Faculty of Medicine

University of Dhaka

Effectiveness of Myofascial Release versus Physio Gun Release of Quadriceps muscle and Iliotibial Band on Pain and Range of Motion in Patients with Knee Osteoarthritis

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Master of Science in Physiotherapy (M.Sc.PT)

DU Roll No: 709

Registration No: 5354

Session: 2020-2021

BHPI, CRP, Savar, Dhaka-1343

Department of Physiotherapy

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University ofDhaka, for acceptance this dissertation entitled **"Effectiveness of Myofascial Release versus Physio Gun Release of Quadriceps muscle and Iliotibial Band on Pain and Range of Motion in Patients with Knee Osteoarthritis"**Submitted by **Md. Atikur Rahman** for the partial fulfillment of the requirements for the degree of Master of Science in Physiotherapy.

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DECLARATION

This work has not previously been accepted in substance for any degree and isn't 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.

I confirm that if anything identified in my work that I have done plagiarism or any form of cheating will directly be awarded a 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 of the finding of this project for future publication, the research supervisor will be highly concerned, it will be duly acknowledged as a graduate thesis and consent will taken from the physiotherapy department of Bangladesh Health Professions Institute (BHPI).

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ACRONYM

ADL	Activity of Daily Living
BHPI	Bangladesh Health Professions Institute
BMI	Body Mass Index
COPCORD	The Modified Community Oriented Program for Control of Rheumatic Disorders
CRP	Centre for the Rehabilitation of the Paralysed
DHQ	District Head Quarter
ITB	Iliotibial Band
KOA	Knee Osteoarthritis
MFR	Myofascial Release
MRG	Myofascial Release Group
NPRS	Numeric Pain Rating Scale
OA	Osteoarthritis
OR	Odd Ratio
PEDro	Physiotherapy Evidence Database
PGG	Physio Gun Group
ROM	Range of Motion
SLR	Straight Leg Raise
TENS	Transcutaneous Electrical Nerve Stimulation
USA	United States of America
VAS	Visual Analog Scale
WHO	World Health Organization
WOMAC	The Western Ontario and MacMaster Universities Osteoarthritis Index

ABSTRACT

Background: Osteoarthritis (OA) is the most common type of chronic, progressive, degenerative, joint disorder causes pain and disability and it have greatest consequence on weight-bearing joints especially knee joint due to more mobility and less stability. There are number of treatment option for knee OA includes conservative and operative. Physiotherapy is one of the important conservative treatments for knee OA. Myofascial release and physio gun release may a treatment choice for treatment of knee OA. ***Objective:*** To identify the efficacy of Myofascial Release and Physio gun release of quadriceps muscle and iliotibial band in knee osteoarthritis. ***Methods:*** This study was single blinded Randomize Clinical Trial (RCT). The study was carried out in outpatient musculoskeletal unit. Thirty participants were randomly assigned into two groups. Structured questionnaire were used for data collection. NPRS, WOMAC and goniometer were used for outcome measurement. SPSS version 22 and Microsoft Word with Excel 2016 were used for inferential statistics, including the Independent T test, Mann-Whitney U test and chi-square test. ***Results:*** After treatment, both the groups showed significant improvement ($p<0.05$) but physio gun release groups shows more improvement in reducing pain, improving ROM and reducing disability. ***Conclusion:*** The result of present study shown that, in patients with knee osteoarthritis, myofascial release along with usual physical therapy has been effective in reducing pain, ROM and function. Moreover, physio gun release along with usual physical therapy enhances the effectiveness of physiotherapy and helps to decrease pain, increase flexibility and ROM and disability.

Key Words: Knee Osteoarthritis, Physio gun release, Myofascial release, Usual care

CHAPTER – I INTRODUCTION

1.1: Background

Osteoarthritis (OA) is the most prominant type of chronic degenerative joint disorder causes musculoskeletal pain and disability (Dor & Kalichman, 2017; Li, Hu, Di & Jiao., 2022; Samal, Panchbudhe, Samal, Dixit & Gawande., 2021) and it have greatest consequence on weight-bearing joints especially knee joint due to more mobility and less stability (Mahmooda et al.,2020). According to World Health Organization (WHO), OA is the eleventh principal reason of disability among elderly (Lohmander, 2013); however, a retrospective study in Bangladesh revealed OA is the fourth leading cause of disability (Dor & Kalichman, 2017). OA creates impacts on elderly and middle age population globally (Dixit, Samal & Ramteke., 2020).

Naylor et al., (2022) estimated that millions of people across the world suffer from the common condition known as knee osteoarthritis (OA). It is a form of joint degeneration that causes the cartilage in the knee joint to break down, resulting in stiffness, pain, and restricted mobility. Although it can affect younger people as well, especially those who are obese or have a history of knee traumas, knee OA is more common in the elderly. Knee OA symptoms might include pain, swelling, stiffness, and a reduced range of motion (Hendrika & Reswari, 2021). Walking, climbing stairs, and prolonged times of inactivity can all make pain worse. Pain might worsen and become more consistent as the condition progresses, which can make daily activities more difficult. Age, heredity, obesity, past joint injuries, and overuse are risk factors for developing knee OA, although the underlying causes are not entirely understood (Teo et al., 2020).

There are number of causative factors are responsible for OA such as age, female gender, heredity, obesity, trauma, occupation, mechanical forces, medical conditions e.g. haemophilia, avascular necrosis, inflammation, biochemical responses and metabolic disturbance (Samal, Panchbudhe, Samal, Dixit & Gawande., 2021; Mahmooda et al.,2020; Rahman, Deepthi, Singh & Wah., 2022). However, age is the prime risk factor for OA (Rahman, Deepthi, Singh & Wah., 2022). Osteoarthritis (OA) is a complex condition, even till date we don't know the exact mechanism and until today there are not available interventions that repair disrupted cartilage or

slowing down the process of degeneration (Rahman, Deepthi, Singh & Wah., 2022; Dor & Kalichman, 2017). The most common clinical feature of OA are joint pain, stiffness, bony crepitus, motion limitations, motor and sensory dysfunction and functional impairments (Dor & Kalichman, 2017). Although, OA commonly affect the weight bearing joints such as knee, ankle; however, OA also seen in hands, hips and spine (Dor & Kalichman, 2017). Diagnosis of OA can be done through pathologically, radio-graphically and/ or clinically (Jahan, Sima, Khalil, Sohel & Kawsar., 2017). Despite the fact, 80% people over the age of 80 years have suffering from OA but half of them have asymptomatic (Jahan, Sima, Khalil, Sohel & Kawsar., 2017).

Knee osteoarthritis (KOA) is a prevalent chronic condition, present with pain, causing disability, psychological distress, and reduced quality of life (Bennell et al., 2016). Knee OA is a progressive degenerative condition of joint which present with loss of articular cartilage and alteration of subchondral bone (Dor & Kalichman, 2017). Globally, more than 250 million individuals were suffering from knee OA, and have significant effect on health care and society (e Silva, de Andrade Alexandre & Silva., 2018). Most frequently Knee OA present with pain and others features are joint stiffness, functional impairment, even disability (Li, Hu, Di & Jiao., 2022; Mahmooda et al.,2020). The global prevalence for symptomatic knee OA over the age of 60 years is 9.6% and 18% in men and women respectfully (Haider et al., 2022). Different cross sectional study stated the incidence of knee OA in India 10.20% and 5.78% in Bangladesh (Samal, Panchbudhe, Samal, Dixit & Gawande., 2021). Even if, the incidence rate for knee OA in Bangladesh and India relatively low but in Pakistan is two to three times higher, this is 28% of the metropolitan population and 25% of the rural population (Samal, Panchbudhe, Samal, Dixit & Gawande., 2021). Knee OA also have similar risk factors like OA; albeit, knee OA mostly seen in older women than men of similar age (Mahmooda et al., 2020).

Myofascial release therapy can be defined as “the facilitation of mechanical, neural and psycho physiological adaptive potential as interfaced by the myofascial system” (Jung et al., 2017; Rahman, Deepthi, Singh & Wah., 2022). Myofascial release therapy is a manual energetic therapy designed to treat the myofascia that surrounds every cell and tissues in the body (Jung et al., 2017; Laimi et al., 2017) and it is a manipulative treatment used to help in releasing tension in the fascia (Rahman,

Deepthi, Singh & Wah., 2022; Jung et al., 2017). Myofascial release therapy is a safe and low load stretch technique which helps in releasing spasticity, muscle shortness and tightness and it's predominantly applied for reducing spasticity (Jung et al., 2017).

According to a study, physical therapy significantly improves individuals with knee OA's pain level, knee range of motion, isometric quadriceps strength, and knee function (Abdel-aziem, Soliman, Mosaad & Draz, 2018). Physio gun is physiotherapeutic device which are usually used in therapeutic purpose for relieving pain and increasing ROM. According to study, it was found that vibrating foam roller have impacts on muscle soreness (Lim et al, 2019). Vibration therapy has effectiveness on reducing pain, enhancing pain threshold, and improving range of motion (Cochrane, 2017). Physio gun is device which is identical to vibrating foam roller. The machine has different moods on the basis of revolutions per minutes (rpm) and moods are used for different purposes.

1.2: Rationale

The primary purpose of this research is to determine how myofascial release therapy works as well as investigate the effects of physio gun release in addition to usual care in both groups of patients with knee osteoarthritis. By the completion of this project, it will be easier to spot the efficacy of myofascial release with usual care comparing physio gun release with usual care for the patients with knee osteoarthritis. It remarkable that, it is important to find out the efficacy of physio gun release for knee OA as there is still no available data about it.

Knee OA is the complex, degenerative, non curable condition which is the one of important causes of disability among older and also causes limitation of movement as well as causes limitation in activity of daily living (ADLs). However, the pathogenesis, disease progression, prognosis of knee OA still non understandable. Different studies illustrate, the causes of pain and limitation are primarily from the myofascial trigger points around the muscle and it would be recovered by myofascial release which may prevent disability.

Some studies are conducted about myofascial release in others country of the world helps us to know about the release of myofascial broadly and its efficacy; however there is no available published study about myofascial release in perspective of Bangladesh.

On the other hand, there is still lacking of data about physio gun release around the world. So, it is also important to know the efficacy and uses of physio gun.

As knee OA is non curable condition; I strongly believe this study finding will be make best solution for physiotherapist in management of knee OA patient in our country as well as world.

1.3: Research question

What is the efficacy of myofascial release and physio gun release in patients with knee OA?

1.4: Research Hypothesis

The study aims to know that, the effects of myofascial release therapy in comparison of physio gun release of quadriceps muscle and iliotibial band in person with knee osteoarthritis.

1) **Null Hypothesis (H0)**

$H0 = \mu 2 - \mu 1 = 0$ or $\mu 1 = \mu 2$, where the initial and final mean differences between the post test and the pretest are equal that means physio gun release is not effective than myofascial release therapy of quadriceps muscle and iliotibial band for individuals with knee osteoarthritis in alongside usual treatments.

2) **Alternative Hypothesis (Ha)**

$H\alpha = \mu 2 - \mu 1 \neq 0$ or $\mu 1 \neq \mu 2$, While the initial and final mean differences comparing the post test and the pretest are distinct that means physio gun release is effective than myofascial release therapy of quadriceps muscle and iliotibial band for individuals with knee osteoarthritis in addition to usual therapy.

Where,
Ho= Null hypothesis
Hα = Alternative hypothesis
μ1 = Mean difference in initial assessment
μ2 = Mean difference in final assessment

1.5: Aim

To determine the effects of myofascial release therapy in comparison of physio gun release of quadriceps muscle and iliotibial band in addition to usual care on pain, range of motion and disability in individual with knee osteoarthritis.

