EFFECTIVENESS OF CLOSE KINETIC CHAIN EXERCISE VERSUS OPEN KINETIC CHAIN EXERCISE IN PATIENTS WITH KNEE JOINT OSTEOARTHRITIS: A COMPARATIVE STUDY

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DU Roll no: 165

Reg no. 5253

Session: 2012-2013

BHPI, CRP, Savar, Dhaka-1343

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Department of Physiotherapy
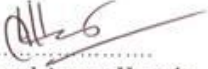
CRP, Savar, Dhaka-1343

Bangladesh

Februrary- 2017

We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled.

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Declaration

I declare that the work presented here is my own. All source used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of the study. I would be bound to take written consent from the Department of Physiotherapy, Bangladesh Health Profession Institute (BHPI).

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Reg no: 5253
Session: 2012-2013
BHPI, CRP, Savar, Dhaka-1343

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Acronyms

ACR   American College of Rheumatology

BMRC   Bangladesh Medical Research Council

BHPI   Bangladesh Health Professions Institute.

CDC   Center for Disease Control

CKCE   Close Kinetic Chain Exercise

CRP   Centre for the Rehabilitation of the Paralysed

IRB   Institutional Review Board

NPRS   Numeric Pain Rating Scale

OA   Osteoarthritis

OARSI   Osteoarthritis Research Society International

OKCE   Open Kinetic Chain Exercise

PT   Physiotherapy

ROM   Range of Motion

SPSS   Statistical Package of Social Science

VAS   Visual Analogue Scale

WOMAC   Western Ontario and McMaster University Osteoarthritis Index

Abstract

Purpose: The purpose of the study was to find out the effectiveness of close kinetic chain exercise versus open kinetic chain exercise in patients with knee joint osteoarthritis. *Objectives:* To find out the effectiveness of close kinetic chain exercise versus open kinetic in patients with knee joint osteoarthritis. *Methodology:* An experimental study design was selected to carry out the research. The experimental study had conduct to find out the objectives. *Results:* In this research, 20 participants were included in this study. 10 in the close kinetic chain exercise along with conventional physiotherapy group (experimental group) and 10 in the open kinetic chain exercise along with conventional physiotherapy (control group). Each participant of both experimental and control group scored on Numeric Pain Rating Scale (NPRS) and WOMAC before and after completion of treatment. Mann Whitney U test applied to the post-test pain score of the participants in the experimental group and control group were revealed a statistically significant difference at the level of (P= 0.001, U= 14.00). Disability reduction of the Numerical Pain Rating Scale (NPRS) in the experimental group was statistically significantly higher than the control group (U= 14.00, P = 0.005). Following application of treatment the study found that the experimental group showed a significant improvement (p<0.05) in case of knee osteoarthritis. In this research, close kinetic chain exercise along with conventional physiotherapy was more effective than open kinetic chain exercise along with conventional physiotherapy. *Conclusion:* The result of this experimental study has identified the effectiveness of Close Kinetic Chain exercise along with conventional physiotherapy is better treatment than Open Kinetic Chain exercise along with conventional physiotherapy alone for reducing pain and disability in osteoarthritis patient.

Key word: Osteoarthritis, knee OA, Close Kinetic Chain Exercise, Open Kinetic Chain Exercise.

| CHAPTER: I | INTRODUCTION |

1.1 Background

In worldwide there are many common musculoskeletal conditions, osteoarthritis is one of the most common condition, affecting the synovial joints and loss of functional abilities of millions of people (kruger-jakins et al., 2016). Osteoarthritis (OA) is a chronic disease. It is located in the joints, affecting one third of adults and presenting a tendency to increase with age (Imoto et al., 2012).Osteoarthritis (OA), the most common rheumatic disease, primarily affects the articular cartilage and subchondral bone of a synovial joint and results in joint failure. The most typical radiographic features are the formation of osteophytes at the joint margins, joint space narrowing, subchondral sclerosis, subchondral cyst formation and chondro calcinosis. It has been estimated that about 40% to 80% of people with radiographic changes will have symptomatic disease. The Framingham Osteoarthritis Study found that 10% of people aged 63 years and over had symptomatic knee OA in the presence of radiographic changes (Fransen et al., 2015).

Among the type of lower limb OA, Knee osteoarthritis is the most common. Osteoarthritis indicates that women, elderly people, increased knee hazard risk such as those who are obese person and the history of people injured of knee joint and radiographic as well as symptomatic OA (Murphy et al., 2015). Knee Osteoarthritis can be related to pain, instability, decrease of range of motion (ROM) and consequently, reducing the quality of life and function. This functional limitation is a result increased risk of disease and death (Imoto et al., 2012).

Knee osteoarthritis (OA) is a major public health issue and in most developed countries, chronic pain and inability develop among the elderly. It is characterized by a number of pathological properties, including narrow composition and osteopathy (Muraki et al.,2013).

The noticeable knee affects osteoarthritis -6% of the adult population and it occurs at about 10% of the age 65 years. It is the majority of total knee replacements in the United States, and recent evidence suggests that it accounts for a lot of other disease like as lower extremity physical disability (Shakoor et al., 2009). Despite the urgent need of

strategies for the prevention and treatment of this condition, demographics on the overall disease prevalence and the affected subgroups are not adequately characterized yet. The reported prevalence of radiographic knee OA differs considerably among previous population-based epidemiologic studies. In addition, apart from age, sex, obesity and occupational activities, there are only a few other established risk factors for knee OA (Muraki et al., 2013).

Linn et al. (2012) stated that, women over 50 years have a high level of osteoarthritis compared to men of the same age group. Although several reasons have been proposed, there is some evidence that sex hormones influence the development of osteoarthritis. This article will focus on the main science and clinical evidence that describe the current state of knowledge regarding the relationship between sex hormones and the development of osteoarthritis.

Weiss & Jurmain (2009) mentioned that are responsible many etiological factors of osteoarthritis and it is related to the degeneration which is such of a disease. Repetitive movements, repetitive mechanical loads and age are officially associated with knee osteoarthritis. The risk factor into 3 sub group: sex, body mass and anatomy are not connected.

King et al. (2015) focused that, both diabetes mellitus (DM) and osteoarthritis ensure their common co-existence to increases the project. We found that In an era of increasing attention to personalized medicine, understanding the influence of common comorbidities such as DM should result in improved care of patients with OA. In this history review, we summarize the literature related to the interactions between DM and OA extending from 1962 to 2014. We differ in the research depending on whether the clinical population, animal models, or cells and tissues investigate.The clinical literature associated to the influence of DM on OA and its therapeutic outcomes suggests that DM may enhance the development and severity of OA and clinical review suggest that DM increases risks associated with joint replacement operation. The few high quality studies using animal models which is characterized by support an adverse effect of DM on OA. We review strengths and weaknesses of DM that is the normal rodent models on OA. The versatile literature derived from studies of elliptical cells and tissues also supports the existence of biological and biomechanical changes in articular tissues in DM, and begins to characterize molecular mechanisms activated in diabetic-like environs which may contribute to OA. An adverse effect of supports of

DM on OA of the development, severity, and therapeutic outcomes for OA, enhance by clinical and laboratory support. To understand the mechanisms through which DM contributes to OA, more studies are clearly necessary. Another study of the DM-affected system may focus on general procedures of OA pathogenesis and provide results of more precise and effective therapies for all OA patients.

According to Muraki et al (2013), Obesity is often a strong risk factor for incident knee OA, due to possible causes of mechanical stress over the knee joint. Another studies have shown that female gender is also a powerful risk factor for incident because of KL $\geq$ 2 knee OA, perhaps the compensation for mechanical stress involved muscle strength. As men generally have more muscle strength than women, muscle strength involvement may compensate for the mechanical stress on the joint, which reduces the risk of occurrence of the disease in men. In Bangladesh, knee osteoarthritis is one of the most commonly known disabling diseases that affects both adult male and female (Connor, 2007).

Osteoarthritis affects 12% of the population at the age range between 25 to 74 years. More than 70 years age, we found radiographic that more than 80% of the population osteoarthritis in the small joint of the hand is present. An approximately 34% of United Kingdom populations more than 45 years of age have radiographic osteoarthritis of the knees and 19% of those more than 55 years of population have radiographic osteoarthritis of the hips. Knees with osteoarthritis, with up to two-thirds of their hip and osteoarthritis, one-third of which have symptoms of their disease (Baar et al., 2008). About 60 million Americans have knee OA and this number will increase by 50% in the next decade. OA is a strong predictor of the need for effective support of knee pain during movement and the second major cause of disability in the United States.Approximately 10–30% of people diagnosed with OA which is characterized severe pain and limit function, the percentage is increasing as a result of the rate of disability rate are ultimately increasing day by day. With increased pain and disability, the knee OA is associated with rapid progression in reducing the strength of the leg muscle (Vincent et al., 2012).

The World Health Organization 2010 study defines physical activity as "any movement produced by skeletal muscle that requires energy expenditure". "Exercise program" is defined as a form of physical activity that is planned, structured, and

repeated over a period of time.(Bouchard et al.,2007).Hafez et al.(2013) suggested that Osteoarthritis (OA) is one of the major public health problem which causes functional impairment that reduces quality of life (QOL) worldwide as reported by World Health Organization.

Osteoarthritis creates a number of burdens which are physical, psychological and socio economic. Significant disability are related to knee osteoarthritis, for example decrease ambulatory function and daily living activities. Main factors are feeling alone, decrease self-reorganization and mental stress. Economic burden are given high frequency of osteoarthritis in the population (Litwice et al .,2013).

Knee osteoarthritis is common and contributes which is a greatly associated to morbidity in the community. To reducing pain and maintaining function to the purpose of the knee osteoarthritis usually. In OA, exercise therapy has increased interest in the role of different forms. Many of the studies to date are limited by small numbers and lack of controls. In addition they have generally used sophisticated and expensive apparatus, which limits their application to a community setting. As hospital based, such studies have focused on subjects with moderate or severe structural change, in whom there may be limited scope for improvement (Reilly et al., 2016).Currently, there is no known cure for OA. However, disease-related factors, such as impaired muscle function and reduced fitness, are potentially amenable to exercise. International guidelines advocate various nonpharmacological treatments, including exercise, as the first line of management for people with knee OA (Fransen et al., 2015).

Patella mobilizations may be beneficial for individuals with a variety of conditions, including post-operative rehab and knee osteoarthritis (Michael et al., 2010). Several studies have used knee mobilizations for treatment of knee pathology. Patella mobilization is critical to prevent patellar tendon adhesion and increase patellofemoral joint reaction (Hurst et al., 2010)

The close-chain group and open chain group showed significantly improvement the open-chain in physical function, energy, role limitation, pain and severity of osteoarthritis at post-exercise stage. The post-exercise value of the close-chain group was lower and but closer to the predetermined angle than those of the strengthening

group. There was significant improvement between two groups in the pre-exercise and post-exercise periods. The mean values of the quadriceps and hamstrings muscles were significantly higher in the open-chain group than the close-chain group at post-exercise training period. There was significant inverse relationship between each of walking-time and stair-climbing and ability to perform the activity of daily living and the health-related quality of life. There was no significant difference in the pre-exercise and post-exercise measures of proprioception at 400 and 800 of knee flexion in the open-chain group. The close-chain group performed significantly better in all performances except in quadriceps muscle strength, symptoms of osteoarthritis, knee stiffness and pain severity (Gbiri et al.,2013). In knee osteoarthritis "Both hamstring muscle and quadriceps muscle are affected together. Both of them, hamstring muscle is more affected. In knee osteoarthritis physiotherapy management protocol hamstring strengthening exercise (OKCE) included with quadriceps strengthening exercise (OKCE) for its obvious necessary .OA knee affects the hamstring muscle more than the quadriceps muscle. Therefore, there is a need for physiotherapists".(Adegoke et al.,2007).

1.2 Rationale

Osteoarthritis (OA) represents a clinical classification of pathological conditions involving a progressive degeneration of articular cartilage, a remodeling of sub-chondral bone and a synovitis which is usually limited. The condition is variously described as a part of a process of age-related change or a disease. It is twice more prevalent in women than men and increases in incidence with age, there being a major rise after 60 years. People with progressive symptomatic knee OA experience increasing difficulty with daily functional activities. In fact, knee OA is responsible for more disability in walking, stair climbing and housekeeping in non-institutionalized people aged 50 years and over than any other disease. The knee joint is most frequently affected by osteoarthritis and the number of patients with disabling osteoarthritis of the knee is rapidly increasing day by day. Most of the available literature shows that there is no effective treatment for osteoarthritis, and individuals with this disease have little benefit from prescribed medications.

There are many common treatment programs of knee joint osteoarthritis such as soft tissue mobilization technique, patellar mobilization, active free range of movement, knee gaping ,Ice ,UST,IRR etc. in the Centre for the rehabilitation of the paralyzed(CRP) of musculoskeletal unit ,savar ,Dhaka.

