Faculty of Medicine

University of Dhaka

EFFECTIVENESS OF KINESIOTAPE OVER KNEE JOINT IN KNEE OSTEOARTHRITIS PATIENTS

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October, 2019

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EFFECTIVENESS OF KINESIO TAPE OVER KNEE JOINT IN KNEE OSTEOARTHRITIS PATIENTS

Submitted by **Md. Zahid Hasan** for the partial fulfilment of the requirements for the degree of Bachelor of Science in Physiotherapy (B.Sc. PT).

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DECLARATION

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

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Acknowledgement

At first, I would like to express my gratitude to the almighty Allah for giving me the opportunity to complete this research .When I started the study I didn't know whether I could complete it or not but I believed that I can do this. So, I was determined strongly to try my best to make it a success and I am most grateful to almighty Allah.

I would like to express the deepest appreciation to my supervisor **Md. Zahid Hossain**, Lecturer, Department of Physiotherapy, BHPI, who has the attitude and the substance of a genius, he continually and convincingly conveyed a spirit of adventure in regard to research and excitement in regard to teaching. Without his guidance and persistent help this research would not have been possible. I am thankful to my respected teacher **Mohammad Anwar Hossain**, Associate Professor of Physiotherapy, senior consultant & Head of the Department of Physiotherapy CRP, Savar, for permission of data collection and providing me excellent guidelines. I gratefully acknowledge my respected teacher Professor **Md. Obaidul Haque**, Head of Physiotherapy Department and Vice principle, BHPI, CRP, Savar. I am also grateful to **Md. Shofiqul Islam,** Assistant Professor, Department of Physiotherapy, BHPI, CRP, Savar and **Ehsanur Rahman**, Assistant Professor, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka and all my teachers of the Bangladesh Health Professions Institute (BHPI) for their support and guidance throughout the study.

I would like to offer my special thanks to the Clinical Physiotherapists working in the Physiotherapy department CRP-Savar specially **Md. Aminul Islam Rasel (C.P.T)**, **Md. Majidur Rahman (C.P.T)** and **Ganesh Dey (I. P.T)** who helped me in all aspects of data collection.

I also pay my thanks to the staffs of the BHPI library that helps me to find out books for collecting literature of the study. Above all I would like to give thanks to the participants of this study .Lastly thanks to all who always are my well –wisher and besides me as friend without any expectation.

List of Abbreviations

ADL	Activity of Daily Living
BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical & Research Council
CRP	Centre for the Rehabilitation of the Paralyzed
IRB	Institutional Review Board
KT	Kinesiotape
MMT	Manual Muscle Testing
NPRS	Numeric Pain Rating Scale
OA	Osteoarthritis
RCT	Randomized control trial
ROM	Range of Motion
SPSS	Statistical Package for Social Science
US	United States
VAS	Visual Analogue Scale
W.H.O	World Health Organization

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Abstract

Purpose: To identify the effectiveness of kinesiotape over knee joint in knee osteoarthritis patients. **Hypotheses:** Kinesiotape along with conventional physiotherapy is more effective than only conventional physiotherapy for the treatment of osteoarthritis of knee joint. **Null hypotheses:** Kinesiotape along with conventional physiotherapy is not more effective than only conventional physiotherapy for the treatment of osteoarthritis of knee joint. **Objectives:** To find out the effectiveness of kinesiotape over knee joint in knee osteoarthritis patients in terms of physical disability, pain intensity, ROM and muscle power. **Methodology:** The study is a single blind Randomized Control Trail (RCT). The patients were selected from the outpatient musculoskeletal unit and 20 patients with OA of knee were randomly selected and then 10 patients with OA of knee were randomly assigned to experimental group and the other 10 patients were selected to the control group for this RCT study. The study has been conducted at musculoskeletal department of CRP, Savar. **Outcome measurement tools:** Western Ontario and McMaster Universities Arthritis Index (WOMAC) was used to measure the physical disability of the participants, Numerical pain rating scale (NPRS) was used to measure pain ,Goniometer was used to measure range of motion and manual muscle testing scale was used to measure muscle power. **Analysis of data:** Inferential statistics such as Mann-Whitney U test and Wilcoxon test was done using SPSS version 20. **Results:** From this research it was observed that physical disability score and pain intensity were decreased both in experimental and control group. In WOMAC score, only lying in bed variable (U=19, p=0.007) was significant in experimental group. No significant effect was found in range of motion of both in experimental and control group. Improvement of muscle power was not significant in manual muscle testing scale in experimental group.

Conclusions: The research showed that the effectiveness of kinesiotape over knee joint along with conventional physiotherapy is not more effective than only conventional physiotherapy in knee osteoarthritis patients.

Key words: Kinesiotape, Knee joint, Osteoarthritis.

CHAPTER-I **INTRODUCTION**

1.1 Background

In this age of modern science, osteoarthritis is one of the major cause of disability in older population through worldwide and the incidence of osteoarthritis of knee joint increases with age as well as approximately 18.4% of the population is exaggerated by this degenerative disease(Park & kim., 2018). Osteoarthritis mainly affect the whole joint including cartilage ,menisci, sub-chondral bone synovium, capsule, ligaments, muscles and the aims of nonsurgical treatment is to reduce the main symptoms of pain and stiffness as well as to improve the functional capacities (Rahlf et al., 2018). The chief complains of osteoarthritis is pain, joint stiffness, crepitation and reduction of joint range of motion (ROM) and the disease restricts the daily activities such as walking, stair-climbing housekeeping that leads to a lack of functional independence and impairment of quality of life (Musemeci, 2017).

Nielsen et al., (2010) stated that the peripheral nociceptors in OA may be sensitized by inflamed synovium, damaged subchondral bone and most often there is a discrepancy between physical damage of joint and pain symptoms. Blalock et al., (2015) stated that there is osteophyte formation, subchondral bone, ligamentous laxity, weakening of particular muscles and thickening of the joint capsule in knee osteoarthritis and it causes a reflective societal and economic burden and conveys significant physical and psychological consequences for the affected individual. The persons who have symptomatic knee osteoarthritis (OA) have much intra-articular structural pathology including cartilage loss, bone marrow lesions, meniscal damage and synovitis (Felson et al., 2015).

The most common contributing factor of osteoarthritis (OA) is aging, trauma, obesity and inflammation and the particular symptoms are related with functional impairment. The disease is mainly characterized by cartilage degradation but it also involves moderate to severe inflammation of the synovial membrane, remodeling of the sub chondral bone and

osteophytosis and the osteophytosis is the progress of a fibro cartilage capped bony outgrowth at the border of the joint forming the so called osteophytes (Junker et al., 2015). MRI studies shows the evidence of abnormal bone structure at the sub chondral boundary with cyst and bone marrow lesions (BMLs) (Neill & Felson, 2018).

The systemic risk factor of osteoarthritis are socio demographic , genetic ,obesity and metabolic syndrome ,vitamins/diet, bone density and mass and the joint level risk factors are bone/joint shape, muscle strength, joint loads and alignment ,occupation and sports ,injury/surgery (Vina & Kwoh, 2018).

Osteoarthritis (OA) is usually managed within primary care and there is no remedy for the disease. Some interventions are used at pain management with simple analgesia and maximizing function and improving quality of life through non pharmacological approaches (Walshe t al., 2017). Strengthening exercises of the knee muscles may increase the joint stability and confidence due to the muscles capacity to create more force by increased muscle power, strength and endurance (Brosseau et al., 2017). Some exercise therapy covers a range of targeted physical activities that is directly aim to improve muscle strength, joint range of motion, neuro motor control and aerobic fitness (Fransenet al.2015). Modifications of daily living activities, weight loss, physical therapies such as exercise, electrotherapy and taping, non-steroidal anti -inflammatory drugs and injection therapies get rid of symptoms in most of the patients with mild or moderate knee osteoarthritis (Kocyigit et al., 2015)

Kinesiotaping was invented by Dr. Kenzo Kase for use in sports for athletic injuries but now it is used in different condition and it is also used to facilitate muscle action, supports the joints, ligaments or tendons improve proprioception, prevents unwanted joint movement and allow healing with minimum stress on injured tissue (Saswadkar et al., 2017). Kinesio tape is one kind of adhesive therapeutic tapes for injury prevention, rehabilitation and performance improvement and it is clinically effective in joint movement promotion, encouraging an earlier manifestation of muscle peak torque, increasing muscle activity and functional enhancement (Cai et al., 2015). Kinesiotape may stimulate different therapeutic objectives like improved circulation, pain inhibition and lymphatic drainage or a reduction of delayed onset of muscle soreness (Csapo & Alegre, 2014).

Kinesiotape is one kind of elastic adhesive-backed cotton tape and is recommended to reduce injury recovery time by decreasing pain and inflammation. It has air permeability, channels away moisture and helps in water evaporation and it also permits a partial to full ROM to applied joints and muscles and in this way kinesiotape decreases pain, swelling and muscle spasm (Tripathi & Hande, 2017).

1.2 Rationale

Worldwide, it is estimated that OA is the fourth leading cause of disability and this disability burden is attributable to the involvement of the hips and knees .The number of OA patients is increasing day by day and it is also common in Bangladesh. There is a correlation between OA and age .It has been estimated that the ratio of people aged 65 years and over in Asia will more than double in the next two decades, from 6.8% in 2008 to 16.2% in 2040 (Fransen et al.,2011). So, it should be a responsibility for the government to arrange the treatment for the patients who suffers from OA .But it is a matter of great regret that there is no curative treatment for OA and only the symptomatic treatment is available for the patients to alleviate pain, stiffness, swelling and increase ROM. For this purposes, many conventional approaches (such as Ice, IRR, soft tissue technique, strengthening exercise etc.) are used for the treatment of OA like knee joint OA.

Kinesiotape is also used for the treatment of knee OA and it has effect on reducing pain, stiffness, swelling and in increasing ROM .But in this perspective there is lack of evidence in kinesiotaping of knee joint in Bangladesh at the case of knee OA.

So, as a physiotherapy student and being a researcher my aim is to work in this area and to establish an evidence based physiotherapy for the knee OA patients. For the management of sports injuries, kinesiotape has been used successfully and nowadays it is suggested to use kinesiotape in different musculoskeletal condition like osteoarthritis, tennis elbow, planter fasciitis etc. There are some research articles which have been published about the physiotherapy interventions of knee OA patients but there is no well-developed research on this area in our country.

1.3 Aim of the study

Identify the effectiveness of kinesiotape along with conventional physiotherapy over knee joint in knee osteoarthritis patients.

1.4 Objectives of the study

1.4.1. General objectives

To identify the effectiveness of kinesiotape over knee joint in knee osteoarthritis patients.

1.4.2. Specific objectives

i. To identify the effect on disability score after applying kinesiotape over knee in knee OA patients.
ii. To assess the effect on pain after applying kinesiotape over knee joint in knee OA patients.
iii. To evaluate the effect on range of motion after applying kinesiotape over knee joint in knee OA patients.
iv. To measure the effect on the muscle power after applying kinesiotape over knee joint in knee OA patients.

1.5 Hypothesis

Kinesiotape along with conventional physiotherapy is more effective than only conventional physiotherapy for the treatment of osteoarthritis of knee joint.

$$\mu_1 - \mu_2 = 0 \text{ or } \mu_1 \geq \mu_2$$

1.6 Null hypothesis

Kinesiotape along with conventional physiotherapy is not more effective than only conventional physiotherapy for the treatment of osteoarthritis of knee joint.

$$\mu_1 - \mu_2 \neq 0 \text{ or } \mu_1 \neq \mu_2$$

1.7 Variables

1.7.1 Independent Variables

i. Kinesiotape
ii. Conventional physiotherapy
iii. Age
iv. Sex
v. NPRS scale
vi. WOMAC scale

1.7.2. Dependent Variables

i. Knee Osteoarthritis

1.8. Operational Definition

Osteoarthritis

Osteoarthritis is one of the serious joint disease that results to a reduced quality of life .osteoarthritis was the sixth leading cause of disability worldwide in 2003 and has been expected to rise to the fourth leading cause by 2019. A protective oily substance called synovial fluid is also contained within the joint, helping to ease movement. When these protective coverings break down, the bones begin to rub together during movement. This can cause pain, and the process itself can lead to more damage in the remaining cartilage and the bones themselves.

Knee osteoarthritis

Knee osteoarthritis (knee OA) is a progressive disease caused by inflammation and degeneration of the knee joint that worsens over time. It affects the entire joint, including bone, cartilage, ligaments, and muscles. Its progression is influenced by age, body mass index (BMI), bone structure, genetics, muscular strength, and activity level. Knee OA also may develop as a secondary condition following a traumatic knee injury. Knee osteoarthritis is clinically characterized by usage-related pain and/or functional limitation. It is a common complex joint disorder showing focal cartilage loss, new bone formation and involvement of all joint tissues. Structural tissue changes are mirrored in classical radiographic features.

Knee joint

Knee joint is one kind of complex joint which is formed by 4 bones like lower end of femur, upper end of tibia and fibula and one sesamoid bone patella .Tendons connect the knee bones to the leg muscle and helps to move the knee joint. Ligaments join the knee bones and provide stability to the knee. The anterior cruciate ligament prevents the femur sliding backward on the tibia and posterior cruciate ligaments prevents the femur from sliding forward on the tibia. Medial and lateral collateral ligaments prevents the femur from sliding side to side. There are two “C” shape piece of cartilage which is called medial and lateral menisci is acts as a shock absorbers between the femur and tibia.

CHAPTER-II LITERATURE REVIEW

There are many kinds of bone and joint disorders and among them osteoarthritis is the most common problem (H-y et al.,2015). The term osteoarthritis is the combination of three Greek words 'Osteo' means 'Bone', 'Arthro' means 'Joint' and 'itis' means 'inflammation'(Deshpande et al., 2015). Now a days, the prevalence of Osteoarthritis is significant due to increase the average age of the population .A research predicted that the approximate number of people diagnosed with osteoarthritis will increase by 57% by the year of 2020 and movement limitations, caused by the out breaks of this disease, will increase by 66% (Sarallahi et al., 2016). About 40 million of people are affected by Osteoarthritis in Europe and similarly, in USA 52.5 million of people affected by OA as well as more than 100 billion dollars costs every year in USA for management of OA and mostly one third of elderly people are affected by OA on the other hand youngers population are affected by OA due to joint injury and abnormal weight loading after injury also causes OA (Musumeci., 2016).

Silver wood et al.,(2014) appraised that the incidence of symptomatic OA in those aged 60 years and above was 9.6 % in men and 18% in women and at least 25% of adults aged over 55 years report at least one episode of knee pain each year, which is close to reflect underlying OA. Osteoarthritis is commonly presented in general practice, over 7 years an estimated 13 % of older adults receive a diagnosis OA.

It is predicted that the percentage of people aged 65 years or over in Asia will more than double in the next two decades, from 6.8% in 2008 to 16.2 % in 2040, Singapore will increase the proportion of people aged 65 years and over by 316%,India by 274%,Malaysia by 269%,Bangladesh by 261% and the Philippines by 256%. Moreover ,in 2008, Japan had the world's oldest population and at that year 21.6% aged 65 years or more as well as India and china were ranked the top two countries in the absolute number of people aged 65 years and over (106 million for china and 60 million for India) (Frensen et al., 2011).

Now it is considered that OA is the fourth leading cause of disability and WHO estimates the prevalence of knee OA was 1770 and 2693 per 100000 men and women in 2000.The prevalence of symptomatic knee OA was 4.9% among adults aged ≥26 years, 16.7% in among adults aged ≥45 years and 12.1% among adults aged ≥60 years in USA (Haq & Davatchi.,2011). In general practice, knee OA and knee pain is the most common complaints and knee pain affects ±25% in those over 55 years of age and women are more affected than men (Landsmeer et al., 2019). In OA of knee joint the 3 compartments of knee joint such as medial, lateral and patellofemoral joint are affected and it usually develops slowly over 10-15 years and interferes daily activities (Jespasio et al., 2017). OA of knee joint consequences low quality of life and functioning of activities of daily living, with increased pain decreased muscle bulk, proprioception deficits and altered gait pattern as well as OA also decrease the speed of gait speed and cadence, longers the double support time, a smaller stride length, increased knee flexion at heel strike and decreases knee flexion during the stance phase of gait, the force of heel strike of affected leg reduces, lowers the external knee flexion moments at the time of early stance, lowers the external knee extension moments in stance phase that results due to excess hamstring activation ,longer muscle activation during in stance and excess co- contraction (L. Heiden et al ., 2009). The individuals who have knee OA have experienced pain, stiffness and decreased range of motion of the joints and these symptoms follows the limitation of an individual's capacity to upswing from a chair, stand securely, walk or climb stairs and at a result, these limitations lead to a loss of functional independence (R. Kaufman et al, 2001). The first characters of knee OA are progressive damage of articular cartilage, bone remodeling and new bone formation on the other hand second features are synovial inflammation, fibrosis of ligaments ,tendons, menisci and capsules occurs in the body (Zamri et al.,2019)

Osteoarthritis has some significant sign and symptoms such as pain at rest, movement and pain during walking, running. In these case pain increase to a greater extent when pressure is placed on the joints during activity (H-Y et al., 2015). OA causes loss of muscle strength, co-ordination and loss of proprioception causes advancement of knee osteoarthritis and decrease the active daily livings of a patient (Sarallahi et al., 2016).

OA limits the daily activities of a patient such as walking, running, stair climbing and housekeeping .Osteoarthritis causes loss of functional independence (Musumeci,2016).

Knee osteoarthritis is diagnosed radio graphically by the presence of joint space narrowing with osteophyte or cyst formation, sclerosis or attrition. Clinical examination, laboratory investigation (including erythrocyte sedimentation rate, serum calcium and rheumatoid factor by the latex and rosewalar tests) and the absence of marginal erosions and isolated osteonecrosis on radiographic screening (Ledingham et al.,2015).

Risk factors of knee Osteoarthritis

Age: Older people has the greater chance of knee osteoarthritis (Li et ali.,2013). Gender: Female has the higher risk of knee and hand OA on the other hand mens are associated with spine OA (Cho et al.,2015). Genetic: Positive family history of knee OA has the possibility to develop knee OA (Venkatachalam et al.,2017). Hypertension: There is a positive association between hypertension and OA (Kim et al., 2010). Diabetes: It is found that there is a association between knee OA and diabetes (Zhang et al., 2016). Osteoporosis (Lee et al., 2015). Higher bone mineral density: High bone mineral density has association with knee OA. 0.1gm/cm^2 increase in BMD and raised the risk of knee OA by 53% (Sudo et al., 2008). Obesity: High BMI has association with knee OA (Ho-pam et al., 2014). Smoking: Smoking habit might be a risk factor of knee OA (Jiang et al.,2012). Repetitive use of joints: Repetitive using of joints at the time of working has association with knee OA (Liu et al., 2016). Poor home ventilation and heating: The person who lives in well ventilated room has lower OA than who lives in poorly ventilated room (Zhang et al., 2016). Area residence: The people who lives in rural or mountain area has the high risk knee OA than the people who lives in urban area (Yoshimura et al., 2009). Lower education: The people with low level of education are more likely to develop knee OA (Zhang et al., 2016). Separation, divorce or death: The people who are separated, widows or divorced has the chance to develop knee OA (Zhang et al., 2016).

There are four bones that creates the knee joint. **1. Femur:** It is known as the thigh bone and it's the largest and strongest bone in the body.The head of femur forms joint with acetabulum and the lower part forms round medial and lateral condyles.**2. Patella:** It is a sesamoid bone. It is flat and triangular in shape. The patella moves when the leg moves. Its function is to release friction between the bones and muscles when the knee is flexed or extended and to protect the knee joint. The patella glides along with the bottom front surface of the femur between two protuberances called femoral condyles. **3.Tibia :** Tibia is known as the shin bone that runs from the knee to the ankle. The upper part of the tibia is made of two plateaus and a knuckle-like protuberance called the tibial tubercle. Attached to the top of the tibia on each side of the tibial plateau are two crescent-shaped shock-absorbing cartilages called menisci which help stabilize the knee Medial and lateral condyles form a groove and it is called the patello femoral groove.**4. Fibula:** It is a long, thin bone in the lower leg on the lateral side and runs near the tibia from the knee to the ankle. The role of ligaments is to attach bones to bones and give strength and stability to the knee joint. Ligaments are strong, tough bands which are not particularly flexible. Once stretched, they tend to stay stretched and if stretched too far, they snap (Palmer, 2007).