1.6: Objectives

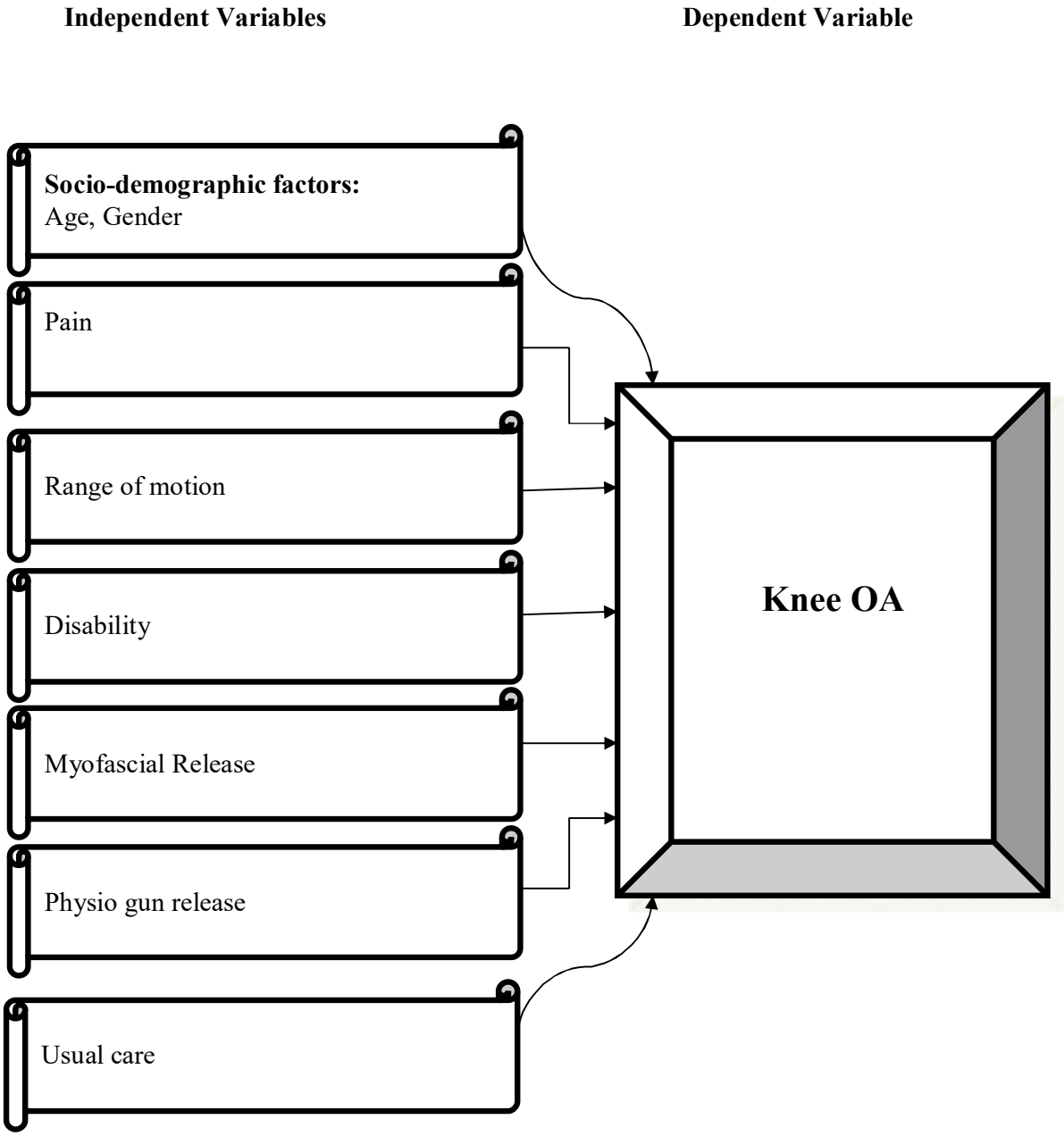
1.6.1: General Objective

To identify the efficacy of Myofascial Release and Physio gun release of quadriceps muscle and iliotibial (IT) band in knee osteoarthritis

1.6.2: Specific Objectives

1) To find out the effects myofascial release and physio gun release of quadriceps muscle and iliotibial band in within & between groups on pain intensity in patients with knee OA.
2) To measure the effects myofascial release and physio gun release of quadriceps muscle and iliotibial band in within & between groups on range of motion in patients with knee OA.
3) To identify the effects myofascial release and physio gun release of quadriceps muscle and iliotibial band in within & between groups on disability in patients with knee OA.

1.7: Variables



1.8: Operational Definition

Myofascial Release

Myofascial release treatment is the facilitation of the myofascial system's interfaced mechanical, neurological, and psycho physiological adaptive capacity. Myofascial release therapy is a type of manual energy treatment used to treat the myofascia that encircles all of the body's cells and tissues. It is a secure and very efficient manual therapeutic technique involving applying gentle long sustained pressure usually in line with the fiber direction of restricted fascia of connective tissues to eradicate pain and reestablish movements (Chen et al., 2021).

Physio Gun Release

It is a technique of muscle release by applying device provided massage directly over the muscle.

Osteoarthritis

Osteoarthritis is the foremost prevalent type of arthritis known as the joint degenerative disease that is categorized by articular cartilage degeneration, subchondral bone sclerosis and osteophyte formation with chief medical indications, containing chronic pain, intense level of inflammation, joint instability, stiffness, and narrowing of the joint space in radiological investigations (Allen., Thoma & Golightly., 2022).

Knee Osteoarthritis

Osteoarthritis of the knee is a common condition caused by the breakdown of the cartilage surrounding the knee joint. The affected knee may experience pain, stiffness, and a restricted range of motion as a result. Although knee osteoarthritis is more common in elderly people, it can also affect younger people who have had a knee injury. Knee pain or tenderness, stiffness or limited range of motion, a grinding or cracking feeling in the knee, and swelling or inflammation around the knee joint can all be signs of osteoarthritis in the knee. These symptoms significantly reduce a person's quality of life and impair their ability to carry out regular tasks like walking or climbing stairs (Leyland et al., 2021).

Functional Disability

Functional disability or diversity is a term for special needs, disability, impairment, and handicap that was first used in scientific writing in Spain in 2005 at the suggestion of persons who were directly impacted. A functional disability restricts a person's capacity for physical activity, results in a major sensory impairment, involves long-term care, and requires the use of technology, assistive devices, or physical therapy (Vaish., Patra & Chhabra., 2020).

Physiotherapy

Physiotherapy, often known as physical therapy, is a healthcare profession that focuses on the prevention, diagnosis, and treatment of physical impairments, disabilities, and pain. A number of diseases, including musculoskeletal injuries, neurological disorders, and chronic conditions like arthritis or chronic pain, can be managed by physiotherapists who work with people of all ages. To assist their patients in achieving their objectives and enhancing their physical performance, physiotherapists employ a range of strategies. Exercises, manual treatment, modalities like ultrasound or electrical stimulation, and instruction in good posture and body mechanics are a few examples of these techniques. Physiotherapy aims to avoid further injuries or complications while also restoring or maintaining a person's physical function and quality of life.

Conventional Physiotherapy

Physiotherapeutic interventions that are widely accepted and evidence based practices (like Stretching, Muscle strengthening, manual therapy technique, Soft tissue mobilization, Thermotherapy) which are used by graduate physiotherapist.

Rehabilitation

The process of restoring or improving an individual's physical, psychological, and social function following an illness, injury, or handicap is known as rehabilitation. Physical therapy, occupational therapy, speech therapy, and cognitive therapy are just a few examples of the approaches and methods that can be used in rehabilitation. The ultimate aim of rehabilitation is to assist the patient in regaining their independence, enhancing their quality of life, and, to the greatest extent feasible, returning to their regular activities. People who have suffered from a variety of medical illnesses, including multiple sclerosis, Parkinson's disease, multiple sclerosis, spinal cord injury, amputation, and traumatic brain injury, may require rehabilitation. People who have had surgery or other medical treatments that have affected their physical or cognitive ability may also require rehabilitation. A multidisciplinary team of healthcare experts, including doctors, nurses, therapists, and social workers, is often involved in rehabilitation. They collaborate to create a thorough treatment plan that takes into account the individual's unique needs and objectives. The individual's environment or lifestyle may need to be changed, in addition to treatments, drugs, assistive devices, and other treatment options (Negrini et al., 2020).

Pain

Pain is an unpleasant sensory or emotional sensation linked to actual or potential tissue damage, or expressed as such adverse effects (Raja et al., 2020).

Range of Motion (ROM)

Range of motion (ROM) defines the amount of movement possible at a particular joint. It plays an important role for physical function and necessary for accomplishing daily tasks including reaching, bending, and walking.

The maximum amounts of movement available at a joint in different plane. It usually measured by using Goniometer.

Disability

Disabilities are a broad phrase that encompasses impairments, activity limitations, and participation limitations.

CHAPTER – II LITERATURE REVIEW

Osteoarthritis (OA) is a degenerative joint condition that affects millions of individuals worldwide. According to research, OA is the most frequent type of arthritis and the primary cause of disability in older persons. Any joint in the body can be impacted by OA, although the hands, hips, knees, and spine are the most frequently affected (Jones et al., 2021). Age, gender, heredity, obesity, joint damage, and occupational risks are among the risk factors for developing OA that have been identified via research. For instance, studies have shown that obesity is a substantial risk factor for knee OA, with the probability of developing knee OA rising by 35% for every additional 5 kg/m2 increase in body mass index (BMI) (Teo et al., 2021).

According to Shamsi et al. (2020), the patho-physiology of OA is thought to involve the progressive degeneration of joint cartilage, which can cause pain, stiffness, and a loss of mobility. Other structural alterations in the joint, such as the development of osteophytes (bony growths) and synovial inflammation, have also been demonstrated by study to be possible in addition to cartilage degeneration. Although there is currently no cure for OA, there are a number of therapeutic options that can help control the symptoms and delay the disease's progression (Shamsi et al., 2020)

Exercise, healthy eating, and physical therapy are examples of non-pharmacological therapies that have been shown to be successful in lowering pain and enhancing function. Although they may have adverse effects, pharmacological pain relief methods such nonsteroidal anti-inflammatory medications (NSAIDs) and analgesics can also effectively reduce pain (Nazari et al., 2019). Based on research by Gwynne-Jones et al. (2020), surgery may be recommended for cases of severe OA that do not improve with conventional therapies. In patients with OA, joint replacement surgery, such as a total knee replacement, can significantly reduce pain and increase mobility (Gwynne-Jones et al., 2020)

The underlying cause of the disease (patho-physiology) is being better understood via ongoing research on OA (Onu et al., 2022). The use of stem cells to repair damaged joint cartilage and the development of specific medical approaches to treat OA based on a person's particular genetic profile are two new areas of research. Especially among older persons, A substantial number of people have osteoarthritis (OA), an

extremely common degenerative joint disease. The prevalence of OA varies based on the population investigated and the affected joint, according to studies (Teo et al., 2020).

According to a 2020 study on worldwide epidemiology, the most prevalent form of OA is knee OA, which is expected to impact 14% of individuals aged 25 and older and 34% of persons aged 65 and older (Mostafaee et al., 2022). Hip OA is another relatively common condition that affects 3-5% of adults over the age of 40 and up to 10% of those over the age of 65. According to a systematic review, OA of the hand, namely the distal inter-phalangeal joints, is also common, with a prevalence of up to 60% in adults aged 70 and older. Around 10-15% of adults 60 and older have OA of the spine, it occurs occasionally (Rosadi et al., 2023).

An epidemiological study by Zhang and Jordan (2010) stated that OA is most common joint problematic condition in USA and over the 60 years old 13% female and 10% male are suffering from symptomatic knee OA. This study also reported that there are number of risk factors which have impact on increasing the numbers of incidence day by day. Old age, female gender, overweight and obesity, injuries to the knees, repetitive joint use, bone density, muscle weakness, and joint laxity are common risk factors (Zhang & Jordan. 2010).

Women, persons with a family history of the condition, and people who have had joint injuries or surgery may all be at an increased risk of getting OA. According to a review, obesity significantly raises the probability of developing knee OA by 35% for every extra 5 kg/m2 that the body mass index (BMI) raises. As the global population ages and obesity rates continue to grow, it is anticipated that the prevalence of OA will climb in the ensuing decades (Naylor et al., 2022). However, Hendrika and Reswari (2021) revealed that that early diagnosis and treatment of OA might lessen the toll the disease takes on both patients and society (Hendrika & Reswari. 2021)

A Retrospective Study by Jahan, Sima, Khalil, Sohel and Kawsar, (2017) titled "Survey on prevalence, risk factors and treatment pattern of osteoarthritis in Bangladesh: retrospective study" which was published on "Rheumatology" Volume no-7, Issue no-230, Pages- 2161-1149. This study was conducted on different hospital of Bangladesh. The purpose of this study was to investigate the prevalence rate, risk factors and pattern of treatment received osteoarthritis patients. The study results revealed that Study explore 84% of the participants were new, and the remaining 16% were geriatric and had long-term osteoarthritis. OA is commonly linked with age and sex, however compared to men, women are more affected and the percentage was 57% & 43% respectively. On the aspect of age, study found the summit of the prevalence at the age in between 45-65 which was 68%. This study also found the person who lived in urban area, poor socioeconomic condition, and housewives are more prone to OA. This study also revealed the recommended course of treatment also includes drugs, relaxation, and joint care. However, study also found 85% patients took physiotherapy treatment for OA. In conclusion, as OA is non-curable condition but physiotherapy, regular exercise can reduces the symptoms (Jahan., Sima., Khalil., Sohel & Kawsar., 2017)

A nationwide cross-sectional survey by Haider and his colleague (2022) titled "Risk factors of knee osteoarthritis in Bangladeshi adults: a national survey" which was published on "BMC musculoskeletal disorders" Volume no-23, Issue no-1, Pages- 1-9. The study's objective was to identify the risk factors for knee OA in adult Bangladeshi. Total 2000 adult's subjects were assigned for this study; Data was collected by the Modified Community Oriented Program for Control of Rheumatic Disorders (COPCORD) questionnaire, and the diagnosis was made in accordance with the standards of the American College of Rheumatology. The study reported prevalence of knee OA 7.3% and highest at 40- 62 years old. Study also found increasing age (OR-13.9), low educational level (OR-1.7), and overweight (OR-1.9) are the major risk factors for knee OA (Haider et al., 2022).

Myofascial release (MFR) is a soft tissue manual therapy that stretches constricted fascia (Jung et al., 2017). Myofascial release is a manual energetic therapy and interactive stretching technique where the direction, force & duration of the stretch determine by feedback from the patient's body, to encourage the greatest possible relaxation of compressed or tight tissues (Jung et al., 2017). "The facilitation of

mechanical, neural and psycho physiological adaptive potential as interfaced by the myofascial system" is the definition of myofascial release therapy (Dewar, 2001). Myofascial release therapy is a safe, manipulative treatment applied with low stretch which used to releasing spasticity, muscle shortness and tightness and it's predominantly applied for reducing spasticity (Chen et al., 2021).

Myofascial Release techniques develop a kinesthetic link between the therapist and the patient by means of touch. This enables the therapist to keep track of both the patient's more obvious muscle tone and natural tissue mobility and neurophysiologic tissue tone and also detect the gross, subtle tightness and restrictions of individual muscle & myofascial unit via touch & successfully treated with myofascial release techniques (Chen et al., 2021).