Research shows that significant improvement and reduce pain and increased joint range of motion of the knee joint both open kinetic chain exercise and close kinetic chain exercise. But close kinetic chain exercise is more effective than open kinetic chain exercise in knee joint patients (Minoonejad.,2010)

The aim of the study was to find out the effectiveness between close kinetic chain exercise and open kinetic chain exercise among the patients with OA. There are some achievements in overall physiotherapy intervention in OA patients such as individual close kinetic chain exercise and individual open kinetic chain exercise of knee OA patients but actually which is the best approach and best effectiveness are not clearly known.

So the purpose of this study is to compare between close kinetic chain exercise and open kinetic chain exercise with OA patients and to find out which is the important intervention for this condition.

1.3 Objectives

General objective

➢ To find out the effectiveness of close kinetic chain exercise versus open kinetic chain in patients with knee joint osteoarthritis.

Specific objectives

➢ To find out the socio-demographic factors affect the level of pain and functional disability within and between groups.

➢ To measure pain level before and after introducing close kinetic chain exercise and open kinetic chain exercise in patients with knee joint osteoarthritis.

➢ To compare functional disability before and after introducing close kinetic chain exercise and open kinetic chain exercise in patients with knee joint osteoarthritis.

1.4 Hypothesis

Null Hypothesis

Ho:μ_1-$\mu2$ = 0 or $\mu1 \geq \mu2$, where the experimental group and control group mean difference is not same or control group is higher than experimental group.

Alternative Hypothesis

Ha: $\mu1$-$\mu2 \neq 0$ or $\mu1 \neq \mu2$ where the experimental group and control group mean difference is not same.

Where,

Ho= Null hypothesis

Ha = Alternative hypothesis

$\mu1$ = Mean difference in initial assessment

$\mu2$ = Mean difference in final assessment

1.7 Variables

1.7.1 Independent variable

1. Close Kinetic Chain exercise along with conventional physiotherapy.

2. Open Kinetic Chain exercise along with Conventional physiotherapy.

1.7.2 Dependent variable

1. Pain

2. Disability

1.8 Operational definition

Knee Osteoarthritis: Knee Osteoarthritis is a degenerative joint disease characterized by pain at knee which is the barrier to do daily activities properly, decreased joint range of motion, difficulty to perform activity daily life (ADL).

Functional disability: Functional disability or diversity is a politically and socially correct term for special needs, disability, impairment and handicap, which began to be used in Spain in scientific writing, at the initiative of those directly affected, in 2005. A functional disability limits a person's ability to perform physical activities, have a significant sensory impairment, need long-term care, use assistive devices, technology or exercises.

Close kinetic chain exercise: Close kinetic chain exercises or close chain exercises (CKC) are physical exercise performed where the hand (for arm movement) or foot (for leg movement) is fixed in space and cannot move. The extremity remains in constant contact with the immobile surface, usually the ground or the base of a machine.

Open kinetic chain exercise: open kinetic chain is defined as "a combination of successively arranged joints in which the terminal segments can move freely". Thus, an open chain movement is when the peripheral segment/joint of an extremity is free to move.

Knee osteoarthritis (OA) is the main cause of pain and disability in older people (Wylde et al., 2016). In knee osteoarthritis that loses cartilage, the bone grows to try and repair the damage. Instead of making things better, however, the bone grows abnormally and makes things worse. For exemple, the bone can become misshapen and make the joint painful and ustable. (Fransen& McConnell, 2008).

Although accurate cause is not known (Mounach et al., 2008) the following factors are suspected to , the primary cause OA including age, obesity , genetics, occupation as well as prolonged standing, sports, multiple metabolic disorders (Conaghan et al., 2008). Another study shows the factors that are responsible for primary osteoarthritis are crystals in joint fluid or cartilage, high bone mineral density, injury to the joint, peripheral neuropathy, joint hyper mobility (Mounach et al., 2008).

The causes of secondary osteoarthritis of the knee are as valgus and varus deformities of the knee, Rheumatoid arthritis, infection, TB, hyperparathyroidism, over use of intra articular steroid therapy (Conaghan et al., 2008). Repeated minor trauma may lead to micro fractures and subsequent OA. Occupational factors are thought to be important in the development of secondary OA. Hemophillia, acromegaly and hyperthyroidism all predispose joints to secondary OA (Veerapan et al., 2007).

The Framingham Osteoarthritis Study found that 10% of people aged 63 years and over had symptomatic knee osteoarthritis in the presence of radiographic changes (Fransen& McConnell, 2008). Osteoarthritis incidence studies indicate that women, older adults, and those who are obese or have a history of a knee injury have a moderate to strongly increased risk of knee symptoms, and radiographic and symptomatic osteoarthritis (Murphy et al., 2015).

Swelling may be intermittent (suggesting an effusion) or continues (with capsular thickening or large osteophytes) (Lawrence et al., 2008). Stiffness is present after rest and a little time to wear off with movement (Veerapan et al., 2007). There is a reduction in compliance of soft tissue as a result of degenerative change and secondary inflammatory process. In addition as the subchondral micro fractures heal and formation of callus that causes a loss of joint mobility and stiffness follows. The combination of joint pain, stiffness and possible effusion will often cause patients to limit their activities and consequent loss of end of range movement (Chapple et al., 2011). Minimal tenderness and coarse crepitus can be elicited (Conaghan et al., 2008).

Berenbaum., (2013) said that, Osteoarthritis (OA) has long been considered a wear and tear disease leading to loss of cartilage. OA used to be considered the sole consequence of any process leading to increased pressure on one particular joint or fragility of cartilage matrix. Progress in molecular biology in the 1990s has profoundly modified this paradigm. The discovery that many soluble mediators such as cytokines or prostaglandins can increase the production of matrix metalloproteinase by chondrocytes led to the first steps of an inflammatory theory. However, it took a decade before synovitis was accepted as a critical feature of OA, and some studies are now opening the way to consider the condition a driver of the OA process. Recent experimental data have shown that subchondral bone may have a substantial role in the OA process, as a mechanical damper, as well as a source of inflammatory mediators implicated in the OA pain process and in the degradation of the deep layer of cartilage. Thus, initially considered cartilage driven, OA is a much more complex disease with inflammatory mediators released by cartilage, bone and synovium. Low-grade inflammation induced by the metabolic syndrome, innate immunity and inflammation are some of the more rece arguments in favor of the inflammatory theory of OA and highlighted in review.

Crepitus can be increased from mild cracking to loud sounds in advanced disease. Loss of proprioception, loss of ligamentous control and loss of negative pressure within the joint as a result of effusions all contribute to joint instability in OA (Veerapan et al., 2007). Chronic muscle inhibition is often linked to chronic pain and will lead to atrophy and ensuing muscle weakness (Chapple et al., 2011). Especially weakness and wasting of the quardriceps muscle which is responsible for the knee extension (Robert &Petrella, 2010). Chronic oedema of synovial membrane and capsule makes the joint appear large. Muscle atrophy may also

make the joint look bigger (Veerapan et al., 2007).

Overweight is a risk factor for knee osteoarthritis. Weight reduction reduces not only the symptoms and progression of osteoarthritis, but also the risk of acquiring osteoarthritis. The Osteoarthritis Research Society International Group strongly recommends that patients with osteoarthritis lose weight and maintain weight at a lower level in overweight patients. Maintaining the body mass index at 25 kg/m2 or below would reduce osteoarthritis in the population by 27–53%. As mentioned, knee injuries such as knee ligament tears, meniscal injuries and fractures involving the articular surfaces is a strong risk factor for knee osteoarthritis (Dillon et al., 2006).

OA principally involves with the patelo-femoral and medial tibiofemoral compartments of the knee (Robert &Petrella, 2010). There are several inter related features common to osteoarthritic joints (Chapple et al., 2011). Predominant symptoms to osteoarthritis are pain (Conaghan et al., 2008). Most knee OA pain is well localized to the anterior or medial aspects of the knee and upper tibia (Robert &Petrella, 2010). It is aggravated by prolongation of work or exertion and relieved by taking rest. Pain occurs due fibrosis of capsule, stretching the shrunken capsule , muscular fatigue, bone pressure due to vascular congestion and intraosseous hypertension (Lawrence et al., 2008). Patella-femoral pain is usually worse going up and down stairs. In late stage pain as being worse at night and after rest, due to raised pressure insubchondral bone (Robert &Petrella, 2010).

Osteoarthritis (OA) is a degenerative joint disease involving the cartilage and many of its surrounding tissues. Disease progression is usually slow but can ultimately lead to joint failure with pain and disability. OA of the hips and knees tends to cause the greatest burden to the population as pain and stiffness in these large weight bearing joints often leads to significant disability requiring surgical intervention. Osteoarthritis (OA) is the most common joint disorder in the United States. Symptomatic knee OA occurs in 10% men and 13% in women aged 60 years or older. The number of people affected with symptomatic OA is likely to increase due to the aging of the population and the obesity epidemic. OA has a multi-factorial etiology and can be considered the product of interplay between systemic and local factors. Old age, female gender, overweight and obesity, knee injury, repetitive use of joints, bone density, muscle weakness, and joint laxity all play roles in the development of joint osteoarthritis, particularly

in the weight-bearing joints. Modifying these factors may reduce the risk of osteoarthritis and prevent subsequent pain and disability (Yuqing., 2010).

Pain is the major stimulus for people with knee osteoarthritis (OA) to seek medical attention but the causes of pain are complex and radiographs which are the standard for clinical imaging in OA are often discordant with symptoms. In recent years there has been increasing interest in the role of the synovium in painful OA. Although nowhere as florid or extensive as the inflammation observed in rheumatoid arthritis, clinical effusions and capsular thickening can be clinically evident in some joints with knee OA, and are more frequently observed using sensitive measures such as ultrasound (US) and MRI3e10. Synovial changes in OA are regarded by many as a secondary response to the degradation of cartilage11 though there are others who advocate them as a primary driver for OA which may be partly responsible for pain and disease progression (Hall et al.,2014).

The pain of OA is usually related to activity. For OA of the knee, activities such as climbing stairs, getting out of a chair, and walking long distances bring on pain. Morning stiffness usually lasts less than 30 minutes (Zhang & Jordan, 2010).In fact, knee OA is more responsible than any other disease for disability in walking, stair climbing and housekeeping among non-institutionalized people 50 years of age and older (Lane et al.,2011).

The menisci perform many important roles within the knee joint complex, such as improving congruity and stability of the femoro-tibial contact, mechanical shock absorption and load sharing, facilitating limited rotation via meniscotibial translation, and generating proprioceptive feedback via internal mechanoreceptors. Menisci consist of approximately 75% collagen by dry weight, with collagen fibrils predominantly oriented in a circumferential fashion to resist tensile hoop stresses during loading. A complex of meniscotibial, meniscofemoral, and peripheral capsular attachments restrain meniscal movement, particularly outward extrusion' under loading (Cake et al., 2013)

Diagnosis of osteoarthritis focuses on two major goals. When diagnosing OA, the doctor must first differentiate osteoarthritis from other types of arthritis. It is also important to determine whether a patient has primary osteoarthritis or a secondary form of osteoarthritis associated with another disease or condition. Early, accurate diagnosis of osteoarthritis is necessary so

that appropriate treatment options can be considered. To diagnose osteoarthritis, doctor will make assessments using: Medical history will include information about past medical conditions, allergies, treatments, and surgical procedures as well as current medical issues (Vincent et al., 2012)

During the physical examination, doctor will observe for any signs and symptoms which commonly are associated with osteoarthritis. The doctor will look for: joint swelling and Joint tenderness, Decreased range of motion in joints, visible joint damage (i.e., bony growths). In imaging studies X-rays are typically used to confirm the diagnosis of osteoarthritis. X-rays can reveal osteophytes at the joint margins, joint space narrowing, and subchondral bone sclerosis. Subchondral bone is the layer of bone which is just below the cartilage. While MRI (magnetic resonance imaging) is a more sensitive imaging (Silverwood et al., 2015).

The majority of patients with osteoarthritis are managed in primary care, and the prevalence of knee osteoarthritis is such that simple interventions which are effective in a community setting are necessary (Andre et al., 2008). Treatment is generally aimed at reducing pain and maintaining function. There is increasing interest in the role of various forms of exercise therapy in osteoarthritis (O'Reilly et al., 2016). Currently, there is no known cure for osteoarthritis. However, disease-related factors, such as impaired muscle function and reduced fitness, are potentially amenable to exercise. International guidelines advocate various non-pharmacological treatments, including exercise, as the first line of management for people with osteoarthritis (Fransen& McConnell, 2008).

