceña, M., Truyols-Domínguez, S., & Fernández-de-las-Peñas, C. (2014). Immediate changes in neck pain intensity and widespread pressure pain sensitivity in patients with bilateral chronic mechanical neck pain: a randomized controlled trial of thoracic thrust manipulation vs non–thrust mobilization. *Journal of manipulative and physiological therapeutics*, *37*(5), 312-319.

Schellingerhout, J. M., Verhagen, A. P., Heymans, M. W., Koes, B. W., Henrica, C., & Terwee, C. B. (2012). Measurement properties of disease-specific questionnaires in patients with neck pain: a systematic review. *Quality of Life Research*, *21*(4), 659-670.

Schroeder, J., Kaplan, L., Fischer, D. J., & Skelly, A. C. (2013). The outcomes of manipulation or mobilization therapy compared with physical therapy or exercise for neck pain: a systematic review. *Evidence-based spine-care journal*, *4*(1), 30.

Senarath, M. K. I. D., Rajeev, P. R., Ranathunga, R. M. R. U., Rasenthiram, A., Senavirathna, S. A. D. C. S., Senavirathna, D. N. K. M., ... & Rajarathne, A. A. J. (2014). Prevalence of Neck Pain Among Female Sewing Workers Due to bad Posture in Garment Factories of Kurunegala.

Silva, A. G., & Cruz, A. L. (2013). Standing balance in patients with whiplash-associated neck pain and idiopathic neck pain when compared with asymptomatic participants: a systematic review. *Physiotherapy theory and practice*, *29*(1), 1-18.

Silva, P. V., Costa, L. O. P., Maher, C. G., Kamper, S. J., & Costa, L. D. C. M. (2019). The new agenda for neck pain research: a modified Delphi study. *Journal of orthopaedic & sports physical therapy*, *49*(9), 666-674.

Smania, N., Picelli, A., Munari, D., Geroin, C., Ianes, P., Waldner, A., & Gandolfi, M. (2010). Rehabilitation procedures in the management of spasticity. *European Journal of Physical Rehabilitation Medicines*, *46*(3), 423-38.

Snodgrass, S. J., Rivett, D. A., Sterling, M., & Vicenzino, B. (2014). Dose optimization for spinal treatment effectiveness: a randomized controlled trial investigating the effects of high and low mobilization forces in patients with neck pain. *Journal of orthopaedic & sports physical therapy*, *44*(3), 141-152.

Srivastava, S., KU, D. K., Mittal, H., Dixit, S., & Nair, A. (2020). Short-term effect of muscle energy technique and mechanical diagnosis and therapy in sacroiliac joint dysfunction:-A pilot randomized clinical trial. *Journal of Bodywork and Movement Therapies.*

Sung, W., Hicks, G. E., Ebaugh, D., Smith, S. S., Stackhouse, S., Wattananon, P., & Silfies, S. P. (2019). Individuals with and without low back pain use different motor control strategies to achieve spinal stiffness during the prone instability test. *Journal of orthopaedic & sports physical therapy*, *49*(12), 899-907.

Suvarnnato, T., Puntumetakul, R., Kaber, D., Boucaut, R., Boonphakob, Y., Arayawichanon, P., & Chatchawan, U. (2013). The effects of thoracic manipulation versus mobilization for chronic neck pain: a randomized controlled trial pilot study. *Journal of physical therapy science*, *25*(7), 865-871.

Takagi, I., Eliyas, J. K., & Stadlan, N. (2011). Cervical spondylosis: an update on pathophysiology, clinical manifestation, and management strategies. *Disease-a-Month*, *57*(10), 583-591.

Thoomes-de Graaf, M., Scholten-Peeters, G. G. M., Schellingerhout, J. M., Bourne, A. M., Buchbinder, R., Koehorst, M., ... & Verhagen, A. P. (2016). Evaluation of measurement properties of self-administered PROMs aimed at patients with non-specific shoulder pain and “activity limitations”: a systematic review. *Quality of Life Research*, *25*(9), 2141-2160.

Todd, A. G. (2011). Cervical spine: degenerative conditions. *Current reviews in musculoskeletal medicine*, *4*(4), 168.

Uddin, Z., MacDermid, J. C., Woodhouse, L. J., Triano, J. J., Galea, V., & Gross, A. R. (2014). The effect of pressure pain sensitivity and patient factors on self-reported pain-disability in patients with chronic neck pain. *The open orthopaedics journal, 8*, 302.

Umar, A., Kashif, M., Zahid, N., Sohail, R., Arsh, A., Raqib, A., & Zada, P. (2019). The prevalence of musculoskeletal disorders and work-station evaluation in bank employees. *Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin, 29(*02), 99-103.

Vigotsky, A. D., & Bruhns, R. P. (2015). The role of descending modulation in manual therapy and its analgesic implications: a narrative review. *Pain research and treatment*, 2015.

Vincent, K., Maigne, J. Y., Fischhoff, C., Lanlo, O., & Dagenais, S. (2013). Systematic review of manual therapies for nonspecific neck pain. *Joint Bone Spine, 80*(5), 508-515.

Vos, T., Allen, C., Arora, M., Barber, R. M., Bhutta, Z. A., Brown, A., ... & Coggeshall, M. (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet, 388(10053), 1545-1602.

Vos, T., Flaxman, A. D., Naghavi, M., Lozano, R., Michaud, C., Ezzati, M., ... & Abraham, J. (2012). Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet, 380*(9859), 2163-2196.

Weerasekara, R. M. I. M., & Madhurangani, I. (2019). Characteristics of chronic ankle instability and the role of joint mobilisation.

Westergren, H., Larsson, J., Freeman, M., Carlsson, A., Jöud, A., & Malmström, E. M. (2018). Sex-based differences in pain distribution in a cohort of patients with persistent post-traumatic neck pain. *Disability and rehabilitation, 40*(9), 1085-1091.

Woods, B. I., & Hilibrand, A. S. (2015). Cervical radiculopathy. *Journal of Spinal Disorders and Techniques, 28*(5), E251-E259.

Young, I. A., Cleland, J. A., Michener, L. A., & Brown, C. (2010). Reliability, construct validity, and responsiveness of the neck disability index, patient-specific functional scale, and numeric pain rating scale in patients with cervical radiculopathy. *American journal of physical medicine & rehabilitation, 89*(10), 831-839.