Randomized clinical trial by Mahmooda et al. (2020) titled “Effects of Mulligan’s Mobilization with Movements Versus Myofascial Release in Addition to Usual Care on Pain and Range in Knee Osteoarthritis” which was published on “Rawal Medical Journal” Volume no-45, Issue no-2, Pages- 353-357. The purpose of the study was to evaluate the effects of Mulligan's mobilization with movement (MWM) and Myofascial release on elements of pain, range of motion, and functional abilities in individuals with knee osteoarthritis. The research was carried out by the physiotherapy departments of Pakistan's DHQ Hospital in Faisalabad and Madinah Teaching Hospital (MTH). To investigate this effectiveness the researcher were included 30 patients and divided them into two groups which was termed as Group A, received Mulligan's MWM and group B received Myofascial release by using lottery methods. Women with grade ii knee OA, as defined by Kellgran and Lawrence, who are between the ages of 40 and 60, who have a BMI between 25 and 29, who report knee pain on the NPRS scale of 3 to 7, and who have lost at least 10 degrees of knee flexion met the inclusion criteria for this study. On contrary, Patients who had received a corticosteroid injection in the previous six months, had a history of joint infection or knee surgery, and had grade i, iii, or iv OA were excluded. The outcome measurement tools of study were universal Goniometer for range of motion, The WOMAC functional disability index measures functional capacity while the numeric pain rating scale (NPRS) measures pain. Same exercise program and electrotherapy were given in both groups for weekly five days for two weeks. Exercise consists of hamstring and quadriceps isometrics (hold for 5 seconds) and knee ROM exercise

with ankle pump. Electrotherapy consists of TENS and hot pack. TENS were used cross manner technique with pulse rate 50Hz for 10 minutes. Beside this conventional treatment, Mulligan's MWM was given to Group A as well, whereas myofascial release were offered to Group B. It is also evident that the hamstrings and quadriceps muscles received myofascial release as a prolonged deep frictional stretch. The study's findings showed that all three measures significantly improved in both groups ($p< 0.05$). Significant lowering of pain ($p<0.05$) and improvement of ROM were found in Mulligan's mobilization with movement (MWM) groups; however In the group receiving myofascial release, stiffness was reduced and physical function was enhanced. ($p<0.05$). Both treatments (Mulligan's MWM and Myofascial release) were found to be beneficial for knee OA in terms of pain, range of motion, and functional capacities in the study (Mahmooda et al., 2020).

A randomized controlled trial by Rahman, Deepthi, Singh and Wah (2022) titled "Effect of Myofascial Release on Hamstring Tightness among Knee Osteoarthritis Patient" which was published on "Journal of Positive School Psychology" Volume no-6, Issue no-3, Pages- 4027-4034. The primary objective of this study was to determine whether the myofascial Release technique was beneficial in relieving hamstring tightness in patients with knee osteoarthritis. The study was conducted at Kedah's old folk home in Malaysia. To find out efficacy of Myofascial release researcher included 30 patients as participants and divided them into two groups. Whereas, Group A received both conventional therapy and myofascial release therapy, while Group B only received conventional therapy. The inclusion criteria of this study were patients who have age in between 40-60 years and have OA in Knee or Tibio-femoral joint; more than 30 degree hamstrings tightness; evidence of less knee space in X- ray or symptoms of OA. On the other hand, exclusion criteria were history of recent fracture, vascular disease or knee surgery, and patient who have any skin sensitivity. The outcomes of the study are evaluated by the 10 cm long Visual Analog Scale for pain, the Knee Osteoarthritis Outcome Score for quality of life, and the goniometer for active knee extension test. The test interpretation was done by online Ortho-Kit. For both groups conventional exercise includes thermotherapy by hot pack for 10 min; Static hamstrings, quadriceps, adductors, abductors exercise (10 reps, 10 second hold, and twice a day for all groups of muscle); Active knee flexion- 10 reps, twice a day. Straight leg raise- 10 reps, 10 second hold, twice a day.

However, group A also received Myofascial Release Technique which was done in comfortable prone lying position; the process started with a hand put over the hamstring muscle from the proximal to the distal end and mild stroking with massage oil. Strictly instructed to patients for not done any stretching or flexibility exercise that might impact on results. According to the study's findings, group A and group B differed significantly from each other in term of pain VAS score (p value=<0.024), in hamstring flexibility (p value=<0.0001) and functional disability (p value=<0.0001). The study found that myofascial release has benefits for treating knee OA in terms of pain relief, range of motion, and functional impairment reduction (Rahman., Deepthi., Singh & Wah., 2022).

A Parallel group randomized controlled trial by Gomaa and Zaky, (2016) which was titled "Effect of Iliotibial Band Myofascial Release on Functional Disability in Patients with Knee Osteoarthritis" published on "Advances in Environmental Biology" Volume no-10, Issue no-1, Pages- 221-230. This study aimed to determine whether iliotibial band myofascial release were beneficial for treating knee osteoarthritis patients' functional limitations. For this study, 36 patients with knee OA who were 50 to 59 years old were randomly divided into Group A (Control), which included 17, and Group B (Experimental), which included 19. The inclusion criteria of this study were patients who, according to the American College of Rheumatology, have been diagnosed with knee OA, age in the range of 50-59 years, difficulty in rising from sitting or climbing stairs or pain and additionally positive Ober & Nobel tests. Exclusion criteria were patients who diagnosed as rheumatoid arthritis, any impairment that prevent actively participation from exercise or manual therapy or walking i.e. vision problem, body weight more 120 kg, neurological condition, back ache, osteoporosis in advance stage, unable to walk for 10 meter without support, varus deformity of knee more than 10 degree, any dominant lower limb deformity and external tibialtortion. The WOMAC index, step test and time up go test were used for assessment. Both groups received 12 session of treatment on every alternative day for four weeks duration range from 20-30 minutes. Conventional exercise program includes Buttock squeeze (5 s hold), SLR (10 s hold) On each side, Terminal knee extension (5 s hold), Leg press (against the wall), Half squats, Step ups, Hamstring stretch (15-20 s hold), ITB stretch (15-20 s hold), Standing balance, Hip abductor strengthening (5 s hold). These all exercise done for 5 repetitions once daily.

Additionally, experimental group received 5-20 min MFR on the basis of number of trigger point. The neuromuscular method (longitudinal strokes) and the ischemic compression (IC) technique are two myofascial release techniques that are applied while the patient is lying on their side over the iliotibial band. According to the study's findings, both groups' measurements for all aspects showed significant enhancements (P-value 0.05). However, there was a highly significant improvement in the experimental group's reduction in pain and physical impairment. The recommended program of exercise alone or in combination with both ITB and MFR approaches has a significant impact on lowering pain and improving functional ability in knee OA patients (Gomaa & Zaky., 2016).

"The Effect of Adding Myofascial Techniques to an Exercise Programmed for Patients with Anterior Knee Pain- A Randomized Clinical Trial" by Telles and his colleague (2016) was published in "Journal of Bodywork and Movement Therapies" Volume no-20, Issue no-4, Pages-844–850. This study intended to investigate the impact of including myofascial treatments into an exercise regimen designed for those with anterior knee pain. For this researchers were includes 18 anterior knee pain patients and randomly assigned into two groups as exercise plus myofascial technique group (EM)-9 and exercise group (E)-9. Age between 27 and 73 years old, male and female patients with pain in the patellar region for at least one month, pain with squatting, going up and down stairs, sitting for extended periods of time, kneeling, and pain on palpation in the patellar region were the inclusion criteria for the study. The exclusion criteria, on the other hand, were a history of undergoing physiotherapy treatment for these symptoms, knee joint surgery within the past year, total knee arthroplasty, trauma, patellar fracture, dislocation, and rheumatoid arthritis diagnosis. The lower extremity functional scale (LEFS) and the numeric pain rating scale (NPRS) were used to assess the study's results in terms of disability and pain, respectively. The intervention for both groups were strengthening exercises for hip abductor muscles by use of elastic resistance band, strengthening exercises for lateral hip rotator muscles, strengthening exercises for gluteus maximus. However, Exercise plus myofascial technique group additionally received myofascial release technique for rectus femoris muscle & tensor fasciae latae muscle and muscle stretching technique for tensor fasciae latae muscle, rectus femoris muscle & hamstrings muscles. During stretching exercise hold for 30 sec with two repetitions for 60 sec for

each muscle. The intervention was given for 10 sessions for weekly two sessions and each session lasts for 30 minutes. Although both groups have significant improvement in term of pain ($p = 0.02$) however EM groups showed also reduce the degree of disability ($p = 0.008$). In conclusion, both exercise and myofascial release have impact on knee pain reduction additionally myofascial release also has impact on disability reduction (Telles et al.,2016)

A Critical review by Dor and Kalichman, (2017) titled "A Myofascial Component of Pain in Knee Osteoarthritis" published on "Journal of Bodywork and Movement Therapies" Volume no-21, Issue no-3, Pages- 642-647. The objective of this review was to determine what happens when myofascial pain affected patients with knee OA. Up to December 2016, researchers conducted searches on the databases of PubMed, Google Scholar, Scopus, and PEDro using the keywords "myofascial pain," "osteoarthritis," "trigger points," "knee," or any combination of these words to identify the role of myofascial pain. This review represent evidence that myofascial pain and the presence of number of myofascial trigger points have play in role in the term of pain and functional disability in the patients with knee OA (Dor & Kalichman., 2017).

A systematic review by Mckenney, Elder, Elder and Hutchins, (2013) titled "Myofascial Release as a Treatment for Orthopaedic Conditions: A Systematic Review" which was published on "Journal of Athletic Training" Volume no-48, Issue no-4, Pages-522-527.The aim of study was to critically published data to ascertain the effectiveness of myofascial release therapy in orthopaedic conditions. Total 88 articles were found in different search engine after applying inclusion and exclusion criteria 10 articles remaining for final review. Overall this review was found positive effects of myofascial release as the treatment option for orthopedic condition however authors suggested conducting more randomize control trial with good quality to determine the actual effectiveness, as the quality of study was mixed (Mckenney, Elder, Elder & Hutchins., 2013)

A randomised clinical trial by Dixit, Samal and Ramteke, (2020) titled "Efficacy of Maitland Mobilization and Myofascial Trigger Point Release in Patients of Osteoarthritis of Knee" which was published on "Indian Journal of Public Health Research & Development" Volume no-11, Issue no-5. This study's primary goal was

to examine the efficacy of Maitland mobilization and myofascial trigger point release in patients with knee osteoarthritis. Researchers chose 72 patients with knee OA as their subjects and randomly divided them into two groups, Group A receiving Maitland mobilization with conventional therapy and Group B receiving myofascial trigger point Release with conventional therapy, in an effort to determine the efficacy of these two treatments. The inclusion criteria for this study were: both genders, patients with single knee OA, patients with tightness in the quadriceps, hamstring, and iliotibial band, patients with Kellegren and Lawrence grade 1 and 2 radiographic evidence of osteoarthritis, age ranges in the 40 to 60 years, duration of disease greater than one year. In contrast, exclusion criteria included having had a knee injury within the previous six months, having had any knee surgery, applying intra-articular steroid injections within the previous three months, having peripheral vascular disease, having patients with unstable mental conditions, having any metallic implants in the lower limbs, and having patients with abnormal thermal sensations around the knee joints. The patients' disability was assessed using the WOMAC score, the goniometer for measuring range of motion, and the VAS scale for measuring pain. Both groups received conventional therapy, which included hydrocollateral packs to alleviate pain, static quadriceps, static hamstring exercise, VMO (vastus medialis strengthening), dynamic quadriceps, wall slides, partial lunges, one-leg standing exercises, as well as a self-stretching program for the quadriceps, hamstrings, and calf muscles at home. Additional to this conventional treatment, Group A received Maitland mobilization for patellofemoral joint, distal glide, in order to maintain patellar mobility for normal knee flexion, tibiofemoral distraction, tibiofemoral posterior glide (to promote flexion), tibiofemoral anterior glide (to increase extension). Group B, on the other hand, received myofascial trigger point release for the quadriceps, hamstrings, and iliotibial band. Treatment was given for total 18 sessions for 3 days as every alternative day for 6 weeks with duration of 30-35 min. The result of this study revealed that both groups have statistical significance on the term of pain, ROM and functional disability. However, Myofascial release group is more significant than Maitland mobilization group ($P<0.0001$). In conclusion, both treatment methods are effective for knee OA (Dixit, Samal & Ramteke., 2020).