Recommendations and guidelines for the management of osteoarthritis have been published by several different scientific organizations .However, most of them are produced by national organizations, or are restricted to the use of specific interventions, such as physical therapy in many instances, or selected drug classes many OA management recommendations across organizations, controversies remain and are related to the use of some non-pharmacological interventions (e.g. acupuncture, knee braces, heel wedges) and, within pharmacological treatments, to the pharmacological class of symptomatic slow-acting drugs in osteoarthritis (SYSADOAs), mainly rep- resented by glucosamine sulfate and chondroitin sulfate, and to some extent by intra-articular hyaluronic acid (Reginster et al., 2015).

Clinical trials in OA suffer from a large placebo effect and most pharmacological treatments are shown to have, at best, a mild-to-moderate effect oral NSAIDs had an effect size in the mild-to moderate range over oral placebo, intra-articular hyaluronic acid emerged asthe most effective treatment for knee OA pain (Rieger, 2008).

The knee joint is commonly affected in osteoarthritis and it is estimated that 10% of people aged over 60 years' experience knee osteoarthritis symptoms, resulting in substantial pain and physical dysfunction. Current evidence demonstrates beneficial effects of exercise therapy on pain and physical function in knee osteoarthritis, without the common and sometimes serious side effects associated with pharmacological and surgical interventions. Consequentially, exercise is considered the cornerstone of conservative management and is recommended in all clinical guidelines internationally (Chang et al., 2016)

 Lyons, 2017 state that of improving function and decreasing pain in open kinetic chain exercises, we found previous research that these types of exercises result in the isolation of quadriceps muscle; so it can be contracted safely and it can strengthen the muscle. Quadriceps strengthening improves joint function. Since deficiency in neuromuscular system is another main problem in Patellofemoral Pain Syndrome patients, another possible mechanism in effectiveness of open and closed kinetic chain exercises might be the effectiveness of these exercises in improving neuromuscular system of knee joint as well as in increasing proprioception in the joint. Improving the neuromuscular system and muscle strengthening can recover fully pattern of muscle activity along with fixed stability of knee joint and ultimately can diminish forces on the joint. Increase in muscle spindle sensitivity would progress the afferent neurons' information to central nervous system about position of the joint. Such exercises can increase proprioception and joint function. These factors would improve joint function in patellofemoral pain syndrome patients.

A reduction in pain and improve functional ability has been shown with a exercise programed, which is consistent for all measures of pain(O'Reilly et al., 2016).High-quality evidence indicates that therapeutic based exercise provides short-term benefit that is sustained for at least two to six months after cessation of formal treatment in terms of reduced knee pain, and moderate-quality evidence shows improvement in physical function among people with knee osteoarthritis .Poor physical fitness is another impairment reported among people with knee OA. Physiological reserve for aerobic capacity is enhanced primarily by

increasing muscle oxidative capacity. Aerobic exercise (e.g. walking, cycling) of sufficient intensity increases muscle oxidative enzymes and muscle capillarisation, hence increasing peak oxygen uptake. Higher oxygen uptake is inversely related to morbidity and mortality and renders every submaximal daily task easier (in terms of effort). Thus, improved fitness may enhance quality of life by allowing a greater range of available daily tasks, thereby improving physical function (Fransen et al., 2015).

There is a good evidence to support the use of a number of physiotherapy interventions in the management of knee joint osteoarthritis (Arshad et al., 2015). The management of OA depends on the joint involvement, the stage of the disorder, the severity of the symptoms, age of the patient and his or her functional needs (Lawrence et al., 2008).

The major goal of physiotherapy are educate the patient , caregivers and relatives, Relieve symptoms such as pain and stiffness, Preserve joint motion and function by limiting disease progression (Reijman et al., 2007), Strengthen weak muscles related to the arthritis joint, Encourage correct function, Minimize disability (Kornaat et al., 2006).

Physical activity is defined as body movement that is produced by the contraction of the skeletal muscles and that increases energy expenditure, whereas exercise is planned, structured and repetitive movement to improve or maintain one or more components of physical fitness. Exercise has proven benefits in the various components of health-related physical fitness—defined by the American College of Sports Medicine (ACSM) to consist of cardiorespiratory fitness, body composition, muscular strength, muscular endurance and flexibility. Exercise programmers are complex interventions that vary with exercise type, frequency, intensity and duration, as well as the mode of delivery (individual-group, supervised-unsupervised or facility-home-based). There is a common tendency to pool clinical trial data on exercise as an indistinct entity when formulating conclusions on exercise effects. Such results can be misleading because the effects of exercise can be moderated by the nature of the exercise programmers itself and by both patient and disease characteristics (Hinman&Crossley, 2007).

Most exercise interventions for OA conventionally fall into one of the following physical performance categories: strengthening, aerobic, flexibility and skills/balance. In theory, the health benefits accrued are specific to the type of exercise. For example, aerobic activity to improve cardiorespiratory fitness can improve sleep and well-being and reduce whereas

strengthening primarily improves local muscle function and proprioception to improve joint stability and local biomechanical functioning. However, there is evidence that both forms of exercise can reduce pain and improve function so both are recommended in most recent guidelines. Other than strengthening or aerobic exercises, range of motion (ROM) exercise is also believed to be beneficial in improving symptoms and function. This is especially useful when functional and structural properties of periarticular soft tissue have been compromised following acute knee swelling or prolonged joint immobilization. Other types of exercise that incorporates mind and body 'components such as Tai Chi and Yoga are also gaining interest for its role in improving symptoms and function. It is possible that these may have additional benefits such as modulation of the inflammatory response and reduction of central sensitization in people with OA (Goh et al., 2016).

Deyle et al. (2016) had shown that, in 2006, 28% of the patients seen by a physical therapist came by direct access. Patients with non–further-specified back problems, patients with nonspecific neck complaints, and higher-educated patients were more likely to refer themselves to a physical therapist, as were patients with health problems lasting for less than 1 month. Younger patients made more use of direct access. In addition, patients with recurring complaints more often referred themselves, as did patients who had received earlier treatment by a physical therapist. Patients with direct access received fewer treatment sessions. Compared with 2005, there was no increase in the number of patients visiting a physical therapist.

Katz et al. (2014) has showed that it has also found that the arthroscopic debridement for OA was no better than a sham procedure in relieving knee pain or improving functional status, and that patients who underwent arthroscopic partial meniscectomy for a degenerative meniscal tear generally did not show more improvement than those who Underwent sham meniscal resection or an intensive course of physical therapy.

Potts et al. (2013) has had a study where it is found that approximately half of the patient population surveyed had received physiotherapy treatment for their hip or knee OA. The majority of participants with OA of the hip or knee (80%) stated physiotherapy was an important part of their management and that the benefits of physiotherapy continued after the conclusion of treatment. Some reported that these benefits depended on their continued performance of prescribed exercises. These findings support the another research works,

demonstrated that these particular physiotherapy interventions are effective for the purpose of reducing pain and increasing function in OA patients. The results are also consistent with similar surveys of patient preferences whereby medications and physiotherapy were the most requested interventions by patients with OA of knee when consulting their general practitioners. Recent findings consistent with respect to the use of exercise and mobilization in particular. Furthermore, recommendations made in the Osteoarthritis Research Society International (OARSI) guidelines support referral to physiotherapy, along with patient education and self-management, aerobic and muscle strengthening exercises, thermal modalities, and acupuncture.

Dewey et al. (2008), has had a study where it is found that interventions that include physiotherapy functional exercises after discharge from hospital result in a short-term benefit after primary Totlal Knee Arthoplasty. The effect sizes were small to moderate, with no long-term benefit.

Prevention programs for sports injury, especially ACL injury, have recently shown encouraging results. Norwegian studies showed that the prevention of ACL injuries was possible with the use of neuromuscular training programs. Prevention of joint injuries would give an additional 14–25% reduction in the prevalence of osteoarthritis (Takeda et al., 2011).

This research was a randomized clinical trail (RCT) design to evaluate the effectiveness of close kinetic chain exercise versus open kinetic chain exercise in patients with knee joint osteoarthritis.

To identify the effectiveness of this treatment regime, Numeric Pain Rating Scale (NPRS) and The Western Ontario and McMaster Osteoarthritis Index (WOMAC) were used as measurement tools for measuring the pain intensity and disability caused by osteoarthritis.

All patients signed an informed consent form prior to their inclusion into the study.

3.1 Study Design

The study was conducted by using a quantitative randomized control trail design with two different subject groups. Randomized control trail design is a method of testing hypothesis by which cause and effect can be established.

The study was true experimental between different subject designs. Both groups received a common treatment regimen. In this study, the experimental group received close chain exercise along with conventional physiotherapy and control group received open kinetic chain exercise along with conventional physiotherapy.

A pre-test (before exercise) and post-test (after exercise) was administered with each subject of both groups to compare the pain effects, and functional ability before and after the treatment. The design could be shown by flowchart -

Flowchart of the phases of randomized clinical trial

Assessed for eligibility

↓

Outdoor knee osteoarthritis patients

↓

Randomly selected 20 patients of knee osteoarthritis patients

↓

Randomized Trail Or Control Group (n=20)

Trail Group (n1=10)	Control Group (n2=10)
↓	↓
Received closed kinetic chain exercise along with conventional physiotherapy	Received open kinetic chain exercise along with conventional physiotherapy
↓	↓
Follow Up (after 6 sessions)	Follow up (after 6 sessions)
↓	↓
Outcome analyzed	Outcome analyzed

A flowchart for a randomized clinical trial of a treatment program including closed kinetic chain exercise along with conventional physiotherapy and open kinetic chain exercise along with conventional for patient with knee joint osteoarthritis.

3.2 Study Area:

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

3.3 Study Population

The study population was the patients diagnosed as Osteoarthritis in the Musculo-skeletal Unit of Physiotherapy Department at CRP, Savar, Dhaka.

3.4 Sample Size

In this study, 20 participants were selected according to inclusion and exclusion criteria. 10 participants were in experimental group and 10 participants in control group.

3.5 Sampling

Simple Random Sample Technique are used in this study. Subjects, who met the inclusion criteria, were taken as sample in this study. 20 patients with osteoarthritis were selected from outpatient musculoskeletal unit of physiotherapy department of CRP, Savar and then 10 patients were assigned to Experimental group for the treatment approaches of Close Kinetic Chain Exercise along with conventional physiotherapy and 10 patients to the Control group for Open Kinetic Chain Exercise along with conventional physiotherapy treatment by computer generated random number using Microsoft Office Excel 2013 because it improves internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc. for the control group and E1, E2, E3 etc. for experimental group. The study was a single blinded technique.

3.6 Inclusion Criteria

1. Patient who is diagnosed by knee osteoarthritis.
2. **Both male and female are included.**
3. Any age knee OA patients are included.
4. Pain in either one knee joint or both.
5. Subject who are willingly participate.
6. Patients who are receiving to Physiotherapy from musculoskeletal unit of CRP.

3.7 Exclusion Criteria

1. Any history of recent surgery or fracture of femur, tibia, fibula or foot bones.
2. Any history of pathological condition (malignancy, heart disease etc).
3. Any history of osteoporosis.
4. Any previous or current history of psychiatric or psychological treatment.
5. Any intra-articular or epidural injection in the last 6 months.
6. Patient with severe psychological problem.

3.8 Data Collection Procedure

The data collection procedure was carried away by an examiner who has no connection with this research. This procedure conducted through assessing the patient on the basis of inclusion and exclusion criteria, randomization through using Microsoft Office 2013 plus Excel, pretest data collection, 6 treatment sessions and final post test data collection.

After screening the patient at department and randomization, the patients were assessed and treated by the qualified physiotherapist. Twenty participants were chosen based on the inclusion criteria and they were given 6 session of treatments individually. The randomization procedure was carried out by the data collector using Microsoft Office 2013 plus Excel and grouping procedure also carried out by using the same manner. Code 1C (10) for the control group and Code 2E (10) for the experimental or trial group. Experimental group received Close Kinetic Chain exercise along with conventional physiotherapy and the control group participants received Open Kinetic Chain Exercise along with conventional physiotherapy according to their condition.

A pilot study was carried out prior to the main data collection procedure to determine the responsiveness and side effect of the exercise as it is applied to the osteoarthritis patients.

Data was gathered through a randomization, pretest, and intervention and posttest procedure and by using a written questionnaire form which was formatted and prepared by the researcher under the supervision of the supervisor which also includes the Numeric Pain Rating Scale (NPRS) to measure pain intensity level and Western Ontario and McMaster University Osteoarthritis Index (WOMAC) to measure the disability level. Pretest was performed before the intervention and the same procedure was performed to collect the posttest data. The researcher gave vague instruction to the data collector how to proceed with the questionnaire and the scales used in that. A Bangla questionnaire of Western Ontario and McMaster University Osteoarthritis Index (WOMAC) was used as the participants are native Bangla speaker and the Bangla translation of was used with the permission from the Developers of the questionnaire. The data collector collected the data both in experimental and control group in presence of the qualified physiotherapist in order to reduce the biasness. The patient was totally blind about the procedure and the researcher has no connection with the data collection procedure. The data collector only gave his the participants filled up questionnaires. At the end of the trail, specific test were performed for statistical analysis.