Young, I. A., Dunning, J., Butts, R., Mourad, F., & Cleland, J. A. (2019). Reliability, construct validity, and responsiveness of the neck disability index and numeric pain rating scale in patients with mechanical neck pain without upper extremity symptoms. *Physiotherapy Theory and Practice*, *35*(12), 1328-1335.

Young, J. L., Walker, D., Snyder, S., & Daly, K. (2014). Thoracic manipulation versus mobilization in patients with mechanical neck pain: a systematic review. *Journal of Manual & Manipulative Therapy*, *22*(3), 141-153.

APPENDIX - A

Verbal consent form

Assalamu-aalaikum/ Greetings!

I am Md. Nazmul Hassan, Part-II M.Sc. in Physiotherapy student of Bangladesh Health Professions Institute (BHPI) under Medicine faculty of University of Dhaka. To participate in the Part-II final exam, I have to conduct an academic 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 Upper and Mid Thoracic Spine Mobilization in Individuals with Mechanical Neck Pain: A Randomized Clinical Trial". Through this study, I will try to explore the effect of upper and mid thoracic spine mobilization on neck pain, 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 from mechanical neck pain patients. Therefore, you could be one of my valuable subjects for this study and I would like to request you as a subject of my study. I want to meet with you a couple of sessions at the time of your physiotherapy appointment. The interventions 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 am committed that the study will not pose any harm or risk to you. You have the absolute right to withdraw or discontinue at any time without any hesitation or risk. I will keep all the information confidential which I obtained from you and personal identification of the participant would not be published anywhere.

If you have any query about the study, you may contact with me and/or my thesis supervisor Mohammad Anwar Hossain, Associate Professor, BHPI and head of the physiotherapy department, CRP, Savar, Dhaka.
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 the witness &
Date……..
Signature of data collector &
Date……..
Signature of the researcher &
Date……..

সম্মতিপত্র

আসসালামু-আলাইকুম/ শুভেচ্ছা নিবেন, আমি মো: নাজমুল হাসান, ২য় বর্ষ ঢাকা বিশ্ববিদ্যালয়ের মেডিসিন অনুষদের অধীনে বাংলাদেশ হেল্‌থ প্রফেশন ইনস্টিটিউট (বিএইচপিআই) এর এম.এস.সি. ইন ফিজিওথেরাপি বিভাগ 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 গবেষণায় অংশগ্রহনের জন্য অনুরোধ করা হলো:

আমার গবেষণার শিরোনাম " **মেকানিক্যালি ঘাড়ে ব্যথার রোগীদের জন্য প্রচলিত চিকিৎসার পাশাপাশি আপার এবং মিড থোরাসিক স্পাইন মবিলাইজেশন এর কার্যকারিতা : একটি রেন্ডমাইজড ক্লিনিকাল ট্রায়াল** "। এই গবেষণার মাধ্যমে আমি ঘাড়ে ব্যথার রোগীদের ব্যথা, ব্যথা জনিত ঘাড়ের গতি সীমাবদ্ধতা এবং ব্যথা জনিত প্রতিবন্ধিতার জন্য প্রচলিত চিকিৎসার পাশাপাশি আপার এবং মিড থোরাসিক স্পাইন মবিলাইজেশন এর কার্যকারিতা খুঁজে বের করার চেষ্টা করবো।যদি আমার গবেষণাটি সফলভাবে সম্পূর্ণ করতে পারি তবে ঘাড়ে ব্যথার রোগীদের জন্য প্রচলিত চিকিৎসার পাশাপাশি আপার এবং মিড থোরাসিক স্পাইন মবিলাইজেশন এর কার্যকারিতা উন্মোচিত হবে এবং এটি হবে একটি পরীক্ষামূলক প্রমাণ।

আমার গবেষণা প্রকল্প বাস্তবায়ন করার জন্য, মেকানিক্যালি ঘাড়ে ব্যথার রোগীদের কাছ থেকে তথ্য সংগ্রহ করা প্রয়োজন। আমার গবেষণায় অংশগ্রহণে আপনার কোন ক্ষতি বা বিপদ হবে না। আপনি যে কোনো সময় নিজেকে এ গবেষণা থেকে প্রত্যাহার করতে পারেন। এই গবেষণায় প্রাপ্ত তথ্য সম্পূর্ণভাবে গোপনীয় থাকবে এবং অংশগ্রহণকারীর ব্যক্তিগত তথ্য অনুমতি ব্যতিরেকে অন্য কোথাও প্রকাশ করা হবে না।

এই গবেষণা সম্পর্কে যদি আপনার কোনো জিজ্ঞাসা থাকে তবে আপনি অনুগ্রহপূবক যোগাযোগ করতে পারেন গবেষক মোঃ নাজমুল হাসান অথবা গবেষণার সুপারভাইজার মোঃ আনোয়ার হোসেন, সহযোগী অধ্যাপক, ফিজিওথেরাপি বিভাগ (বিএইচপিআই) এবং বিভাগীয় প্রধান, ফিজিওথেরাপি বিভাগ, সিআরপি, সাভার, ঢাকা-১৩৪৩ এর সাথে।

শুরু করার আগে আপনার কোন প্রশ্ন আছে কি?

আমি কি শুরু করতে পারি ? ☐ হ্যা ☐ না

অংশগ্রহণকারী (স্বাক্ষর ও তারিখ) .....

ফিজিওথেরাপিস্ট/ সাক্ষী (স্বাক্ষর ও তারিখ) .....

তথ্য সংগ্রহকারী (স্বাক্ষর ও তারিখ) .....

গবেষক (স্বাক্ষর ও তারিখ) .....

APPENDIX - B

Effectiveness of Upper and Mid Thoracic Spine Mobilization in Individuals with Mechanical Neck Pain: A Randomized Clinical Trial

Part: 1- Personal details: **CRP ID:**

1.1 Patients name:

1.2 Age:

1.3 Sex: 1. Male 2. Female

1.4 Height:

1.5 Weight:

1.6 Address: Village: Post office:

Thana: District:

Part: 2-Socio-demographic information

2.1 Occupation:

1. Farmer 2. Day labor 3.Service holder 4. Garments worker
5. Driver 6. Rikshawola 7.Businessman 8. Unemployment
9. Housewife 10.Teacher 11.Student 12.Others