There are five ligaments in the knee joints.**1. Anterior cruciate ligament:** It attaches the tibia and the femur in the midpoint of the knee joint. It is situated deep inside the knee and in front of the posterior cruciate ligament. It confines rotation and forward motion of the tibia **2. Posterior cruciate ligament:** It is the strongest ligament and attaches the tibia and the femur. It is situated deep inside the knee behind the anterior cruciate ligament and limits the backwards motion of the knee. **3. Medial Collateral Ligament:** It is also known as tibial collateral ligament that attaches the medial side of the femur to the medial side of the tibia and limits the sideways motion of the knee joint. **4. Lateral Collateral Ligament:** It is also known as fibular collateral ligament that attaches the lateral side of the femur to the lateral side of the fibula and limits the sideways motion of the knee joint. **5. Patellar ligament:** It attaches the kneecap to the tibia. The muscles in the leg keeps the knee joint stable, well aligned and moving. There are two main muscle groups such as the quadriceps and hamstrings. The quadriceps are a collection of 4 muscles on the front of the thigh and

are responsible for flattening the knee by turning a bent knee to a straight position. The hamstrings is a group of 3 muscles on the back of the thigh and control the knee moving from a straight position to a bent position. The 4 muscles of quadriceps are vastus lateralis, vastus medialis, vastus intermedius, and rectus femoris and 3 muscles of hamstrings are semimembranosus, semitendinosus and biceps femoris (Datta, 2007).

The treatment protocol for OA of knee is frequently directed to reduce pain and thereby improving function (Hurwitz, et al, 2000). To reduce the symptoms of osteoarthritis and to improve the condition, surgical and conservative interventions are applied and in this case, pharmacological and non-pharmacological management are used. Surgical interventions mainly used when conservative treatment is failed .Sometimes it shows less efficacy (H-Y et al 2015). Surgical interventions needs a huge amount of costs and it is actually economic burden for the individuals and society and among the different kinds of treatment strategy in osteoarthritis, kinesiotape is more effective to correct proprioception error,to reduce pain and to improve quality of life and to improve in knee joint position is achieved by using quadriceps kinesiotape (Sarallahi et al., 2016).

It is suggested to use kinesiotape to short the injury recovery time by reducing pain and inflammation and it permits a partial to full range of motion to applied muscle and joints and reduces pain, swelling and muscle spasm (Tripathi & Hande., 2017). Kinesiotaping is a technique that has created new propensity to the treatment of pain, strength, functionality and other outcomes related to skeletal muscle and joint injuries (Ballesteros, et al., 2018). The effect of Kinesiotaping has been shown in patients who have experienced anterior knee pain, patella-femoral pain ,OA and other musculoskeletal condition .Mainly Kinesiotaping is used to prevent pain ,to give support and to protect the ligaments ,tendons ,and muscle and to prevent unwanted stress to the tissue(Park & Kim., 2018).

Elevations of the epidermis by applying kinesiotape reduces the pressure on the mechanoreceptors remains below the dermis and as a result , reduces the nociceptive stimuli and increase the speeds of healing by slightly lifting skin away from sore or injured tissues, improves blood flow and lymphatic drainage and supports injured joints and

muscles without restraining their range of motion as well as in kinesiology tape ,motor control should be related to the increase of afferent informations due to the stimulation of the cutaneous mechanoreceptors such as Meissner corpuscle end-organs, Pacinian corpuscle end organs, hair follicle end organs and some free nerve endings (Torres et al.,2016). Facilitatory kinesiotape increases muscle strength and it is attributed to a placebo effect on the regular kinesiotape users not non-kinesiotape users (Mak et al., 2018). The facilitating treatment with kinesiotape increases the isokinetic knee extensor peak torque performance in the healthy adults when it is compared with the inhibitory procedure and the magnitude of the effect is not large (S. young &W. young., 2016). The main therapeutic effect of kinesiotape is re-educating muscle function, improvement of fluid exchange between tissue layers, decreasing pain through neurological suppression repositioning of subluxed joint, improvement of joint proprioception, ligament and tendon support, postural education, flexibility improvement and correcting scar formation as well as it should be kept in mind that the long term effect of KT therapy is remain unknown (Ferreira et al., 2017) Taping has an effective adjunct therapy in the management of knee osteoarthritis for activity and nocturnal pain control and the study indicates inconclusive evidence of a beneficial effect of KT(Kocyigit et al.,2015).

Kinesiotape is a new method of treatment regimen which is used in clinical practice and sports environment to prevent and treat the musculoskeletal disorder, sports injuries and inflammatory conditions. KT accelerates the healing process by lifting the skin away from the sore or injured tissues, increase lymphatic drainage and blood flow to area (Torres et al.,2016).

CHAPTER-III METHODOLOGY

This research was an experimental design to evaluate the effectiveness of kinesiotape over knee joint for the management of physical disability, range of motion, muscle power and other symptoms of the patients with knee osteoarthritis. To identify the effectiveness of this treatment regime, WOMAC scale, Numeric Pain Rating Scale (NPRS), Goniometer and Manual muscle testing scale (MMTS) Questionnaire were used as measurement tools for measuring the pain intensity, joint stiffness, physical function level, range of motion and muscle power.

3.1 Study Design

The study is a single blind Randomized Control Trail (RCT). The patients were selected from the outpatient musculoskeletal unit and 20 patients with OA of knee were randomly selected and then 10 patients with OA of knee were randomly assigned to experimental group and the other 10 patients were selected to the control group for this RCT study. The study has been conducted at musculoskeletal department of CRP, Savar.

A pretest (before intervention) and posttest (after intervention) was administered with each subject of both groups to compare the pain, joint stiffness, physical function, range of motion, muscle power effects before and after the treatment.

The study is designed using an experimental design quantitative research. According to Depoy & Gitlin (2013) the design could be shown by:

Experimental Group:	R	O_1	X	O_2
Control Group:	R	O_1		O_2

Flow chart of the phases of randomized control trial

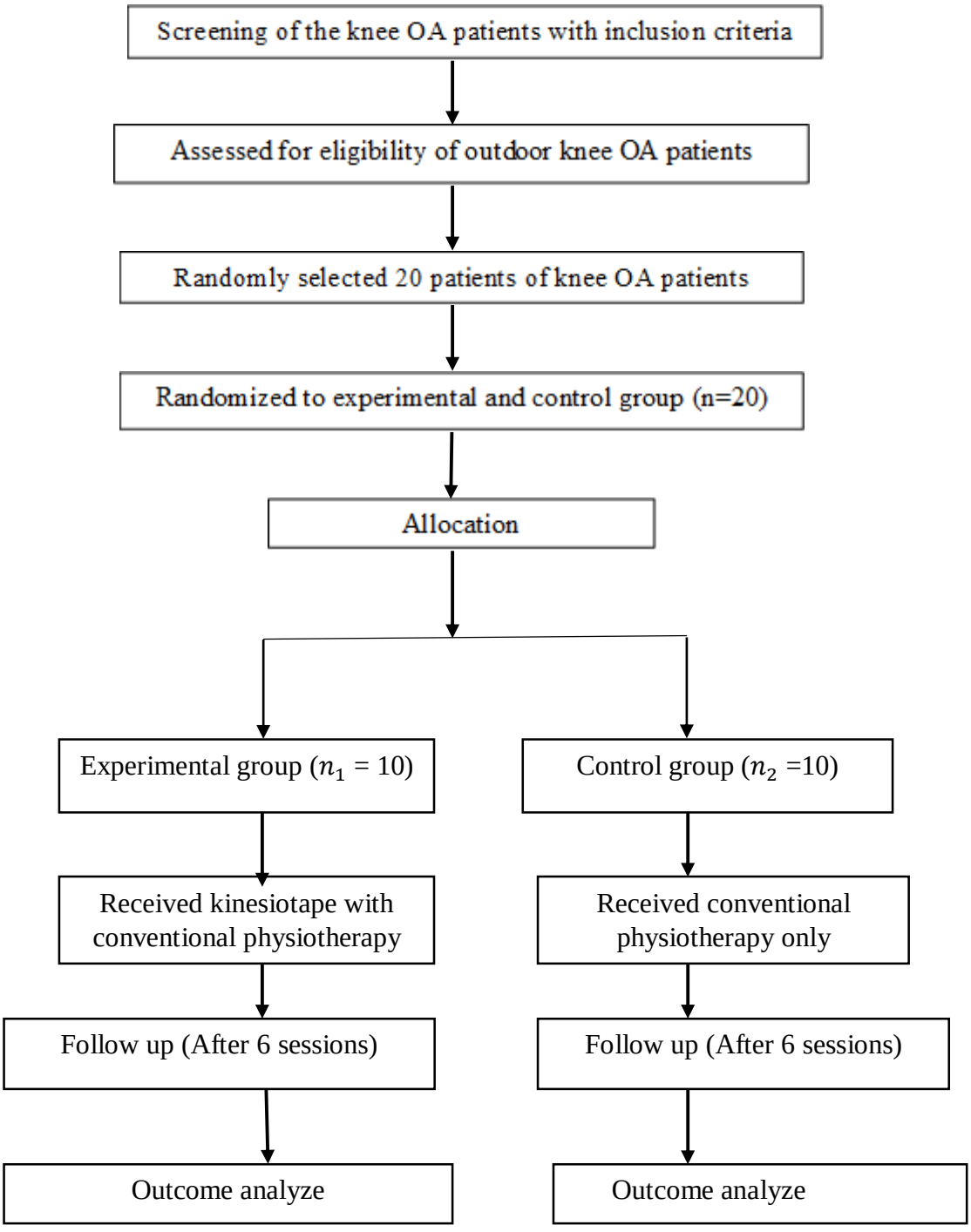


Figure -01: Flow chart of the phases of randomized control trial

3.2 Study area

Musculoskeletal Outpatient Unit of Physiotherapy Department at CRP, Savar, Dhaka.

3. 3 Study Population

A population denotes to the entire group of people or items that meet the criteria set by the researcher. The populations of this study were the knee OA Patients at outpatient department of CRP, Savar.

3.4 Sampling technique

Simple random sampling technique was used for data collection. The patients, who met the inclusion criteria, were taken as sampling frame in this study from Outpatient musculoskeletal physiotherapy department of CRP, Savar. Among them researcher selected 20 patients with Knee OA randomly as sample and then 10 patients with Knee OA were randomly allocated to Kinesiotape with conventional physiotherapy group and 10 patients to the only conventional physiotherapy group for this RCT study. The study was a single blind study. When the samples were collected, the researcher randomly allocated the participants into experimental and control group, because it develops internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc. for the control and E1, E2, E3 etc. for experimental group. Total 20 samples included in this study, among them 10 patients were allotted for the experimental group (Kinesiotape with conventional physiotherapy) and rest 10 patients were assigned for control group (received conventional physiotherapy only).

3.5 Subject inclusion criteria

i. The patients who have osteoarthritis of knee joint (Tripathi & Hande,2017).
ii. Age range 28 to 77 years.
iii. Both male and female gender (Tripathi & Hande,2017).
iv. Both unilateral and bilateral knee OA (Tripathi & Hande,2017).

3.6 Subject exclusion criteria

i. Patients who have OA in hip or others joint but not in knee joint. (Tripathi & Hande,2017).
ii. Incomplete or unclear documents. (Tripathi & Hande,2017).
iii. Patient got surgery for knee OA. (Tripathi & Hande,2017).
iv. Patient taking steroid injection. (Tripathi & Hande,2017).

3.7 Data collection method and materials

3.7.1. Data collection tools

i. Data collection form.
ii. Informed consent.
iii. Structured questionnaire (both open ended and close ended questionnaire).
iv. Numeric Pain Rating Scale (NPRS) – for measuring pain.
v. WOMAC questionnaire.
vi. Manual Muscle testing scale.
vii. Goniometer.
viii. Pen.

3.7.2. Measurement tools

Numeric Pain Rating Scale (NPRS) McCaffery & Pasero (1999) used a numeric scale to rate the pain status practiced by patients. It is recognized as Numeric Pain Rating Scale. The scale is a 10 cm long scale ranging from 0-10. Here a zero (0) means no pain, 1-3 specifies mild pain, 4-6 specifies that pain is in moderate state and 7-10 is severe pain feeling experienced by patients.

WOMAC Osteoarthritis Index:

This questionnaire is developed according to, "The Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC SCORE)" for measuring the pain and disability of the patient with knee osteoarthritis. Each question has 4 score. Where 0

indicates no pain, 1 indicates mild pain, 2 indicates moderate pain, 3 indicates very pain and 4 indicates severe pain. Total questions are 24. Total number is 96. Here, 20 score is for pain, 8 score is for stiffness and 68 score for physical function measurement. More WOMAC score indicates more severe condition and less WOMAC score indicates less severe condition. A sound and healthy person may has WOMAC score 0.

Goniometer

Here, researcher used Goniometer for measuring joint range of motion and most commonly used Double-armed Goniometer, with one arm stationary and another arm is movable. The pin or axis of the movable arm is positioned directly over the center of the joint. The stationary arm is held in the line with the stationary segment of joint. Then the movement should perform. At the completion of movement the indicator show the number of degree through which the segment has moved.

Manual Muscle Testing Scale:

Manual muscle testing is used to evaluate contractile units, including muscles and tendons, and their ability to generate forces. When used as part of rehabilitation, muscle testing is an important evaluative tool to assess impairments and deficits in muscle performance, including strength, power, or endurance**.** In this study Manual Muscle Testing Scale was used to evaluate how much muscle power is present in knee. Here, 0 indicates no visible or palpable contraction , 1 indicates visible or palpable contraction,2 indicates partial ROM with gravity eliminated, 3 indicates full ROM with gravity eliminated, 4 indicates gravity eliminated with slight resistance or less than half range against gravity, 5 indicates more than half but less than full ROM against gravity , 6 indicates full ROM against gravity , 7 indicates full range of motion against gravity with slight resistance, 8 indicates full ROM against gravity with mild resistance, 9 indicates full ROM against gravity with moderate resistance , 10 indicates full ROM against gravity with almost full resistance , 11 indicates normal ROM with maximal resistance

3.8 Data collection procedure

The study procedure was accompanied through evaluating the patient, early recording, treatment and ultimate recording. After screening the patient at department, the patients were assessed by qualified physiotherapist. Six sessions of treatment was provided for

every patients. Twenty patients were chosen for data collection according to the inclusion criteria. The researcher divided all participants into two groups and coded C1,C2,C3,C4,C5,C6,C7,C8,C9,C10 for control group and E1, E2, E3, E4, E5, E6,E7,E8,E9,E10 for experimental group. Experimental group received conventional physiotherapy with kinesiotape over knee joint and control group received only conventional physiotherapy. Data was gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form which is formatted by the researcher. Pretest was performed before beginning the treatment and the physical disability score, intensity of pain ROM of knee movements and the muscle power of hamstring, quadriceps, planter flexor and dorsi flexor was noted on questionnaire form. The same procedure was performed to take post-test at the end of six sessions of treatment. The researcher will collect the data from both experimental and control group being in front of the qualified physiotherapist in order to reduce the biasness. At the end of the study, specific test was performed for statistical analysis.

3.9 Data analysis

With the intention to confirm that the research have some values, the significance of composed data has to be accessible in ways that other research workers can understand the study. On the other hand the researcher has to make sense of the results. Here, in this research the result came from an experiment, data analysis was done with statistical analysis for maintaining the participant's confidentiality, all participants were coded according to group. All subjects of both experimental and control groups score their physical disability on WOMAC osteoarthritis index and pain intensity on pain numeric scale before starting the treatment and after completing the treatment. Reduction of physical disability and pain intensity for both groups is the difference between pre-test and post-test score. ROM on Goniometer and muscle power on Manual muscle testing scale (MMTS) were measured and scored before starting treatment and after completing treatment by the researcher. In experimental studies with the different subject design where two groups are used and each group tested in two different conditions and the data is

interval or ratio should be analyzed by Mann-Whitney 'U' test and Wilcoxon signed rank test in case of non-parametric test (Hicks, 2009).

It was an experimental study and had unequaled groups of different subjects, who was randomly allocated to conventional physiotherapy with kinesiotape over knee joint and only conventional physiotherapy group and the measurement of the outcome came from collecting WOMAC score, pain score, ROM score and Manual muscle testing score with considering the interval or the ratio data Nonparametric Mann-Whitney 'U' test is used to calculate the level of significance of WOMAC score, pain score, ROM score and Manual muscle testing score after receiving six sessions of treatment for both experimental and control group. When calculating the Mann-Whitney U test, we find the value called U which we then look up in the probability tables associated with the Mann-Whitney U test to find out whether the U value represents a significant difference between the results from the two groups. In addition, Wilcoxon signed rank test was used to assess the the level of significance of WOMAC score, pain score, ROM score and Manual muscle testing score after receiving six sessions of treatment of within groups (Hicks, 2009).

3.10 Hypothesis test

Mann Whitney U test

Mann-Whitney U test is one kind of non-parametric test which simply compares the result that is measured from the each group to see if they differ significantly.

Assumption

i. All the observations from both experimental and control groups are independent of each other.
ii. The responses are ordinal
iii. Under the null hypothesis Ho, the distribution of both populations are similar.

Null and alternative hypothesis

Null Hypothesis

Ho: μ_1-μ_2 = 0 or $\mu_1 \geq \mu_2$, Here, The mean difference of the experimental group and control is not same or control group is higher than experimental group.

Alternative Hypothesis

Ha: μ_1-$\mu_2 \neq 0$ or $\mu_1 \neq \mu_2$, Here, The mean difference of experimental and control group is not same.

Where,

Ho = Null hypothesis

Ha = Alternative hypothesis

μ_1 = mean difference in initial assessment

μ_2 = mean difference in final assessment

The formula of Mann-Whitney U-test:

$U = n_1 n_{2+} \frac{nx(nx+1)}{2} - T_x$

n_1= The number of the subjects in trail group

n_2= The number of the subject in control group

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

T_x= The larger rank total

Calculation of U value of post-test pain between groups

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

Score of the participants in NPRS scale (Post –test)

Experimental group			Control group		
Subject	NPRS Score	Rank	Subject	NPRS Score	Rank
E1	5	3	C1	5	1
E2	6	3	C2	6	6.5
E3	5	3	C3	4	11.5
E4	4	6.5	C4	2	11.5
E5	3	6.5	C5	5	11.5
E6	3	6.5	C6	7	11.5
E7	4	11.5	C7	6	17
E8	6	11.5	C8	5	17
E9	3	17	C9	6	17
E10	4	17	C10	5	20
Total	43	85.5	Total	51	124.5
Mean	4.3	8.55	Mean	5.1	12.45

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

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

$$U=n_1n_2+\frac{n_x(n_x-1)}{2}-T_x$$

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 (124.5)

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

U= ?

So,

$$U=n_1n_2+\frac{n_x(n_x-1)}{2}-T_x$$

$$=10\times10+\frac{10(10+1)}{2}-124.5$$

$$=100+\frac{110}{2}-124.5$$

$$=100+55-124.5$$

$$=155-124.5$$

$$=30.5$$

Level of Significant

The researcher has used 5% level of significance 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 Uvalue 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.

In this way researcher measure the U value of the variables of WOMAC scale, Numeric pain rating scale (NPRS), Range of motion (ROM) and Manual muscle testing scale (MMTS).

The formula of Wilcoxon signed rank test:-

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

Here,

n=Number of pairs where difference is not 0

W_s=Smallest of absolute values of the sum

3.11 Level of significance

The researcher calculated the "p" value with the aim to find out the significance of the study. This is known as the probability of the result for experimental study. Here, the word probability means the accuracy of the findings. In an experiment "p" value is called the level of significance. In health service research, "p" value less than or equal of 0.05 is accepted as significant result.

Level of significance for two tailed hypothesis

For "U" test

n_1/n_2	0.20	0.10	0.05	0.02	0.01
10	32	27	23	19	16

Here,

n_1/n_2 = Number of the participants (Experimental and Control)

3.12 Ethical consideration

The total procedure of this research project was completed by following the guidelines of Bangladesh Medical Research Council (BMRC) and World Health Organization (WHO). The proposal of the thesis paper including the methodology was offered to the Institutional Review Board (IRB).After that the proposal of the thesis paper including the methodology

was accepted and achieved permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI).Then before starting data collection procedure, researcher was attained permission from the concerned authorities ensuring the safety of the participants. The confidentiality regarding patient's conditions and treatments was maintained strictly by the researcher. Researcher took written consent from every participants before starting data collection. Participants was informed that they are able to withdraw them and also have the rights to meet with other senior physiotherapist if they think that the treatment is not enough for them and the condition become worsen. Every patients had the chance to discuss their problems with the senior authority or administration of CRP and had any questioned answer to their satisfaction.

3.13 Treatment protocols:

3.13.1 Conventional treatment protocols:

Patellar mobilization	3 minutes
Isometric strengthening exercise	5 repetitions × 5 seconds hold×2 set
Soft tissue release technique	3-5 minutes
Stretching exercise	10 repetition
Ice	7 minutes
IRR	10 minutes
UST	5 minutes
Knee gaping	10 repetition
Movement with mobilization	10 repetition
Progressive strengthening exercise	10 repetition

Table 02: Conventional treatment protocols

3.13.2 Experimental group treatment protocol:-

Experimental group patients took kinesiotape over knee joint along with conventional treatment protocol. Patients kept kinesiotape on the knee joint for 24-48 hours in each sessions.

3.13.3 Control group treatment protocol:-

Control group patients took only conventional treatment protocols.