3.9 Data Collection Tool

In this particular study, a written questionnaire, pen, paper and a Numeric Pain Rating Scale and the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) were used as a data collection tools.

3.10 Questionnaire

The questionnaire for this study was carefully developed under the constant observations, advice and permission of the supervisor following certain guidelines. There were close ended questions with Numeric Pain Rating Scale (NPRS) and the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) with some objective questions which were measured by the examiner and each question was formulated to identify the effect of motor control exercise along with the conventional physiotherapy for the treatment of osteoarthritis.

3.11 Measurement Tools

3.11.1 Numeric Pain Rating Scale (NPRS)

The Numeric Pain Rating Scale (NPRS) is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0–10 integers) that best reflects the intensity of the individual's pain (Rodriguez, 2001).

According to McCaffery et al. (1989) and later on Stevens, Lin, and Maher, (2016) the Numeric Pain Rating Scale (NPRS -11) is an 11-point scale for the patient self-reporting of pain. It is for adults and children 10 years old or older.

3.11.2 The Western Ontario and McMaster Universities Arthritis Index (WOMAC)

The Western Ontario and McMaster Universities Arthritis Index (WOMAC) is a widely used, proprietary set of standardized questionnaires used by health professionals to evaluate the condition of patients with Osteoarthritis of the knee including pain, stiffness, and physical functioning of the joints.

The WOMAC measures five items for pain (score range 0–20), two for stiffness (score range 0–8), and 17 for functional limitation (score range 0–68). Physical functioning questions cover everyday activities such as stair use, standing up from a sitting or lying position, standing, bending, walking, getting in and out of a car, shopping, putting on or taking off socks, lying in bed, getting in or out of a bath, sitting, and heavy and light household duties.

The WOMAC takes approximately 15-20 minutes to complete, and can be taken on paper, over the telephone or computer. Both the computerized and the mobile versions of the test have been found to be comparable to the paper form, with no significant difference.

The test questions are scored on a scale of 0-4, which correspond to: None (0), Mild (1), Moderate (2), Severe (3), and Extreme (4).

The scores for each subscale are summed up, with a possible score range of 0-20 for Pain, 0-8 for Stiffness, and 0-68 for Physical Function. Usually a sum of the scores for all three subscales gives a total WOMAC score, however there are other methods that have been used to combine scores.

Higher scores on the WOMAC indicate worse pain, stiffness, and functional limitations. The test-retest reliability of the WOMAC varies for the different subscales. The pain subscale has not been consistent across studies, but it generally meets the minimum standard. The physical function subscale is more consistent, and has stronger test-retest reliability. The stiffness subscale has shown low test-retest reliability.

3.12 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 has to make sense of the results. As the result came from an experiment in this research, data analysis was done by using the software named Statistical Package of Social Science (SPSS) version 20.

Mann Whitney U test had used to analysis the collected data. All participants were code according to group to maintain participant's confidentiality and both the experiment and control group participants score their pain intensity on the Numeric Pain Rating Scale (NPRS) and disability level through Western Ontario and McMaster University Osteoarthritis Index (WOMAC) prior to the trial and after the intervention sessions. Reduction of pain intensity level for both groups and improvement of functional disability are the differences between pre-test and post-test score and it should be analysed with the help of U test.

The U test was done for the analysis of the pain and disability after six session treatment of both control and experimental groups. Experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is ordinal should be analyzed with Mann-Whitney U test. This test can only be used with ordinal or interval/ ratio data.

Wilcoxon matched pair signed rank test was performed for the analysis of the pain and disability within group data. when there are two measures to be compared from the same cases and the data are normally distributed , then Wilcoxon test is applied. The study has an experimental study and has unmatched groups of different participants, who was randomly assigned by computer generated random allocation using Excel to Close Kinetic Chain Exercise along with conventional Physiotherapy in experimental group and Open Kinetic Chain exercise along with conventional physiotherapy in control group.

Estimated predictor

Hypothesis test of mean difference between the experimental group and the control groups, within groups, unlike the t- test it does not require the assumption of normal distribution. It is nearly as efficient as the t- test on normal distributions. This test can be used to determine whether two independent samples were selected from population having the same distribution.

Hypothesis test
Mann Whitney U test
Mann-Whitney U test is a non-parametric test that is simply compares the result obtained from the each group to see if they differ significantly.

Assumption
- All the observations from both groups are independent of each other.
- The responses are ordinal
- Under the null hypothesis Ho, the distribution of both populations are equal.

Null and alternative hypothesis

Null Hypothesis

Ho: $\mu1-\mu2 = 0$ or $\mu1 \geq \mu2$, where the experimental group and control group mean difference is not same or control group is higher than experimental group.

Alternative Hypothesis

Ha: μ1-μ2 ≠ 0 or μ1 ≠ μ2 where the experimental group and control group mean difference is not same.

Where,

Ho = Null hypothesis

Ha = Alternative hypothesis

μ1 = mean difference in initial assessment

μ2 = mean difference in final assessment

Formula: test statistic is follows:

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

Where,

n_1 = The number of subjects in experimental group

n_2 = The number of subjects in control group

T_x=The larger rank total

n_x = The number of subject in the group with large rank total

Calculation of U value of post-test pain between groups

Accordingly Mann Whitney U test formula here researcher need the value of T_x that means researcher need the value of larger rank total in posttest pain in between group.so researcher found T_x in this following way.

Table-1: Score of the participants in NPRS scale (Post –test)

	Experimental group			Control group	
Subject	**NPRS score**	**Rank**	**Subject**	**NPRS score**	**Rank**
E1	5	18	C1	2	7.5
E2	1	2.5	C2	4	16
E3	1	2.5	C3	2	7.5
E4	3	13	C4	3	13
E5	2	7.5	C5	2	7.5
E6	1	2.5	C6	3	13
E7	2	7.5	C7	3	13
E8	3	13	C8	2	7.5
E9	1	2.5	C9	5	18
E10	5	18	C10	6	20
Total	**24**	**87**	**Total**	**32**	**123**
Mean	**2.4**		**Mean**	**3.2**	

Above this table researcher found larger rank total T_x, Calculated U test for posttest pain in between group according to the formula.

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

Where,

n_1=The number of subject in experimental group (10)

n_2=The number of subject in control group (10)

T_x= The larger rank total (123)

n_x= The number of subject in the group with large rank total(10)

U= ?

So,

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

$$=10 \times 10 + \frac{10(10+1)}{2} - 123$$

$$=100+55-123$$

$$=155-123$$

$$=32$$

Level of Significant

The researcher has used 5% level of significant to test the hypothesis. Calculated the value and compared with standard U value .Null hypothesis will be rejected when observed U vale is smaller than the standard U value and alternative hypothesis is accepted

In this way researcher had calculated nonparametric U value and significant level for post- test pain between group and presented in the following tables

Mann Whitney U test analysis of post- test pain condition among

the participants (Between Group Analysis).

Table-2: Analysis of post -test pain (Between group analysis)

Numerical pain rating scale score	Category of the participant	Number	Mean of post- test pain	Mean Rank	Mean Whitney U score	P
	Control	10	6.40	8.70	32.00	0.001
	Experimental	10	4.40	12.30		
	Total	20				

Calculation of U value of Disability between groups

Accordingly Mann Whitney U test formula here we need the value of T_x that means researcher needed the value of larger rank total in posttest disability in between group.so researcher found T_x in this following way.

Table-3: Score of the participants in WOMAC scale (Post –test)

	Experimental group			Control group	
Subject	WOMAC score	Rank	Subject	WOMAC score	Rank
E1	25	11	C1	26	13
E2	14	2	C2	37	19
E3	25	11	C3	34	17.5
E4	17	17.5	C4	33	15.5
E5	24	8.5	C5	29	14
E6	23	6.5	C6	22	7
E7	23	6.5	C7	21	4
E8	25	11	C8	33	15.5
E9	10	1	C9	33	15.5
E10	24	8.5	C10	44	20
Total	**210**	**57.5**	**Total**	**312**	**141.0**
Mean	**21.0**		**Mean**	**31.2**	

Above this table researcher found larger rank total T_x, Calculated U test for posttest disability in between group according to the formula

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

Where,

n_1=The number of subject in experimental group (10)

n_2=The number of subject in control group (10)

T_x= The larger rank total (141.0)

n_x= The numberof subject in the group with large rank total(10)

$U=$?

So,

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

$$=10\times10+\frac{10(10+1)}{2} - 141$$

$$=100+55-141$$

$$=155-141$$

$$= 14$$

Level of Significant

The researcher has used 5% level of significant to test the hypothesis. Calculated the value and compared with standard U value .Null hypothesis will be rejected when observed U vale is smaller than the standard U value and alternative hypothesis is accepted

In this way researcher had calculated nonparametric U value and significant level for post -test disability between group and presented in the following tables.

Mann Whitney U test analysis of post- test disability condition among The participants (Between Group Analysis).

Table-4: Analysis of post- test disability (Between group analysis*)***

The Western Ontario and McMaster University Osteoarthritis Index (WOMAC) score	Category of the participant	Number	Mean of post- test pain	Mean Rank	Mean Whitney U score	P
	Control	10	44.33	14.10	1400	0.005
	Experimental	10	21.90	6.90		
	Total	20				

Patient rated general pain within the experimental group

Table-5: Rank and test statistics of patient rated general pain in the experimental group

Pain at resting position (cm) pre-test - Pain at resting position (cm) post-test	N	Mean Rank	Sum of Ranks	Test Statistics (Wilcoxon Signed-Rank Test) Based on positive ranks Z	P
Positive rank	0	0.00	0.00		
Negative rank	10	5.50	55.00	-2.81	0.005
Ties	0				
Total	10				

Patient rated general pain within the control group

Table- 6. Patient rated general pain within the control group

Pain at resting position (cm) pre-test - Pain at resting position (cm) post-test	N	Mean Rank	Sum of Ranks	Test Statistics (Wilcoxon Signed-Rank Test)	
				Based on positive ranks Z	on P
Positive rank	0	0.00	0.00		
Negative rank	9	5.00	45.00	-2.701	0.007
Ties	1				
Total	10				

Table 7: Rank and test statistics of patient rated general disability in WOMAC within the experimental group

Patient rated general disability in WOMAC within the experimental group.

Disability score in WOMAC at post-test - Disability score in WOMAC at pre test	N	Mean Rank	Sum of Ranks	Test Statistics (Wilcoxon Signed-Rank Test)	
				Based on positive ranks Z	P
Positive rank	0	0.00	0.00		
Negative rank	10	5.50	55.00	-2.803	0.005
Ties	0				
Total	10				

Table 8: Rank and test statistics of patient rated general disability in WOMAC within the control group.

Patient rated general disability in WOMAC within the control group.

Disability score in WOMAC at post-test - Disability score in WOMAC at pre test	N	Mean Rank	Sum of Ranks	Test Statistics (Wilcoxon Signed-Rank Test)	
				Based on positive ranks Z	P
Positive rank	0	0.00	0.00		
Negative rank	10	5.50	55.00	-2.805	0.005
Ties	0				
Total	10				

3.13 Ethical Consideration The proposal of the dissertation including methodology was approved by IRB and obtained permission from the concern authority of ethical committee of Bangladesh Health Profession Institute (BHPI) .The whole process of this research project was done by following the Bangladesh Medical and Research Council (BMRC) guidelines and World Health Organization (WHO) research guidelines.

In order to avoid ethical claims, the participants were set free to receive treatment for other purposes as usual. Each participant was informed about the purpose and goal of the study before collecting data. The information regarding the study had kept confidential and after the study all the documents had been destroyed.

A signed informed consent was ensured from every participant prior to the beginning of the trial and the data collector. The researcher obtained consent to participate from every subject. All participants stopped taking medicine willingly for the particular trial period and that was known prescribed by the responsible physiotherapist. All participants are informed that they have full authority over the decision. Participants were informed that they were completely free to decline answering any questions during the study and were free to withdraw their consent and terminate participation at any time. Withdrawal of the participation from the study, it would not affect their treatment in the Physiotherapy Department and they would still get the same facilities and treatment according to their condition.

Every subject had the opportunity to discuss their problem with the senior authority or administration of CRP and have any questioned answer to their satisfaction. Any query or questions related to the study or participation would be welcomed by the researcher his self.