2.2 Marital status:

1. Married 2. Unmarried 3.Window 4. Divorce

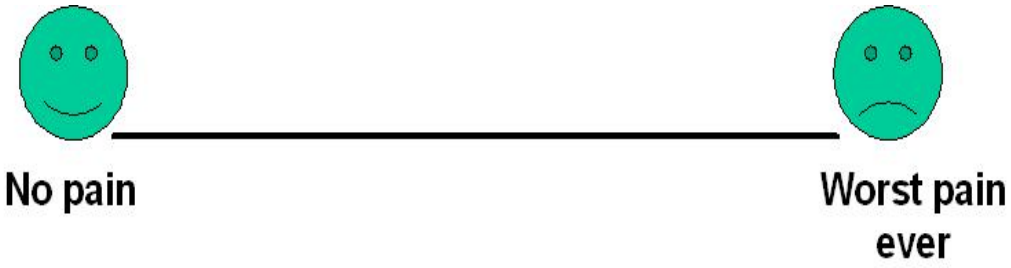
2.3 Educational status:

1. Illiterate 2.Primary 3.Secondary
4. HSC passed 5. Graduate & Masters

2.4 Monthly income:

অধ্যায়ঃ ৩- ভিজুয়্যাল অ্যানালগ স্কেল (VAS)

- আপনার ব্যাথার তীব্রতা কতটুকু?



Visual analogue scale (VAS)

Instruct the patient to point to the position on the line between the faces to indicate how much pain they are currently feeling. The far left end indicates "no pain" and the far right end indicates "worst pain ever."

অধ্যায়ঃ ৪- ঘাড়ের অস্থি-সন্ধির মুভমেন্ট পরিমাপ

	Passive ROM measured in Degree by Goniometer	Reference Value in degree
Flexion		50
Extension		60
Side bending (Right)		45
Side bending (Left)		45
Rotation (Right)		80
Rotation (Left)		80

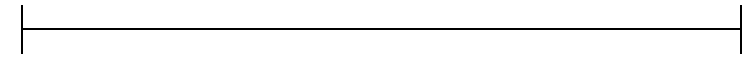
Short-Form McGill Pain Questionnaire (SF-MPQ) Form X

A. PLEASE DESCRIBE YOUR PAIN DURING THE LAST WEEK. *(✓one box on each line.)*

	None	Mild	Moderate	Severe
1. Pounding	0 ☐	1 ☐	2 ☐	3 ☐
2. Shooting	0 ☐	1 ☐	2 ☐	3 ☐
3. Stabbing	0 ☐	1 ☐	2 ☐	3 ☐
4. Sharp	0 ☐	1 ☐	2 ☐	3 ☐
5. Cramping	0 ☐	1 ☐	2 ☐	3 ☐
6. Gnawing	0 ☐	1 ☐	2 ☐	3 ☐
7. Hot-burning	0 ☐	1 ☐	2 ☐	3 ☐
8. Aching	0 ☐	1 ☐	2 ☐	3 ☐
9. Heavy	0 ☐	1 ☐	2 ☐	3 ☐
10. Tender	0 ☐	1 ☐	2 ☐	3 ☐
11. Splitting	0 ☐	1 ☐	2 ☐	3 ☐
12. Tiring-exhausting	0 ☐	1 ☐	2 ☐	3 ☐
13. Causing nausea	0 ☐	1 ☐	2 ☐	3 ☐
14. Fearful	0 ☐	1 ☐	2 ☐	3 ☐
15. Punishing-cruel	0 ☐	1 ☐	2 ☐	3 ☐

B. RATE YOUR PAIN DURING THE PAST WEEK

The following line represents pain of increasing intensity from "no pain" to "worst possible pain". Place a slash (|) across the line in the position that best describes your pain **during the past week**.



No Pain — **Worst possible pain**

Score in mm
(Investigator's use only)

C. PRESENT PAIN INTENSITY

0 ☐ No pain
1 ☐ Mild
2 ☐ Discomforting
3 ☐ Distressing
4 ☐ Horrible
5 ☐ Torturing

Questionnaire Developed by: Ronald Melzack

Neck Disability Index

THIS QUESTIONNAIRE IS DESIGNED TO HELP US BETTER UNDERSTAND HOW YOUR **NECK PAIN** AFFECTS YOUR ABILITY TO MANAGE EVERYDAY -LIFE ACTIVITIES. PLEASE MARK IN EACH SECTION THE **ONE BOX** THAT APPLIES TO YOU.
ALTHOUGH YOU MAY CONSIDER THAT TWO OF THE STATEMENTS IN ANY ONE SECTION RELATE TO YOU, PLEASE MARK THE BOX THAT **MOST CLOSELY** DESCRIBES YOUR PRESENT -DAY SITUATION.

SECTION 1 - PAIN INTENSITY

- ❑ I have no neck 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.

SECTION 2 - PERSONAL CARE

- ❑ I can look after myself normally without causing extra neck pain.
- ❑ I can look after myself normally, but it causes extra neck pain.
- ❑ It is painful to look after myself, and I am slow and careful.
- ❑ I need some help but 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.

SECTION 3 – LIFTING

- ❑ I can lift heavy weights without causing extra neck pain.
- ❑ I can lift heavy weights, but it gives me extra neck pain.
- ❑ Neck pain prevents me from lifting heavy weights off the floor but I can manage if items are conveniently positioned, ie. on a table.
- ❑ Neck pain prevents me from lifting heavy weights, but I can manage light weights if they are conveniently positioned.
- ❑ I can lift only very light weights.
- ❑ I cannot lift or carry anything at all.

SECTION 4 – READING

- ❑ I can read as much as I want with no neck pain.
- ❑ I can read as much as I want with slight neck pain.
- ❑ I can read as much as I want with moderate neck pain.
- ❑ I can't read as much as I want because of moderate neck pain.
- ❑ I can't read as much as I want because of severe neck pain.
- ❑ I can't read at all.

SECTION 5 – HEADACHES

- ❑ I have no headaches at all.
- ❑ I have slight headaches that come infrequently.
- ❑ I have moderate headaches that come infrequently.
- ❑ I have moderate headaches that come frequently.
- ❑ I have severe headaches that come frequently.
- ❑ I have headaches almost all the time.

SECTION 6 – CONCENTRATION

- ❑ I can concentrate fully without difficulty.
- ❑ I can concentrate fully with slight difficulty.
- ❑ I have a fair degree of difficulty concentrating.
- ❑ I have a lot of difficulty concentrating.
- ❑ I have a great deal of difficulty concentrating.
- ❑ I can't concentrate at all.

SECTION 7 – WORK

- ❑ I can do as much work as I want.
- ❑ I can only do my usual work, but no more.
- ❑ I can do most of my usual work, but no more.
- ❑ I can't do my usual work.
- ❑ I can hardly do any work at all.
- ❑ I can't do any work at all.