A systematic review by Laimi et al, (2018) titled " Effectiveness of Myofascial Release in Treatment of Chronic Musculoskeletal Pain: A Systematic Review" which was published on "Clinical Rehabilitation" Volume no-32, Issue no-4, Pages-440-450. This systematic review's goal was to evaluate the effectiveness of myofascial release therapy in terms of pain, range of motion (ROM), functional ability, and quality of life in patients with chronic musculoskeletal pain. Total 513 articles were found out of these only 8 was relevant, rest of them were excluded. Different study reported the duration of treatment period varied from 30-90 minutes, session varied from 4-24 in 2-20 weeks. The authors found that there was higher risk of biasness and actual effects are not founded due to low sample size. The study was concluded as myofascial release therapy was not sufficient alone to create impacts on chronic musculoskeletal pain (Laimi et al., 2018)

“Effects of Myofascial Release and Stretching Technique on Range of Motion and Reaction Time”, a randomized clinical experiment conducted by Kuruma and his colleague (2013), was published in the “Journal of Physical Therapy Science”, Volume no. 25, Issue no. 2, pages 169–171. The primary goal of this research was to evaluate the effectiveness of myofascial release with stretching in terms of range of motion, muscular stiffness, and reaction time. For this, 40 healthy individuals were divided into four groups at random: controls; myofascial release for the quadriceps; myofascial release for the hamstrings; stretching for the quadriceps. Eight minutes of MFR were applied to the quadriceps in the supine position for the MFR-Q group participants, eight minutes to the hamstrings in the MFR-H group participants, eight minutes to the quadriceps in the stretch group subjects, and eight minutes to the quadriceps in the control group participants. In accordance with the study's findings, premotor time was greatly decreased in both myofascial groups, and active and passive range of motion was both significantly increased. Reaction time was significantly lower for quadriceps and hamstrings group and static stretching groups after intervention for 8 min in compare to control group. In conclusion, Myofascial releases have significant impacts on movement tranquility and also improve the ROM of joints (Kuruma et al., 2013)

A randomised control trial by Lim and his colleague (2019) titled "The effects of vibration foam roller applied to hamstring on the quadriceps electromyography activity and hamstring flexibility" which was published on "Journal of exercise rehabilitation" Volume no-15, Issue no-4, Pages- 560-565. The overall objective of this study was to examine towards the relationship between quadriceps electromyography (EMG) activity and hamstring flexibility after implementing a vibrating foam roller (VFR). 16 participants in total were divided into two groups at randomly. The foam roller or the VFR were applied to the dominant hamstring alternately by the two groups at a rate of 40 times per minute for a total of 200 times in 5 minutes. The main result, which was hamstring extensibility, has been assessed by the sit and reach test. Result of this study reported that sit-and-reach distance increased significantly in both groups after the intervention when compared to pre-intervention. After the intervention, there is no longer noticeable distinction in sit and reach between VFR and NVFR. These findings suggest that, regardless of vibration, rolling the hamstrings with a foam roller may promote hamstring flexibility (Lim et al., 2019).

Another randomised control trial by Cheatham, Stull and Kolber, (2019) titled "Comparison of a vibrating foam roller and a non-vibrating foam roller intervention on knee range of motion and pressure pain threshold: a randomized controlled trial" which was published on "Journal of Sport Rehabilitation" Pages-1-23. The reason for the conduct of this study was to establish a comparison between the effects of two roller interventions—one vibrating and one non-vibrating—on the quadriceps' passive range of motion (ROM) and pressure pain thresholds (PPT). For this study 45 adults were included as subject. Total time for each roll intervention was 2 minutes. Rolls were not applied in the control groupPPT significantly rose with the vibrating roller (p 0.001), accompanied by the non-vibrating roller ($p<0.001$) and the control ($p<0.001$). More than the non-vibrating roller or the control, the vibrating roller considerably improved knee ROM ($p<0.001$). As suggested by the results, a vibrating roller might increase an individual's pain threshold more than a non-vibrating roller (Cheatham, Stull & Kolber., 2019).

"Effectiveness of using wearable vibration therapy to alleviate muscle soreness", a randomised control trial conducted by Cochrane, (2017), published in the "European Journal of Applied Physiology", Volume No. 117, Pages 501–509. The purpose of this study was to investigate the short- and long-term effects of wearing a vibration device following a challenging eccentric elbow flexor exercise. Male university students (n = 13) who were physically active and in good health and had prior experience with resistance training engaged for the study. After eccentric exercise, for 15 minutes Vibration Therapy was applied 24, 48, and 72 hours later, the contralateral arm did not get any Vibration Therapy. Vibration Therapy was able to greatly lessen biceps brachii pain, enhance pain threshold, and improve range of motion in the short term. Acute and short-term VT reduced pain in the muscles, elevated creatine kinase levels, and increased range of motion (Cochrane, 2017).

An experimental study by Konrad, Glashuttner, Reiner, Bernsteiner and Tilp, (2020) titled "The acute effects of a percussive massage treatment with a hypervolt device on plantar flexor muscles' range of motion and performance" which was published on "Journal of sports science & medicine" Volume no-19, Issue no-4, Page- 690. The primary objective of this study was to determine how the plantar flexor muscles' range of motion and maximal voluntary contraction (MVC) torque were affected by a 5-minute percussion therapy of the calf muscles. In this study, 16 healthy recreational male athletes volunteered to participate. All those with lower leg injuries in the past, as well as those with neuromuscular diseases of any kind, were included in the study. However, elite athletes were excluded from the study. Before to and following both treatments, the plantar flexor muscles' dorsiflexion range of motion (ROM) and MVC torque were evaluated (massage and control). Maximum dorsiflexion range of motion increased considerably after massage therapy by 5.4° (+18.4%; p = 0.002, d=1.36), whereas there was no change in the control group. A portable percussive massage treatment can increase range of motion (ROM) similarly to a regular massage from a therapist without affecting muscular strength (Konrad, Glashuttner, Reiner, Bernsteiner & Tilp., 2020)

Another experimental study by Lee, Chu, Lyu, Chang and Chang, (2018) titled "Comparison of vibration rolling, nonvibration rolling, and static stretching as a warm-up exercise on flexibility, joint proprioception, muscle strength, and balance in young adults" which was published on “Journal of sports sciences” Volume no-36, Issue no-22, Pages- 2575-2582. This study explored the short-term effects of static stretching, vibration rolling, and nonvibration rolling as part of a warm-up routine on the flexibility, muscle strength, and dynamic balance of young adults' lower extremities. Thirty male college students (aged 20.4–1.2, weighing 68.8–8.9 kg, and standing 1.7–0.6 m tall) took part in three trials: static stretching, foam rollers with vibration, and foam rollers without vibration. In comparison to the pre-intervention, VR significantly increased isokinetic peak torque and dynamic balance for muscular strength and dynamic balance by 33%-35% and 1.5%, respectivelyAdditionally, it significantly increased knee flexion and extension range of motion by 2.5% and 6%, respectivelyHowever, participants' knee joint positioning errors were considerably greater after NVR than after VR, indicating that NVR may have a negative impact on knee joint proprioception. The majority of outcomes between VR and NVR were equal. These results suggest that VR may be considered by athletic professionals when designing a more effective pre-performance routine to enhance workout performances (Lee, Chu, Lyu, Chang & Chang., 2018)

Another experimental study by Garcia-Gutierrez, Guillen-Rogel, Cochrane, and Marin, (2018) titled "Cross transfer acute effects of foam rolling with vibration on ankle dorsiflexion range of motion" which was published on “Journal of musculoskeletal & neuronal interactions” Volume no-18, Issue no-2, Page- 262. The primary objective of this study was to examine into the effects of vibrating the ankle plantarflexors while applying a foam roller on the mobility of the ankle joint. 38 undergraduate students-19 men and 19 women participated in the study in a randomized order, three conditions were carried out. There was a cross-effect in the non stimulated limb. The Roller and Roller + VIB conditions had significant effects on ankle mobility (6% and 7%, respectively, p=0.001). Massage using a foam roller and vibration stimulation an additional benefit of foam roller massage is increased ankle mobility (Garcia-Gutierrez, Guillen-Rogel, Cochrane & Marin., 2018)

CHAPTER – III METHODOLOGY

3.1 Study design

It was a Randomized Clinical Trail (RCT)

MFR group:	R	O_1	X	O_2
Physio gun group:	R	O_1	X	O_2

A randomized clinical trial with assessor blinding that included baseline, post-treatment, and two group comparisons was the focus of the study. Classical experimental research demonstrates a causal relationship between independent and dependent variables and calculates the results for generalization (Stangor, & Walinga, 2019). A method for evaluating hypotheses by which cause and effect can be demonstrated is the randomized clinical trial design. The study used different subject designs in a genuine experimental setting. Each group received the same course of treatment. Myofascial release therapy and Physio gun release was apply additionally both groups was received usual physiotherapy treatment. To assess the efficacy of myofascial release treatment and physio gun release, pre- and post-tests were administered to each patient in both groups before and after the interventions.

3.2 Study Site

The research was carried out at outpatient musculoskeletal unit of Physiotherapy Department of the center for rehabilitation of the paralysed (CRP), Savar, and Dhaka 1343.

3.3 Study period

The duration of the study was 6 Months. This study was conducted from September, 2022 to March, 2023.

3.4: CONSORT Flow Diagram

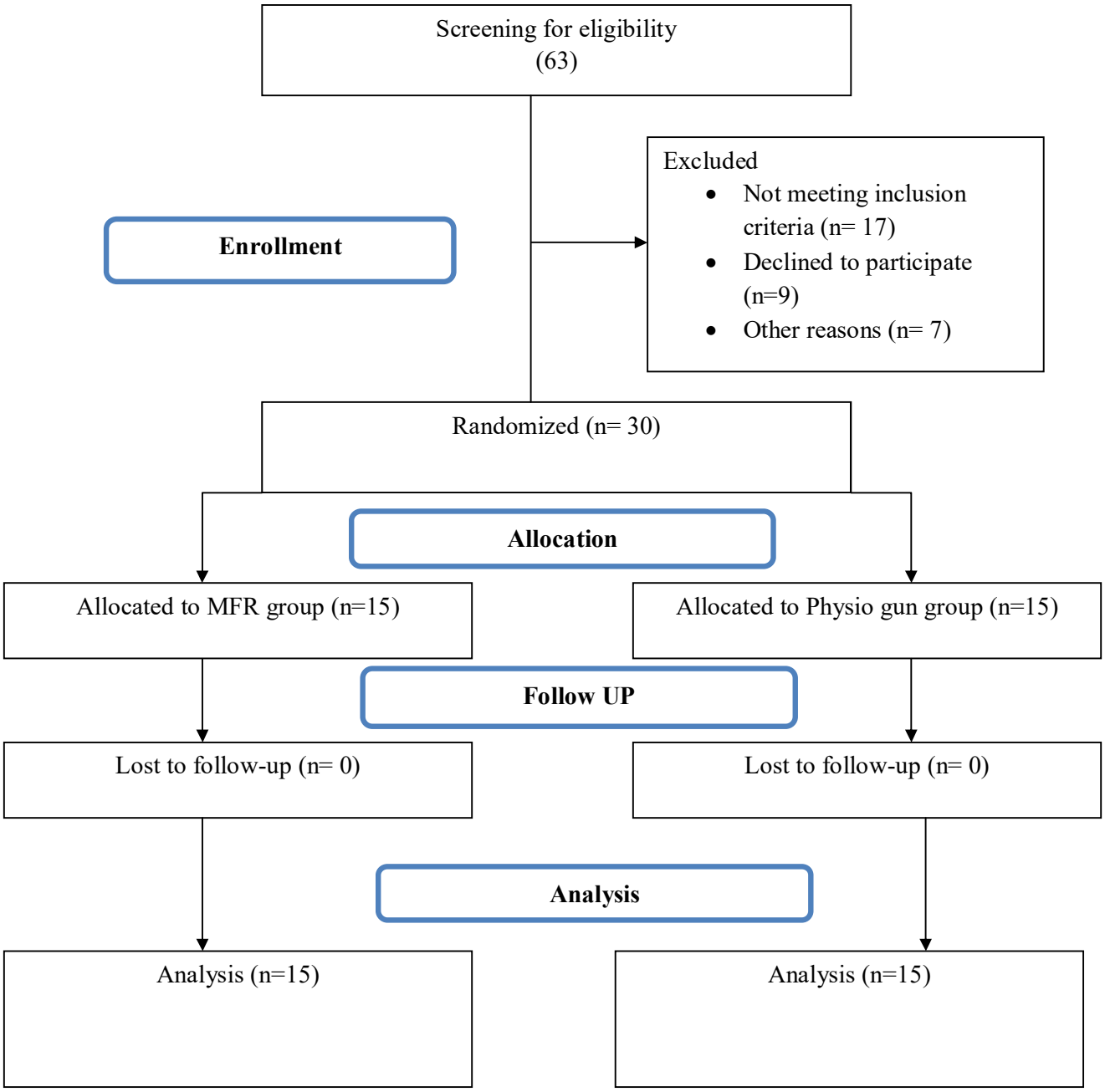


Figure 01: Consort flow chart of the phases of Randomized Clinical Trial

3.5: Study Population

The study population was the patients with knee OA attended in the Musculo-skeletal Unit of Physiotherapy Department at CRP. Savar, Dhaka.

3.5 Sample size

A power analysis is done to determine sample size with 5.78% prevalence of knee OA in Bangladesh (Samal, Panchbudhe, Samal, Dixit & Gawande., 2021). Where a 5% type – I error (α), 80% power (1 – type II error/β) and a clinically acceptable margin, δ = 0.1, then according to Zhong (2009),

$N = 2 \times (\frac{Z_{1-\alpha}+Z_{1-\beta}}{\delta})^2 \times p \times (1 - p)$

$= 29.66 \approx 30$

Here,

$1 - \alpha = 0.95$

$1 - \beta = 0.80$

$Z\ (0.95) = 1.96$

$Z\ (0.90) = 1.65$

So, researcher considered 30 participants for each group.

3.6 Sampling technique

Computerized random sampling technique was used in this study. A single blinded (assessor) randomized clinical trial with pre-measurements and post-measurements were conducted. Participants were measured by a blinded assessor once before randomization and intervention and again once 4 weeks after randomization and getting intervention. The assessor were responsible for conducting the baseline assessments had checked that each participant meets the inclusion criteria and had collected demographic information including date of birth, sex. Prior to the start of the experiment, a secure random allocation schedule had been developed by another person. The randomization schedule consisted of a block (1:1) to assure that the myofascial and physio gun groups received an equal number of participants. When the allocation was provided and the baseline information was recorded, a person had enrolled in the trial.