3.14 Characteristics and level of significance before and after intervention among different variables in between group and control group

Table 03: Characteristics and level of significance before and after intervention among different variables in between group.

No	Variables	Observed U value	Observed p value	Significant/Not significant
A)	Variables of disability			
	A)Pain			
	1.Walking	50	<0.05=23	Not significant
	2. Stair climbing	39.5	<0.05=23	Not significant
	3. Nocturnal	46	<0.05=23	Not significant
	4. Rest	38	<0.05=23	Not significant
	5. Weight bearing	46.5	<0.05=23	Not significant
	B)Stiffness			
	1. Morning stiffness	38.5	<0.05=23	Not significant
	2. Stiffness occurring later in the day	41.5	<0.05=23	Not significant
	C)Physical function			
	1. Descending stairs	36	<0.05=23	Not significant
	2. Ascending stairs	46	<0.05=23	Not significant
	3. Rising from sitting	31	<0.05=23	Not significant
	4. Standing	48.5	<0.05=23	Not significant

	5. Bending to floor	41.5	<0.05=23	Not significant
	6. Walking on flat surface	38.5	<0.05=23	Not significant
	7. Getting in/ out of car	45	<0.05=23	Not significant
	8. Going shopping	36.5	<0.05=23	Not significant
	9. Putting on socks	35	<0.05=23	Not significant
	10. Lying in bed	19	<0.05=23	Significant
	11. Taking off socks	29.5	<0.05=23	Not significant
	12. Rising from bed	40.5	<0.05=23	Not significant
	13. Getting in/ out of bath	38	<0.05=23	Not significant
	14. Sitting	42	<0.05=23	Not significant
	15.Getting on/ off toilet	29	<0.05=23	Not significant
	16. Heavy domestic duties	49	<0.05=23	Not significant
	17. Light domestic duties	34	<0.05=23	Not significant
B)	Variables of pain	30.5	<0.05=23	Not significant
C)	Variables of ROM			
	Knee Flexion (active)	40	<0.05=23	Not significant
	Knee Extension (active)	45	<0.05=23	Not significant
	Knee Flexion (Passive)	50	<0.05=23	Not significant

	Knee Extension (Passive)	50	<0.05=23	Not significant
D)	Variables of muscle power			
	Quadriceps	26.5	<0.05=23	Not significant
	Hamstring	31	<0.05=23	Not significant
	Dorsi flexor muscle	35	<0.05=23	Not significant
	Planter flexor muscle	45	<0.05=23	Not significant
E)	Post WOMAC score	34	<0.05=23	Not significant

Table-03: Characteristics and level of significance before and after intervention among different variables in between group.

Table 04: Characteristics and level of significance before and after intervention among different variables among experimental group (Within group)

No	Variables	Observed Z value	Observed p value	Significant/Not significant
A)	Variables of disability			
	A)Pain			
	1.Walking	-2.53	0.01	Significant
	2. Stair climbing	-173	0.08	Not significant
	3. Nocturnal	-1.41	0.15	Not significant
	4. Rest	-1.34	0.18	Not significant
	5. Weight bearing	0	1	Not significant
	B)Stiffness			
	1. Morning stiffness	-2	0.04	Significant
	2. Stiffness occurring later in the day	-0.57	0.56	Not significant
	C)Physical function			
	1.Descendingstairs	-2.53	0.01	Significant
	2. Ascending stairs	-0.74	0.45	Not significant
	3. Rising from sitting	-1.26	0.20	Not significant
	4. Standing	-1.89	0.05	Significant
	5. Bending to floor	-0.70	0.48	Not significant
	6. Walking on flat surface	-2.23	0.02	Significant

	7. Getting in/ out of car	-1.66	0.09	Not significant
	8. Going shopping	-1.93	0.05	Significant
	9. Putting on socks	-2.25	0.02	Significant
	10. Lying in bed	-1.84	0.06	Not significant
	11. Taking off socks	-2.25	0.02	Significant
	12. Rising from bed	0	1	Not significant
	13. Getting in/ out of bath	-1.51	0.12	Not significant
	14. Sitting	-2.40	0.01	Significant
	15.Getting on/ off toilet	-1.89	0.05	Significant
	16. Heavy domestic duties	-0.57	0.56	Not significant
	17. Light domestic duties	-1.41	0.15	Not significant
B)	Variables of pain	-2.15	0.03	Significant
C)	Variables of ROM			
	Knee Flexion (active)	-1.41	0.15	Not significant
	Knee Extension (active)	-1.41	0.15	Not significant
	Knee Flexion (Passive)	-1	0.31	Not significant
	Knee Extension (Passive)	0	1	Not significant
D)	Variablesof muscle power			

	Quadriceps	-1.89	0.05	Significant
	Hamstring	-2.46	0.01	Significant
	Dorsi flexor muscle	-0.57	0.56	Not significant
	Planter flexor muscle	-1.41	0.15	Not significant
E)	Post-WOMAC score	-2.70	0.007	Significant

Table-04: Characteristics and level of significance before and after intervention among different variables among experimental group (Within group)

Table 05: Characteristics and level of significance before and after intervention among different variables among control group (Within group)

No	Variables	Observed Z value	Observed p value	Significant/Not significant
A)	Variables of disability			
	A)Pain			
	1.Walking	-1.47	0.15	Not significant
	2. Stair climbing	-0.27	0.78	Not significant
	3. Nocturnal	-2.81	0.005	Significant
	4. Rest	-2.12	0.03	Significant
	5. Weight bearing	-1	0.31	Not significant
	B)Stiffness			
	1. Morning stiffness	-2.64	0.008	Significant
	2. Stiffness occurring later in the day	-2.64	0.008	Significant
	C)Physical function			
	1.Descending stairs	-2.12	0.03	Significant
	2. Ascending stairs	0	1	Not significant
	3. Rising from sitting	2	0.04	Significant
	4. standing	-2.07	0.03	Significant
	5. Bending to floor	-1	0.31	Not significant
	6. Walking on flat surface	-1.89	0.05	Significant

	7. Getting in/ out of car	-2.12	0.03	Significant
	8. Going shopping	-2.12	0.03	Significant
	9. Putting on socks	-2.73	0.006	Significant
	10. Lying in bed	-1.99	0.04	Significant
	11. Taking off socks	-2.04	0.04	Significant
	12. Rising from bed	-1	0.31	Not significant
	13. Getting in/ out of bath	-2.42	0.01	Significant
	14. Sitting	-2.42	0.01	Significant
	15.Getting on/ off toilet	-1.34	0.18	Not significant
	16. Heavy domestic duties	0	1	Not significant
	17. Light domestic duties	-1.54	0.12	Not significant
B)	Variables of pain	-2.54	0.01	Significant
C)	Variables of ROM			
	Knee Flexion (active)	-2.82	0.005	Significant
	Knee Extension (active)	-1.73	0.08	Not significant
	Knee Flexion (Passive)	-1.41	0.15	Not significant
	Knee Extension (Passive)	0	1	Not significant

D)	Variables of muscle			
	power			
	Quadriceps	-2.58	0.01	Significant
	Hamstring	-2.64	0.008	Significant
	Dorsi flexor muscle	-2.33	0.02	Significant
	Planter flexor muscle	-2.53	0.011	Significant
E)	Post WOMAC score	-2.80	0.005	Significant

Table-05: Characteristics and level of significance before and after intervention among different variables among control group (Within group)

3.15 Intervention

The **M**KT kinesiotape was used in the experimental group. Before applying the Kinesiotape, physiotherapist checked the contraindication and then applied the tape carefully. The tape was placed on the quadriceps muscle with giving maximum stretch. Patient was on supine lying with hip and knee 60 degree flexion of the affected side. The tape was applied from origin to insertion in order to stimulate the sensory mechanoreceptor.They also produce facilitatory and inhibitory effect on quadriceps muscle specially vastus medialis and vastus lateralis muscle. Physiotherapist applied 25%-50% stress on central position and another two side was stress free. One band was applied through the knee join line below the lower border of the patella and the another two band was applied on vastus medialis to shine of tibia (Tibial tuberosity) and shine of tibia (Tibial tuberosity) to vastus lateralis (Kenzo et al.,2003).

CHAPTER-IV RESULTS

In this study, total 20 patients who have knee osteoarthritis were selected as sample from the Musculoskeletal outpatient unit of Center for Rehabilitation of Paralyzed(CRP),Savar ,Dhaka to measure the effectiveness of kinesiotape over knee joint with conventional physiotherapy versus only conventional physiotherapy in patients with knee Osteoarthritis.

4.1. Comparison of baseline characteristic of the patients

Variable(S)	Experimental group	Control group
Age, mean (SD), years	57.70 (±13.53)	46.90 (±13.18)
Gender (%)	Male=08 (80) Female=02 (20)	Male=03 (30) Female=07 (70)
Area (%)	Urban=04 (40) Rural=06 (60)	Urban=07 (70) Rural=03 (30)
Education (%)	Illiterate=1 (10) Primary=4 (40) Secondary=4 (40) Under graduate=1 (10) Post graduate=0 (0)	Illiterate=2 (20) Primary=1 (10) Secondary=4 (40) Under graduate=2 (20) Post graduate=1 (10)
Weight (kg), mean (SD)	69.30 (± 9.95)	60.80 (±6.79)
Height (cm), mean (SD)	163.70 (±6.56)	158.20 (±4.07)
BMI (kg/m2), SD	25.86 (±3.61)	24.27 (±2.44)
Dominant Hand (%)	Right=9 (90) Left=1(10)	Right=9 (90) Left=1 (10)
Affected side (%)	Right=4 (40) Left=3 (30)	Right=5 (50) Left=3 (30)

	Both=3 (30)	Both=2 (20)
Occupation (%)	Farmer=3 (30) Housewife=1 (10) Business=1 (10) Employee=3 (30) Retired person=2 (20)	Farmer=1 (10) Housewife=6 (60) Business=1 (10) Employee=1 (10) Retired person=1 (10)

Table 06:- Baseline characteristic of the patients

Table compares the baseline characteristics of the patients between experimental and control group. In experimental group, the mean age (± SD) of the Patients was 57.70 (±13.53) years and in control group 46.90 (±13.18) years. In experimental group, male and female patients percentage were 80% and 20% on the other hand in control group, male and female patients percentage were 30% and 70%. The male - female ratio in experimental and control group were 4:1 and 1:2.33. 60 % patients lived in rural area and 40% patients lived in urban area in experimental group conversely 70% patients lived in urban area and 30% patients lived in rural area in control group. In experimental group, patient's educational categories were illiterate 10%, primary 40%, secondary 40%, under graduate 10% and post graduate nil (0%) and in control group patients categories were illiterate 20%, primary 10%, secondary 40%, under graduate 20% and post graduate 10%. The mean body weight of experimental group was 69.30 (± 9.95) kg and on the other hand, the mean weight of control group was 60.80 (±6.79) kg. The mean height of experimental group was 163.70 (±6.56) cm and in control group mean height was 158.20 (±4.07) cm. The mean BMI of experimental group was 25.86 ±3.61) kg/m2 and in control group mean BMI was 24.27 (±2.44) kg/m^2. Both in experimental group and control group 90% patients was right handed and only 10% patients patient is left handed. In experimental group, 40% patient's right knee joint, 30 % patients left knee joint and 30% patient's both knee joint is affected. On the other hand, in control group, 50% patient's right knee joint, 30% patients left knee joint and 20% patient's both knee joint were affected. In experimental group, 30% patients were farmer, 10% patients were housewife, 10% patients were business man, 30% employee and 20% patients were retired from their work. Conversely, In control group,

10% patients were farmer, 60% patients were housewife, 10% patients were business man, 10% patients were employee and 10% patients were retired from their work.

4.2 Age range of the patients:

Age range	Number
28-37 years	4
38-47 years	5
48-57 years	5
58-67 years	2
68-77 years	4

Table 07:-Age range of the patients

Five (n=5) patients were in both “38-47” and “48-57” years of age groups, followed by four patients (n=4) were in “28-37” and “68-77” years, two patients (n=2) were in “58-67” years of age group.

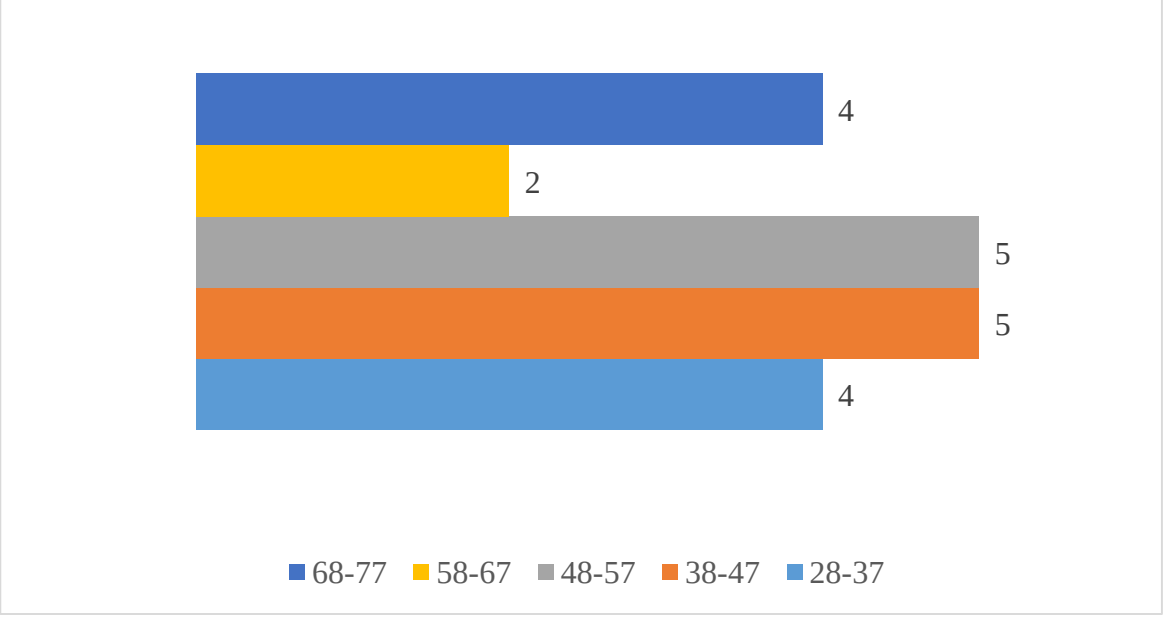


Figure -02: Age range of the patients

4.3 Gender distribution among the patients

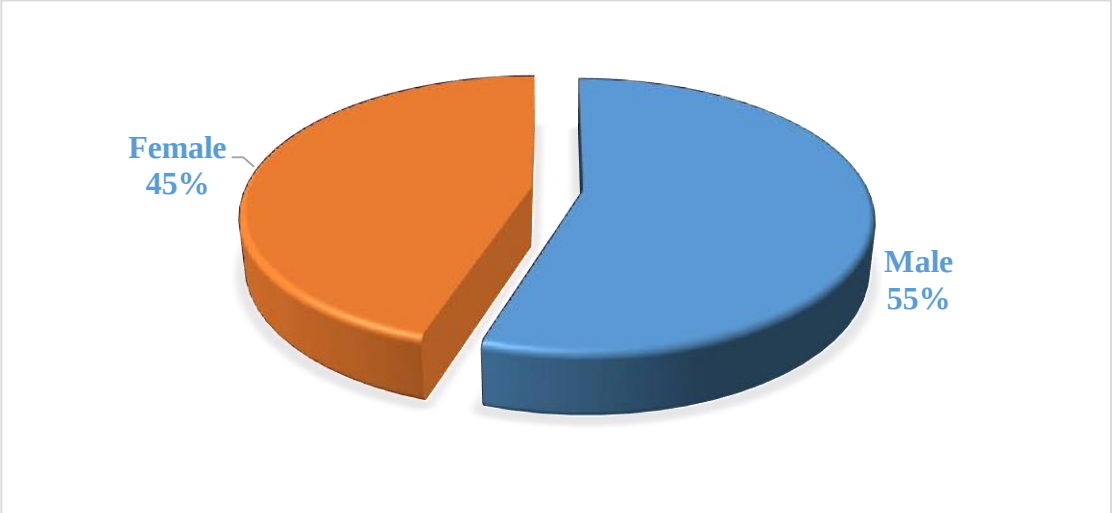


Figure-03: Gender distribution among the patients

Figure 3 described that among the 20 participants, 11 (55%) participants were male and 9 (45%) participants were female.

4.4 Living area among the patient

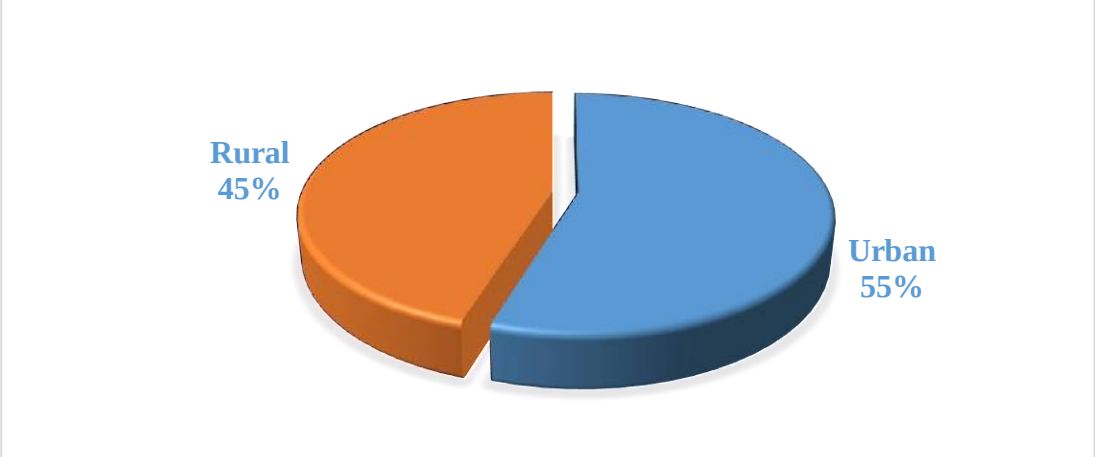


Figure-04: Living area among the patient

Figure 4 described that among the 20 participants, 11 (55%) participants were from urban area and 9(45%) participants were from rural area.

4.5 Education among the patients

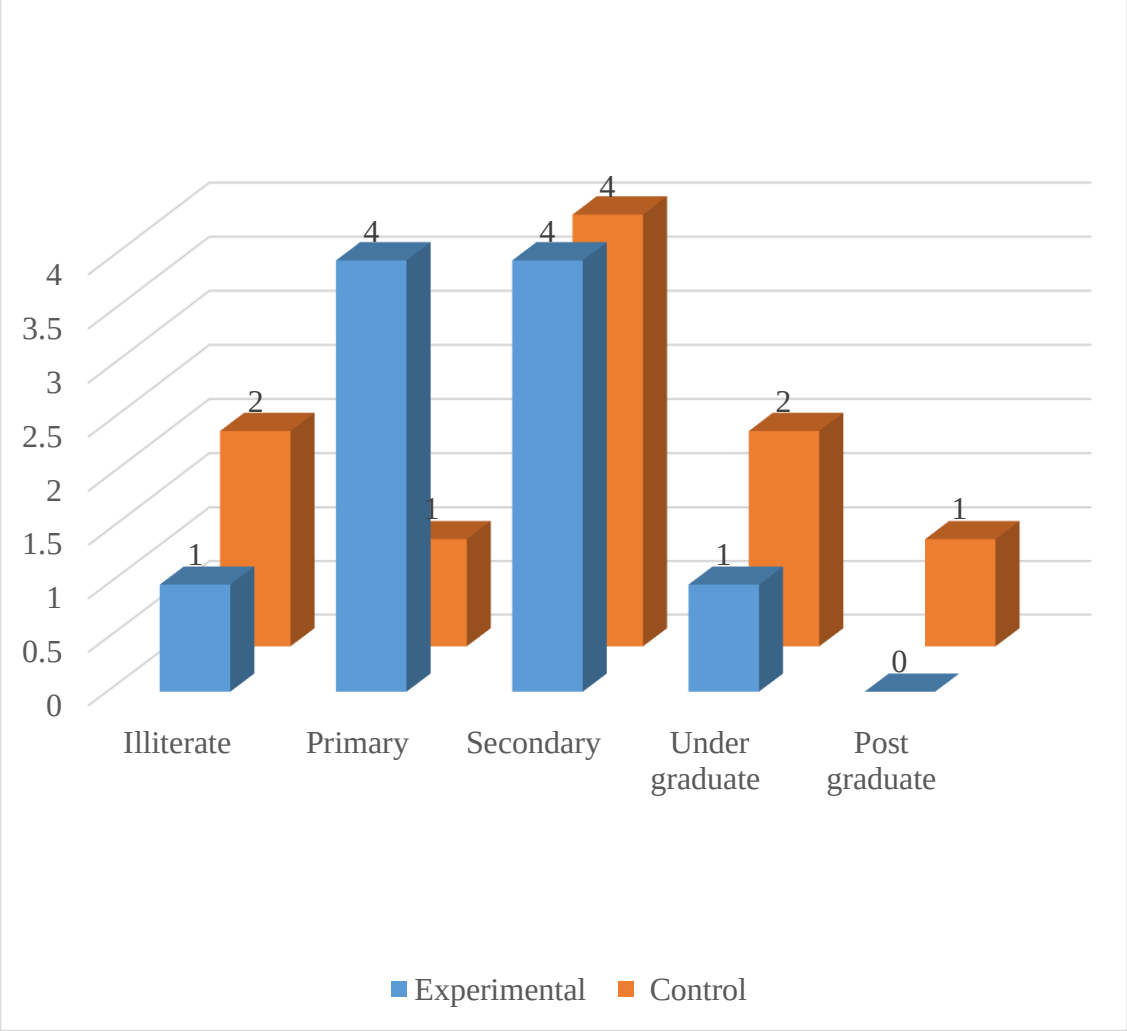


Figure-05: Education among the patients

Figure -05 described that among all the patients (n=20), In experimental group (n=10), patient's educational categories are illiterate 1(10%), primary 4(40%), secondary 4(40%) and under graduate 1(10%). In control group patients categories are illiterate 2(20%), primary 1 (10%), secondary 4(40%), under graduate 2(20%) and post graduate 1 (10%).