SECTION 8 – DRIVING

- ❑ I can drive my car without neck pain.
- ❑ I can drive my car with only slight neck pain.
- ❑ I can drive as long as I want with moderate neck pain.
- ❑ I can't drive as long as I want because of moderate neck pain.
- ❑ I can hardly drive at all because of severe neck pain.
- ❑ I can't drive my car at all because of neck pain.

SECTION 9 – SLEEPING

- ❑ I have no trouble sleeping.
- ❑ My sleep is slightly disturbed for less than 1 hour.
- ❑ My sleep is mildly disturbed for up to 1-2 hours.
- ❑ My sleep is moderately disturbed for up to 2-3 hours.
- ❑ My sleep is greatly disturbed for up to 3-5 hours.
- ❑ My sleep is completely disturbed for up to 5-7 hours.

SECTION 10 – RECREATION

- ❑ I am able to engage in all my recreational activities with no neck pain at all.
- ❑ I am able to engage in all my recreational activities with some neck pain.
- ❑ I am able to engage in most, but not all of my recreational activities because of pain in my neck.
- ❑ I am able to engage in only a few of my recreational activities because of neck pain.
- ❑ I can hardly do recreational activities due to neck pain.
- ❑ I can't do any recreational activities due to neck pain.

PATIENT NAME _____ **DATE** _____

SCORE _____ [50]

মেকানিক্যালি ঘাড়ে ব্যথার রোগীদের জন্য প্রচলিত চিকিৎসার পাশাপাশি আপার এবং মিড-থোরাসিক স্পাইন মবিলাইজেশন এর কার্যকারিতা : একটি রেন্ডমাইজড ক্লিনিকাল ট্রায়াল

অধ্যায় : ১-পরিচিতি **রোগীর কোড নং :**

১.১ নাম :

১.২ বয়স :

১.৩ লিঙ্গ: ১. পুরষ ২. মহিলা

১.৪ উচ্চতা :

১.৫ ওজন:

১.৬ ঠিকানা:

অধ্যায় : ২- আথ-সামাজিক ও জনসংখ্যাতাত্ত্বিক তথ্য

২.১ পেশা :

১. কৃষক ২.দিনমজুর ৩.চাকুরীজীবি

৪. গার্মেন্টস্ কর্মী ৫. গাড়ী চালক ৬. রিক্সা চালক

৭. ব্যবসায়ী ৮. বেকার ৯. গহিনী

১০. শিক্ষক ১১. ছাত্র ১২.অন্যান্য

২.২ বৈবাহিক অবস্া

১. বিবাহিত ২. অবিবাহিত ৩. আলাদা ৪. তালাকপাপ্ত

২.৩ শিক্ষাগত যোগ্যতা

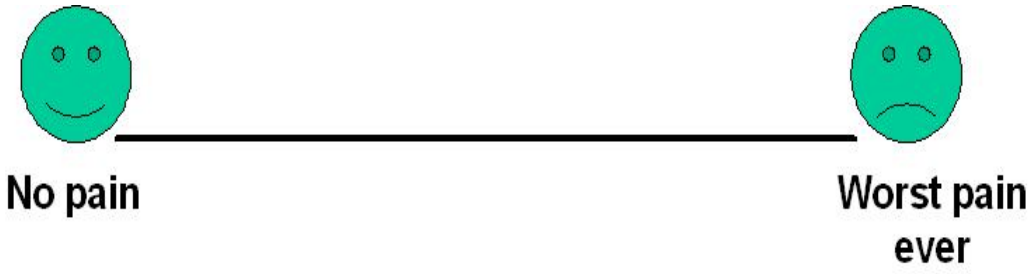
১. কখনো স্কলে যাইনি ২. পাথমিক ৩. মাধ্যমিক

৪. উচ্চ মাধ্যমিক ৫. স্নাতক/ স্নাতকোত্তর

২.৪ আয়ঃ

অধ্যায়ঃ ৩- ভিজুয়্যাল অ্যানালগ স্কেল (VAS)

- আপনার ব্যাথার তীব্রতা কতটুকু?



Visual analogue scale (VAS)

Instruct the patient to point to the position on the line between the faces to indicate how much pain they are currently feeling. The far left end indicates "no pain" and the far right end indicates "worst pain ever."

অধ্যায়ঃ ৪- ঘাড়ের অস্থি-সন্ধির মুভমেন্ট পরিমাপ

	Passive ROM measured in Degree by Goniometer	Reference Value in degree
Flexion		50
Extension		60
Side bending (Right)		45
Side bending (Left)		45
Rotation (Right)		80
Rotation (Left)		80

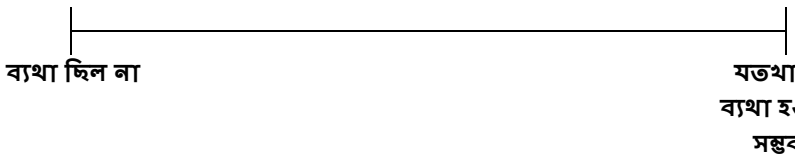
সংক্ষিপ্ত-আকারের McGill ব্যথা প্রশ্নমালা
(SF-MPQ)
Form X

A আপনার বিগত সপ্তাহের ব্যথার বর্ণনা দিন। *(প্রতি লাইনের একটি খোপে ✓ দাগ দিন।)*

		একটুও না	সামান্য	মাঝারি	তীব্র
1.	দপদপে	0 ☐	1 ☐	2 ☐	3 ☐
2.	বিদ্যুতের ঝলকের মত	0 ☐	1 ☐	2 ☐	3 ☐
3.	ছুরি বেঁধার মত	0 ☐	1 ☐	2 ☐	3 ☐
4.	তীক্ষ্ণ	0 ☐	1 ☐	2 ☐	3 ☐
5.	খিঁচ ধরা	0 ☐	1 ☐	2 ☐	3 ☐
6.	চিবোনো	0 ☐	1 ☐	2 ☐	3 ☐
7.	গরম-জ্বালা করা	0 ☐	1 ☐	2 ☐	3 ☐
8.	টনটনে	0 ☐	1 ☐	2 ☐	3 ☐
9.	ভারি	0 ☐	1 ☐	2 ☐	3 ☐
10.	স্পর্শকাতর	0 ☐	1 ☐	2 ☐	3 ☐
11.	ফেটে যাওয়ার মত	0 ☐	1 ☐	2 ☐	3 ☐
12.	ক্লান্তিকর-পরিশ্রান্তিকর	0 ☐	1 ☐	2 ☐	3 ☐
13.	গা বমি করা	0 ☐	1 ☐	2 ☐	3 ☐
14.	ভীতিপ্রদ	0 ☐	1 ☐	2 ☐	3 ☐
15.	কষ্টকর-সাংঘাতিক	0 ☐	1 ☐	2 ☐	3 ☐