3.7: Selection Criteria

3.7.1: Inclusion criteria

- Patients who already diagnosed as Knee OA through guideline of American College of Rheumatology (Gomaa & Zaky, 2015; 2016)
- Male and female both will be included (Rahbar., Toopchizadeh., Eftekharsadat & Ganjeifar., 2013).
- Age 35–60 years (Rahman et al., 2022).
- Knee pain 3-7 on NPRS (Mahmooda et al., 2020).
- Patients who lost at least 10-degree flexion of knee (Mahmooda et al., 2020).

3.7.2: Exclusion Criteria

- Patients who taken any intra-articular corticosteroid injection during last 6 months (Mahmooda et al., 2020).
- Patients who had any previous history of knee joint surgery (Rahman et al., 2022).
- Patients who had any previous history of knee joint infection (Mahmooda et al., 2020).
- Patients who were mentally unstable (Rahbar., Toopchizadeh., Eftekharsadat & Ganjeifar., 2013).
- Obese patients (Dixit, Samal and Ramteke, 2020)
- Severe disability such as walking disability with or without crutches, contraindications for physical modalities (Gomaa & Zaky, 2015; 2016).
- Any history of rheumatic diseases such as rheumatoid arthritis or systemic lupus erythematous, recent operation or fracture of lower extremities or pathological conditions such as malignancy, heart disease etc (Gomaa & Zaky, 2015; 2016).

3.8: Methods of Data Collection

Patients who met the inclusion criteria were enrolled in the trial. The procedure was explained to all the patients. Written informed consent from the patients was taken. Data was collected by a structured, closed-ended questionnaire, a face-to-face interview for patient evaluations and assessing the patient, initial recording treatment

and final recording. The patients were assessed and treated by a qualified Physiotherapist in the meantime the assessor had taken the pre-test data. The pre-test data were taken before starting intervention. The researcher had given a verbal and practical training session about the treatment protocol towards 4 qualified physiotherapists before giving treatment to the patients.

The total 4 weeks treatment session was provided to each participant. After completing the 4 weeks of treatment the post-test data were taken. Pre-test and post-test data were collected using a written questionnaire developed by the researcher. The questionnaire was formulated in both Bengali and English for better understanding.

3.9: Randomization

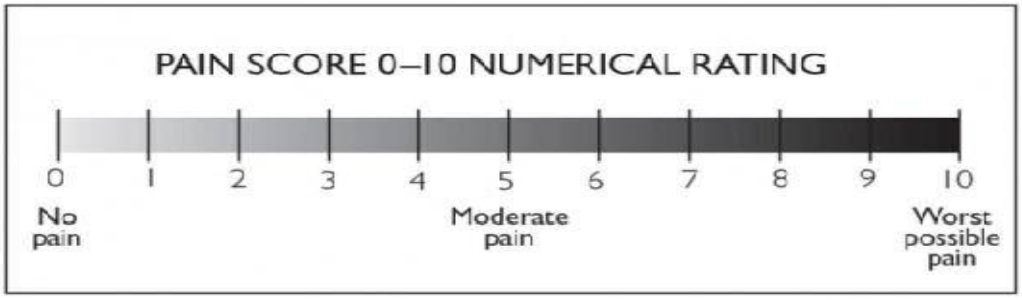
Subject with knee OA who was meet the inclusion criteria were randomly chosen from outdoor musculoskeletal physiotherapy unit of CRP, Savar and then they were assigned by simple randomization process. The study was single blinded. For this randomized clinical trial study, internal validity of the experimental research was increased by using computer-generated random numbers in Microsoft Office Excel 2013. The samples were given numerical identification numbers P1, P2, P3, etc. for the physio gun group and M1, M2, M3, etc. for the myofascial release group.

3.10: Measurement Tools

The structured questionnaire, which was designed to collect information on related topics, was used by the interviewer. Name, sex, age, education level as socio-demographic data and background information were included in the questionnaire. The Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC SCORE) have been presented in the next section and after that Numeric pain rating scale (NPRS). Range of motion (ROM)-related items was in the final segment.

Numeric pain rating scale (NPRS)

The Visual Analog Scale (VAS) has a segmented numerical version called the NPRS. Where every participant is asked to circle the number between 0 and 10 that best reflects patient's pain intensity (Haefeli & Elfering, 2005).



(CC.: National Institute of Clinical Studies., 2011)

Figure: Numeric pain rating scale (NPRS)

The Western Ontario and McMaster Universities Arthritis Index (WOMAC)

There are 24 items a set of standardized questionnaires in the Western Ontario and McMaster Universities Arthritis Index (WOMAC) (5 items asking pain at activity or rest, the stiffness dimension includes 2 questions and the function dimension explores the degree of difficulty in 17 activities) divided into 3 subscales is widely used to evaluate the pain, stiffness, and physical functioning of the Hip and Knee joint osteoarthritis where the patients were questioned on their pain, stiffness, dysfunction (disability) in following descriptions for all items: none, mild, moderate, severe and extreme and these correspond to an ordinal scale of 0-4 (Ebrahimzadeh et al., 2014; Salaffi et al., 2003).

Goniometer

In this study, the flexion and extension range of the knee were measured using a goniometer.

(CC.: Eric Trauber., 2021)

Figure: Goniometer

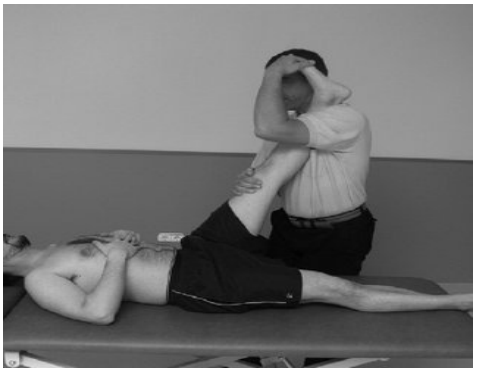
3.11: Treatment Protocol

Myofascial release therapy and physio gun was applied by a graduate qualified trained physiotherapist who is enough experts in myofascial release therapy to the patients of trial group. There are no exact treatment sessions for myofascial release therapy, however different study did 4-20 sessions, most of the study were given 10-12 sessions. In this study treatment session was 12, done in four weeks. All the patients were evaluated with outcome measurement tools, for two times, on day one before intervention, and at the end of 12 sessions. Treatment was given 3 days per weeks for 4 weeks.

Usual Care

For both groups, a standard intervention program was used as usual care that consists of-

Stretching: Sustained manual stretches of 15–30s duration with 3-5 repetition to reduce muscle tightness (Gomaa and Zaky, 2016)



Muscle strengthening such as static quad sets in knee extension: Hold each contraction for 10 sec with 2sec rest between repetitions for 10 repetitions (Mahmooda et al. 2020).

Manual therapy technique: Mobilization grades I, II for pain and III and IV for ROM for 10 repetitions (Samal, Panchbudhe, Samal, Dixit & Gawande., 2021)

Patient's education and home advice

Table: Usual Care

Treatment Options	Duration/Repetitions
Sustain Manual Stretching	15–35 second holds with 3-5 repetitions
Static quad sets in Knee extension	10 sec contraction with 10 repetitions
Maitland mobilization	Grade I, II, III, IV for ten repetitions

Myofascial release

Myofascial release was applied on quadriceps muscle and iliotibial band for 5-15 min in a session depending on the targeted number of Trigger points (Gomaa and Zaky ., 2016).

Table: Myofascial release

Treatment Options	Duration/Repetitions
Vastus medialis release	3-5 minutes per session
Vastus lateralis release	3-5 minutes per session
Iliotibial band release	3-5 minutes per session

Physio gun

Physio gun were also applied on quadriceps muscle and iliotibial band. In this study "Massage Gun" was used. There were number of study which demonstrated the use and effect of vibrating foam roller. Vibrating foam roller is identical to muscle gun. Most of the study use vibration at 120 Hz. On this basis dose of the study were designed for this study. In this study it was also used and dose were also designed as directed in user manual of device which is 240 rpm/min. The duration of treatment will be for quadriceps muscle 6 min 2 times in one treatment session and for iliotibial band 3 min 2 times.

3.11: Data Analysis

In order to ensure that the research have some values, the meaning of collected data has to be presented in ways that other research workers can understand. In other words, the researcher needed to interpret the findings. Since this research's findings are the outcome of an experiment, statistical analysis was used to analyze the data. Descriptive statistics for demographic information and inferential statistics for participant group differences in disability, pain, and range of motion were used in the statistical study through Statistical Package for the Social Science (SPSS) version 23.

3.12: Statistical test

The between group analysis of disability, pain and range of motion (ROM) of the participants was analyzed by Mann-Whitney U-test. The within group analysis of disability, pain and range of motion (ROM) of the participants was done by Wilcoxon singed rank test.

Parametric test was used to do analyzed interval/ ratio data and non-parametric test used to analyze the nominal or ordinal data. Also normality of data was checked. Normality of data was tested by Kolmogorov-Smirnov test. As the value of Kolmogorov-Smirnov test is less than .05, which indicate that the data distribution is not normal. The normal distribution was determined using the Kolmogorov-Smirnov test of The Western Ontario and McMaster Universities Arthritis Index (WOMAC) and Numeric pain rating scale (NPRS) data.

Mann-Whitney U test: It is a non-parametric test that simply analyzes the outcomes from each group to determine whether they substantially differ from one another. Use of this test is confined to ordinal or interval/ratio data.

The formula of Mann-Whitney U test:

$$U = n_1 n_2 + \frac{n_x(n+1)}{2} - T_x$$

Here,

n_1 = number of subjects from experimental group.

n_2 = number of subjects from control group.

T_x = the larger rank total.

n_x = the number of the subjects of the group with larger rank total.

Wilcoxon sign-ranked test: It is used to determine whether there is significant deference within the groups when there are two groups of matched participants, one group reflecting one condition and the other group reflecting a different condition.

The formula of Wilcoxon sign-ranked test:

$$Z = \frac{W_S - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}}$$

Here,

n = number of pairs where differences is not 0

W_s = smallest of absolute values of the sum

The statistical approach to determining sample size was the power calculation. Statistical power is a measure of how likely the study was to produce a statistically significant result for a difference between groups of a given magnitude (Serdar, Cihan, Yucel, & Serdar, 2021).

3. 13: Level of Significance

The study's significance was determined by calculating the "p" value. The probability of the findings in an experimental investigation is indicated by the “p” values. Probability describes how accurate the findings are. The 95% ($p<0.05$) level was used to determine significance. A p value is often referred to as the level of significance for an experiment, and for health care research, a p value of 0.05 is regarded as significant. The results can be regarded as significant if the p value is equal to or less than the significant level (De Poy & Gitlin, 2013).

3.14: Quality control and assurance

Blinding of Patients: Allocation of patient to experimental and control group by using computerized allocation system.

Homogeneity: Both groups are homogenous regarding inclusion criteria and socio-demographic factors.

Pilot trial: Before beginning the study, the researcher ran a brief pilot experiment (7 days with 5 patients) to ensure that the procedure and outcome measures were feasible.

Questionnaire: The questionnaire's framework was strictly structural, which made it possible to provide a conclusive response. The questionnaire was developed using the results of the literature review. Employ an accredited questionnaire that has been peer reviewed and accepted internationally.

Selection bias: The researcher used randomization in an effort to avoid selection bias and criteria for inclusion and exclusion are rigorously followed.

3.15: Ethical consideration

This experimental study includes clients, physiotherapists, other staff members and resources for better outcome. All participants' information was kept confidential. The participants had the right to withdraw from treatment anytime.

The World Health Organization (WHO) and Bangladesh Medical and Research Council (BMRC) ethical guidelines were followed. First, a formal research project proposal (CRP/BHPI/IRB/10/2022/670) was submitted to the Institutional Review Board (IRB) of the Bangladesh Health Professions Institute. Data was collected from Savar and CRP after receiving authorization to collect the data. All data and assessment files were kept confidential and in a secure environment.

CHAPTER – IV RESULTS

After randomization between, targeted 30 patients were assigned to Myofascial release group (MRG) (n=15) and Physio gun Group (PGG) (n=15) (Figure 01). There was no drop out among both groups during post assessment.

Table 4.1: Socio-demographics and Baseline characteristics of the participants

Characteristics		Myofascial release group (MRG)	Physio gun Group (PGG)	p value
Age (Mean±SD)		50.87±7.530	51.00±9.281	0.263[b]
Gender % (n)	Male	12(80.0)	11(73.3)	0.665[b]
	Female	3(20.0)	4(26.7)	
Education % (n)	Primary	1(6.7)	2(13.3)	0.467[b]
	SSC	4(26.7)	7(46.7)	
	HSC	5(33.3)	4(26.7)	
	Graduation or more	5(33.3)	2(13.3)	
Living Area % (n)	Rural	3(20.0)	7(46.7)	0.292[b]
	Town	10(66.7)	7(46.7)	
	City	2(13.3)	1(6.7)	
Outcome Measures	**NPRS** (Mean±SD)	5.133±1.302	4.400±1.121	0.806[a]

(a = Mann Whitney U test; b = Chi-square test)

There is no statistically significant difference (p >.05) between the myofascial release group and the physio gun Group at baseline parameters (Table 1). On the assessed demographic characters (age, sex, education, and living area) and participants pain level which were measured through NPRS.