3.15 Treatment Protocols

3.15.1 Conventional Treatment Protocol

Treatment option	Duration/Repetition
Soft tissue release technique	3-5 minutes
Patellar mobilization	2 minutes
Active free movement against gravity	10 repetition
Isometric strengthening exercise	3 repetition
Progressive Strengthening exercise	5-7 repetition
Movement with mobilization	10 repetition
Stretching exercise	10 repetition
Knee gaping	10 repetition
Ice	5 minutes
UST	5-7 minutes
IRR	15 minutes

Table- 9. Conventional Treatment Protocol

3.15.2 Experimental Group (CKCE) Treatment Protocol

Treatment option	Duration/Repetition
Seated leg press	10-15 repetition,1 set
Double or Single one third knee bend	10-15 repetition,1 set
Stationary Biking	5-7 minutes
Rowing Machine Exercise	5-7 minutes
Set up and Down Exercise	10-15 repetition,1 set
Progressive jumping exercise on mini trampoline	3-5 minutes

Table-10.Experimental Treatment Protocol

3.15.3 Control Group (OKCE) Treatment Protocol

Treatment option	Duration/Repetition
Maximal static quadriceps contractions (quadriceps setting) with the knee in full extension.	10 repetition,1 set
Straight leg raising with the patient in the supine position.	5-7 repetition,1 set
Short arc movement from 10 degree of knee flexion to terminal extension	5-7 repetition,1 set
Leg adduction exercise in the lateral decubitus position.	5-7 repetition,1 set

Table-11.Control Group Treatment Protocol

In the open kinetic chain exercise protocol, each exercise was held isometric ally for a count of 6 seconds with a 3-second rest between repetitions. Each exercise in the close kinetic chain protocol was performed dynamically with a 3-second rest between repetitions.

For this study 20 patients with knee osteoarthritis were taken as sample from Musculo-skeletal outpatient unit of Center for Rehabilitation of Paralyzed (CRP), Savar to compare the efficacy of close kinetic chain exercise versus open kinetic chain exercise in patients with knee joint osteoarthritis. In this study the results which were found have been shown in different bar diagrams, pie charts and tables.

4.1 Sociocultural Related Information

4.1.1 Variables

Base line graph

variables	Experimental	control
Age(years) (Mean ± SD)	49.10±14.73	55.5 ± 12.64
Gender	M=6 F=4	M=4 F=6
Mean pain at rest pretest data (cm) ± SD	6.80±1.61	6.30±1.25
Disability pretest data(cm) ± SD	44.80±14.16	48.90± 7.40

Table-11: Baseline chart characteristic of experimental and control group

4.1.2 Age range of the participant:

Age range	Frequency	percentage
30 – 45 years	7	35%
46 – 60 years	8	40%
61 – 75 years	5	25%

Table 12: Age Range of The participant

The table shows that among them of the 20 participant, age range of the patients 30 – 45 years (n=7)   were 35%,46 -60 years (n=8) were 40% and age range 61-75 years (n=5) were 25% of the patient included this research.
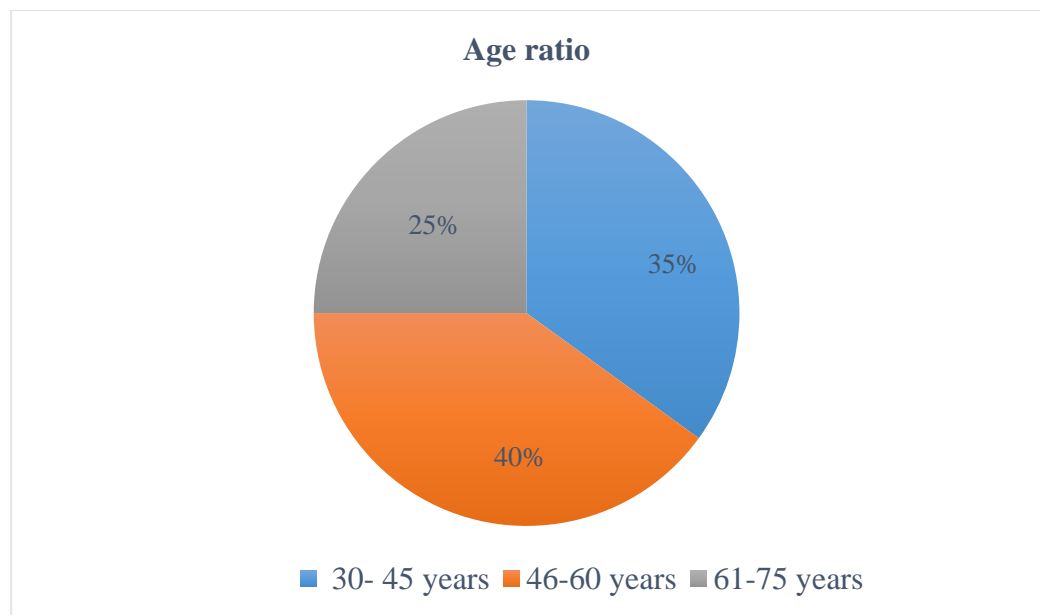
Figure 1: Age ratio of the participants

4.1.3 Gender distribution:
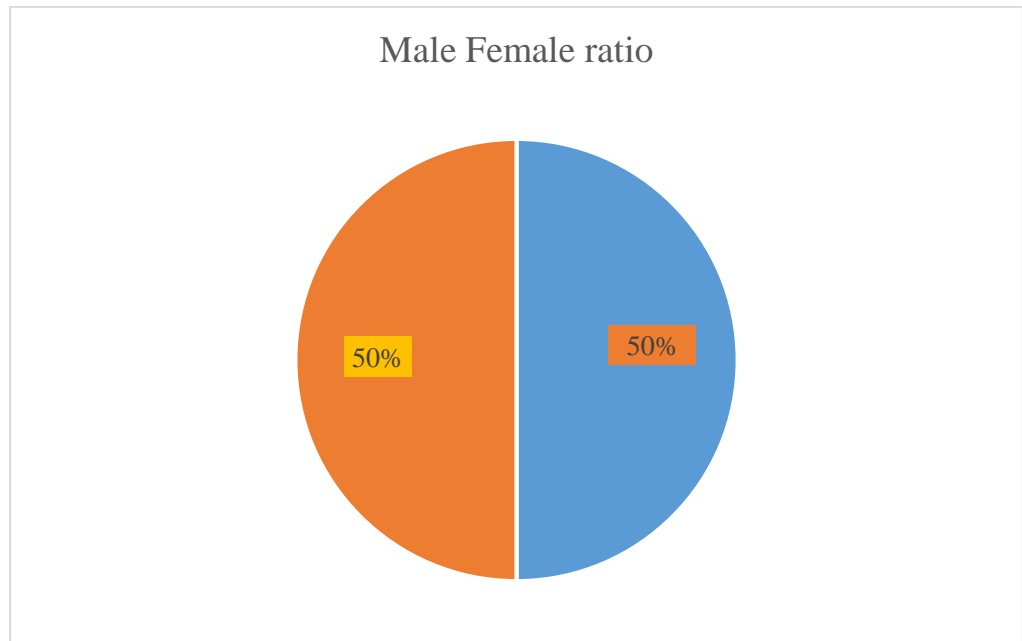
Figure 2: Gender distribution of the participants

20 participants of knee osteoarthritis were included as simple of the study. Among of the participants 10 patients were male (50%) and 10 patients were female (50%).

4.1.4 Sex Ratio
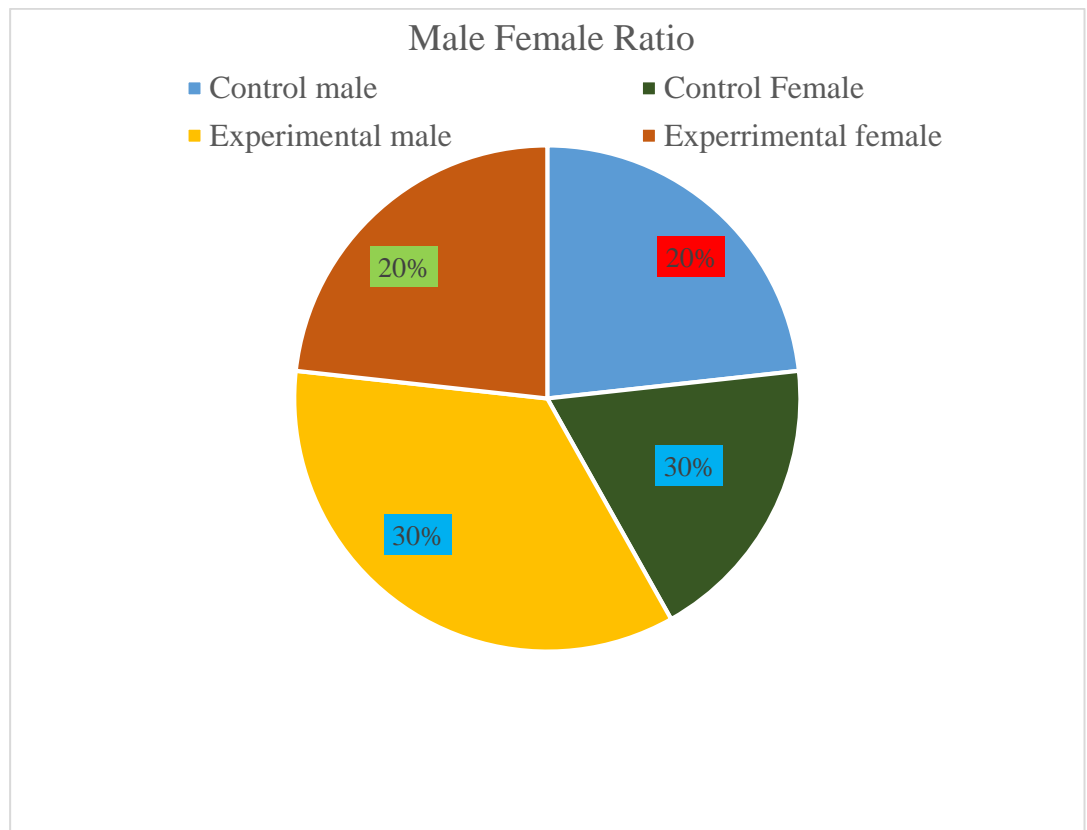
Figure 3: Sex ratio of the participants

On the other hand, In Control Group 20% (n=4) were Male and 30% (n=6) were Female and in Experimental Group 30% (n=6) were Male and 20% (n=4) were Female.

4.1.5 Occupation Distribution:
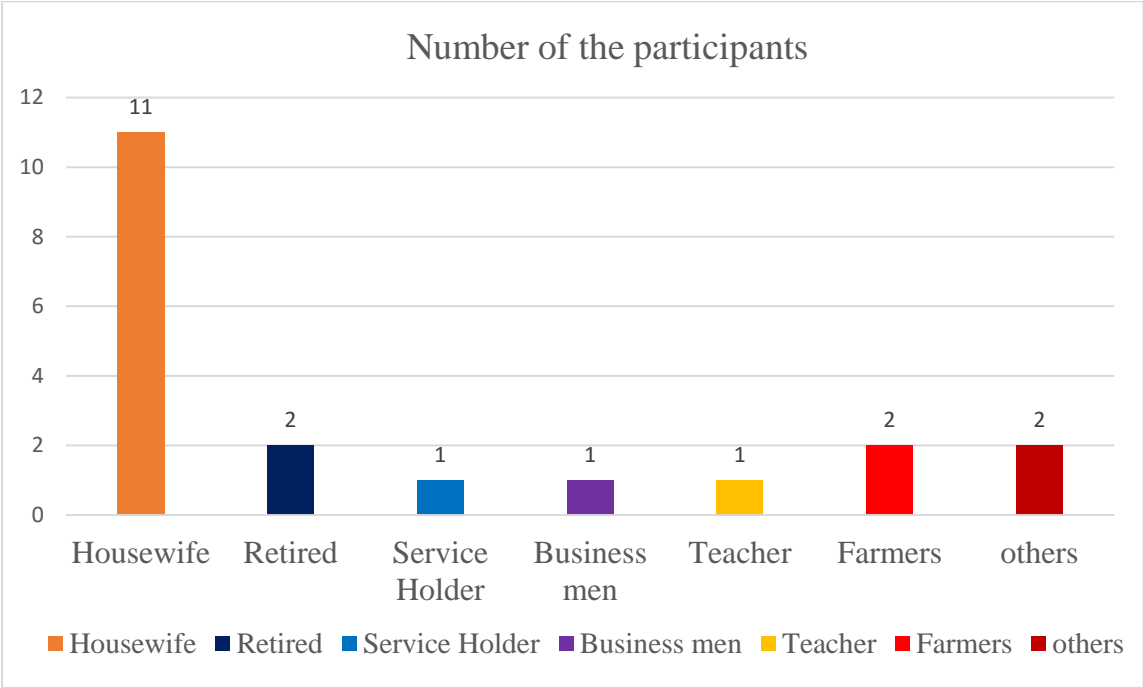
Figure 4: Occupation distribution of the participants

Among the 20 participants, there were 6 kinds of occupation. Most of them are house wife (55%, n=11) and rest of them are retried, service holder, farmer and business man.