B. বিগত সপ্তাহে আপনার যতটা ব্যথা হয়েছিল তার মূল্যায়ন করুন।

নিচের লাইনে "ব্যথা ছিল না থেকে" আরম্ভ করে "যতখানি ব্যথা হওয়া সম্ভব" পর্যন্ত ব্যথার বাড়তে থাকা তীব্রতাকে বোঝানো হয়েছে। লাইনের যে জায়গাটি **বিগত সপ্তাহে** আপনার ব্যথার তীব্রতাকে সব থেকে ভালোভাবে বর্ণনা করে সেখানে একটি সোজা দাগ (|) দিন।



Score in mm
(Investigator's use only)

C. বর্তমান ব্যথার তীব্রতা

0 ☐ ব্যথা নেই
1 ☐ সামান্য
2 ☐ অস্বস্তিকর
3 ☐ যন্ত্রণাকর
4 ☐ ভয়ংকর
5 ☐ অসহ্য

এই প্রশ্নমালাটি তৈরি করেছেন: Ronald Melzack

Neck Disability Index (বাংলা সংস্করণ)

এই প্রশ্নাবলী তৈরি করা হয়েছে যাতে আমি জানতে পারি যে আপনার ঘাড়ের সমস্যা আপনার প্রতিদিনের কাজে কি পরিমান বাধাগ্রস্ত করে। প্রতিটি অধ্যায়ে অন্তর্গত একটি বক্সটিতে টিক দিন। 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। Neck Disability Index - **এর প্রতিটি অংশের সর্বনিম্ন নম্বর ০ এবং সর্বোচ্চ নম্বর ৫।**

অধ্যায় ১- ব্যথার তীব্রতা ☐ আমার এই মুহূর্তে কোন ব্যথা নেই। ☐ আমার এই মুহূর্তে খুব হালকা ব্যথা আছে। ☐ আমার এই মুহূর্তে মাঝারি ব্যথা আ... ☐ আমার এই মুহূর্তে ব্যথা মোটামুটি গুরুতর। ☐ আমার এই মুহূর্তে ব্যথা খুব গুরুতর। ☐ আমার এই মুহূর্তে ব্যথা সবচেয়ে খার।		অধ্যায় ৬- মনোযোগ ☐ আমি কোন অসুবিধা ছাড়াই যখন চাই তখনই সম্পূর্ণরূপে মনোযোগ দিতে পারি। ☐ আমি সামান্য অসুবিধার মধ্যেও সম্পূর্ণরূপে মনোযোগ দিতে পা... ☐ মনোযোগ দিতে আমার খুব অল্প মাত্রার অসুবিধা হয়। ☐ আমি যখন মনোযোগ দিতে চাই তখন অনেক অসুবিধা হয়। ☐ আমি যখন মনোযোগ দিতে চাই তখন গুরুতর অসুবিধা। ☐ আমি একদমই মনোযোগ দিতে পারিনা।
অধ্যায় ২- ব্যক্তিগত যত্ন ☐ 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 গেলে ব্যাথা 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।		অধ্যায় ৭- কাজ ☐ 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।
অধ্যায় ৩- উদ্ধরণ ☐ 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 আমি তা 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।		অধ্যায় ৪- গাড়িতে ভ্রমণ ☐ আমি কোনো ঘাড় ব্যথা ছাড়াই আমার গাড়ী চালাতে পারি। ☐ আমি আমার ঘাড়ে সামান্য ব্যথা নিয়ে গাড়ী চালাতে পারি। ☐ আমি আমার ঘাড়ে মধ্যমীয় ব্যথা নিয়ে গাড়ী চালাতে পারি। ☐ আমি আমার ঘাড়ে মাঝারি ব্যথার কারণে যতক্ষণ দীর্ঘ খুশি ততক্ষণ গাড়ি চালাতে পারি না। ☐ আমি আমার ঘাড়ে তীব্র ব্যথার কারণে গাড়ী চালাতে পারি না। ☐ আমি একদমই আমার গাড়ীতে চালাতে পারি না।
অধ্যায় ৪- পড়া ☐ 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 মধ্যমীয় 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		অধ্যায় ৯- ঘুমানো ☐ 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 ৩ ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম ব্যাপক ভাবে নষ্ট হয় (৩ থেকে ৫ ঘন্টা নির্ঘুম কাটে) ☐ আমার ঘুম সম্পূর্ণভাবে নষ্ট হয় (৫ থেকে ৭ ঘন্টা নির্ঘুম কাটে)

অধ্যায় ৫- মাথা ব্যথা		অধ্যায় ১০- বিনোদন
☐ 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		☐ 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

রোগীর নাম_____ তারিখ_____

প্রাপ্ত নম্বর_____ [৫০]

APPENDIX - C

Conventional Physiotherapy for Mechanical Neck Pain Patients

Centre for the Rehabilitation of the Paralysed (CRP)
Department of Physiotherapy
CRP, P.O: CRP-Chapain, Savar, Dhaka-1343, Bangladesh
Tel: 880-2-7745464-5, Fax: 880-2-7745069, E-mail: contact@crp-bangladesh.org, Website: www.crp-bangladesh.org

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)

Centre for the Rehabilitation of the Paralysed (CRP)
Department of Physiotherapy
CRP, P.O: CRP-Chapain, Savar, Dhaka-1343, Bangladesh
Tel: 880-2-7745464-5, Fax: 880-2-7745069, E-mail: contact@crp-bangladesh.org, Website: www.crp-bangladesh.org

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.