4.6 Body Mass Index (BMI)

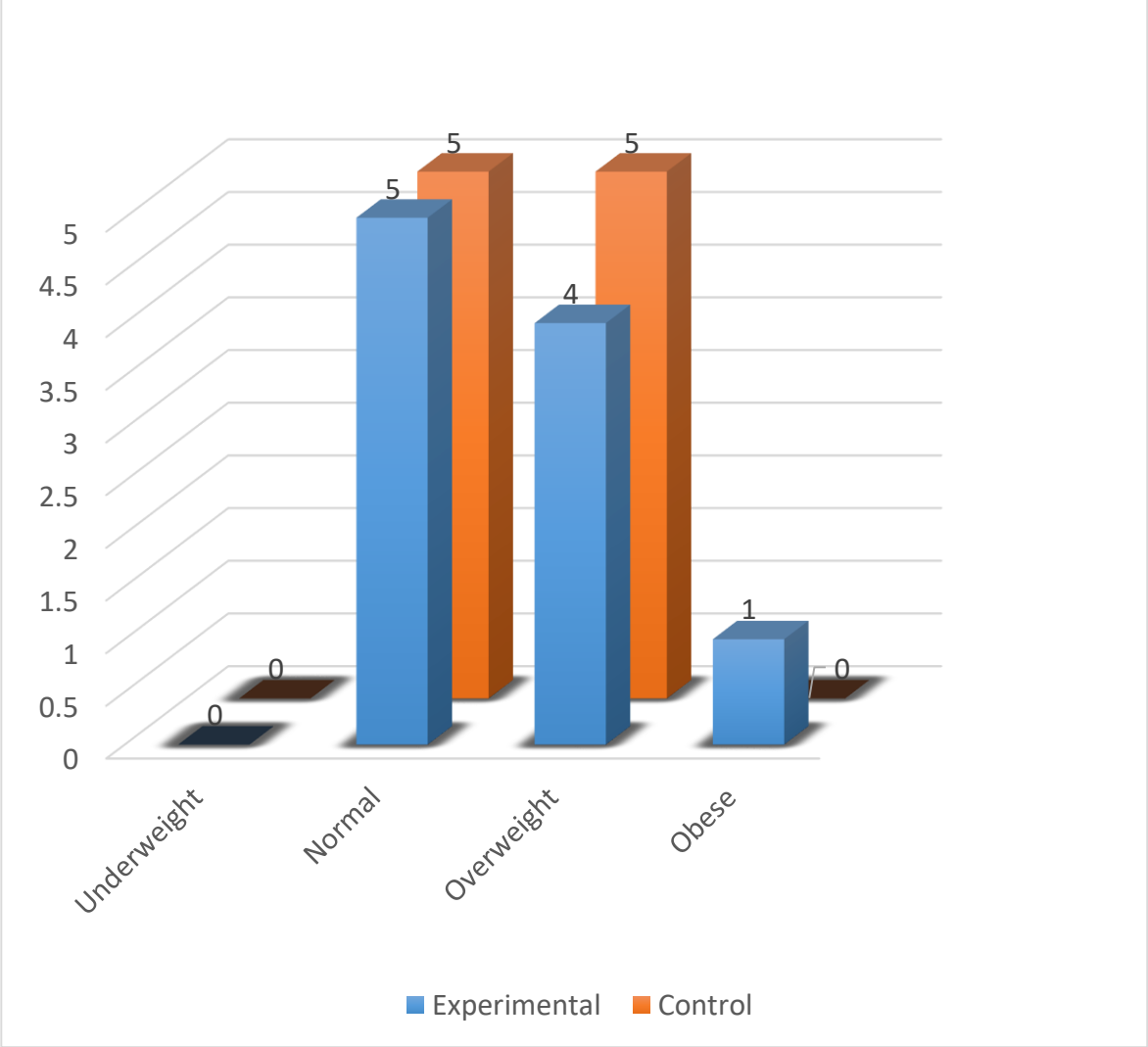


Figure-06:BMI among the patients

Figure 06 showed that among 10 participants in the experimental group, no participant (0%) was underweight, 5 (50%) in normal weight, 4 (40%) in overweight and 1 (10%) was obese. On the other hand, among 14 participants in the control group, no participant (0%) was underweight, 5 (50%) was in normal weight, 5 (50%) were in overweight and there was no patient in obese.

1.7 Dominant hand

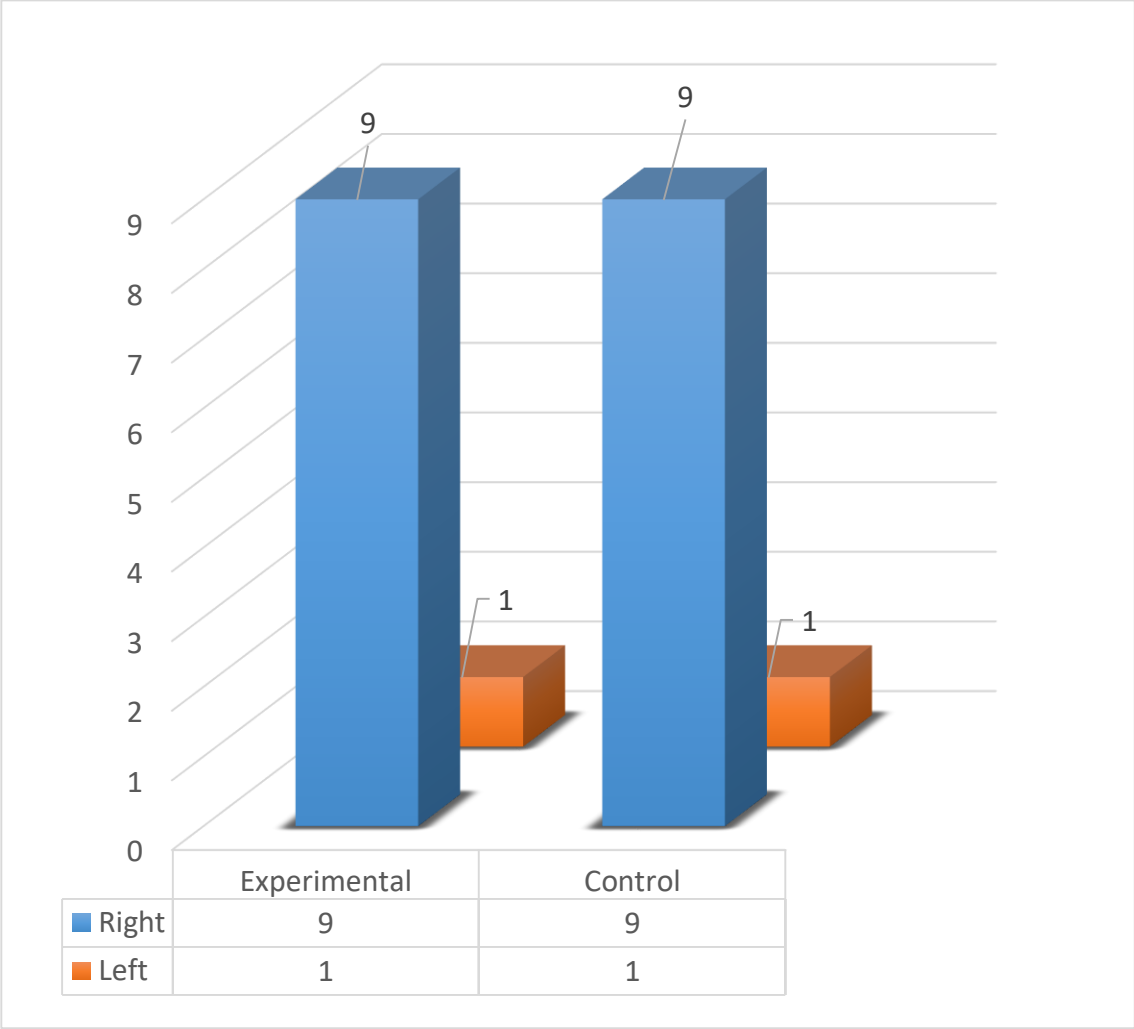


Figure-07: Dominant Hand among the patient

Figure 07 narrated that among 10 patients in the experimental group 9(90%) were right hand dominant and 1 (10%) was left hand dominant . Similarly, in the control group among 10 patients ,9 (90%) were right hand dominant and 1(10%) was left hand dominant.

4.8 Affected side

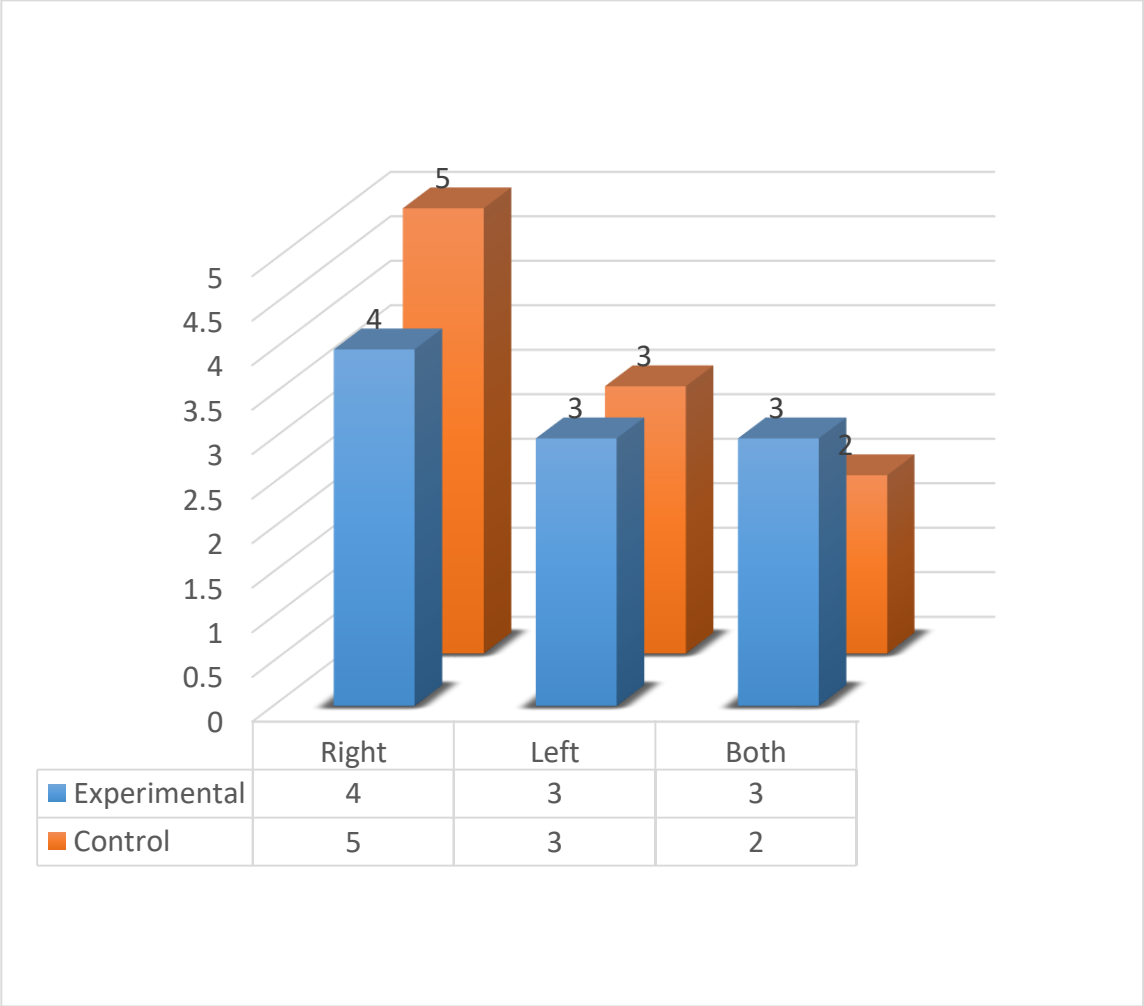


Figure-08:-Affected side among the patients

Figure 08 demonstrated that among 10 patients in the experimental group 4(40%) right knee joint, 3(30%) left knee joint and 3 (30%) patients both knee joint was affected. On the other hand, in control group among 10 patients, 5 (50%) right knee joint, 3(30%) left knee joint and 2 (20%) patients both knee joint was affected.

4.9 Occupation

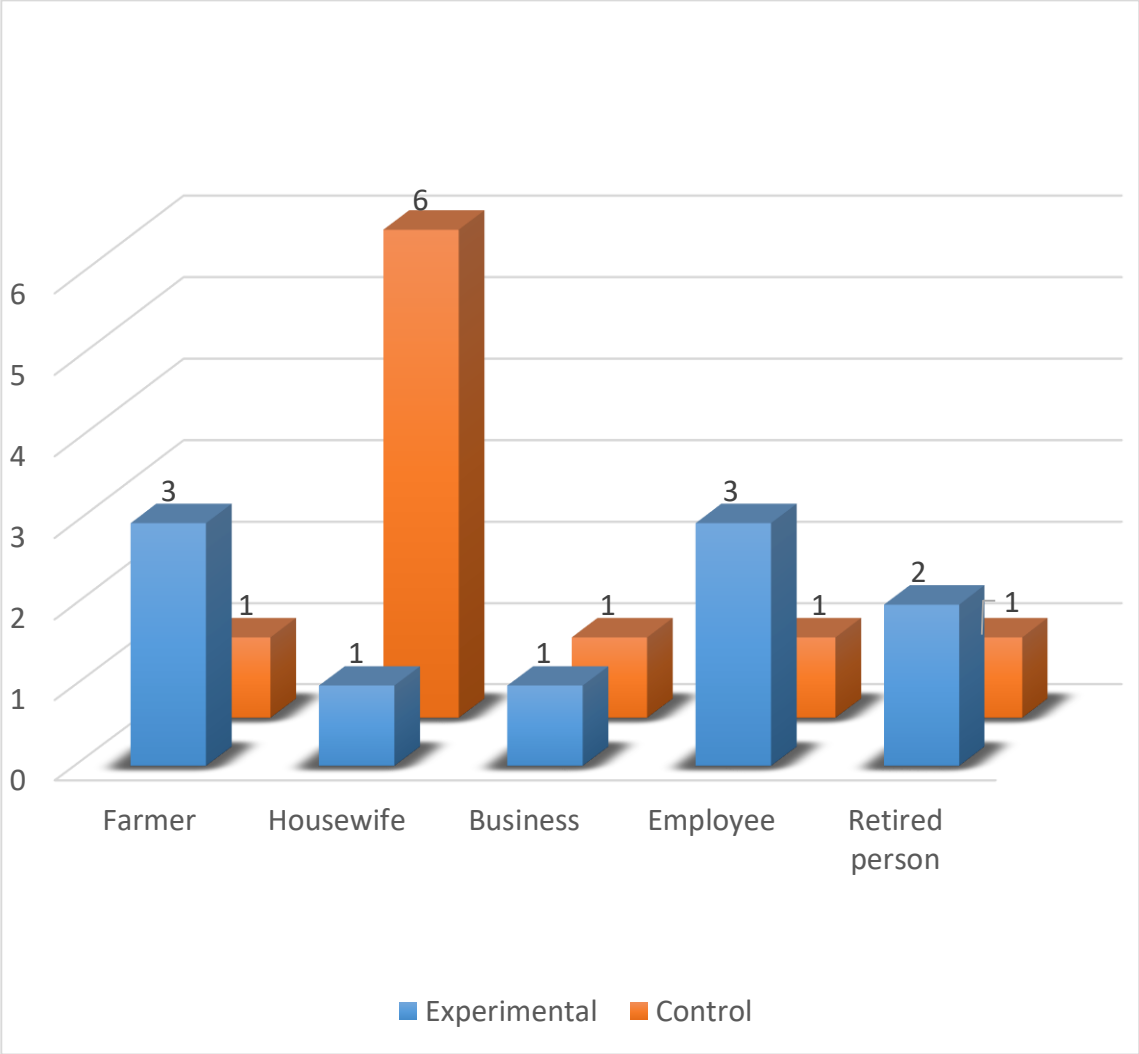


Figure-9: Occupation of the patients

Figure 09 showed that among 10 patients in the experimental group, 3(30%) farmer, 1(10%) housewife, 1(10%) businessman, 3(30%) employee, 2(20%) are retired person. Conversely, In control group, 1(10%) farmer, 6(60%) housewife, 1(10%) businessman 1(10%), employee and 1(10%) patient is retired person.

4.10 Statistical difference of disability in experimental group

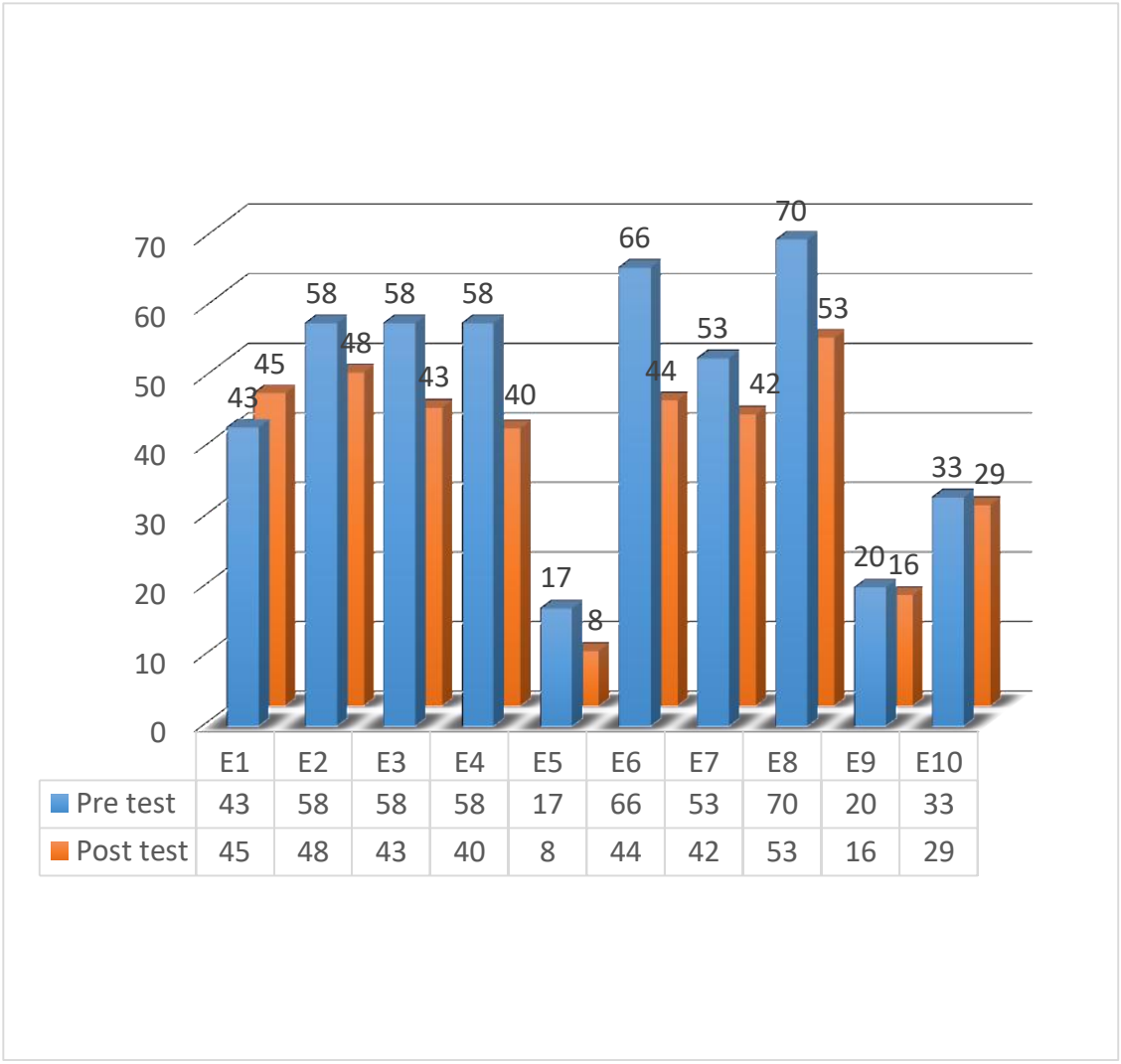


Figure-10: Reduction of physical disability in experimental group

Figure 10 demonstrated that among 10 patients in experimental group 9 patient's disability score reduced and only 1 patient's disability score increased. The average pretest score was 47.6 and average post test score was 36.8. So the mean difference was 10.8.