4.1.6 Residential Area Distribution:

Residential Area Distribution

35%

65%

■ Rural ■ Urban
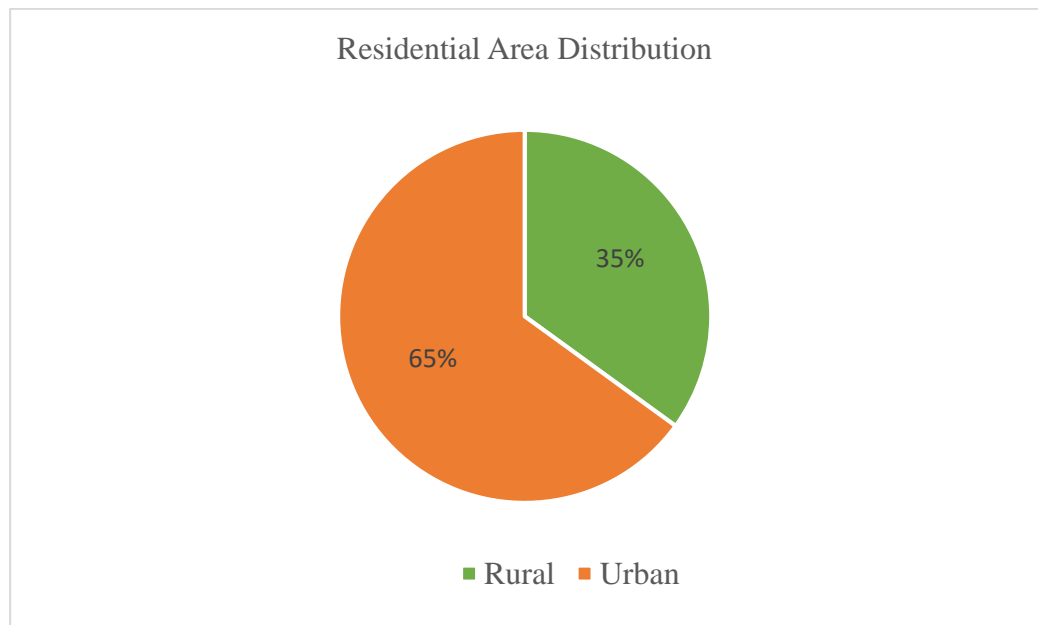
Figure 5: Area distribution of the participants

20 Patients with knee osteoarthritis were included as sample of the study, among them almost 65% (n=13) were urban area, about 35 % (n=7) were rural area.

4.1.7 Marital Status Distribution:

Marital status	Experimental group	Control group	Total number of the participants
Married	9	10	19
Unmarried	1	0	1

Table 13: Participant of the marital status distribution

The table shows that, among the 20 participants most were married (95%, n= 19) and few of them were unmarried (5%, n= 1). Among them 9 participants in experimental group and 10 participants in control group were married and only 1 participant in control group were unmarried. No participant in control group was unmarried.

Statistical difference of pain in experimental group

Reduction of pain in Experimental group

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
pre	7	5	6	5	9	5	9	8	6	8
post	5	1	1	3	2	1	2	3	1	5
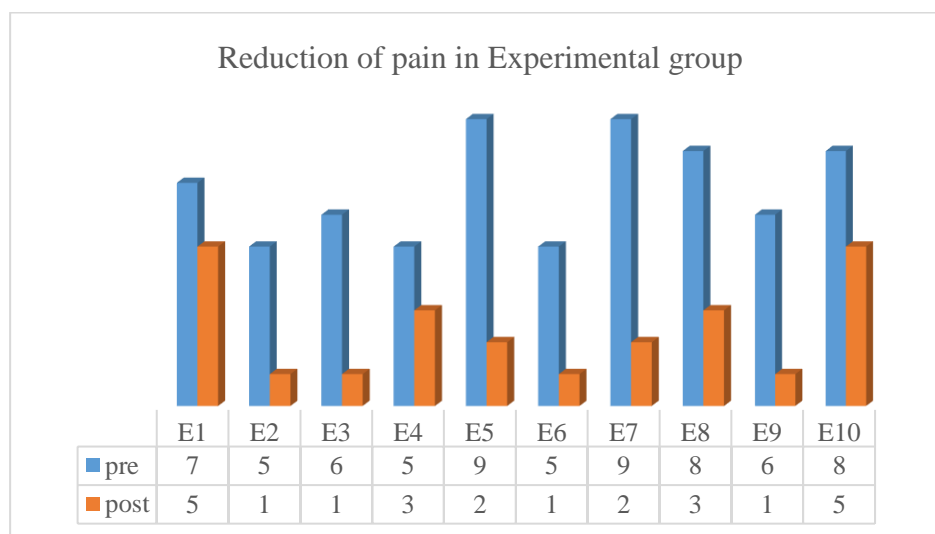
Figure 6: Reduction of pain in Experimental group

Statistical difference of pain in control group

Reduction of pain in control group

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
pre	5	8	6	7	5	5	7	5	7	8
post	2	4	2	3	2	3	3	2	5	6
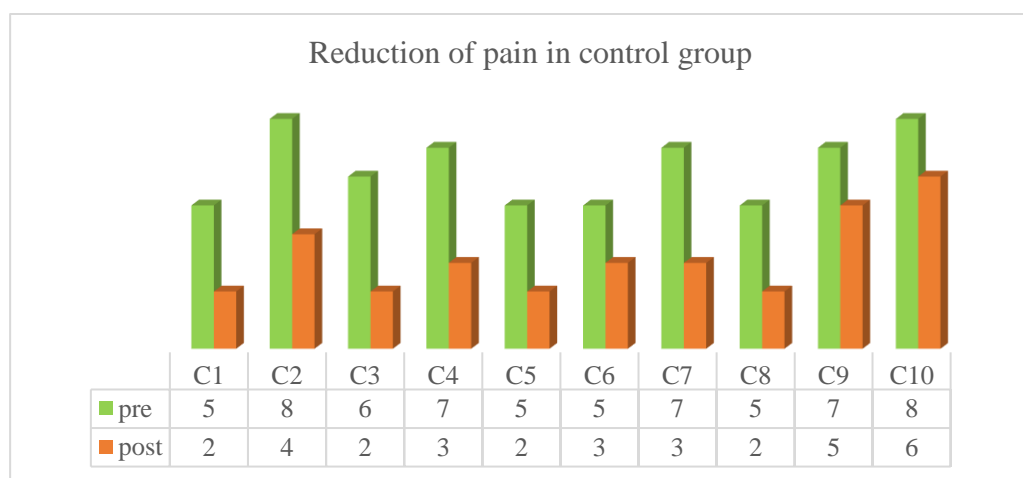
Figure 7: Reduction of pain in control group

Statistical difference of disability in experimental group
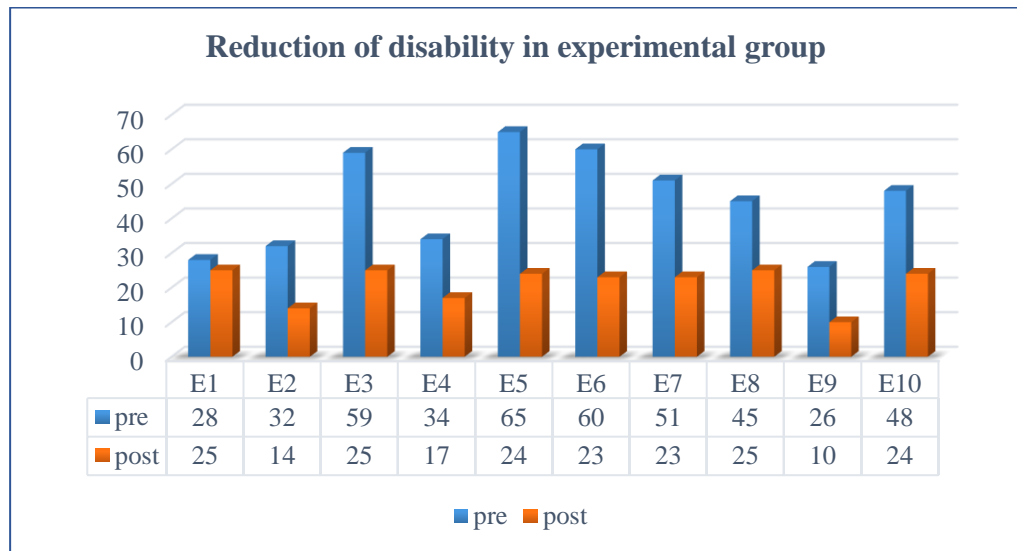
Figure- 8: Reduction of disability in experimental group

Statistical difference of disability in control group
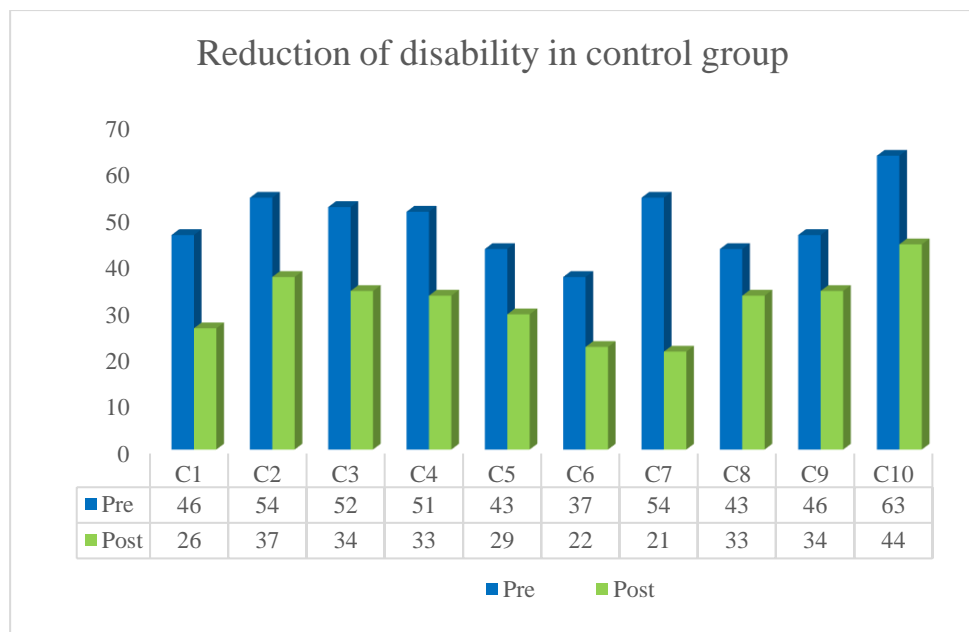
Figure-9: Reduction of disability in control group

4.2 Pain and Disability Related Information

4.2.1 Comparison of Pain

From Comparison of pain data, it can be concluded that pain reduction score on the Numerical Pain Rating Scale (NPRS) in experimental group was statistically significantly higher than the control group ($U = 32.00$, p = .001).

The observe U value was 32.00 in the between group and standard table value in U test was 27 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant. That was associated in pain and disability.

4.2.2 Comparison of Disability

The above mentioned disability tabulated data, it can be concluded that disability reduction score on the the Western Ontario and McMaster Universities Arthritis Index (WOMAC) in experimental group was statistically significantly higher than the control group ($U = 14.00$, p = 0.005).

The observe U value was 14.00 in the between group and standard table value in U test was 27 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant. That was associated in pain and disability.

4.2.3 Patient rated general pain within the experimental group

The study found that it can be concluded that pain reduction score on the Numerical Pain Rating Scale (NPRS). The comparison of the participants pretest and posttest score. The experimental group was statistically significantly ($Z = 2.81$, p = .001). P value is <0.005 which that there is less than a 5% chance that the results are due to random error and it is significant. Therefore it can be said that the hypothesis is accepted and the null hypothesis is rejected.

4.2.4 Patient rated general pain within the control group

The study found that it can be concluded that pain reduction score on the Numerical Pain Rating Scale (NPRS). The comparison of the participants pretest and posttest score. The experimental group was statistically significantly ($Z = 2.81$, p = .001). P value

is <0.005 which that there is less than a 5% chance that the results are due to random error and it is significant. Therefore it can be said that the hypothesis is accepted and the null hypothesis is rejected.

4.2.5 **Patient rated general disability in WOMAC within the experimental group**

The study found that it can be concluded that disability reduction score on the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) Scale. The comparison of the participants pretest and posttest score. The experimental group was statistically significantly ($Z= 2.803$, p = .005). P value is <0.005 which that there is less than a 5% chance that the results are due to random error and it is significant. Therefore it can be said that the hypothesis is accepted and the null hypothesis is rejected.