Mohammad Anwar Hossain
Associate Professor & Head
Department of Physiotherapy
CRP, Savar, Dhaka-1343

APPENDIX - D

Treatment Protocol of Trial Group

I) Conventional physiotherapy interventions &

II) Upper & Mid-thoracic spine mobilization:

Different studies (Suvarnnato et al., 2013) described the procedure of upper & mid-thoracic spine mobilization. All the exercises were performed at center 3 sessions per week for 4 weeks and totaling 12 sessions. Each session consists of total 30 minutes including Conventional Physiotherapy Interventions.

a. Subjects who were randomly assigned to receive mobilization were positioned in the prone position. The clinician performed one 30-second bout of grade III or IV central posterior-anterior mobilization at the T1 spinous process as described by Maitland et al (Dunning et al., 2012). After the 30-second session, the therapist proceeded to T2 and performed the same technique. This process was continued sequentially in a caudal direction to T6, for an overall intervention time of approximately 3 - 5 minutes (Cleland et al., 2007).

b. Subjects in this group received mobilization targeting the upper thoracic and middle thoracic spine. The upper thoracic spine procedure was administered first and was performed with the subject in the prone position. The clinician was instructed to target between segments T1 and T4 with this technique. Because, mobilization of the thoracic spine reportedly lacks spatial sensitivity, and we did not capture the exact segments targeted for each subject (Cleland et al., 2007).

c. The subject remained in the prone position, and the treating therapist performed a middle thoracic spine mobilization. The clinician was instructed to target between segments T5 and T8 with this technique. The subject was instructed to lie in prone position gently. The therapist's manipulative hand was used to apply force through the subject's back to produce a oscillatory, low-amplitude movement. This process was continued sequentially in a caudal direction to T8, for an overall intervention time of approximately 3 - 5 minutes (Suvarnnato et al., 2013).

APPENDIX – E

IRB Application

The Chairmen,
Institutional Review Board (IRB)
Bangladesh Health Professions Institute (BHPI),
CRP, Chapain, Savar, Dhaka-1343, Bangladesh.

Subject: Application for review and ethical approval.

Dear Sir,

With due respect, I am Md. Nazmul Hassan, student of Part II of M.Sc. in Physiotherapy program at Bangladesh Health profession institute (BHPI), an academic institute of Centre for the Rehabilitation of the Paralysed (CRP) under the faculty of medicine, university of Dhaka. As per the course curriculum, I have to conduct a thesis entitled **"Effectiveness of Upper and Mid Thoracic Spine Mobilization in Individuals with Mechanical Neck Pain: A Randomized Clinical Trial"**, under the most honorable supervisor Associate Prof. Mohammad Anwar Hossain. The purpose of the study is to determine the effectiveness ofupper & mid-thoracic mobilization combined with conventional care among patients withmechanical neck pain.

The study involves use of a McGill pain questionnaire (short-form) and neck disability index (NDI) to measure pain and disability of the individual and it may take 10 to 15 minutes to fill in the questionnaire. There is no likelihood of any harm to the participants and / or participation in the study may benefit the participants or other stakeholders. Related information will be collected from the patient's guide books. Data collectors will receive informed consent from all participants: any data collected will be kept confidential.

Therefore, I look forward to having your kind approval for the thesis proposal and to start data collection. I can also assure you that 1 will maintain all the requirements for study.

Sincerely,

.....

Md. Nazmul Hassan
Part-(II) M.Sc. in Physiotherapy
Session: 2018-2019
Bangladesh Health Professions Institute
(An academic Institution of CRP)

Thesis presentation date: 28/09/19

Course coordinator: M.Sc. in Physiotherapy

Firoz Ahmed Mamin
Associate Professor
Dept. of Rehabilitation Science
Coordinator
M.Sc. in Physiotherapy Program
BHPI, CRP, Savar, Dhaka-1343

Recommendation from the thesis supervisor

Assoc. Professor Mohammad Anwar Hossain
Head, Physiotherapy department,
CRP, Savar, Dhaka-1343, Bangladesh

IRB Permission

BANGLADESH HEALTH PROFESSIONS INSTITUTE

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)

(The Academic Institute of CRP)

Ref: *Date:*

CRP/BHPI/IRB/02/2020/1388

18/02/2020

To
Md. Nazmul Hassan
Session:2018-2019, Student ID: 111180054
BHPI, CRP, Savar, Dhaka- 1343, Bangladesh

Subject: Approval of thesis proposal **"Effectiveness of Upper and Mid Thoracic Spine Mobilization in Individuals with Mechanical Neck Pain: A Randomized Clinical Trial"** by ethics committee.

Dear Md. Nazmul Hassan,

Congratulations.
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the Principal investigator. The following documents have been reviewed and approved:

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

Since the study involves questionnaire that takes maximum 40- 45 minutes and have no likelihood of any harm to the participants, the members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09:00 AM on September 28, 2019 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.

Best regards,

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

CRP-Chapain, Savar, Dhaka-1343, Tel : 7745464-5, 7741404
E-mail : principal-bhpi@crp-bangladesh.org, Web: bhpi.edu.bd, www.crp-bangladesh.org

Data Collection Permission

Dated: 01-12-2019

The Head of the Department,

Department of Physiotherapy,

Centre for the Rehabilitation of the Paralyzed (CRP),

CRP-Chapain, Savar, Dhaka-1343.

Through: Course coordinator, MPT Program, Department of Physiotherapy, BHPI.

Subject: Prayer for seeking permission for data collection to conduct my academic thesis.

Sir,

With due respect and humble submission to state that I am Md. Nazmul Hassan, student of Part-(II) M.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical Committee has approved my research study title on **"Effectiveness of Upper & Mid Thoracic Spine Mobilization in individuals with Mechanical Neck Pain: A Randomized Clinical Trial"** under the supervision of Mohammad Anwar Hossain, Associate Professor, BHPI and Head of Physiotherapy Department, CRP. Conducting this research work is partial fulfillment of the requirement for the degree of Part-II M.Sc. in Physiotherapy. I want to collect research data for my research work at Musculo-skeletal unit, CRP. So, I need permission in this regard. I would like to assure that, anything of my study will not be harmful for the participants.

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

Yours faithfully,

Hassan

.....

Md. Nazmul Hassan
Part-(II) M.Sc. in Physiotherapy
Session: 2018-2019
Bangladesh Health Professions Institute
(An academic Institution of CRP)
CRP- Chapain, Savar, Dhaka- 1343.