The socio-demographic analysis contrasted two groups (MRG and PGG) across a number of dimensions. Each variable's mean values (standard deviation) and percentage were determined. A P-value was used to assess the significance of the observed differences between the groups. The average age of the MRG was found to be 50.87 ± 7.530 years, while that of the PGGs was 51.00 ± 9.281 years. Together, the two groups had a mean age of 50.93 ± 8.304 years. Twelve of the fifteen members of the MRG (80%) and eleven of the fifteen members of the PGG (73%) identified as male. Twenty-three (76.6%) of the entire sample were men. Three people (20.0%) in the MRG group resided in rural areas, ten (66.7%) lived in towns, and two (13.3%) lived in cities, as indicated by the living area variable. Seven members of the PGG group were located in rural areas, seven in towns, and one in a metropolis (6.7%). Overall, 13 people (41.9%) called the countryside home, 12 called a town or village home, and 6 called a city home (19%). One member of the MRG (6.7%) had completed only elementary school; four members (26.7%) had completed only secondary school; five members (33.3% had completed only high school); and five members (33.3%) had completed only college. Two people (13.3%) in the PGG group had completed high school, seven (46.7%), four (26.7%), and two (13.3%) had obtained SSC or SSC-equivalent degrees. Three people (9.8%) in the sample had only completed elementary school, ten (32.3%) had completed secondary school, nine (28.5%) had completed high school, and nine (29.4%) had completed college.

Table 4.2: Between group comparisons of Post treatment ROM (MRG and PGG) among the participants (Mann-Whitney U Test)

ROM	MRG		PGG		z value	p value
	Pre-test Mean	Post test Mean	Pre-test Mean	Post test Mean		
Active knee Flexion	1.67±0.488	1.60±0.507	1.53±0.743	1.13±0.352	-2.607	0.009**
Active knee Extension	1.67±0.617	1.60±0.507	1.40±1.056	1.13±0.516	-1.73	0.083
Passive Knee Flexion	0.87±0.640	0.80±0.676	1.00±0.655	0.40±0.507	-1.672	0.094
Passive Knee Extension	0.87±0.743	0.80±0.775	1.20±0.862	0.40±0.632	-1.521	0.128

(* = < 0.05; ** = <0.01; *** = <0.001 Significant)

Table 4.2 displays the results of a pre-and post-intervention assessment of ROM in the MRG and PGG groups. The z-value and corresponding p-value for determining statistical significance are supplied alongside the mean values (± standard deviation) for each variable.

Prior to treatment, the MRG group had a mean range of motion (ROM) of 1.67±0.488 for the variables "Active knee flexion," while the PGG group had a ROM of 1.53±0.743. Following the treatment, the MRG group saw a reduction in mean ROM to 1.60±0.507, whereas the PGG group saw a considerable drop to 1.13±0.352. After the treatment, there was a statistically significant split between the two groups (z = -2.607, p = 0.009).

After treatment, the MRG group had a mean ROM of 1.67±0.617 degrees in "Active knee extension," while the PGG group had a mean ROM of 1.40±1.056 degrees. After the treatment, the MRG group's mean ROM reduced to 1.53±0.640 and the PGG group's mean ROM decreased to 1.13±0.516. After the intervention, the z-value was -1.73, suggesting a possible difference between the groups (p = 0.083), however the difference was not significant.

Before treatment, the MRG group had a mean ROM of 0.87±0.640 for "Passive knee flexion," while the PGG group had a ROM of 1.00±0.655. After the treatment, the MRG group's mean ROM dropped to 0.80±0.676 while the PGG groups dropped dramatically to 0.40±0.507. The intervention significantly differentiated the two groups, as measured by a z-value of -1.672 (p = 0.094).

Before treatment, the MRG group had a mean ROM of 0.87±0.743 in "Passive knee extension," while the PGG group had a ROM of 1.20±0.862. Following treatment, the MRG group saw a decrease in mean ROM of 0.80±0.775, while the PGG group saw a decrease of 0.40±0.632. After the intervention, the z-value was -1.521, suggesting a possible difference between the groups (p = 0.128), but the difference was not statistically significant.

This study found that for post treatment ROM, Mann-Whitney U test for “Active knee flexion” in between group gives Z = -2.607 which is greater than -1.96, the critical value Z for 95% Confidence level and p value is 0.009 which is less than 0.05. As z value is negative, that means second group treatment is significant for “Active knee flexion”. That means PGG is statistically significant than MRG. However, results for others parameters such as “Active knee extension”, “Passive knee flexion” and “Passive knee extension” are not statistically significant.

Table 4.3: Within group comparisons of ROM (MRG and PGG) among the participants (Wilcoxon signed- ranked test)

ROM	MRG		PGG	
	Z	p	Z	p
Active knee Flexion	-1.000	0.317	-1.897	0.058
Active Knee Extension	-1.414	0.157	-1.155	0.248
Passive Knee Flexion	-0.557	0.564	-2.460	0.014**
Passive knee Extension	-0.577	0.564	-2.585	0.010**

(* = < 0.05; ** = <0.01; *** = <0.001 Significant)

The distinction within MRG and PGG on the ROM Scores is presented in the above table. These results imply a statistically significant difference in WOMAC Scores within the MRG and PGG groups.

By examining the final test statistics through Wilcoxon signed- ranked test, it was discovered that for n = 15 in MRG, Wilcoxon test gives Z = -1.000, p = 0.317 for Active knee flexion, Z = -1.414, p = 0.157 for Active knee extension, Z= -0.557, p =0.564 Passive knee flexion and Z= -0.577, p =0.564 for Passive knee extension. Within group analysis for MRG group illustrated that there was no statistical significance for MRG participants. On the other hand, Wilcoxon signed- ranked test for PGG gives Z = -1.897, p = 0.058 for Active knee flexion, Z = -1.155, p = 0.157 for Active knee extension, Z= 0.248, p =0.014 Passive knee flexion and Z= -2.585, p =0.010 for Passive knee extension. Within group analysis for PGG have statistical significance passive knee flexion and passive knee extension.

Table 4.4: Between group comparisons of Post treatment NPRS Score for MRG and PGG among the participants (Mann-Whitney U Test)

NPRS	MRG		PGG		z value	p value
	Pre-test Mean	Post test Mean	Pre-test Mean	Post test Mean		
	5.133±1.302	4.800±1.320	4.400±1.121	2.733±1.279	-3.118	0.002*

(* = < 0.05; ** = <0.01; *** = <0.001 Significant)

The results of the MRG and PGG groups' NPRS (Numerical Pain Rating Scale) assessments are shown in the table below. The mean NPRS Score for the MRG group was 5.133±1.302 before treatment, while the PGG group's score was 4.400±1.121. After treatment NPRS score mean was 4.800±1.320 and 2.733±1.279 for MRG and PGG respectively. There was no significant difference between the two groups before the intervention. However, Post treatment PGG group have statistical significance in reduction of pain as measured by the z-value (-3.118; p = 0.002).

These results imply that the PGG group, compared to the MRG group, experienced a statistically significant reduction in NPRS score following the intervention.

Table 4.5: Within group Comparison of NPRS Score for MRG and PGG among the participants (Wilcoxon signed- ranked test)

NPRS	MRG		PGG	
	Z	p	Z	p
	-2.495	0.013**	-3.370	0.001***

(* = < 0.05; ** = <0.01; *** = <0.001 Significant)

The distinction within MRG and PGG on the WOMAC Scores is presented in the above table. These results imply a statistically significant difference in WOMAC Scores within the MRG and PGG groups.

This study found that within group analysis of NPRS score for both groups after treatment, Wilcoxon signed- ranked test in MRG was Z= -2.495, p= 0.013 which means MRG have statistical significance on NPRS score. On the other hand, Wilcoxon signed- ranked test in PGG group was Z= -3.370 and p= 0.001 that means PGG also significant for NPRS.

Table 4.6: Between group comparisons of Post treatment WOMAC score (MRG and PGG) among the participants (Mann-Whitney U Test)

WOMAC	MRG		PGG		z value	p value
	Pre-test Mean	Post test Mean	Pre-test Mean	Post test Mean		
Pain	1.920±0.603	1.560±0.560	1.813±0.515	1.106±0.319	-1.776	0.076
Stiffness	0.700±0.774	0.500±0.597	1.100±0.910	0.400±0.430	-0.247	0.805
Physical Function	1.749±0.511	1.521±0.568	1.917±0.405	1.070±0.332	-2.184	0.029*

(* = < 0.05; ** = <0.01; *** = <0.001 Significant)

Comparison of MRG and PGG WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) scores

The MRG group had a mean score of 1.920±0.603 on the variable "Pain" before the intervention, while the PGG group had a mean score of 1.813±0.515. There was no significant difference between the two groups before the intervention, as measured by the t-value (0.520; p = 0.607). After the intervention, the mean score dropped from 1.660±0.560 in the MRG group to 1.106±0.319 in the PGG group. After the intervention, there was a statistically significant split between the two groups, as measured by a z-value of -1.776 (p = 0.076).

Before treatment, the MRG group scored "Stiffness" at 0.700±0.774 on average, while the PGG group scored "Stiffness" at 1.100±0.910 on average. There was no significant difference between the two groups before the intervention, as measured by the t-value (1.296; p = 0.206). After the intervention, the MRG group's mean score dropped to 0.500±0.597, and the PGG group's mean score dropped to 0.400±0.430. No statistically significant change was seen between the two groups following the intervention (z = -0.247, p = 0.805).

The pre-intervention mean score for "Physical Function" was 1.749±0.511 in the MRG group and 1.917±0.405 in the PGG group. There was no significant difference between the two groups before the intervention, as measured by the t-value (1.001; p = 0.325). Scores declined after the intervention, with the MRG group's averaging 1.521±0.568 and the PGG group's dropping to a substantially lower 1.070±0.332. After the treatment, there was a statistically significant split between the two groups (z = -2.184, p = 0.029).

These results imply that the PGG group improved significantly more in pain and physical function scores following the intervention than the MRG group did. However, neither the pre-intervention nor post-intervention scores for physical function differed significantly between the two groups.

Table 4.7: Within group comparisons of WOMAC scores (MRG and PGG) among the participants (Wilcoxon signed- ranked test)

WOMAC	MRG		PGG	
	Z	p	Z	p
Pain	-2.699	0.007**	-3.201	0.001***
Stiffness	-1.511	0.131	-2.708	0.007**
Physical Function	-2.670	0.008**	-3.297	0.001***

(* = < 0.05; ** = <0.01; *** = <0.001 Significant)

The distinction within MRG and PGG on the WOMAC Scores is presented in the above table. These results imply a statistically significant difference in WOMAC Scores within the MRG and PGG groups.

By examining the final test statistics through Wilcoxon signed- ranked test, it was discovered that for n = 15 in MRG, Wilcoxon test gives Z = -2.699 for pain, which is greater than -1.96, the critical value Z for 95% Confidence level and p value is 0.007 which is less than 0.05; Z = -1.511 for stiffness, which is less than -1.96, the critical value Z for 95% Confidence level and p value is 0.131 which is more than 0.05 and Z = -2.670 for physical function, which is greater than -1.96, the critical value Z for 95% Confidence level and p value is 0.008 which is less than 0.05; that means MRG treatment has statistical significance for pain and physical function; however statistically not significant for stiffness.

On contrary, the final test statistics through Wilcoxon signed- ranked test, it was discovered that for n = 15 in PGG, Wilcoxon test gives Z = -3.201 for pain, which is greater than -1.96, the critical value Z for 95% Confidence level and p value is 0.001 which is less than 0.05; Wilcoxon test gives Z = -2.708 for stiffness, which is less than -1.96, the critical value Z for 95% Confidence level and p value is 0.007 which is less than 0.05; Wilcoxon test gives Z = -3.297 for pain, which is greater than -1.96, the critical value Z for 95% Confidence level and p value is 0.001 which is less than 0.05. That means PGG treatment has statistical significance for pain, stiffness and physical function.

CHAPTER – V DISCUSSION

5.1: Discussion

The aim of this study was to determine the effects of myofascial release therapy in comparison of physio gun release of quadriceps muscle and iliotibial band in addition to usual care on pain, range of motion and disability in patients with knee osteoarthritis. The study results revealed that physio gun release of quadriceps muscle and iliotibial band are more effective than myofascial release therapy for improving pain, ROM and reducing disability, which measured by NPRS, goniometer, WOMAC, respectively. The overall effect size observed in the study is in favor of the physio gun group. This study is the first of its kind to use a physio gun on patients with knee osteoarthritis, to the best of the researcher's knowledge. The use of physio gun and its effectiveness was quite impressive in this study, suggesting using for reducing pain and disability in patient with knee osteoarthritis.

In this study, osteoarthritis of the knee patients received a non-invasive effective approach via myofascial release or physio gun release to reduce symptoms and improve their overall well-being. This might be a helpful addition to the treatment of osteoarthritis of the knee joint.

Smith et al. (2021) conducted a study in which they compared the outcomes of a new drug in three age groups: 40 to 50, 51 to 60, and 60 and up & it was found that drug are more effective in less than 35 years age of participants with knee OA, they also suggested that above the age of 50 years drug has very limited efficacy in knee OA; however the study did not evaluate the medication's long-term effects. In this study the average age of the MRG was found to be 50.87 ± 7.530 years, while that of the PGGs was 51.00 ± 9.281 years. Together, the two groups had a mean age of 50.93 ± 8.304 years. As knee OA is a non curable condition, so it’s better to avoid drugs rather than use of alternative treatment like physiotherapy.