4.2.5 **Patient rated general disability in WOMAC within the control group**

The study found that it can be concluded that disability reduction score on the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) Scale. The comparison of the participants pretest and posttest score. The experimental group was statistically significantly ($Z= 2.805$, p = .005). P value is <0.005 which that there is less than a 5% chance that the results are due to random error and it is significant. Therefore it can be said that the hypothesis is accepted and the null hypothesis is rejected.

The study was indicated a process that could be continuing to establish the result. Here the aim of this study could be achieved if the researcher could show effective support. The purpose of this study was to evaluate the effectiveness of close kinetic chain exercise with conventional physiotherapy was compare to open kinetic chain exercise along with conventional physiotherapy knee osteoarthritis.

In this experimental study 20 patients were enrolled and 10 patients were assigned to control group who received Open Kinetic Chain Exercise along with conventional physiotherapy. The rest of 10 patients were assigned to experimental group who received Close Kinetic Chain exercise along with conventional physiotherapy. Each group attended for 6 sessions of treatment within three weeks in the Physiotherapy outpatient Unit of CRP, Savar in order to demonstrate the improvement. The outcome was measured by using Numeric Pain Rating Scale (NPRS) for pain intensity and Ontario &McMaster Universities Osteoarthritis Index was used as measurement tools for measuring the level of pain, stiffness and functional activities in several functional positions.

The researcher found the male female ratio between 20 the patients, and 50% (n=10) were Male and 50% (n=1o) were Female. Among them, In Control Group 20% (n=4) were Male and 30% (n=6) were Female and in Experimental Group 30% (n=6) were Male and 20% (n=4) were Female.

Sadhana et al in 2012 had a study on effects on comparing open kinetic chain with close kinetic chain exercise on quadriceps strength and functional status of women on pain, stiffness and physical function in patients with knee osteoarthritis. In their study there was 30 patients. The result of their study about age told that the mean age of experimental group was 60.20 years and the mean age of control group is 61.27 years.

In this study there were total 20 participants. The mean age of experimental group was 49.1 years and the mean age of control group is 55.5 years.

The results of the study demonstrated that close kinetic chain exercises brought significant gains in strength of the quadriceps muscle in the experimental group after

the 6 session training program. In the between-group analysis, the improvement in strength in the experimental group was greater than that of the control group at the end of the training period.

The analysis of significance was carried out by using non parametric Mann-Whitney U test to compare the effectiveness of Close Kinetic Chain exercise along with conventional physiotherapy compared to the Open Kinetic Chain exercise along with conventional physiotherapy for the management of osteoarthritis.

By using a non-parametric Mann-Whitney U test on the data the results were found to be significant ($p < 0.005$ for a one tailed hypothesis). The null hypothesis therefore can be rejected. That actually means that the Close Kinetic Chain exercise along with conventional physiotherapy is more effective than Open kinetic Chain exercise along with conventional physiotherapy technique reducing pain and disability in the patients with osteoarthritis.

The researcher found significance improvement of pain. . Numerical pain rating scale was used in the study to measure pain level in participants in pretest and after intervention. The researcher found significant improvement ($p= <.05$) of pain intensity in experimental group on NPRS. In Experimental group, the post-test Mean on NPRS was 2.4 and Control group,the posttest Mean on NPRS was 3.2. We found Journal of Sports and Physical Education, 2013 state that in experimental group, Mean of reduction of pain was 8.13 and control group, the posttest mean on NPRS 5.266. In case of the pain reduction was statistically significant in all cases, in all groups pain was reduced.

In previous study Western Ontario and McMaster University Osteoarthritis Index was used in case of osteoarthritis generated disability so was used by Sadhana Barma 2012. In here, subjects sored in between 0-96 in the WOMAC score. The mean of the WOMAC score in experimental group was 55.7 and the mean of the WOMAC score in control group was 64.8. The functional level of the patient was increased and the disability caused by osteoarthritis was significantly reduced. The disability scored reduced in both groups but the experimental group shows promising result.

In present study Western Ontario and McMaster University osteoarthritis Index was used in case of osteoarthritis generated disability. In this research, subjects score in

between 0-96 in the WOMAC score. The mean of the WOMAC score in experimental group was 21.00 and the mean of the WOMAC score in control group was 31.30.

The results of the present study showed that the 6 session intervention brought about a significant reduction in knee pain and improvement in function both the experimental group and control group. But the reduction in pain and improvement in function in the experimental group is most significant than control group and therefore the rate of the increase stability of the knee joint in experimental group than control group.

The researcher had not got the enough time for such a study, this is the main limitation of this study. In this study it was used 20 patients with osteoarthritis. This was a very small number of samples in both groups which was not sufficient for the study to generalize to wider population of osteoarthritis. Physiotherapists could not be blinded to the interventions.

This research carried out in CRP, Savar such a small environment; it was very difficult to keep confidential the aims of the study for blinding procedure. The samples were selected between the any age of the participants are including, but the researcher couldn't find out which age group patients were more effective. If the most effective age group were found then the result will be more specific. There was no available researches representing effectiveness of this intervention in this area in Bangladesh and did not get enough equipment's to fulfill the research which was very difficult.

| CHAPTER: VI | CONCLUSION AND RECOMMENDATION |

6.1 CONCLUSION

The result of the study have identified that the efficacy of close kinetic chain exercise along with conventional physiotherapy was better than open kinetic chain exercise along with conventional physiotherapy for the patient with knee osteoarthritis which was a Quantitative experimental study. Participants in the close chain exercise along with conventional physiotherapy group showed a greater benefit than those in the open kinetic chain exercise along with conventional physiotherapy group. The result indicate that the significant changes in both groups are due to the selection of a well- defined population of knee osteoarthritis patients using specific inclusion and exclusion criteria. So it may become more helpful for patients with osteoarthritis to determine close kinetic chain exercise with conventional physiotherapy than open kinetic chain exercise along with conventional physiotherapy as intervention for reducing the features of osteoarthritis. From this research the researcher wishes to explore the effectiveness of close kinetic chain exercise along with conventional physiotherapy to reduce the features of patient with osteoarthritis, which will be helpful to facilitate their rehabilitation and to enhance functional activities.

6.2 RECOMMENDATION

As a consequence of this researcher it is recommended to do further study including combined close kinetic chain exercise along with conventional physiotherapy and open kinetic chain exercise along with conventional physiotherapy alone to assess the effectiveness of these interventions with well blinding procedure. It is also recommended to include the functional outcome assessment of patient and to identify the average number of sessions that are needed to be discharged from treatment to validate the treatment technique.

As a consequence of the research it is recommended that with further to find out the effectiveness close kinetic chain exercise along with conventional physiotherapy or to find out the effectiveness of open kinetic chain exercise along with conventional physiotherapy include individual assessing effects and efficacy of these treatments. In particular, since the knee is very important area of the lower limb to do daily living activities and this area is a frequent cause of functional disability and pain. This study directed towards an assessment of the specific management in treating knee of specific knee problem in an outpatient, if pursued further could prove extremely fruitful. Furthermore, chronic associated with many cases of knee pain, and the extensive pathology that exists in the surrounding structure that was joints, tissues and bone, may suggest a further study of a longer duration as this may give even better results.

The researcher did not enough environment and enough equipment to complete the research. That's why researcher recommended to do further study with enough time and by maintaining available equipment to make the study more valid.

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CONSENT FORM (ENGLISH)

Assalamu-alaikum / Namasker. I am Md. Saddam Hossain, a student of 4th year B.sc.in Physiotherapy at Bangladesh Health Professions Institute (BHPI), CRP. I am conducting a study for partial fulfilment of Bachelor of Science in Physiotherapy degree, titled, "Effectiveness of close kinetic chain exercise versus open kinetic chain exercise in patients with knee joint osteoarthritis: A comparative study".

You will need to answer some questions which are mentioned in this form. It will take approximately 20-30 minutes.

I would like to inform you that is purely academic study and will not be used for any other purpose. All informations provided by you will be kept confidential.it is ensured that the source of information remains anonymous. Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequence. You also have the right not to answer a particular question that you don't like or you do not want to answer during interview.

If you have any query about the study or your right as a participant , you may contact with, researcher Md. Saddam Hossain or my supervisor, Mohammad Habibur Rahman, Assistant Professor, Department of Physiotherapy BHPI,CRP,Savar,Dhaka-1343.

Do you have any questions before I start?

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

Yes: ☐   No: ☐

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

Signature of the Data Collector……………….….….Date…………………………

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

Questionnaire (English)

This questionnaire is developed to measure the pain of the patient with knee osteoarthritis and this portion will be filled by physiotherapist/researcher using a pencil.

Please give a tick (√) mark on the left side of the box of correct answer

Part-I: Socio-demographic information

Patient name: Code name:

Contact name: Date:

Address: Village: Post office:

Police station: District:

Occupation:

Age:

Sex: ☐   Male

            ☐   Female

Marital status: ☐   Married

                   ☐   Unmarried

                   ☐   Divorced

                   ☐   Widow

Residential area: ☐ Urban

                   ☐ Rural

Pre-test Data

Part-II: Pain Intensity

1. How much you feel pain today?

```
 ├───┼───┼───┼───┼───┼───┼───┼───┼───┼───┤
 0   1   2   3   4   5   6   7   8   9   10
```

No pain   Severe pain

Part-III: Physical disability questionnaire

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

Instructions: Please rate the activities in each category according to the following scale
of difficulty: 0 = None

                       1 = Slight

                       2 = Moderate

                       3 = Very

                       4 = Extremely

Circle **one number** for each activity

Pain:

1. Walking	0	1	2	3	4
2. Stair climbing	0	1	2	3	4
3. Nocturnal	0	1	2	3	4
4. Rest	0	1	2	3	4
5. Weight bearing	0	1	2	3	4

Stiffness:

1. Morning stiffness	0	1	2	3	4
2. Stiffness occurring later in the day	0	1	2	3	4

Physical Function:

1. Descending stairs	0	1	2	3	4
2. Ascending stairs	0	1	2	3	4
3. Rising from sitting	0	1	2	3	4
4. standing	0	1	2	3	4
5. Bending to floor	0	1	2	3	4
6. Walking on flat surface	0	1	2	3	4
7. Getting in/ out of car	0	1	2	3	4
8. Going shopping	0	1	2	3	4
9. Putting on socks	0	1	2	3	4
10. Lying in bed	0	1	2	3	4

11. Taking off socks	0	1	2	3	4
12. Rising from bed	0	1	2	3	4
13. Getting in/ out of bath	0	1	2	3	4
14. Sitting	0	1	2	3	4
15.Getting on/ off toilet	0	1	2	3	4
16. Heavy domestic duties	0	1	2	3	4
17. Light domestic duties	0	1	2	3	4

Pretest score of the patient is_____/ 96.

Post-test Data

Part-II: Pain Intensity

1. How much you feel pain today?

```
 |----|----|----|----|----|----|----|----|----|----|
 0    1    2    3    4    5    6    7    8    9   10
No pain                                        severe pain
```

Part-III: Physical disability questionnaire

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

Instructions: Please rate the activities in each category according to the following scale of difficulty: 0 = None

1 = Slight

2 = Moderate

3 = Very

4 = Extremely

Circle **one number** for each activity

Pain:

1. Walking	0	1	2	3	4
2. Stair climbing	0	1	2	3	4
3. Nocturnal	0	1	2	3	4
4. Rest	0	1	2	3	4
5. Weight bearing	0	1	2	3	4

Stiffness:

1. Morning stiffness	0	1	2	3	4
2. Stiffness occurring later in the day	0	1	2	3	4

Physical Function:

1. Descending stairs	0	1	2	3	4
2. Ascending stairs	0	1	2	3	4

3. Rising from sitting	0	1	2	3	4
4. standing	0	1	2	3	4
5. Bending to floor	0	1	2	3	4
6. Walking on flat surface	0	1	2	3	4
7. Getting in/ out of car	0	1	2	3	4
8. Going shopping	0	1	2	3	4
9. Putting on socks	0	1	2	3	4
10. Lying in bed	0	1	2	3	4
11. Taking off socks	0	1	2	3	4
12. Rising from bed	0	1	2	3	4
13. Getting in/ out of bath	0	1	2	3	4
14. Sitting	0	1	2	3	4
15.Getting on/ off toilet	0	1	2	3	4
16. Heavy domestic duties	0	1	2	3	4
17. Light domestic duties	0	1	2	3	4

Post-test score of the patient is____/ 96.