Recommended
09/12/19
Prof. Md. Obaidul Haque
Head, Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Savar, Dhaka-1343

Concern
09/12/19

Approved
12/12/19

Forwarded
Fy
9.12.19

Firoz Ahmed Mamin
Associate Professor
Dept. of Rehabilitation Science
Coordinator
M.Sc. in Physiotherapy Program
BHPI, CRP, Savar, Dhaka-1343

APPENDIX – F

WHO Trial Registration

CLINICAL TRIALS REGISTRY - INDIA
ICMR - National Institute of Medical Statistics

PDF of Trial
CTRI Website URL - http://ctri.nic.in

Clinical Trial Details (PDF Generation Date :- Thu, 13 Aug 2020 15:48:08 GMT)

CTRI Number	CTRI/2020/06/026090 [Registered on: 24/06/2020] - **Trial Registered Retrospectively**
Last Modified On	23/06/2020
Post Graduate Thesis	Yes
Type of Trial	Interventional
Type of Study	Physiotherapy (Not Including YOGA)
Study Design	Randomized, Parallel Group Trial
Public Title of Study	Effectiveness of a physiotherapy in neck pain
Scientific Title of Study	Effectiveness of Upper and Mid Thoracic Spine Mobilization in Individuals with Mechanical Neck Pain: A Randomized Clinical Trial

Secondary IDs if Any

Secondary ID	Identifier
NIL	NIL

Details of Principal Investigator or overall Trial Coordinator (multi-center study)

Details of Principal Investigator	
Name	Md Nazmul Hassan
Designation	Clinical Physiotherapist
Affiliation	Centre for the Rehabilitation of the Paralysed
Address	Musculoskeletal Unit, Department of Physiotherapy Savar, Dhaka, 1343 1343 Other
Phone	01918032333
Fax	
Email	hassan.crp@gmail.com

Details Contact Person (Scientific Query)

Details Contact Person (Scientific Query)	
Name	Mohammad Anwar Hossain
Designation	Senior Consultant
Affiliation	Centre for the Rehabilitation of the Paralysed
Address	Department of Physiotherapy, centre for the Rehabilitation of the Paralysed (CRP),Savar, Dhaka-1343 1343 Other
Phone	8801753559949
Fax	
Email	anwar_physiobd@yahoo.com

Details Contact Person (Public Query)

Details Contact Person (Public Query)	
Name	Mohammad Anwar Hossain
Designation	Senior Consultant & Associate Professor
Affiliation	Centre for the Rehabilitation of the Paralysed
Address	Department of physiotherapy Savar, Dhaka, 1343 1343 Other
Phone	
Fax	

	Email	anwar_physiobd@yahoo.com

Source of Monetary or Material Support

Source of Monetary or Material Support
> Musculoskeletal Unit, Department of Physiotherapy, CRP, Savar, Dhaka-1343

Primary Sponsor

Primary Sponsor Details	
Name	Md Nazmul Hassan
Address	CRP-Savar, Dhaka-1343
Type of Sponsor	Other [Self-funded]

Details of Secondary Sponsor

Name	Address
NIL	NIL

Countries of Recruitment

List of Countries
Bangladesh

Sites of Study

Name of Principal Investigator	Name of Site	Site Address	Phone/Fax/Email
Mohammad Anwar Hossain	Centre for the Rehabilitation of the Paralysed	Musculoskeletal Unit, Department of Physiotherapy, CRP-Savar Not Applicable N/A	8801753559949 anwar_physiobd@yahoo.com

Details of Ethics Committee

Name of Committee	Approval Status	Date of Approval	Is Independent Ethics Committee?
Institutional Review Board	Approved	18/02/2020	No

Regulatory Clearance Status from DCGI

Status	Date
Not Applicable	No Date Specified

Health Condition / Problems Studied

Health Type	Condition
Patients	Other soft tissue disorders related to use, overuse and pressure

Intervention / Comparator Agent

Type	Name	Details
Intervention	Thoracic Mobilization	Oscillatory Thoracic Spine Mobilization 60 to 120 Hz per seconds
Comparator Agent	Conventional Physiotherapy	Mckenzie Therapy, Manual Therapy, Maitland, Exercise therapy, electrotherapy for 30 minutes for 3 weeks

Inclusion Criteria

Inclusion Criteria	
Age From	20.00 Year(s)
Age To	55.00 Year(s)
Gender	Both
Details	Age range between 20 to 55 years: (Chiu, et al., 2012; Gautam, et al., 2014). Male and female both will be included (Schopflocher, et al., 2011) Patient who will be diagnosed as mechanical neck pain (El-Sodany, et al., 2014).

Exclusion Criteria

Exclusion Criteria	
Details	Age below 20 years and above 55 years (Ummar, et al., 2012)

	Sustaining red flags of neck pain (McColl, 2013). Associated pathology of the upper cervical region or upper limb (El-Sodany, et al., 2014). Unwilling to participate (Halvorsen, et al., 2014). Post-operative subjects.

Method of Generating Random Sequence	Coin toss, Lottery, toss of dice, shuffling cards etc
Method of Concealment	Sequentially numbered, sealed, opaque envelopes
Blinding/Masking	Participant and Outcome Assessor Blinded

Primary Outcome

Outcome	Timepoints
Pain, Range of Motion	3 weeks

Secondary Outcome

Outcome	Timepoints
Disability and daily activities	3 weeks

Target Sample Size	**Total Sample Size=**100 **Sample Size from India=**0 **Final Enrollment numbers achieved (Total)=**Applicable only for Completed/Terminated trials **Final Enrollment numbers achieved (India)=**Applicable only for Completed/Terminated trials
Phase of Trial	Phase 1/ Phase 2
Date of First Enrollment (India)	No Date Specified
Date of First Enrollment (Global)	28/06/2020
Estimated Duration of Trial	**Years=**1 **Months=**0 **Days=**0
Recruitment Status of Trial (Global)	Not Yet Recruiting
Recruitment Status of Trial (India)	Not Applicable
Publication Details	NIL
Brief Summary	Mechanical neck pain is worldwide health problem. Most often, it is the result of a compression or inflammatory pathology from a space occupying lesion such as disc herniation, spondylitic spur, or cervical osteophyte (Rai, Ajith, Bhagavan, & Pinto, 2013). The average annual incidence rate of cervical radiculopathy is 85 per 100,000 for the population in its entirety, with an increased prevalence occurring in the fifth decade of life, 203 per 100,000 (priya Vishnu, 2015). The most frequently involved nerve roots are the cervical 6 (C6) and cervical 7 (C7) cervical roots which are typically caused by C5-C6 or C6-C7 disc herniation or spondylosis (Sambyal and Kumar, 2013). It's estimated that 50% of the population experienced neck and upper extremity pain at some time in their lifetime (Sambyal and Kumar, 2013).

SPECIAL TERMS

These User License Agreement Special Terms ("Special Terms") are issued between Mapi Research Trust ("MRT") and Nazmul Hassan ("User").

These Special Terms are in addition to any and all previous Special Terms under the User License Agreement General Terms.