4.11 Statistical difference of disability in control group

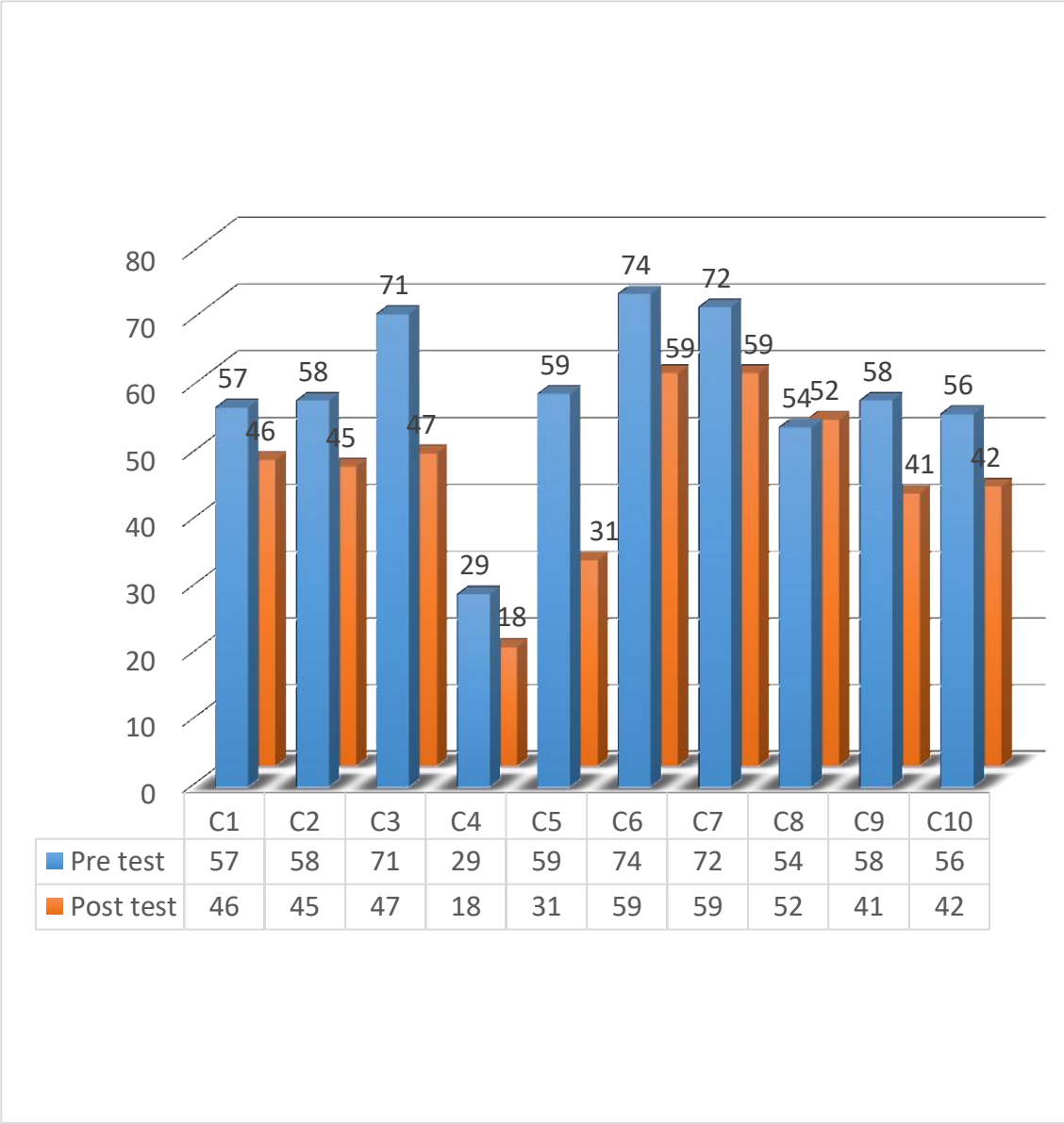
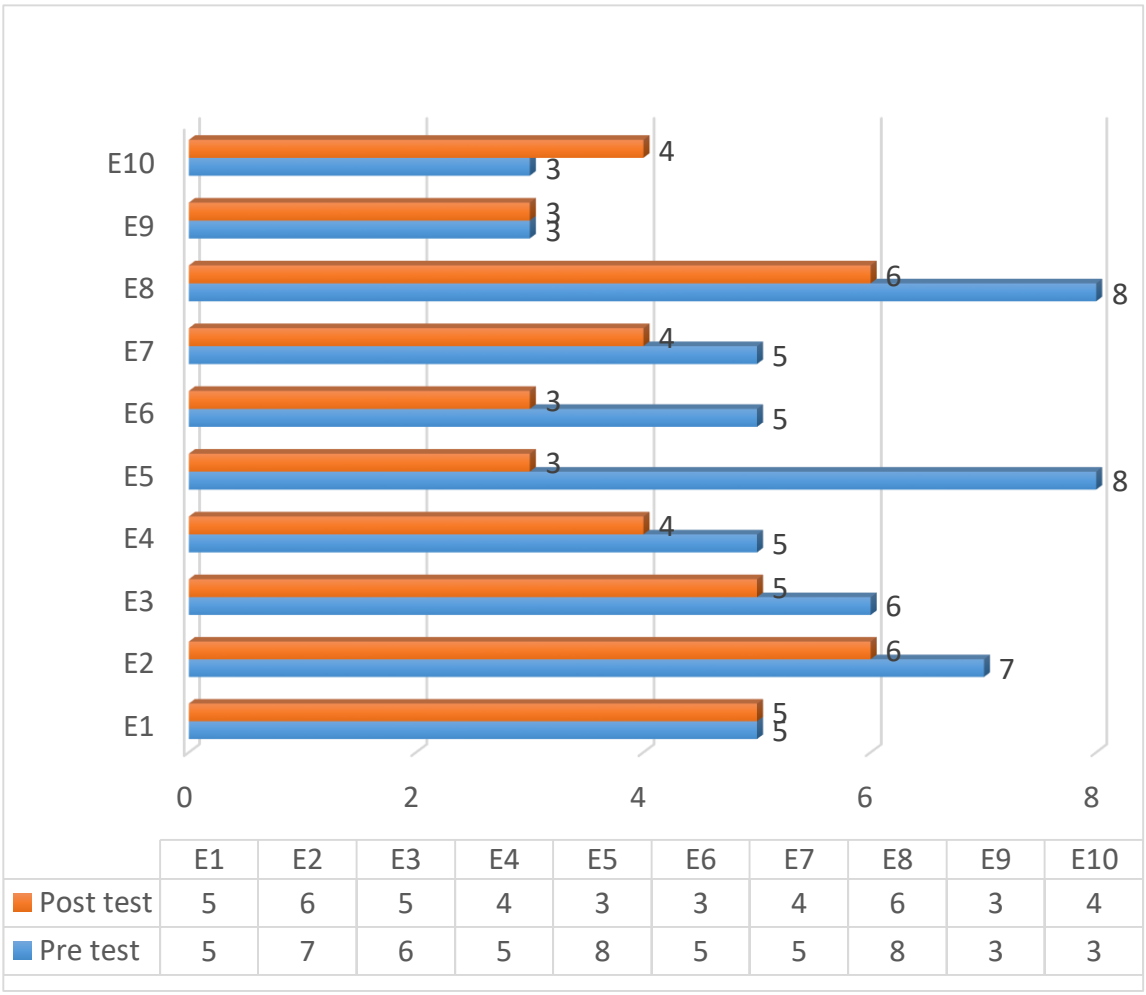


Figure-11: Reduction of physical disability in control group

Figure 11 showed that among 10 patients in control group 10 patient's disability score reduced. The average pretest score was 51.6 and average post test score was 44. So, the mean difference was 7.6

4.12 Statistical difference of pain in experimental group

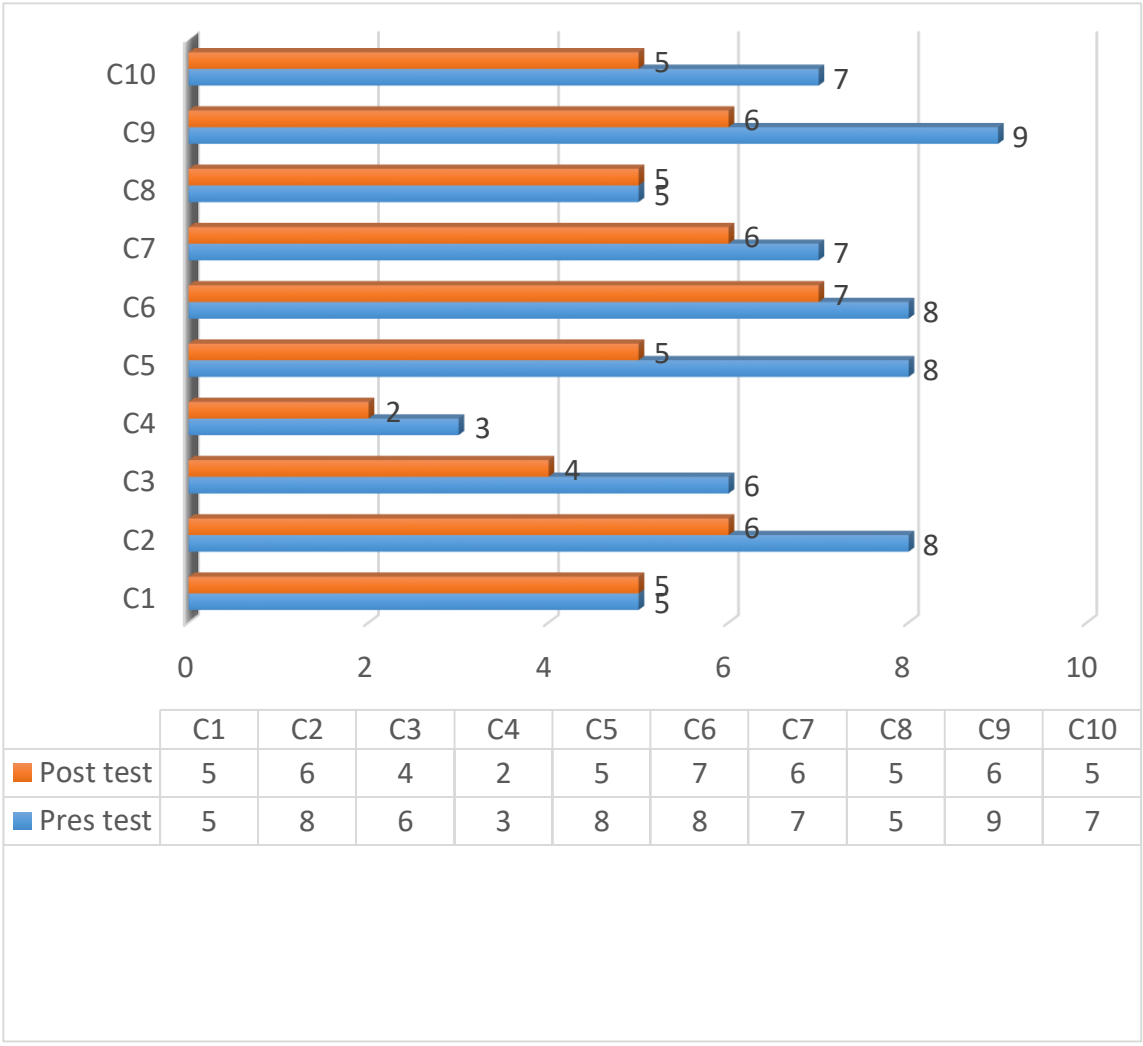


	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
Post test	5	6	5	4	3	3	4	6	3	4
Pre test	5	7	6	5	8	5	5	8	3	3

Figure-12: Reduction of pain in experimental group

Figure 12 demonstrated that among 10 patients in experimental group, 7 patient's pain intensity score reduced, 1 patient's pain intensity score increased and 2 patient's pain intensity score unchanged. The average pretest score was 5.5 and average post test score was 4.3. The mean difference of pretest and post test score was 1.2.

4.13 Statistical difference of pain in control group



	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Post test	5	6	4	2	5	7	6	5	6	5
Pres test	5	8	6	3	8	8	7	5	9	7

Figure-13: Reduction of pain in control group

Figure 13 described that among 10 patients in control group, 8 patient's pain intensity score reduced and 2 patient's pain intensity score unchanged. The average pretest score was 6.6 and average post test score was 5.1.The mean difference of pretest and post test score was 1.5.

4.14 Statistical progression of range of motion in experimental group (Active knee flexion)

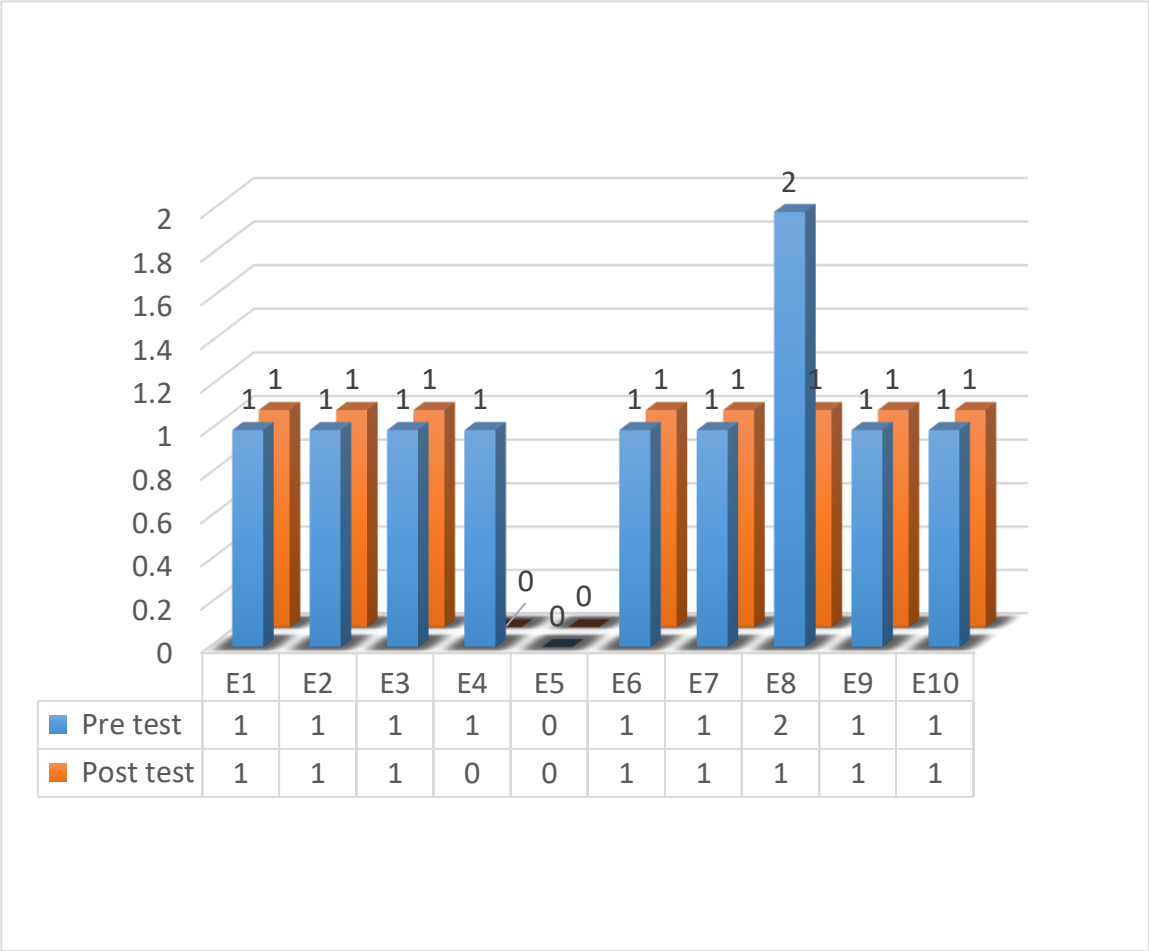


Figure-14:- Range of motion in experimental group (Active knee flexion)

Figure 14 demonstrated that among 10 patients in experimental group 2 patient's ROM in active knee flexion increased and 8 patient's ROM in active knee flexion unchanged.

4.15 Statistical progression of range of motion in control group (Active knee flexion)

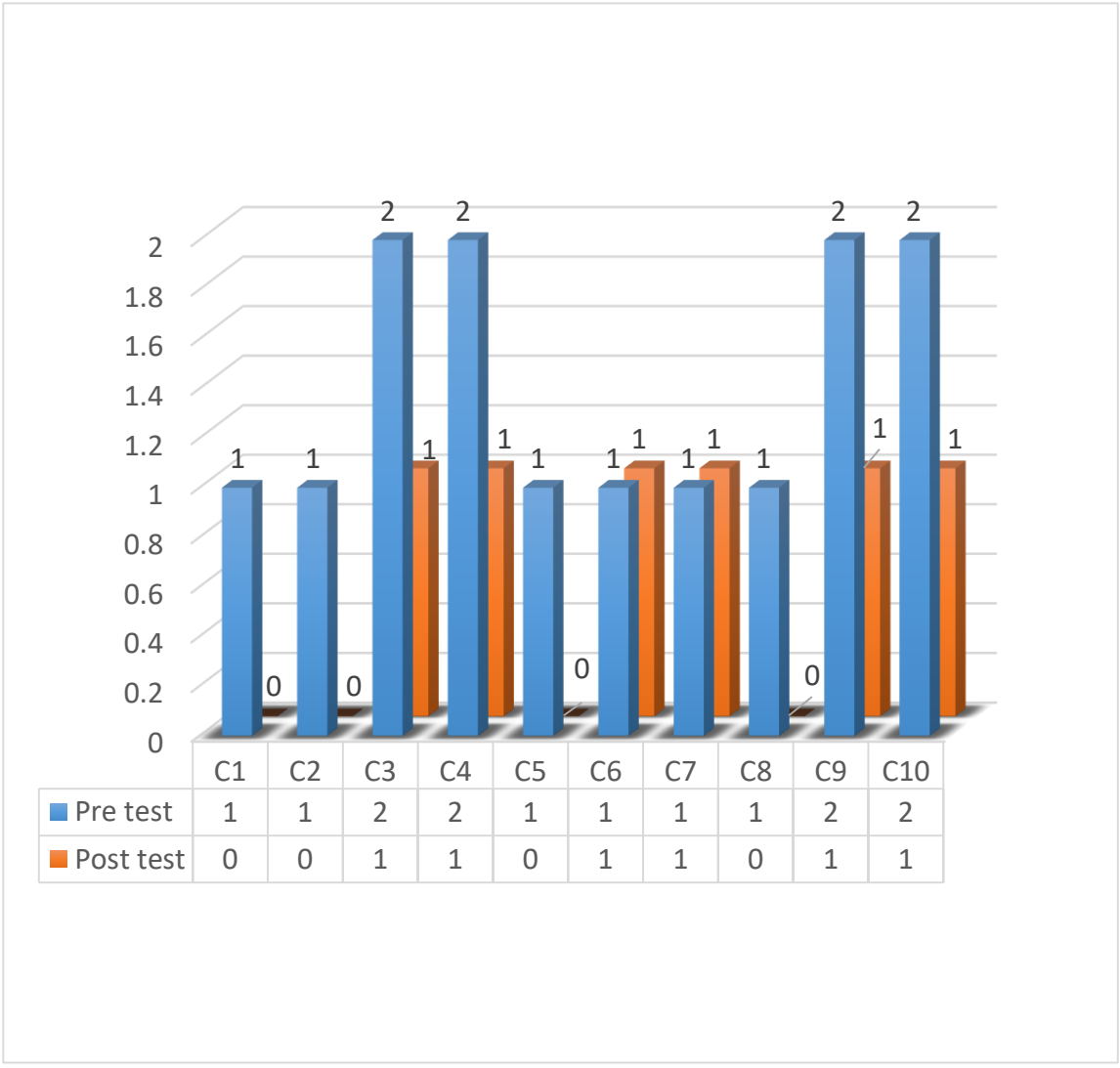


Figure-15:- Range of motion in control group (Active knee flexion)

Figure 15 showed that among 10 patients in control group, 8 patient's ROM in active knee flexion increased and 2 patient's ROM in active knee flexion unchanged.