This study's gender distribution was twelve of the fifteen members of the MRG (or 80 percent) and eleven of the fifteen members of the PGG (or 73 percent) identified as male. Twenty-three (or 76.6%) of the entire sample were men. There was no statistically significant difference between MRG and PGG, according to a p-value of

0.637. Three people (20.0%) in the MRG group resided in rural areas, ten (66.7%) lived in towns, and two (13.3%) lived in cities, as indicated by the living area variable. Seven members of the PGG group were located in rural areas, seven in towns, and one in a metropolis (6.7%). Overall, 13 people (41.9%) called the countryside home, 12 called a town or village home, and 6 called a city home (19.0%). According to a p-value of 0.787, there was no statistically significant difference between MRG and PGG.

One member of the MRG (6.7%) had completed only elementary school; four members (26.7%) had completed only secondary school; five members (33.3% had completed only high school); and five members (33.3%) had completed only college. Two people (13.3%) in the PGG group had completed high school, seven (46.7%), four (26.7%), and two (13.3%) had obtained SSC or SSC-equivalent degrees. Three people (9.8%) in the sample had only completed elementary school, ten (32.3%) had completed secondary school, nine (28.5%) had completed high school, and nine (29.4%) had completed college. Gupta, Chakroborty & Singh., (2022) did another study that examined how an intervention influenced persons with various socioeconomic origins and educational levels and study included 31 individuals; ten (32.3%) had an SSC, nine (28.5%) had an HSC, and nine (29.4%) had completed high school or higher. It was found that there was no statistical significance in treatment and educational qualification. In this current study, a p-value of 0.665 also indicated that there was no statistically significant difference between MRG and PGG.

After the treatment, there was a statistically significant split between the two groups ($z = -2.607$, $p = 0.009$) for “Active knee flexion”. Post test analysis suggested the z-value was -1.73, suggesting a possible difference between the groups ($p = 0.083$) for “Active knee extension” however the difference was not statistically significant. After the treatment, the MRG group's mean “Passive knee flexion” ROM dropped to 0.80±0.676 while the PGG groups dropped dramatically to 0.40±0.507. The intervention significantly differentiated the two groups, as measured by a z-value of -1.672 ($p = 0.094$), which also not statistically significant. After the intervention, the z-value was -1.521, suggesting a possible difference between the groups ($p = 0.128$) for “Passive knee extension”, this is also not statistically significant for any group.

These results demonstrate that the PGG group saw a statistically significant reduction in “Active knee flexion” range of motion following the intervention when compared to the MRG group. While there were some trends suggesting variations in “Active knee flexion and Active and Passive knee extension” between the groups after the intervention, none of the changes were statistically significant.

Similarly, a randomised control trial by Cheatham, Stull and Kolber, (2019) found the vibrating foam roller significantly increased knee ROM ($p<0.001$). An experimental study by Konrad, Glashuttner, Reiner, Bernsteiner and Tilp, (2020) suggested that a portable percussive massage treatment can increase range of motion (ROM). However, different study by Mahmooda et al. (2020), Kuruma and his colleague (2013), and Mckenney, Elder, Elder and Hutchins, (2013) found that myofascial release has significant effect in improvement of knee ROM ($p<0.05$). In contrast, a systematic review by Laimi et al, (2018) stated that myofascial release therapy was not sufficient alone to create impacts on chronic musculoskeletal pain and ROM.

The mean NPRS Score for the MRG group was 5.133±1.302 before treatment, while the PGG group's score was 4.400±1.121. There was no significant difference between the two groups before the intervention ($p = 0.806$). The average NPRS score dropped from 4.800±1.320 before the intervention to 2.733±1.279 afterward for both the MRG and PGG groups. After the intervention, there was a statistically significant split between the two groups, as indicated by the $Z= -3.118$ and $p=0.002$. This results also means that PGG is significant than MRG as PGG is second group and Z value is negative.

Similarly, different study by Mahmooda et al. (2020) stated myofascial release has significant effect in pain reduction ($p<0.05$); Rahman, Deepthi, Singh and Wah (2022) revealed in term of pain myofascial release has significance (p value <0.024); Gomaa and Zaky, (2016) reported that myofascial release was highly significant improvement in decreasing pain; Telles and his colleague (2016) has also stated that myofascial release has significant improvement in term of pain ($p = 0.02$); and Dixit, Samal and Ramteke, (2020) illustrated that myofascial release is more significant than maitland mobilization ($P<0. 0001$). On the other hand, study by Cheatham, Stull and Kolber, (2019) and Cochrane, (2017) found that vibrating foam roller (which is identical to physio gun) has a significant effect in pain reduction ($p<0.001$).

In WOMAC score, The MRG group had a mean score of 1.920±0.603 on the variable "Pain" before the intervention, while the PGG group had a mean score of 1.813±0.515. After the intervention, the mean score dropped from 1.660±0.560 in the MRG group to 1.106±0.319 in the PGG group and Pain variable was not statistically significant split between the two groups, as measured by Z -value of -1.776 and p = 0.076). In contrast, a study by Mahmooda et al. (2020) stated myofascial release has significant effect in pain reduction ($p<0.05$).

Before treatment, the MRG group scored "Stiffness" at 0.700±0.774 on average, while the PGG group scored "Stiffness" at 1.100±0.910 on average. There was no significant difference between the two groups before the intervention. After the intervention, the MRG group's mean score dropped to 0.500±0.597, and the PGG group's mean score dropped to 0.400±0.430. No statistically significant change was seen between the two groups for stiffness following the intervention (Z = -0.247, p = 0.805). However, a study by Lim and his colleague (2019) found that myofascial release has effect on improving flexibility of muscle ($p<0.05$).

The pre-intervention mean score for "Physical Function" was 1.749±0.511 in the MRG group and 1.917±0.405 in the PGG group. Scores declined after the intervention, with the MRG group's averaging 1.521±0.568 and the PGG group's dropping to a substantially lower 1.070±0.332. After the treatment, there was a statistically significant split between the two groups (Z = -2.184, p = 0.029). These results imply that the PGG group improved significantly more in pain and physical function scores following the intervention than the MRG group did.

Similarly, different study by Mahmooda et al. (2020) stated myofascial release has significant effect in disability reduction ($p<0.05$); Rahman, Deepthi, Singh and Wah (2022) revealed in term of disability myofascial release has significance (p value <0.024); Gomaa and Zaky, (2016) reported that myofascial release was highly significant improvement in decreasing disability; Telles and his colleague (2016) has also stated that myofascial release has significant improvement in term of physical function (p = 0.02).

5.2: Limitations

Generalization of study may be questionable due to small number of subject. The study would be more reliable if it done with bigger sample size.

- Lack of evidence in regarding of physio gun
- This study focuses on short term effect; however it important to find out long term effect as knee OA is progressive non curable condition.
- Data was collected only from one clinical setting CRP Savar, it might be influenced the result.

CHAPTER – VI CONCLUSION

6.1: Conclusion

Osteoarthritis (OA) is the most common type of chronic progressive degenerative joint disorder causes pain and disability and it have greatest consequence on weight-bearing joints especially knee joint due to more mobility and less stability. The aim of this study was to determine the effects of myofascial release therapy in comparison of physio gun release of quadriceps muscle and iliotibial band in addition to usual care on pain, range of motion and disability in patients with knee osteoarthritis. The findings of the research project showed that patients suffering from knee joint osteoarthritis benefited from participating in myofascial release therapy as well as from physio gun release. It was a clinical trial; Participants from both groups who participated in the MRG and PGG program saw significant improvements in a variety of end measures, including a decrease in pain, an increase in joint range of motion, and an enhancement in physical function. According to these study findings, it was revealed that MR and Physio gun release both have significant effect in reducing symptoms of knee joint OA; however, it was illustrated that physio gun has some more benefit in terms of flexibility, pain and reduction of disability.

The result of present study shown that, in patients with knee osteoarthritis, myofascial release along with usual physical therapy has been effective in reducing pain, ROM and function. Moreover, physio gun release along with usual physical therapy enhances the effectiveness of physiotherapy and helps to decrease pain, increase flexibility and ROM and disability. Though within group analysis showed a relevant significant improvement, between groups analysis findings gave a clear idea that physio gun release along with usual physiotherapy are more effective therapeutic approach for patients with knee OA.

6.2: Recommendations

The aim of this study was to determine the effects of myofascial release therapy in comparison of physio gun release of quadriceps muscle and iliotibial band in addition to usual care on pain, range of motion and disability in patients with knee osteoarthritis. Present study had few limitations. Some further steps that might be taken for future research.

- A double blinded randomized clinical trial is recommended with large sample size.
- Present study only focuses on short term effect; further study should be to find out long term effect.
- According to stage of knee OA, the home exercise program should be included.
- To find out actual efficacy of physio gun, further study may conduct in different area like spine.

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APPENDIXES

Appendix- A

Institutional Review Board (IRB) Letter

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

Ref: CRP/BHPI/IRB/10/2022/670

Date: 25/10/2022

To
Md. Atikur Rahman
M.Sc. in Physiotherapy
Session: 2020-2021, DU Reg No.: 5354
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Myofascial Release versus Physio Gun Release of Quadriceps muscle and Iliotibial Band on Pain and Range of Motion in Patients with Knee Osteoarthritis"** by ethics committee.

Dear Md. Atikur Rahman
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 version)
3	Information sheet & consent form.

The purpose of the study is to determine the effects of myofascial release therapy in comparison of physio gun release of quadriceps muscle and iliotibial band in patients with knee osteoarthritis. Should there any interpretation, typo, spelling, and grammatical mistake in the title, it is the responsibility of investigator. Since the study involve questionnaire that may take 25 to 30 minutes and have no likelihood of any harm to the participants. Data collector will receive informed consents from all participants; the members of the Ethics committee approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 24th September 2022 at BHPI.

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

Best regards,

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

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

Appendix- B

Data Collection Permission Letter

Permission Letter

Date: 29 October, 2022

To,
The Head of the Department of Physiotherapy,
Centre for the Rehabilitation of the Paralysed (CRP),
CRP-Chapain, Savar, Dhaka-1343.
Through: Head of the Department of Physiotherapy, BHPI.

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

Dear Sir,

With due respect and humble submission to state that I am Md. Atikur Rahman, student of M.Sc. in Physiotherapy (Part-II) at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: **"Effectiveness of Myofascial Release versus Physio Gun Release of Quadriceps muscle and Iliotibial Band on Pain and Range of Motion in Patients with Knee Osteoarthritis"** under the supervision of Prof. Dr. Mohammad Sohrab Hossain (PhD), Professor, Department of Physiotherapy, BHPI & Executive Director (ED), Centre for the Rehabilitation of the Paralysed (CRP). I want to collect data for my research project from the Outpatient department, Musculoskeletal Unit, Department of Physiotherapy at CRP. So, I need permission for data collection from the honorable Head, Department of Physiotherapy, CRP, Savar. I would like to assure that anything of the study will not be harmful for the participants.

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

Yours Obediently,

Md. Atikur Rahman

Md. Atikur Rahman
M.Sc. in Physiotherapy (Part-II)
Reg No: 5354
Session: 2020-21
Bangladesh Health Professions Institute (BHPI)
CRP-Chapain, Savar, Dhaka-1343.

Forwarded & Recommended
E. Rahman
30/10/22

Ehsanur Rahman
Associate Professor
Coordinator M.Sc. Physiotherapy Program
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343

Approved
12/11/22

Approved, by Supervisor
30.10.22

Appendix- C

Consent Form (English)

Assalamu Alaikum,

I am Md. Atikur Rahman, student of M.Sc. in Physiotherapy (Part-II), Bangladesh Health Professions Institute (BHPI), and faculty of medicine under the University of Dhaka. For the partial fulfillment of my Master degree, I have to conduct a research project and it is a part of my study. My Research title is "Effectiveness of Myofascial Release versus Physio Gun Release of Quadriceps muscle and Iliotibial Band on Pain and Range of Motion in Patients with Knee Osteoarthritis".

Now I want to ask you some questions those are mentioned in this form. The conversation time will be 20-30 minutes. I would like to inform you that this is a purely academic study and will not to be used for any other purposes. I assure you that all the data will be kept confidential. Your participation will be voluntary. You may have the rights to withdraw your consent and discontinue from the study. You also have the right not to answer any other question that you don't like of this questionnaire.

If you have any query about the study, you may contact with me or my supervisor Prof. Dr. Mohammad Sohrab Hossain (PhD), Professor, Department of Physiotherapy, BHPI. Executive Director (ED), Centre for the Rehabilitation of the Paralysed (CRP).