These Special Terms include the terms and conditions of the User License Agreement General Terms, which are hereby incorporated by this reference as though the same was set forth in its entirety and shall be effective as of the Special Terms Effective Date set forth herein.

All capitalized terms which are not defined herein shall have the same meanings as set forth in the User License Agreement General Terms.

These Special Terms, including all attachments and the User License Agreement General Terms contain the entire understanding of the Parties with respect to the subject matter herein and supersedes all previous agreements and undertakings with respect thereto. If the terms and conditions of these Special Terms or any attachment conflict with the terms and conditions of the User License Agreement General Terms, the terms and conditions of the User License Agreement General Terms will control, unless these Special Terms specifically acknowledge the conflict and expressly states that the conflicting term or provision found in these Special Terms control for these Special Terms only. These Special Terms may be modified only by written agreement signed by the Parties.

1. **User information**

User name	Nazmul Hassan
Category of User	
User address	CRP-Savar Chapain Savar 1343 Dhaka Bangladesh
User VAT number	
User email	hassan.crp@gmail.com
User phone	+8801918032333
Billing Address	CRP-Savar Chapain Savar 1343 Dhaka Bangladesh

2. **General information**

Effective Date	Date of acceptance of these Special Terms by the User
Expiration Date ("Term")	Upon completion of the Stated Purpose
Name of User's contact in charge of the request	Nazmul Hassan

3. **Identification of the COA**

Name of the COA	NDI - Neck Disability Index
Author	Vernon H Mior S
Copyright Holder	
Copyright notice	NDI © Dr Howard Vernon, 1991. All Rights Reserved
Bibliographic reference	Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther. 1991 Sep;14(7):409-15. Erratum in: J Manipulative Physiol Ther 1992 Jan;15(1) (PubMed abstract)
Modules/versions needed	NDI

4. **Context of use of the COA**

The User undertakes to use the COA solely in the context of the Stated Purpose as defined hereafter.

4.1 Stated Purpose

Clinical Practice

Type of use*	Educational purpose
Planned Term*	Start: 10/2019; End: 06/2020
Number of screened patients	200
Number of sites	2
Number of submissions of the COA for each patient	2
Mode of administration*	Paper
If electronic administration, please indicate mode of data collection	
Use of IT Company (e-vendor)	No

4.2 Country and languages

MRT grants the License to use the COA on the following countries and in the languages indicated in the table below:

Version/Module	Language	For use in the following country
NDI	Bengali	Bangladesh
NDI	English	the USA

The User understands that the countries indicated above are provided for information purposes. The User may use the COA in other countries than the ones indicated above.

5. **Specific requirements for the COA**

- The Copyright Holder of the COA has granted ICON LS exclusive rights to translate the COA in the context of commercial studies or any project funded by for-profit entities. ICON LS is the only organization authorized to perform linguistic validation/translation work on the COA.

- In case the User wants to use an e-Version of the COA, the User shall send the Screenshots of the original version of the COA to MRT or ICON LS for review and approval. The Screenshots review may incur additional fees

- In case the User wants to use an e-Version of the COA, the User shall send the Screenshots of the translations of the COA to ICON LS for approval.

SPECIAL TERMS

These User License Agreement Special Terms ("Special Terms") are issued between Mapi Research Trust ("MRT") and Nazmul Hassan ("User").

These Special Terms are in addition to any and all previous Special Terms under the User License Agreement General Terms.

These Special Terms include the terms and conditions of the User License Agreement General Terms, which are hereby incorporated by this reference as though the same was set forth in its entirety and shall be effective as of the Special Terms Effective Date set forth herein.

All capitalized terms which are not defined herein shall have the same meanings as set forth in the User License Agreement General Terms.

These Special Terms, including all attachments and the User License Agreement General Terms contain the entire understanding of the Parties with respect to the subject matter herein and supersedes all previous agreements and undertakings with respect thereto. If the terms and conditions of these Special Terms or any attachment conflict with the terms and conditions of the User License Agreement General Terms, the terms and conditions of the User License Agreement General Terms will control, unless these Special Terms specifically acknowledge the conflict and expressly states that the conflicting term or provision found in these Special Terms control for these Special Terms only. These Special Terms may be modified only by written agreement signed by the Parties.

1. **User information**

User name	Nazmul Hassan
Category of User	
User address	CRP-Savar Chapain Savar 1343 Dhaka Bangladesh
User VAT number	
User email	hassan.crp@gmail.com
User phone	+8801918032333
Billing Address	CRP-Savar Chapain Savar 1343 Dhaka Bangladesh

2. **General information**

Effective Date	Date of acceptance of these Special Terms by the User
Expiration Date ("Term")	Upon completion of the Stated Purpose
Name of User's contact in charge of the request	Nazmul Hassan

3. **Identification of the COA**

Name of the COA	SF-MPQ - McGill Pain Questionnaire Short Form
Author	Melzack R
Copyright Holder	Melzack Ronald
Copyright notice	SF-MPQ © Ronald Melzack, 1984. All Rights Reserved
Bibliographic reference	Melzack R. The short-form McGill Pain Questionnaire. Pain 1987; 30(2):191-7
Modules/versions needed	SF-MPQ

4. **Context of use of the COA**

The User undertakes to use the COA solely in the context of the Stated Purpose as defined hereafter.

4.1 Stated Purpose

Clinical Practice

Type of use*	Educational purpose
Planned Term*	Start: 10/2019; End: 06/2020
Number of screened patients	200
Number of sites	2
Number of submissions of the COA for each patient	2
Mode of administration*	Paper
If electronic administration, please indicate mode of data collection	
Use of IT Company (e-vendor)	No

4.2 Country and languages

MRT grants the License to use the COA on the following countries and in the languages indicated in the table below:

Version/Module	Language	For use in the following country

SF-MPQ	Bengali	India
SF-MPQ	English	India

The User understands that the countries indicated above are provided for information purposes. The User may use the COA in other countries than the ones indicated above.

5. **Specific requirements for the COA**

- The Copyright Holder of the COA has granted ICON LS exclusive rights to translate the COA in the context of commercial studies or any project funded by for-profit entities. ICON LS is the only organization authorized to perform linguistic validation/translation work on the COA.

- In case the User wants to use an e-Version of the COA, the User shall send the Screenshots of the original version of the COA to MRT or ICON LS for review and approval. The Screenshots review may incur additional fees

- In case the User wants to use an e-Version of the COA, the User shall send the Screenshots of the translations of the COA to ICON LS for approval.