সম্মতিপত্র (বাংলা)

আসসালামুয়ালাইকুম/ নমস্কার,

আমি মোঃ সাদ্দাম হোসেন, আমি এই গবেষণা প্রকল্পটি বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই) –এ পরিচালনা করছি যা আমার ৪র্থ বর্ষ বিএসসি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত । আমার গবেষণার শিরোনাম হল–"**হাঁটুর অস্টিওআর্থ্রাইটিস রোগীদের ক্ষেত্রে ক্লোজড চেইন এক্সারসাইজ বনাম ওপেন চেইন এক্সারসাইজ এর কার্যকারিতা –একটি তুলনামূলক গবেষণা**" এখন আমি আপনাকে কিছু প্রশ্ন করতে চাচ্ছি যা এই ফর্ম এ উল্লেখ আছে। এতে আনুমানিক ২০–৩০ মিনিট সময় নিবো ।

আমি আপনাকে অবগত করছি যে, এটা আমার অধ্যয়নের অংশ এবং যা অন্য কোন উদ্দেশ্যে ব্যবহত হবে না । আপনি যেসব তথ্য প্রদান করবেন তার গোপনীয়তা বজায় থাকবে এবং আপনার প্রতিবেদনের ঘটনা প্রবাহে এটা নিশ্চিত করা হবে যে এই তথ্যের উৎস অপ্রকাশিত থাকবে ।

এই অধ্যয়নে আপনার অংশগ্রহণ স্বেচ্ছাপ্রণোদীত এবং আপনি যেকোন সময় এই অধ্যয়ন থেকে কোন নেতিবাচক ফলাফল ছাড়াই নিজেকে প্রত্যাহার করতে পারবেন এছাড়াও কোন নির্দিষ্ট প্রশ্ন অপছন্দ হলে উত্তর না দেয়ার এবং সাক্ষাৎকারের সময় কোন উত্তর না দিতে চাওয়ার অধিকারও আপনার আছে ।

এই অধ্যয়নে অংশগ্রহণকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা এবং আমার সুপারভাইজার মোহাম্মদ হাবিবুর রহমান, সহকারী অধ্যাপক, ফিজিওথেরাপী বিভাগ, বিএইচপিআই, সিআরপি, সাভার, ঢাকা–তে যোগাযোগ করতে পারেন ।

সাক্ষাৎকার শুরু করার আগে কি আপনার কোন প্রশ্ন আছে ?

সুতরাং আমি আপনার অনুমতিতে এই সাক্ষাৎকার শুরু করতে পারি ?

| | হ্যাঁ | | না |

১। অংশগ্রহণকারীর স্বাক্ষর ও তারিখ _____

২। উপাত্ত সংগ্রহকারীর স্বাক্ষর ও তারিখ _____

৩। সাক্ষীর স্বাক্ষর ও তারিখ _____

অংশ- ১: সামাজিক-প্রেক্ষাপটের তথ্যাবলী

এই প্রশ্ন পত্রটি তৈরি করা হয়েছে অস্টিওআর্থ্রাইটিস রোগীদের হাটু ব্যথার পরিমাপ এবং অক্ষমতাজনিত তথ্যাবলী এই অংশটি ফিজিওথেরাপিস্ট / গবেষক কালো কলম / পেন্সিল দ্বারা পূরণ করবেন।

অনুগ্রহপূর্বক নিচের প্রশ্নগুলোর মধ্যে সঠিক উত্তরের বাম পাশে টিক ✓ চিহ্ন দিন

১) রোগীর নাম: কোড নং:

২) মোবাইল নং:   তারিখ:

৩) ঠিকানা: গ্রাম: পোস্ট অফিস:

        থানা:   জেলা:
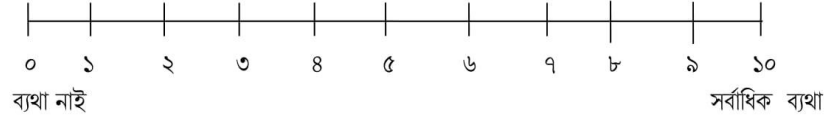
৪) পেশা:

৫) বয়স: (বছর)

৬) লিঙ্গ: ☐ পুরুষ
       ☐ মহিলা

৭) বৈবাহিক অবস্থা: ☐ বিবাহিত
             ☐ অবিবাহিত
             ☐ তালাকপ্রাপ্ত
             ☐ বিধবা

৮) আবাসিক এলাকা: ☐ শহর
             ☐ গ্রাম

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চিকিৎসার পূর্ববর্তী তথ্য

অংশ- ২: ব্যথার পরিমান

i) আপনার ব্যথার তীব্রতা আজকে কতটুকু?

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├──┼──┼──┼──┼──┼──┼──┼──┼──┼──┤
০   ১   ২   ৩   ৪   ৫   ৬   ৭   ৮   ৯   ১০
ব্যথা নাই                              সর্বাধিক ব্যথা
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অংশ- ৩: শারীরিক অক্ষমতার প্রশ্নাবলী

প্রত্যেক প্রশ্নের চারটা স্কোর, সর্বমোট প্রশ্ন ২৪ এবং সর্বমোট ফলাফল ৯৬

নির্দেশিকা: দয়া করে প্রত্যেক ধরনের কাজকে নিচের কাঠিন্যের মাপকাঠি অনুযায়ী নির্ধারণ করুন

০ = নাই

১ = অল্প

২ = মাঝারী

৩ = অনেক

৪ = সর্বাধিক

প্রত্যেক কাজের জন্য **একটা সংখ্যায়** গোল দাগ দিন

i) ব্যথা:

১। যখন হাঁটেন	০	১	২	৩	৪
২। যখন সিড়িতে উঠেন	০	১	২	৩	৪
৩। রাতের বেলায়	০	১	২	৩	৪

৭১

৪। বিশ্রামের সময়	o	১	২	৩	8
৫। যখন ওজন বহন করেন	o	১	২	৩	8

ii) শক্ত হয়ে যায়:

১। সকালে শক্ত হয়ে যায়	o	১	২	৩	8
২। দিনের অন্য সময় শক্ত হয়ে যায়	o	১	২	৩	8

iii) শারীরিক কাজ:

১। সিঁড়ি দিয়ে নামতে	o	১	২	৩	8
২। সিঁড়ি দিয়ে উঠতে	o	১	২	৩	8
৩। বসা থেকে ওঠার সময়	o	১	২	৩	8
৪। দাঁড়িয়ে থাকার সময়	o	১	২	৩	8
৫। আসন দিয়ে বসার সময়	o	১	২	৩	8
৬। সমতলে হাটার সময়	o	১	২	৩	8
৭। যানবাহনে ওঠার সময়/ যানবাহন থেকে নামার সময়	o	১	২	৩	8
৮। কেনাকাটা করার সময়	o	১	২	৩	8
৯ । মোজা পরার সময়	o	১	২	৩	8
১০। বিছানায় শুতে	o	১	২	৩	8
১১। মোজা খোলার সময়	o	১	২	৩	8

১২। শোয়া থেকে ওঠার সময়	০	১	২	৩	৪
১৩। গোসলে যাওয়ার সময়/বের হওয়ার সময়	০	১	২	৩	৪
১৪। বসে থাকা অবস্থায়	০	১	২	৩	৪
১৫। টয়লেটে যাওয়ার সময়	০	১	২	৩	৪
১৬। বাসার ভারী কাজ গুলো করতে	০	১	২	৩	৪
১৭। বাসার হালকা কাজ গুলো করতে	০	১	২	৩	৪

চিকিৎসার পূর্ববর্তী রোগীর প্রাপ্ত নম্বর ____/৯৬

চিকিৎসার পরবর্তী তথ্য

অংশ- ৪: ব্যথার পরিমান

i)আপনার ব্যথার তীব্রতা আজকে কতটুকু ?

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 ├──┬──┬──┬──┬──┬──┬──┬──┬──┬──┤
 ০    ১    ২    ৩    ৪    ৫    ৬    ৭    ৮    ৯    ১০
ব্যথা নাই                                    সর্বাধিক ব্যথা
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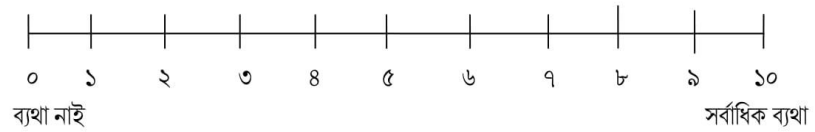
অংশ ৩: শারীরিক অক্ষমতার প্রশ্নাবলী

নির্দেশিকা: দয়া করে প্রত্যেক ধরনের কাজকে নিচের কাঠিন্যের মাপকাঠি অনুযায়ী নির্ধারণ করুন

০ = নাই

১ = অল্প

২ = মাঝারী

৩ = অনেক

৪ = সর্বাধিক

প্রত্যেক কাজের জন্য **একটা সংখ্যায়** গোল দাগ দিন

i) ব্যথা:

১| যখন হাটেন	০	১	২	৩	৪
২| যখন সিড়িতে উঠেন	০	১	২	৩	৪
৩| রাতের বেলায়	০	১	২	৩	৪
৪| বিশ্রামের সময়	০	১	২	৩	৪
৫| যখন ওজন বহন করেন	০	১	২	৩	৪

ii) শক্ত হয়ে যায়:

১| সকালে শক্ত হয়ে যায়	০	১	২	৩	৪
২| দিনের অন্য সময় শক্ত হয়ে যায়	০	১	২	৩	৪

iii) শারীরিক কাজ:

১। সিঁড়ি দিয়ে নামতে	০	১	২	৩	৪
২। সিঁড়ি দিয়ে উঠতে	০	১	২	৩	৪
৩। বসা থেকে ওঠার সময়	০	১	২	৩	৪
৪। দাড়িয়ে থাকার সময়	০	১	২	৩	৪
৫। আসন দিয়ে বসার সময়	০	১	২	৩	৪
৬। সমতলে হাটার সময়	০	১	২	৩	৪
৭। যানবাহনে ওঠার সময়/ যানবাহন থেকে নামার সময়	০	১	২	৩	৪
৮। কেনাকাটা করার সময়	০	১	২	৩	৪
৯ । মোজা পরার সময়	০	১	২	৩	৪
১০। বিছানায় শুতে	০	১	২	৩	৪
১১। মোজা খোলার সময়	০	১	২	৩	৪
১২। শোয়া থেকে ওঠার সময়	০	১	২	৩	৪
১৩। গোসলে যাওয়ার সময়/বের হওয়ার সময়	০	১	২	৩	৪
১৪। বসে থাকা অবস্থায়	০	১	২	৩	৪
১৫। টয়লেটে যাওয়ার সময়	০	১	২	৩	৪
১৬। বাসার ভারী কাজ গুলো করতে	০	১	২	৩	৪
১৭। বাসার হালকা কাজ গুলো করতে	০	১	২	৩	৪

চিকিৎসার পরবর্তী রোগীর প্রাপ্ত নম্বর ____/৯৬

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Permission letter

26 April, 2017

Head of the Department

Department of Physiotherapy

Centre for the Rehabilitation of the paralysed (CRP).

CRP, Chapain, Savar, Dhaka-1343.

Through: Head, Department of Physiotherapy, BHPI

Subject: Seeking permission for data collection to conduct my research project.

Dear Sir,

With due respect and humble submission to state that I am Md. Saddam Hossain, a student of 4th Professional B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). In 4th year, we have to do a research project and I have chosen a title that is **"Effectiveness of close kinetic chain exercise versus open kinetic chain exercise in patients with knee joint osteoarthritis: A comparative study".** To conduct this research, I want to collect data from the patients with knee osteoarthritis who would attend in the outdoor musculoskeletal physiotherapy department of CRP. So, I need permission for data collection to make my research project successful. I would like to assure that anything of my study will not be harmful for the participants.

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

Sincerely yours

Md. Saddam Hossain

Md. Saddam Hossain

Student of 4th Professional B.Sc. in Physiotherapy

Class Roll-21, Session: 2012-2013

Bangladesh Health Professions Institute (BHPI)

(An academic Institute of CRP)

CRP, Chapain, Savar, Dhaka-1343.

Ref: CRP-BHPI/IRB/04/17/105   *Date:* 15/04/2017

To
Md. Saddam Hossain
B.Sc. in Physiotherapy
Session: 2012-2012, Student ID 181150031
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: "Effectiveness of close kinetic chain exercise versus open kinetic chain exercise in patients with knee joint osteoarthritis: A comparative study".

Dear Md. Saddam Hossain,

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application on 08/08/2016 to conduct the above mentioned thesis, with yourself, as the Principal investigator. The Following documents have been reviewed and approved:

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

Since the study involves "WOMAC scale" and Numerical Pain Rating(NPR) Scale" will be used that will take about 30 to 40 minutes followed by measurements of physical disability and pain intensity related question and have no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09:00 AM on August 17, 2016 at BHPI.

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

Best regards,

Leellothansain

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

CRP-Chapain, Savar, Dhaka-1343. Tel: 02-7745464-5, 7741404 , Fax: 02-7745069,
Email: contact@crp-bangladesh.org, www.crp-bangladesh.org

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