4.16 Statistical progression of range of motion in experimental group (Active knee extension)

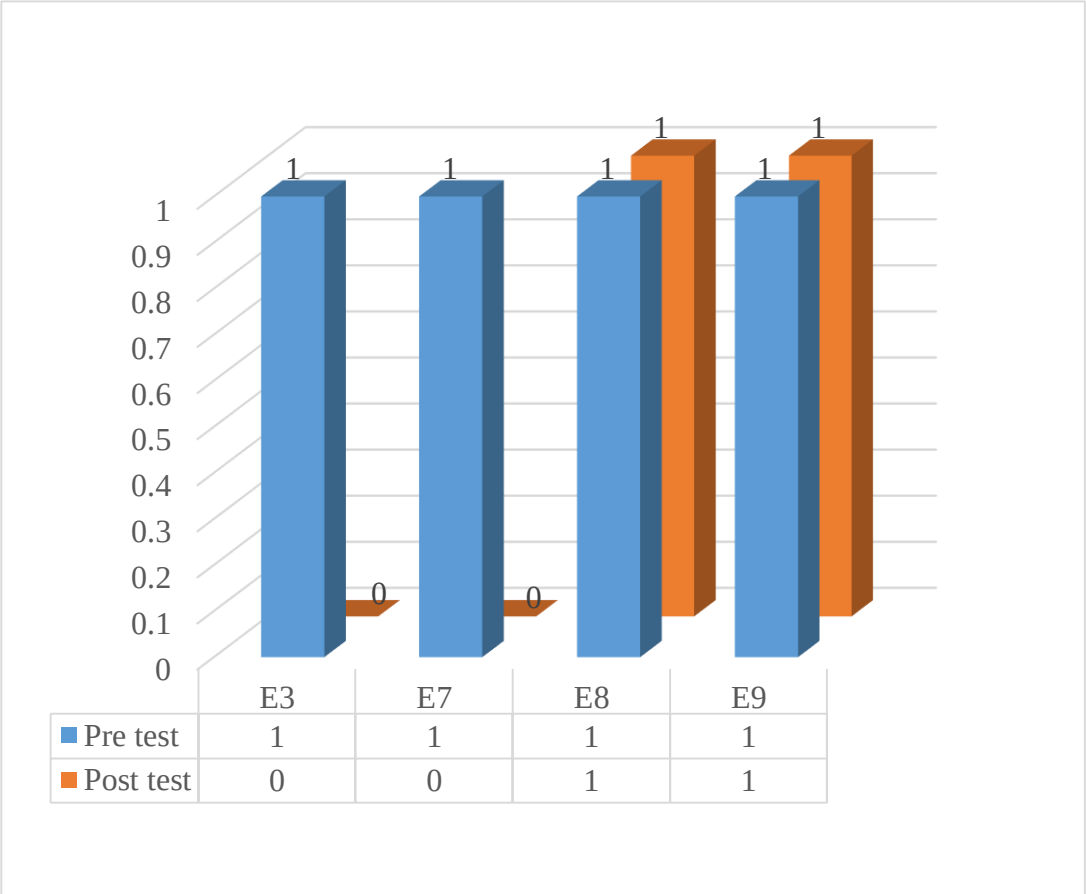


Figure-16: Range of motion in experimental group (Active knee extension)

Figure 16 demonstrated that among 10 patients in experimental group, 6 patient's had full ROM in active knee extension, 2 patient's ROM increased and 2 patient's ROM unchanged.

4.17 Statistical progression of range of motion in control group (Active knee extension)

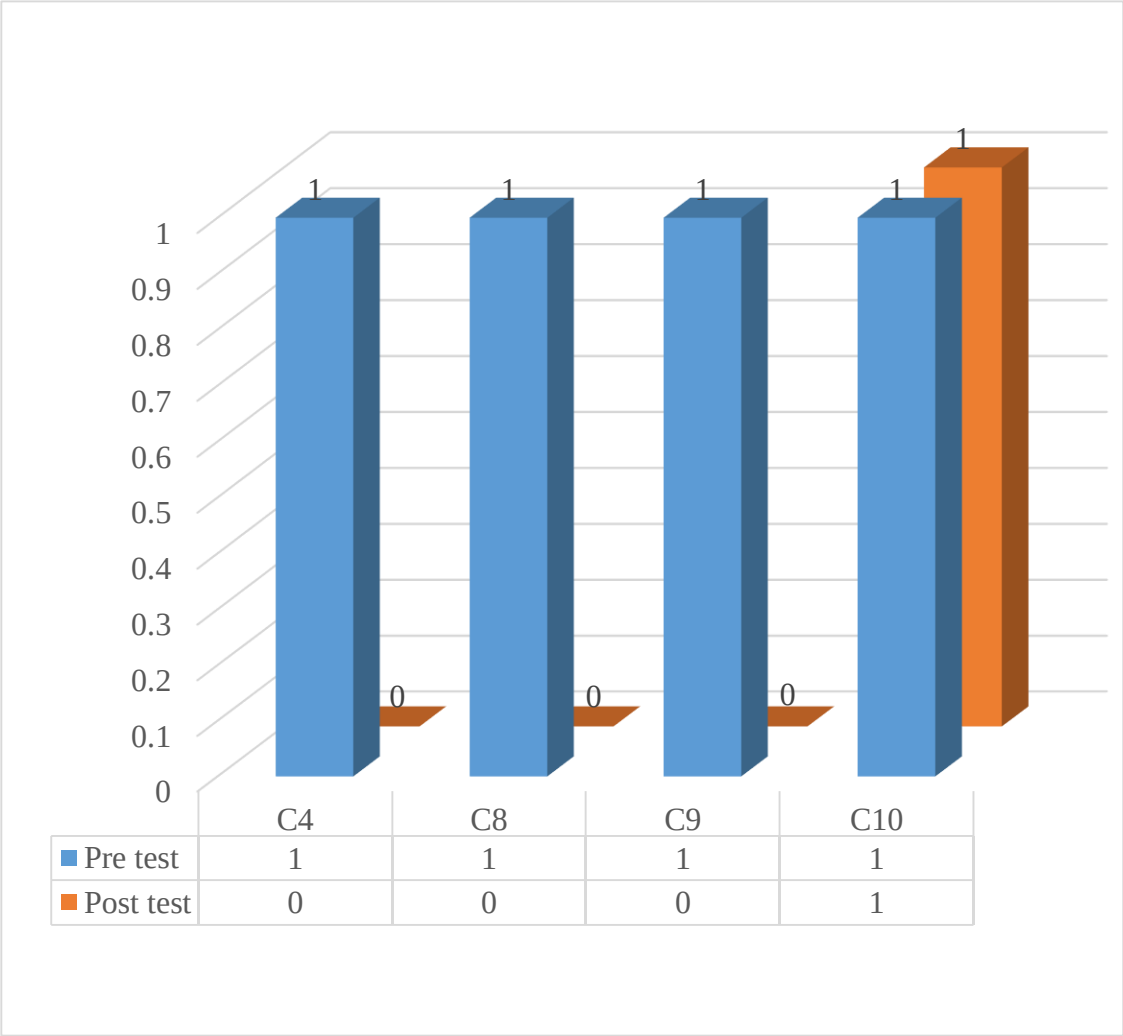


Figure-17: Range of motion in control group (Active knee extension)

Figure 17 stated that among 10 patients in control group 6 patient's had full ROM in active knee extension, 3 patient's ROM increased and 1 patient's ROM unchanged.

4.18 Statistical progression of range of motion in experimental group (Passive knee flexion)

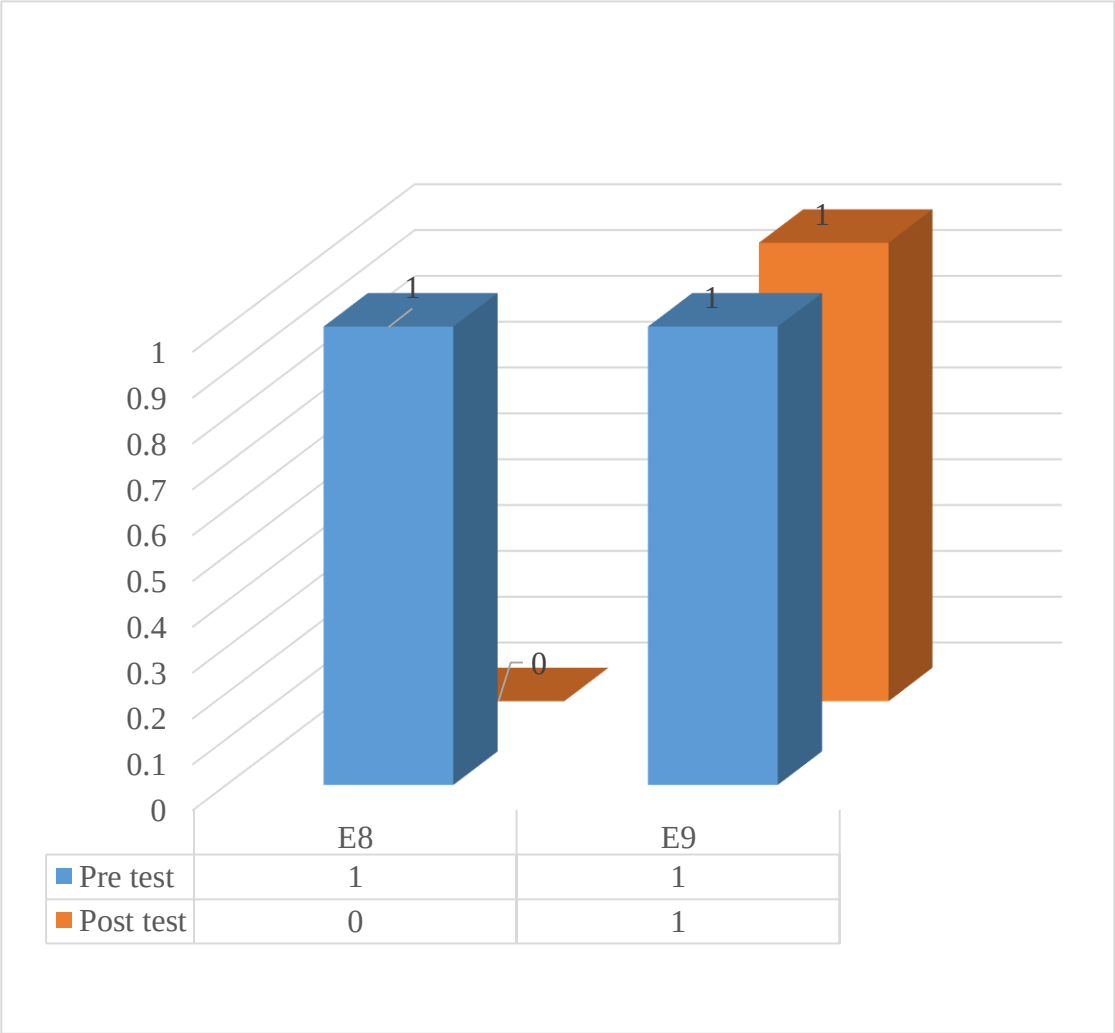


Figure 18: Range of motion in experimental group (Passive knee flexion)

Figure 18 described that among 10 patients in experimental group,7 patient's had full ROM in passive knee flexion, 1 patient's ROM increased and 1 Patient's ROM unchanged.

4.19 Statistical progression of range of motion in control group (Passive knee flexion)

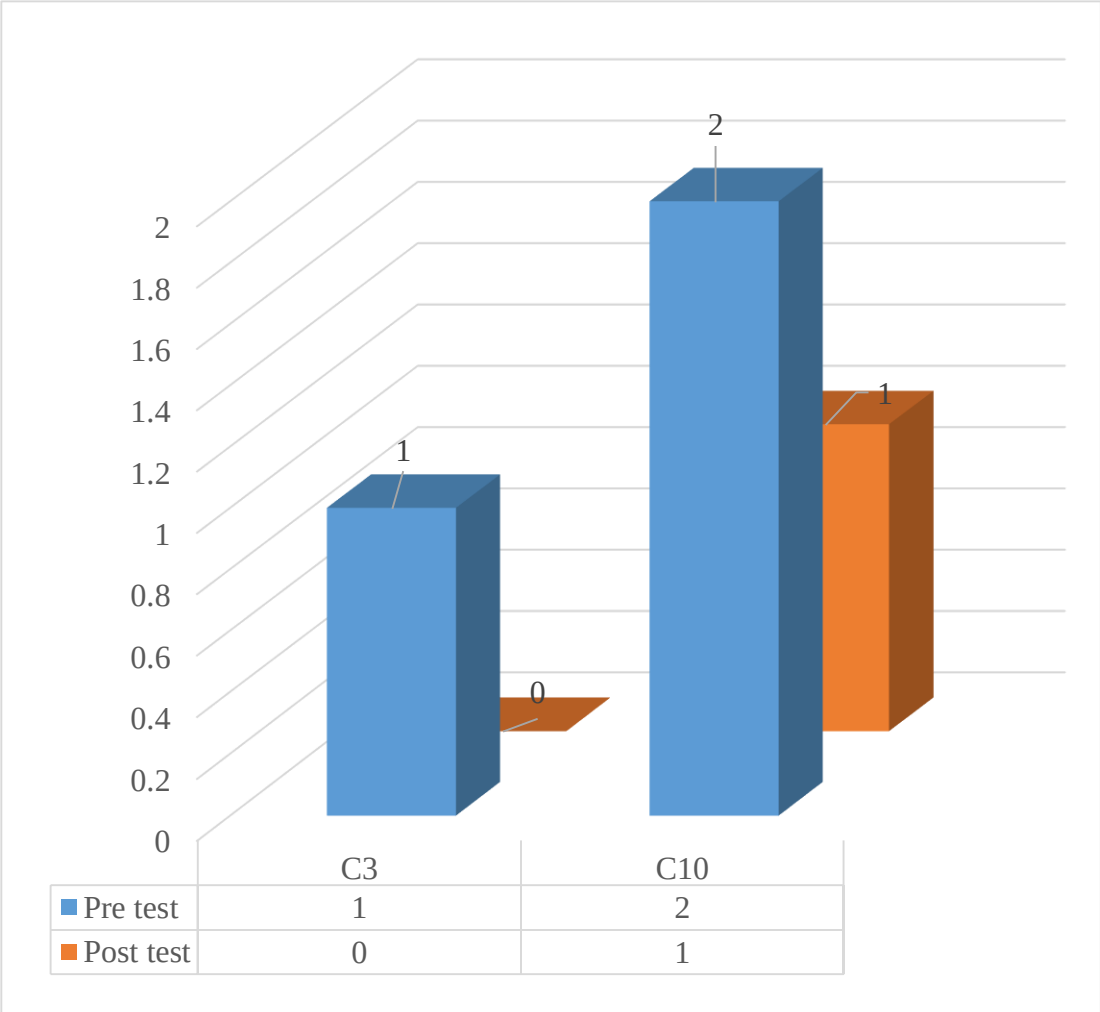


Figure 19: Range of motion in control group (Passive knee flexion)

Figure 19 described that among 10 patients in control group, 8 patient's had full ROM in passive knee flexion and 2 patient's ROM increased.

4.20 Statistical progression of range of motion in experimental group (Passive knee extension)

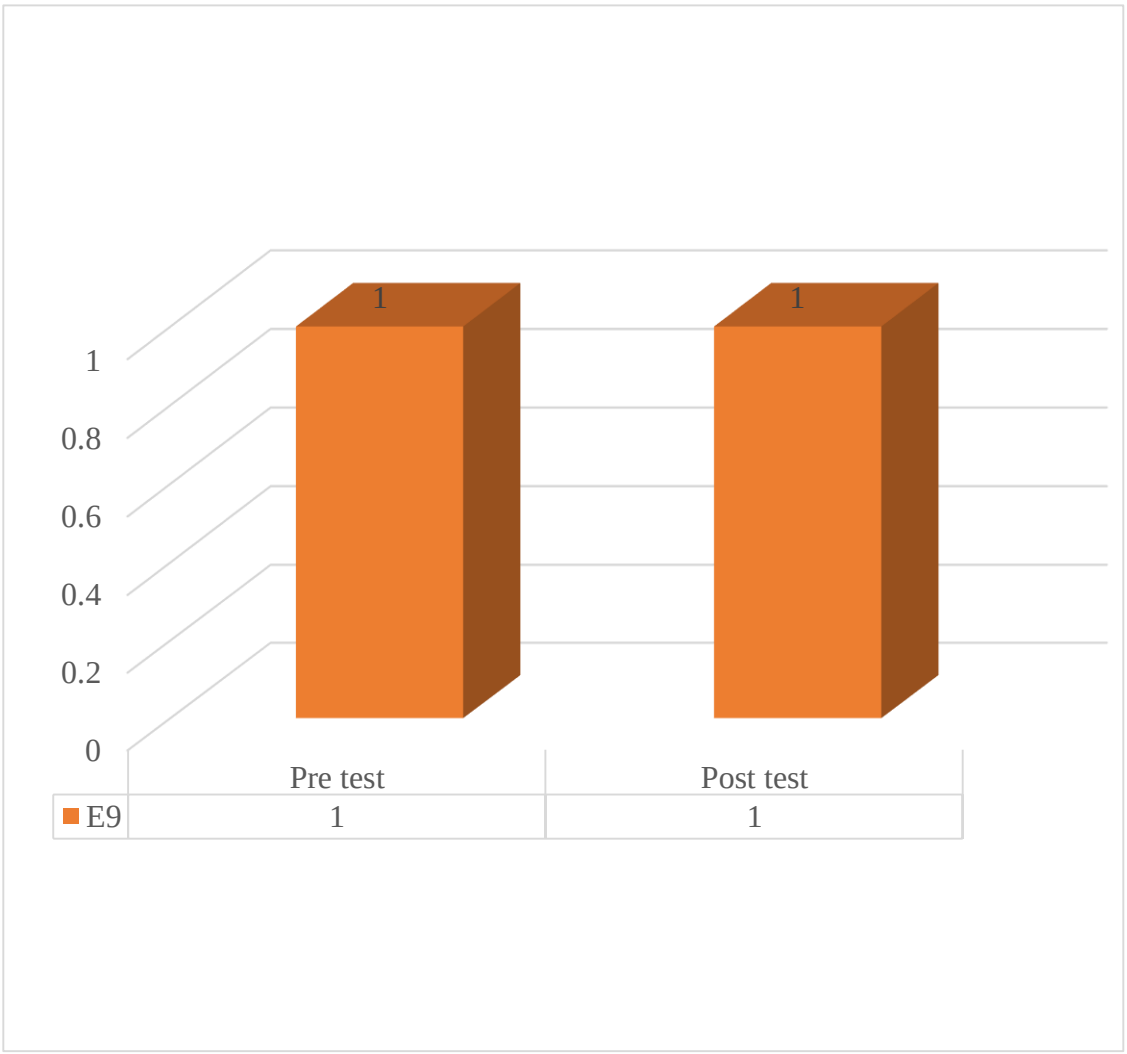


Figure 20: Range of motion in experimental group (Passive knee extension)

Figure 20 stated that among 10 patients in experimental, 9 patient's had full ROM in passive knee extension and 1 Patient's ROM unchanged.