Signature of the participant……..Date…..…….……

Signature of the witness…….....Date…...…….……..……

Signature of the researcher……...Date.……..…….……...…

Appendix- D

Consent Form (Bengali)

সম্মতি পত্র

আসসালামু আলাইকুম,

আমি মোঃ আতিকুর রহমান , ঢাকা বিশ্ববিদ্যালয়ের মেডিসিন অনুষদের অধীনে, বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই) এর এমএসসি ইন ফিজিওথেরাপি (পার্ট-২) এর ছাত্র । আমার স্নাতকোত্তর ডিগ্রি আংশিক পরিপূর্ণতার জন্য, আমাকে একটি গবেষণা প্রকল্প পরিচালনা করতে হবে এবং এটি আমার অধ্যয়নের একটি অংশ । আমার গবেষণার শিরোনাম হল " হাঁটুর অস্টিওআর্থারাইটিস রোগীদের ব্যথা এবং জয়েন্ট রেঞ্জ অফ মুশন পরিসরে কোয়াড্রিসেপস পেশী এবং ইলিওটিবিয়াল ব্যান্ডের ফিজিও গান রিলিজ বনাম মায়োফেসিয়াল রিলিজের চিকিৎসাবিদ্যাগত কার্যকারিতা অনুসন্ধান "।

এখন আমি আপনাকে কিছু প্রশ্ন করতে চাই যেগুলো এই ফর্মে উল্লেখ করা হয়েছে, এতে আনুমানিক ২০-৩০ মিনিট সময় নিব । আমি আপনাকে অবগত করছি, এটি আমার গবেষণার একটি অংশ এবং অন্য কোন উদ্দেশ্যে ব্যবহার করা হবে না । আপনি যে সব তথ্য প্রদান করবেন তার গোপনীয়তা বজায়া রাখা হবে এবং তা অপ্রকাশিত থাকবে । এই গবেষনায় অংশ গ্রহন সেচ্ছা প্রনোদিত এবং আপনি যে কোন সময়, কোন কারন ছাড়াই এই গবেষণা হতে নিজেকে প্রত্যাহার করে নিতে পারবেন । এই প্রশ্নাবলীর থেকে আপনি পছন্দ করেন না এমন অন্য কোনো প্রশ্নের উত্তর না দেওয়ার অধিকারও আপনার আছে ।

গবেষণা সম্পর্কে আপনার কোন প্রশ্ন থাকলে, আপনি আমার সাথে বা আমার সুপারভাইজার প্রফেসর ড. মোহাম্মদ সোহরাব হোসেন (পিএইচডি), অধ্যাপক, ফিজিওথেরাপি বিভাগ, বিএইচপিআই, এক্সিকিউটিভ ডিরেক্টর (ইডি), সেন্টার ফর দ্য রিহ্যাবিলিটেশন অফ দ্য প্যারালাইজড (সিআরপি) সাথে যোগাযোগ করতে পারেন ।

১) অংশগ্রহণকারীর স্বাক্ষর.....তারিখ.....

২) সাক্ষীর স্বাক্ষর.....তারিখ.....

৩) গবেষকের স্বাক্ষর .....তারিখ .....

Appendix- E

Questionnaire (English)

Research Title: Effectiveness of Myofascial Release versus Physio Gun Release of Quadriceps muscle and Iliotibial Band on Pain and Range of Motion in Patients with Knee Osteoarthritis

Questionnaire (English)

Part-I: Socio-demographic information

Code No:

Patient ID No:

Name of Participant:	
Age:	
Sex:	
Address:	Village/Area: P/O: P/S: District:
Monthly Family Income	
Contact No:	
Education:	
Start Date of intervention:	
End Date of intervention:	

Part-II: Physical disability questionnaire

This questionnaire is developed according to, "The Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC SCORE)" for measuring the pain and disability of the patient with knee osteoarthritis.

Each question has 4 score. Total questions are 24. Total number is 96.

Test score of the patient is _____ / 96.

Instructions: Please rate the activities in each category according to the following scale of difficulty:

0 = None

1 = Slight

2 = Moderate

3 = Severe

4= Extreme

Circle one number for each activity

A) Pain

1. How much pain you feel during walking?	0	1	2	3	4
2. How much pain you feel during climbing on the stairs?	0	1	2	3	4
3. How much pain you feel during sleeping at night?	0	1	2	3	4
4. How much pain you feel while you taking rest?	0	1	2	3	4
5. How much pain you feel during weight bearing?	0	1	2	3	4

B) Stiffness

1. What type of stiffness you feel in your foot muscles during morning?	0	1	2	3	4
2. What type of stiffness you feel in your foot muscles during evening?	0	1	2	3	4

C) Physical Function:

1. What kind of problems you feel during getting down to the stairs?	0	1	2	3	4
2. What kind of problems you feel during climbing up to the stairs?	0	1	2	3	4
3. What kind of problems you feel during rising from sitting?	0	1	2	3	4
4. What kind of problems you feel during standing?	0	1	2	3	4
5. What kind of problems you feel during bending toward the floor?	0	1	2	3	4
6. What kind of problems you feel during walking on flat surface?	0	1	2	3	4
7. What kind of problems you feel during getting in or getting out from a car?	0	1	2	3	4
8. What kind of problems you feel when you going for shopping?	0	1	2	3	4
9. What kind of problems you feel during putting on socks?	0	1	2	3	4
10. What kind of problems you feel while you get out from bed?	0	1	2	3	4

11. What kind of problems you feel during taking off socks?	0	1	2	3	4
12. What kind of problems you feel when you rising from bed?	0	1	2	3	4
13. What kind of problems you feel during getting in getting out of bath?	0	1	2	3	4
14. What kind of problems you feel when you sitting for a while?	0	1	2	3	4
15. What kind of problems you feel when you getting on/ off toilet?	0	1	2	3	4
16. What kind of problems you feel when doing your heavy domestic duties like moving furniture?	0	1	2	3	4
17. What kind of problems you feel when doing your light domestic duties like cooking, dusting?	0	1	2	3	4

Part-III: Pain Intensity

Please mark the scale below to show how intense your pain is.

Instructions:

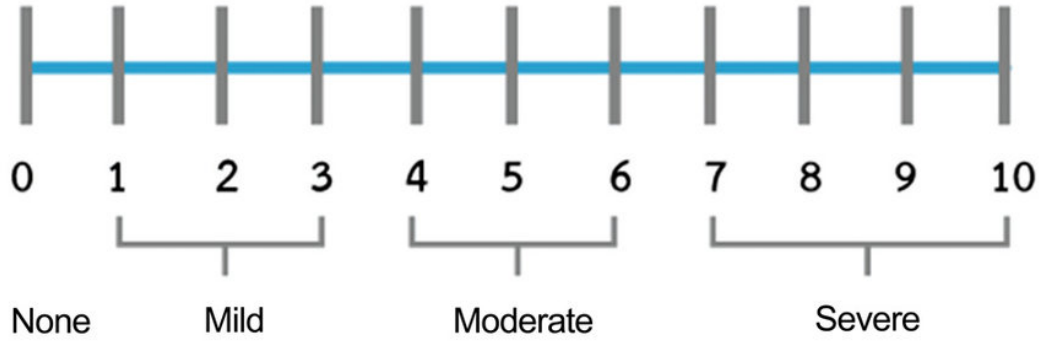
0 = No pain

1-3 = Mild pain

4-6 = Moderate pain

7-10 = Severe pain

How intense is your pain now?



Part-IV: Estimate the Range Of Motion

This part of questionnaire is designed for knee range of motion measurement.

Goniometer is used for taking measurement.

Instructions:

0= Normal

1= Mild loss

2= Moderate loss

3= Severe loss

Movement	Range of Motion
Knee Flexion (active)	
Knee Extension (active)	
Knee Flexion (Passive)	
Knee Extension (Passive)	

Appendix- F

Questionnaire (Bengali)

গবেষণার শিরোনাম: হাঁটুর অস্টিওআর্থারাইটিস রোগীদের ব্যথা এবং জয়েন্ট রেঞ্জ অফ মুশন পরিসরে কোয়াড্রিসেপস পেশী এবং ইলিওটিবিয়াল ব্যান্ডের ফিজিও গান রিলিজ বনাম মায়োফেসিয়াল রিলিজের চিকিৎসাবিদ্যাগত কার্যকারিতা অনুসন্ধান

প্রশ্নপত্র (বাংলা)

পার্ট-১: সামাজিক প্রেক্ষাপট সংক্রান্ত তথ্য

কোড নং:

রোগীর আইডি নম্বর:

অংশগ্রহণকারীর নাম:	
বয়স:	
লিঙ্গ:	
ঠিকানা:	গ্রাম/এলাকা: ডাকঘর: থানা: জেলা:
মাসিক পারিবারিক আয়	
যোগাযোগের নম্বর:	

শিক্ষাগত যোগ্যতা:	
চিকিৎসা শুরুর তারিখ:	
চিকিৎসা শেষ তারিখ:	

চিকিৎসার পূর্ববর্তি তথ্য

পার্ট-২: শারীরিক অক্ষমতা প্রশ্নাবলী

হাঁটুর অস্টিওআর্থারাইটিসে আক্রান্ত রোগীর ব্যথা এবং অক্ষমতা পরিমাপের জন্য এই প্রশ্নপত্রটি "দ্য ওয়েস্টার্ন অন্টারিও এবং ম্যাকমাস্টার ইউনিভার্সিটিজ অস্টিওআর্থারাইটিস ইনডেক্স (WOMAC SCORE)" অনুসারে তৈরি করা হয়েছে

প্রতিটি প্রশ্নের ৪ স্কোর আছে, মোট প্রশ্ন ২৪, মোট নম্বর ৯৬

চিকিৎসার পূর্ববর্তি স্কোর _____/৯৬

নির্দেশাবলী: অনুগ্রহ করে প্রতেক ধরনের কাজকে কাঠিন্য মাপকাঠি অনুযায়ী নির্ধারণ করুন
০ = নাই; ১ = অল্প; ২ = মাঝারি; ৩ = অনেক; ৪ = সর্বাধিক

প্রতিটি কার্যকলাপের জন্য একটি সংখ্যা বৃত্ত

ক) ব্যথা

১. হাঁটার সময় আপনি কতটা ব্যথা অনুভব করেন?	০	১	২	৩	৪
২. সিঁড়িতে ওঠা নামার সময় আপনি কতটা ব্যথা অনুভব করেন?	০	১	২	৩	৪
৩. রাতে ঘুমানোর সময় আপনি কতটা ব্যথা অনুভব করেন?	০	১	২	৩	৪

৪. বিশ্রাম নেওয়ার সময় আপনি কতটা ব্যথা অনুভব করেন?	০	১	২	৩	৪
৫. ওজন বহন করার সময় আপনি কতটা ব্যথা অনুভব করেন?	০	১	২	৩	৪

খ) শক্ত হয়ে যাওয়া

১. দিনের বেলায় আপনার পায়ের মাংসপেশী শক্ত হয়ে যাওয়ার ধরন কেমন হয়?	০	১	২	৩	৪
২. রাতের বেলায় আপনার পায়ের মাংসপেশী শক্ত হয়ে যাওয়ার ধরন কেমন হয়?	০	১	২	৩	৪

গ) শারীরিক কাজ:

১. সিঁড়ি দিয়ে নামার সময় কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
২. সিঁড়ি বেয়ে ওঠার সময় আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
৩. বসা থেকে ওঠার সময় কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
৪. কিছুক্ষন দাঁড়িয়ে থাকলে আপনি কি ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪

৫. মেঝের দিকে ঝুকলে আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
৬. সমতল মেঝেতে হাঁটার সময় আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
৭. গাড়িতে উঠতে বা নামতে আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
৮. কেনাকাটা করতে গেলে আপনি কি ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
৯. মোজা পরার সময় আপনি কি ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১০. বিছানায় শুয়ে থাকার সময় আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১১. মোজা খোলার সময় আপনি কি ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১২. শুয়া থেকে ওঠার সময় আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১৩. গোসলে যাওয়া/ বের হওয়ার সময় কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১৪. কিছুক্ষণ বসে থাকলে কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪

১৫. টয়লেট যাওয়া/আসার করার সময় আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১৬. ভারী গৃহস্থালীর কাজের সময় (আসবাবপত্র নড়াচড়া) আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪
১৭. হালকা গৃহস্থালীর কাজের সময় আপনি কী ধরনের সমস্যা অনুভব করেন?	০	১	২	৩	৪

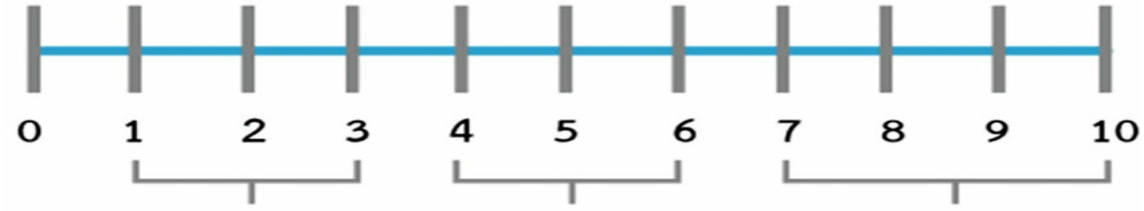
পার্ট-৩: ব্যথার তীব্রতা

আপনার ব্যথা কতটা তীব্র তা দেখানোর জন্য অনুগ্রহ করে নিচের স্কেলটি চিহ্নিত করুন

নির্দেশাবলী:

০ = ব্যথা নেই; ১-৩ = অল্প ব্যথা; ৪-৬ = মাঝারি ব্যথা; ৭-১০ = তীব্র ব্যথা

আপনার ব্যথা এখন কতটা তীব্র?



ব্যথা নেই অল্প ব্যথা মাঝারি ব্যথা তীব্র ব্যথা

পার্ট-৪: হাটুর জয়েন্ট রেঞ্জ অফ মুশন নির্ধারণ

প্রশ্নাবলীর এই অংশটি হাঁটুর জয়েন্ট রেঞ্জ অফ মুশন নির্ধারণ করার জন্য

পরিমাপক যন্ত্র হিসেবে গনিওমিটার ব্যবহার করা হয়

নির্দেশাবলী:

0 = স্বাভাবিক; ১= অল্প হ্রাস পেয়েছে; ২ = মাঝারি হ্রাস পেয়েছে; ৩ = অনেকখানী হ্রাস পেয়েছে

নড়াচড়া	জয়েন্ট রেঞ্জ অফ মুশনের পরিসীমা
হাঁটু সংকোচন (সক্রিয়)	
হাঁটু প্রসারণ (সক্রিয়)	
হাঁটু সংকোচন (পরোক্ষ)	
হাঁটু প্রসারণ (পরোক্ষ)	