4.21 Statistical progression of range of motion in control group (Passive knee extension)

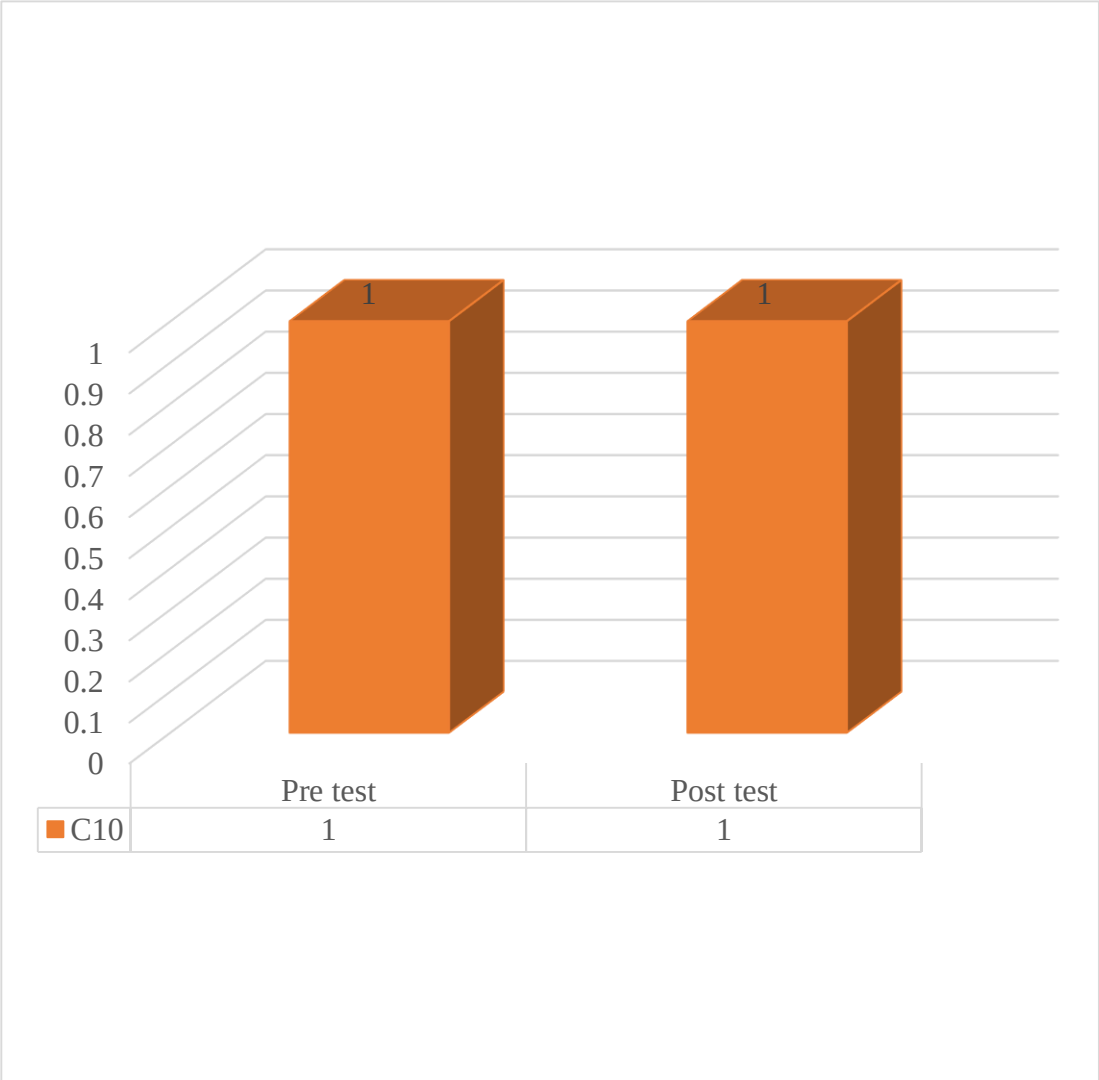


Figure 21: Range of motion in control group (Passive knee extension)

Figure 21 demonstrated that among 10 patients in control group, 9 patient's had full ROM in passive knee extension and 1 Patient's ROM unchanged.

4.22 Statistical progression of muscle power in experimental group (Quadriceps muscle)

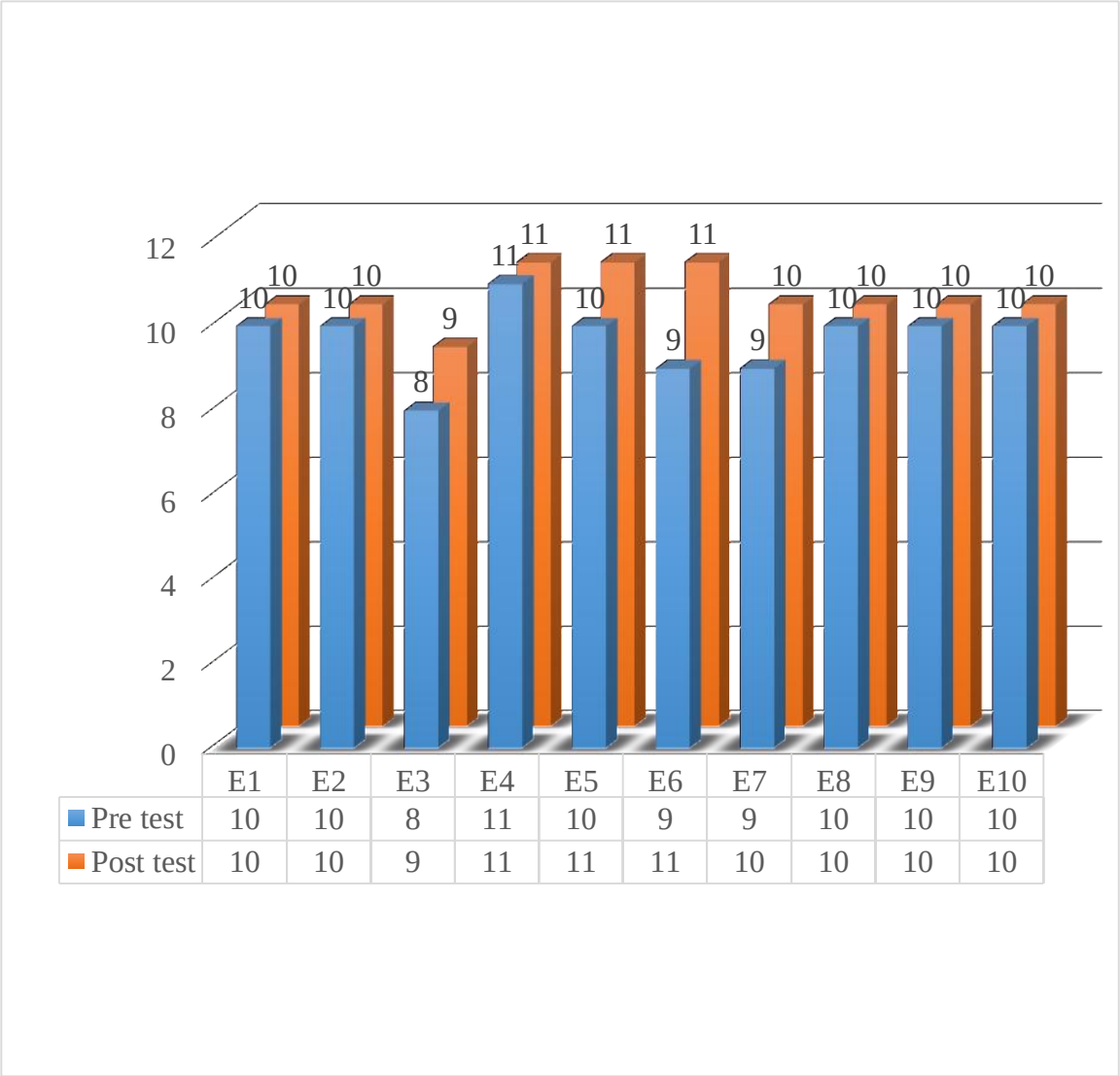


Figure 22: Muscle power in experimental group (Quadriceps muscle)

Figure 22 described that among 10 patients in experimental group 4 patient's quadriceps muscle power increased and 6 patients muscle power unchanged.

4.23 Statistical progression of muscle power in control group (Quadriceps muscle)

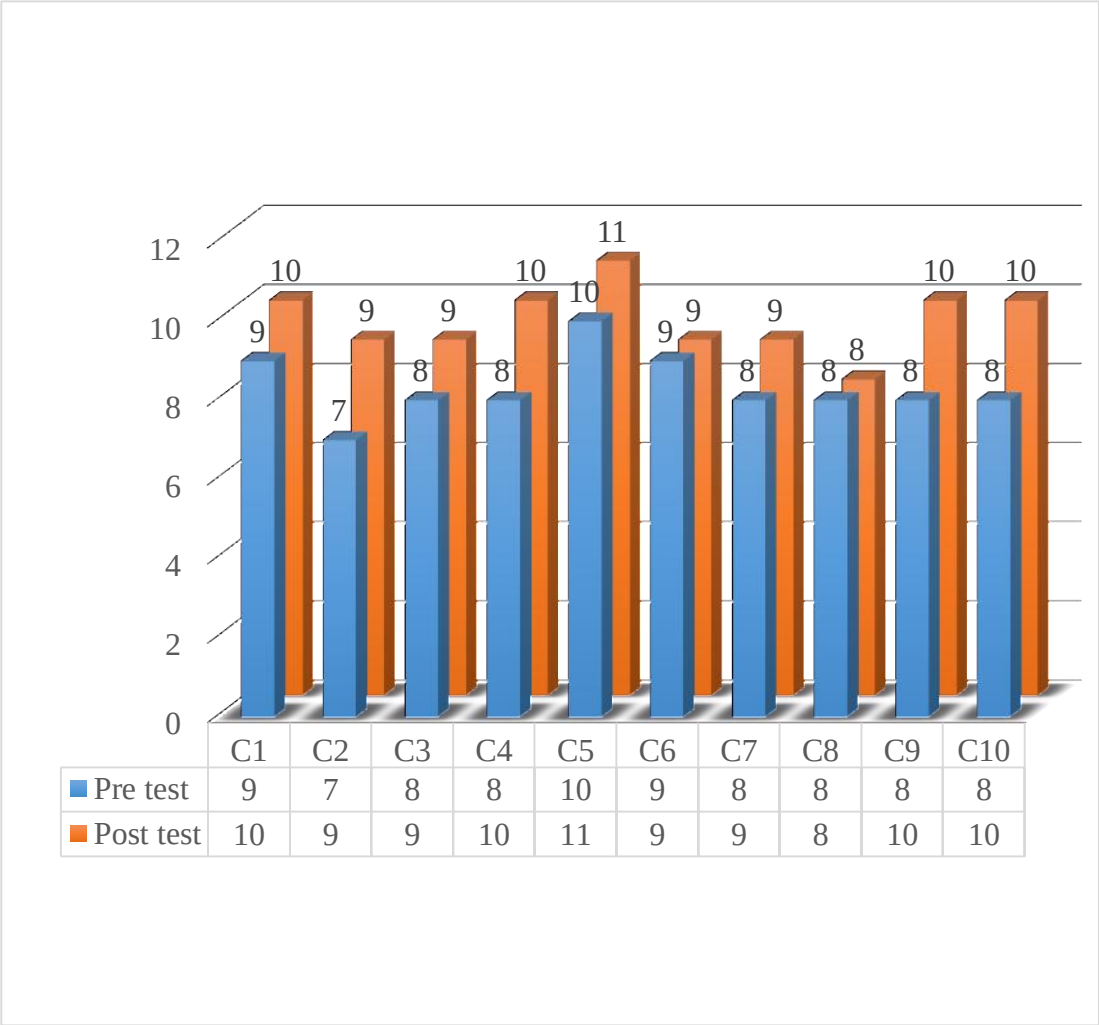
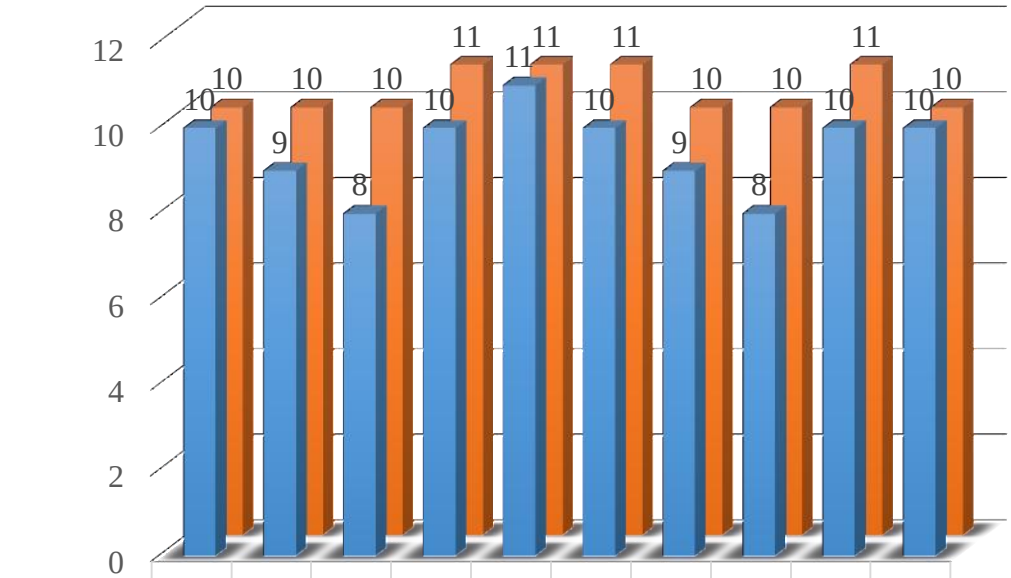


Figure 23: Muscle power in control group (Quadriceps muscle)

Figure 23 stated that among 10 patients in control group 8 patient's quadriceps muscle power increased and 2 patients muscle power unchanged.

4.24 Statistical progression of muscle power in experimental group (Hamstring muscle)

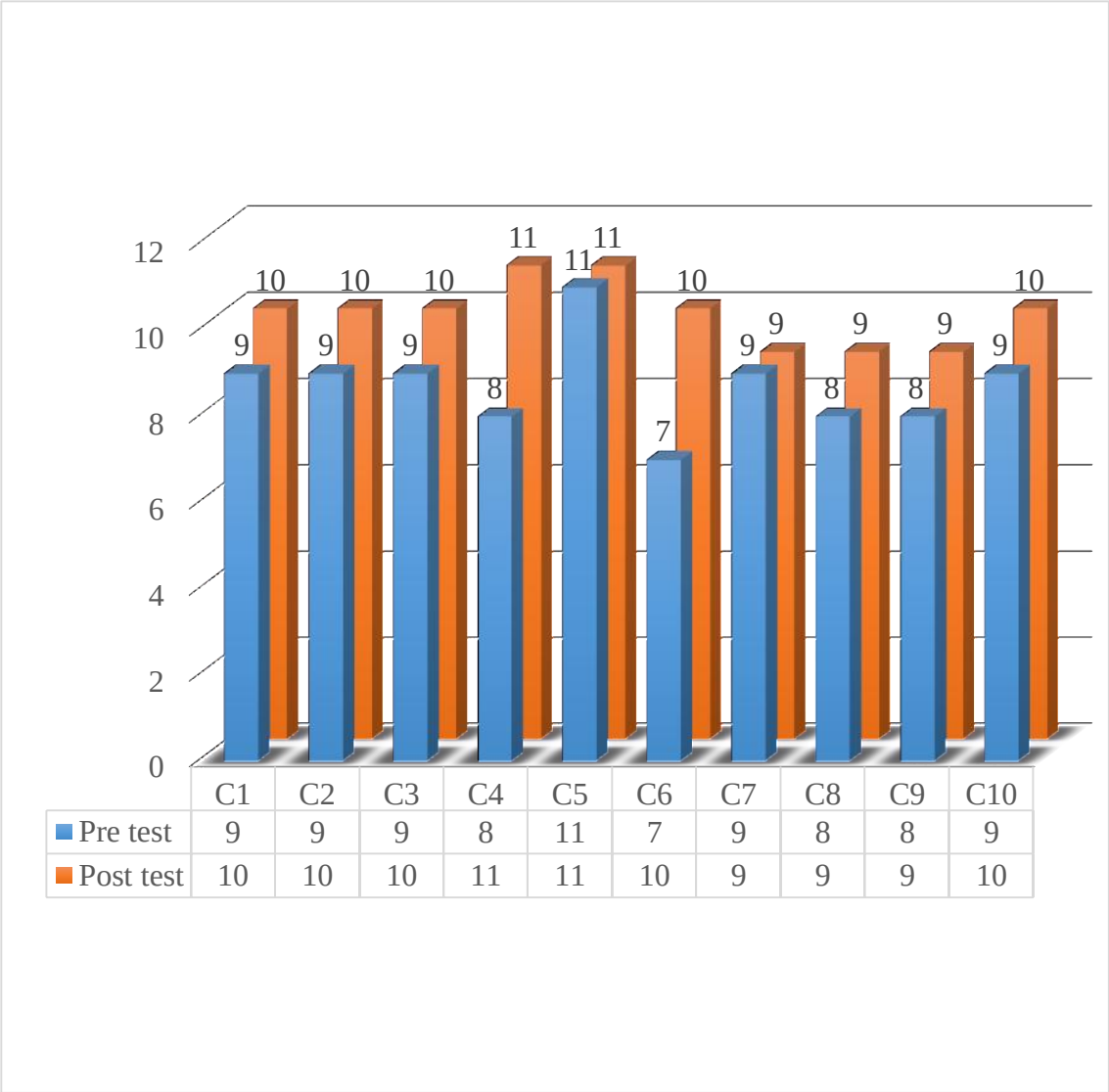


	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
Pre test	10	9	8	10	11	10	9	8	10	10
Post test	10	10	10	11	11	11	10	10	11	10

Figure 24: Muscle power in experimental group (Hamstring muscle)

Figure 24 described that among 10 patients in experimental group 7 patient's hamstring muscle power increased and 3 patients muscle power unchanged.

4.25 Statistical progression of muscle power in control group (Hamstring muscle)



	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Pre test	9	9	9	8	11	7	9	8	8	9
Post test	10	10	10	11	11	10	9	9	9	10

Figure 25: Muscle power in control group (Hamstring muscle)

Figure 25 stated among 10 patients in group 8 patient's hamstring muscle power increased and 2 patients muscle power unchanged.

4.26 Statistical progression of muscle power in experimental group (Dorsiflexor muscle)

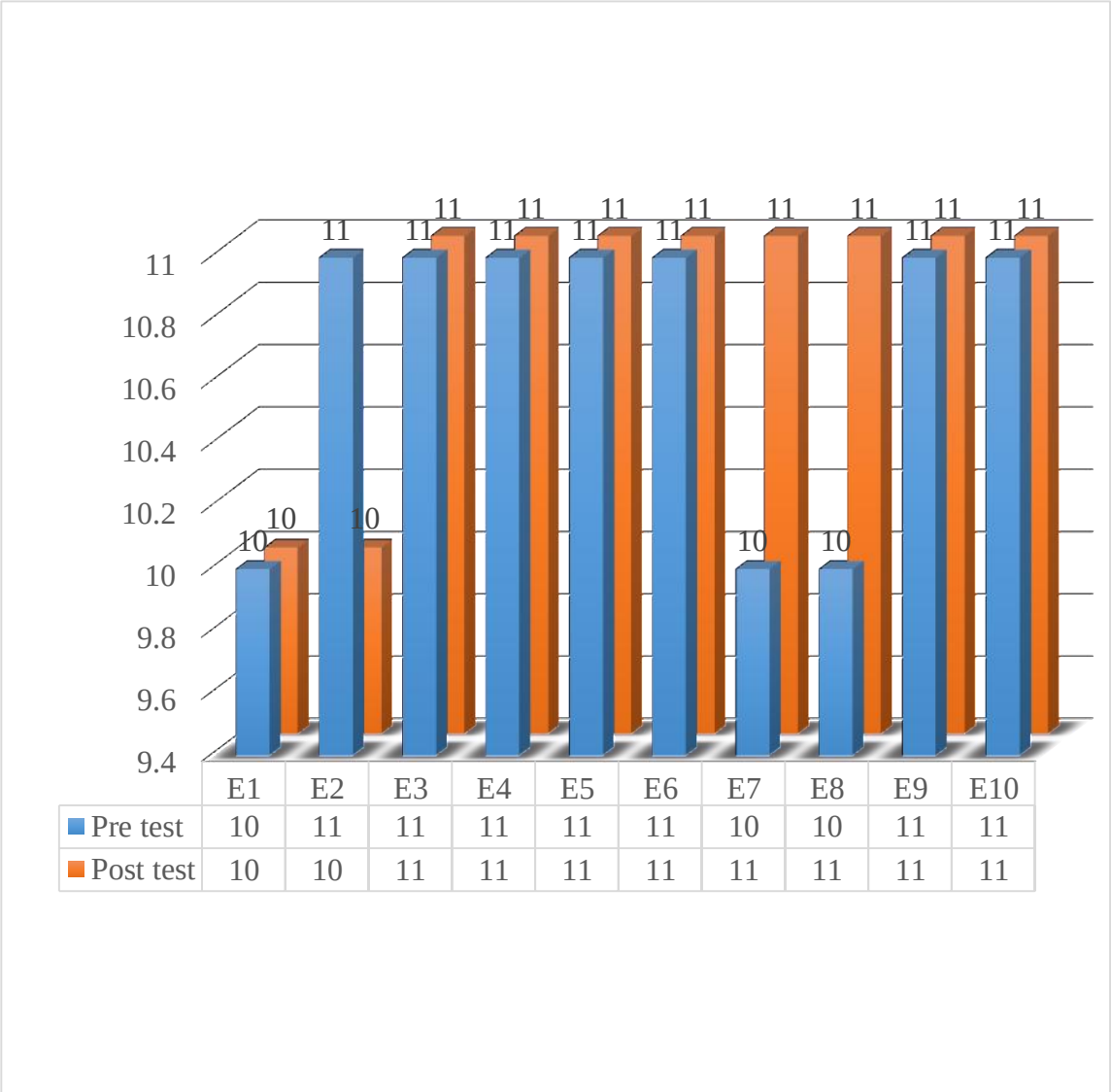


Figure 26: Muscle power in experimental group (Dorsiflexor muscle)

Figure 26 described that among 10 patients in experimental group 2 patient's dorsiflexor muscle power increased, 1 patient's muscle power decreased and 7 patients muscle power unchanged.

4.27 Statistical progression of muscle power in control group (Dorsiflexor muscle)

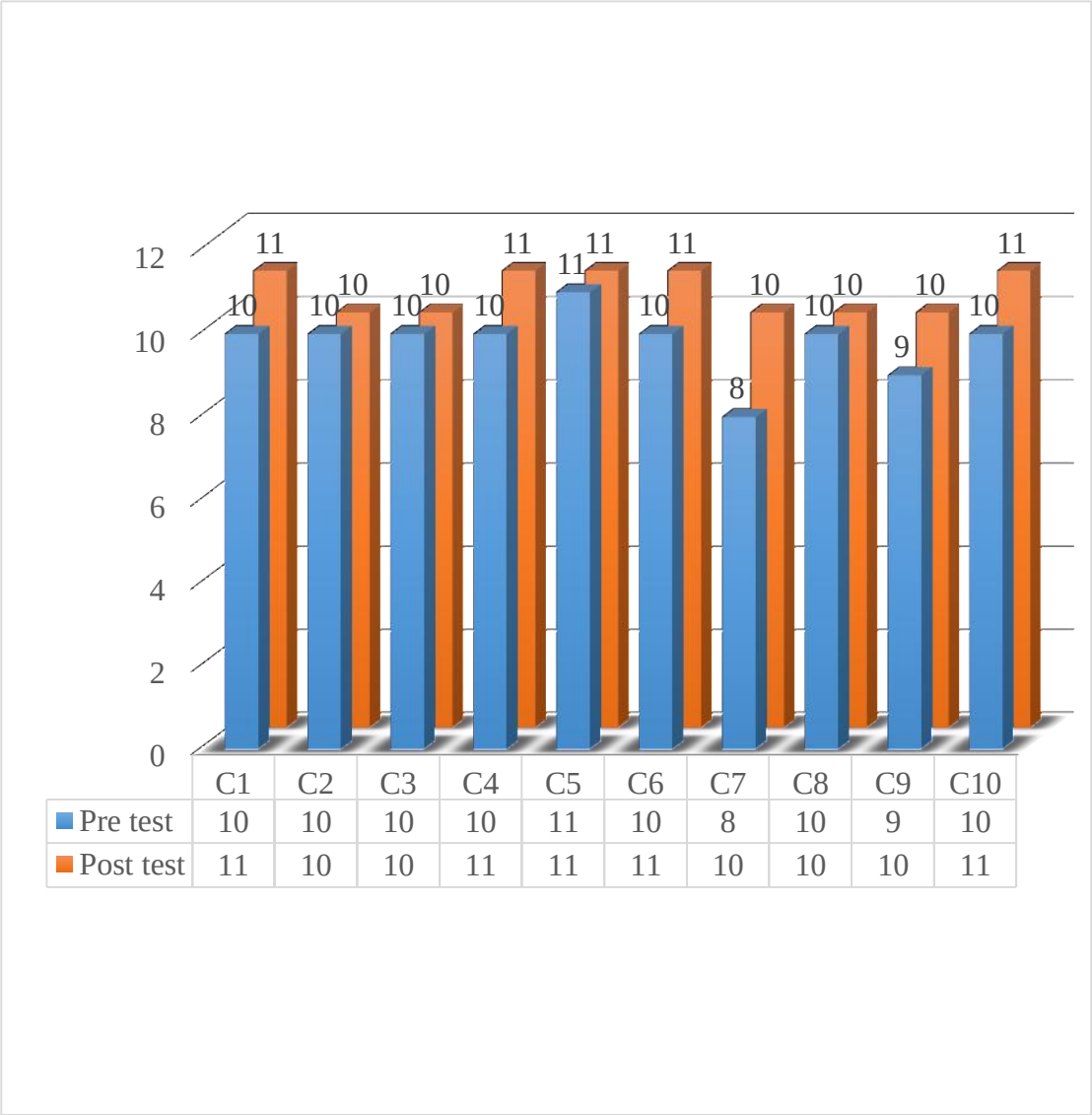


Figure 27: Muscle power in control group (Dorsiflexor muscle)

Figure 27 stated that among 10 patients in control group 5 patient's dorsiflexor muscle power increased and 5 patients muscle power unchanged.

4.28 Statistical progression of muscle power in experimental group (Planter flexor muscle)

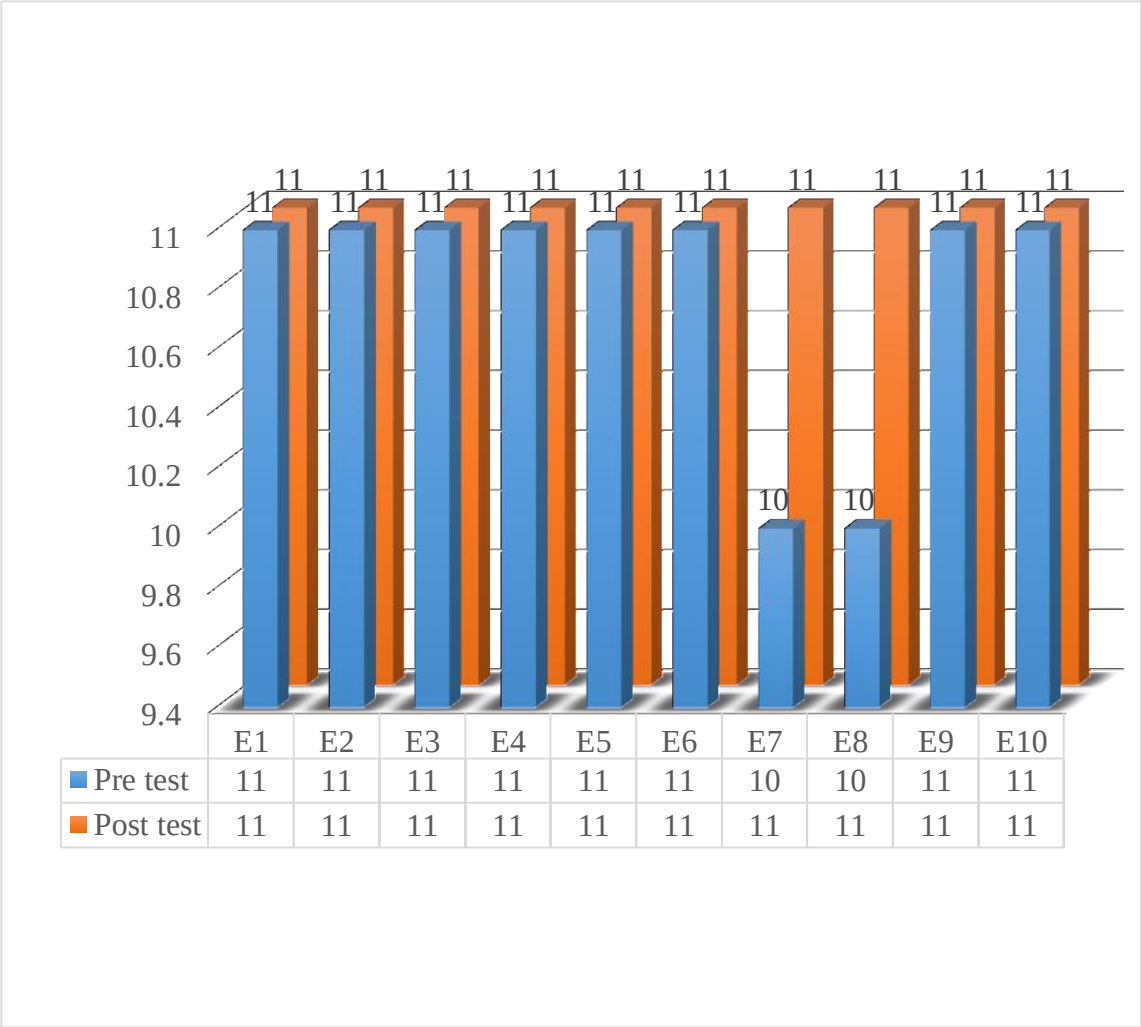


Figure 28: Muscle power in experimental group (Planter flexor muscle)

Figure 28 described that among 10 patients in experimental group 2 patient's planterflexor muscle power increased and 8 patients muscle power unchanged.

4.29 Statistical progression of muscle power in control group (Planter flexor muscle)

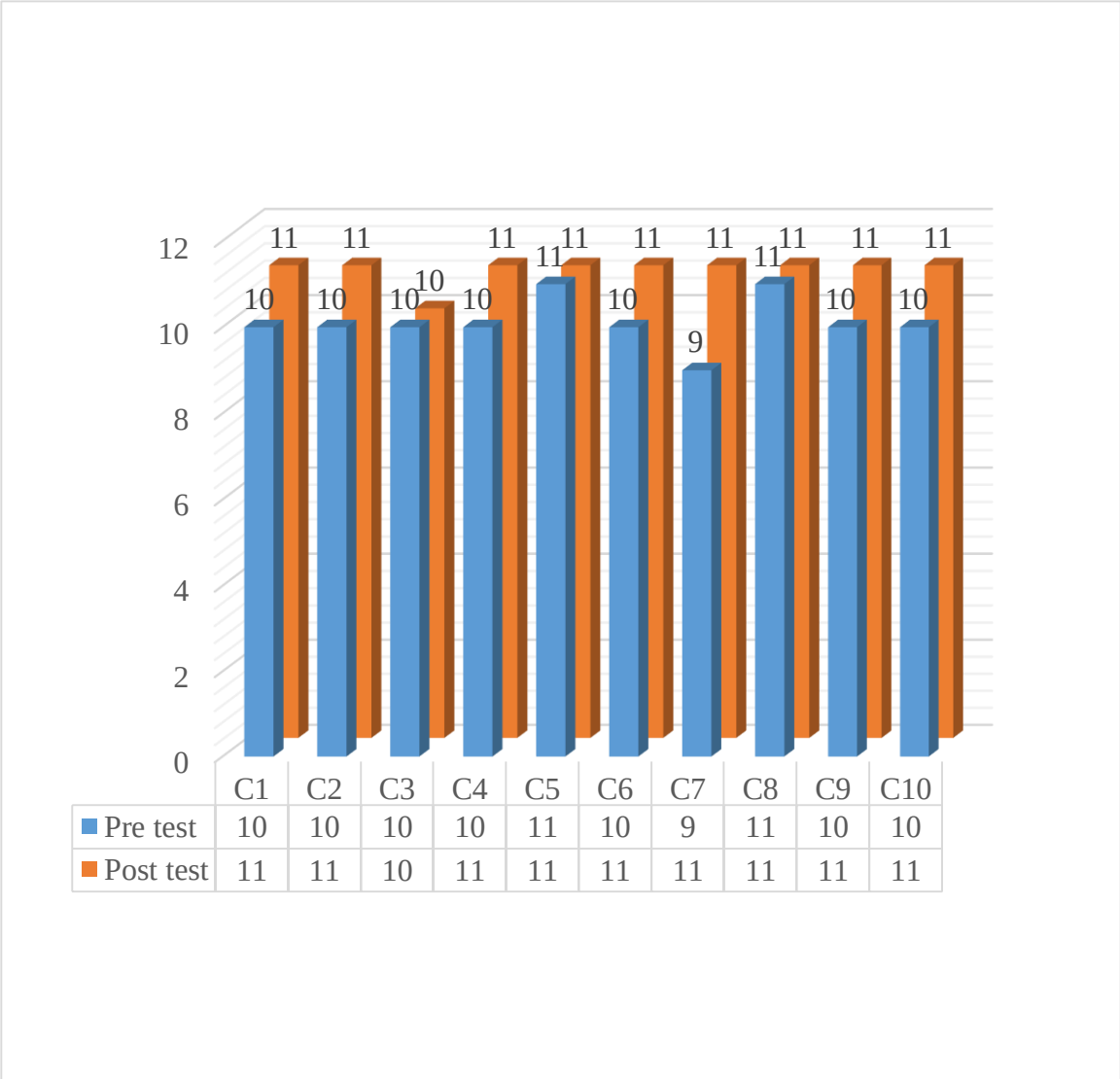


Figure 29: Muscle power in control group (Planter flexor muscle)

Figure 29 stated that among 10 patients in control group 7 patient's planterflexor muscle power increased and 3 patients muscle power unchanged.

4.29 Physical disability, Pain, Range of Motion (ROM) and Muscle power related information.

4.29.1 Comparison of physical disability

According to the tabularized data, it was found that physical disability reduction score on the Western Ontario and McMaster Universities Arthritis Index (WOMAC) in experimental group was statistically significant in lying in bed. Here, the observed "U" value of lying in bed was 19 and "p" value was 0.007 .The observed "U" value of lying in bed in between groups was less than the table value (U=23). In this case null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significance. The rest of the variables in the Western Ontario and McMaster Universities Arthritis Index (WOMAC) in experimental group was not significant where the observed "U" value of pain in walking was 50.00 and "p" value was 1.00, the observed "U" value of pain in stair climbing was 39.50 and "p" value was 0.39, the observed "U" value of pain in nocturnal was 46.00and "p" value was 0.73, the observed "U" value of pain in rest was 38.00 and "p" value was0.34, the observed "U" value of pain in weight bearing was 46.50 and "p" value was 0.75, the observed "U" value of morning stiffness was 38.50 and "p" value was 0.31, the observed "U" value of stiffness occurring later in the day was 41.50 and "p" value was 0.42, the observed "U" value of descending stairs was 36.00 and "p" value was 0.34, the observed "U" value of ascending stairs was 46.00 and "p" value was 0.73, the observed "U" value of rising from sitting was 31.00 and "p" value was 0.101, the observed "U" value of standing was 48.50 and "p" value was 0.90, the observed "U" value of bending to floor was 41.50 and "p" value was 0.35, the observed "U" value of walking on flat surface was 38.50 and "p" value was 0.34, the observed "U" value of getting in/out of car was 45.00 and "p" value was 0.65, the observed "U" value of going shopping was 36.50 and "p" value was 0..28, the observed "U" value of putting on socks was 35.00 and "p" value was 0.13, the observed "U" value of rising from bed was 40.50 and "p" value was 0.42, the observed "U" value of getting in/out of bath was 38.00 and "p" value was 0.31, the observed "U" value of sitting was 42.00 and "p" value was 0.48, the observed "U" value of getting on/off toilet was 29 and "p" value was 0.06, the observed "U" value of heavy domestic duties was 49.00 and "p" value was 0.93, the observed "U" value of

light domestic duties was 34.00 and "p" value was 0.16.All these cases, the observed "U" value in between groups are more than the table values (U=23). So, in these cases the null hypothesis is accepted and the alternative hypothesis is rejected at 5% level of significance.

In general the observed "U" value of the Western Ontario and McMaster Universities Arthritis Index (WOMAC) score in experimental group was 34.00 and the "p" value was 0.22. Here, the observed "U" value is greater than the table value (U=23). So, the null hypothesis is accepted and alternative hypothesis is rejected.

4.29.2 Comparison of pain intensity level

In comparison of pain intensity level, it was found that pain reduction score on the Numerical Pain Rating Scale (NPRS) in experimental group was not significant. Here, the observed "U" value was 30.50 and "p" value was 0.13. The observed "U" value in between group was slightly more than the standard table value (U=23.00). So, null hypothesis was accepted and alternative hypothesis was rejected at 5% level of significance.

4.29.3 Comparison of range of motion

In comparison of range of motion, it was found that range of motion improvement in experimental group was not significant. Here, the observed value "U" of active knee flexion was 40.00 and the "p" value was 0.34, the observed value "U" of active knee extension was 45.00 and the "p" value was 0.54, the observed value "U" of passive knee flexion was 50.00 and the "p" value was 1.00, the observed value "U" of passive knee extension was 50.00 and the "p" value was 1.00. All of the observed "U" value in between group was more than the table value (U=23). So, null hypothesis was accepted and alternative hypothesis was rejected at 5% level of significance.

4.29.4 Comparison of muscle power

In comparison of muscle power, it was found that range of motion improvement in experimental group was not significant in any muscles. Here, the observed value "U" of quadriceps muscle was 26.5 and the "p" value was 0.05, the observed value "U" of hamstring muscle was 31 and the "p" value was 0.10, the observed value "U" of dorsiflexor muscle was 35 and the "p" value was 0.17, the observed value "U" of planter flexor muscle was 45 and the "p" value was 0.31. Here, the observed "U" value of quadriceps, hamstring, dorsiflexor and planter flexor muscle was more than the table value (U=23). So, in these cases null hypothesis is accepted and alternative hypothesis is rejected at 5% level of significance.

4.29.5 Patient rated general physical disability within the experimental group

The pre-test and post -test Western Ontario and McMaster University Osteoarthritis Index (WOMAC) score was assessed to determine the improvement of the condition of physical disability. The experimental group is statically significant in pain in walking(Z=-2.53, p=0.01), morning stiffness (Z=-2, p=0.04), descending stairs (Z=-2.53, p=0.01), standing (Z=-1.89, p=0.05), walking on flat surface (Z=-2.23, p=0.02), going shopping (Z=-1.93, p=0.05), putting on socks (Z=-2.25, p=0.02), taking off socks (Z=-2.25, p=0.02), sitting (Z=-2.40, p=0.01), getting on/off toilet (Z=-1.89, p=0.05)

4.29.5 Patient rated general physical disability within the control group

The pre-test and post -test Western Ontario and McMaster University Osteoarthritis Index (WOMAC) score was assessed to determine the improvement of the condition of physical disability. The control group was significant in pain in nocturnal (Z=-2.81, p=0.005), pain in rest (Z=-2.12, p=0.03), morning stiffness(Z=-2.64, p=0.008), Stiffness occurring later in the day (Z=-2.64, p=0.008) , Descending stairs (Z=-2.12, p=0.03), Rising from sitting(Z=2, p=0.04), standing (Z=-2.07, p=0.03), Walking on flat surface (Z=-1.89, p=0.05) , Getting in/ out of car (Z=-2.12, p=0.03), Going shopping (Z=-2.12, p=0.03), Putting on socks

(Z=-2.73, p=0.006), Lying in bed (Z=-1.99, p=0.04), Taking off socks (Z=-2.04, p=0.041), Getting in/ out of bath (Z= -2.42, p=0.01), Sitting (Z=-2.42, p=0.01).

4.29.6 Patient rated general pain within the experimental group

The pre and post-test NPRS score was assessed to measure the level of pain .In experimental group, Z value was -2.15 and p value was 0.03. So, it is significant.

4.29.7 Patient rated general pain within the control group

The pre and post-test NPRS score was assessed to measure the level of pain. In control group, Z value was -2.54 and p value was 0.001. So, it is significant.

4.29.8 Patient rated range of motion within the experimental group

The pre-test and post test range of motion was measured to evaluate the progression of range of motion. In experimental group, the z value and p value of active knee flexion was z=-1.41 and p=0.015, the z value and p value of active knee extension was z= -1.41 and p=0.15, the z value and p value of passive knee flexion was z= -1 and p=0.31, the z value and p value of passive knee extension was z=0 and p=1. All of these values were not significant. All “p” values were more than 0.05.

4.29.9 Patient rated range of motion within the control group

The pre-test and post test range of motion was measured to evaluate the progression of range of motion. In control group, the z value and p value of active knee flexion was z=-2.82 and p=0.005, the z value and p value of active knee extension was z= -1.73 and p=0.08, the z value and p value of passive knee flexion was z= - 1.41 and p=0.15, the z value and p value of passive knee extension was z= 0 and p=1 . Here, only active knee flexion showed significance ($p < 0.05$).The rest of the movement did not show significance and all these p values were more than 0.05.

4.29.10 Patient rated muscle power within the experimental group

The pre -test and post -test manual muscle testing score was assessed to measure the improvement of muscle power. In experimental group, he z value and p value of quadriceps muscle was z= -1.89 and p=0.05, the z value and p value of hamstring muscle was z= -2.46 and p= 0.01, the z value and p value of dorsiflexor muscle was z= - 0.57 and p=0.56, the z value and p value of planter flexor muscle was z=-1.41 and p=0.15. Here, quadriceps and hamstring muscles showed significance.

4.29.11 Patient rated muscle power within the control group

The pre -test and post -test manual muscle testing score was assessed to measure the improvement of muscle power. In control group, the z value and p value of quadriceps muscle was z=-2.58 and p=0.01, the z value and p value of hamstring muscle was z= -2.64 and p=0.008, the z value and p value of dorsi flexor muscle was z=-2.33 and p=0.02, the z value and p value of planter flexor muscle was z=-2.53 and p= 0.001. Here, all four muscles showed significance. All the p values were less than 0.05.

CHAPTER –V DISCUSSION

The study was signposted a process that could be continuing to launch the result. Here the objective of this study could be succeeded if the researcher could show effective support. In this study the aim was to assess the effectiveness of kinesiotape over knee joint in knee osteoarthritis patients with traditional conventional physiotherapy compare to only traditional conventional physiotherapy for knee osteoarthritis patients.

In this investigational study 20 patients were registered and 10 patients were allotted to control group who received only conventional physiotherapy. The rest of 10 patients were given to experimental group who received kinesiotape over knee joint in knee osteoarthritis patients along with conventional physiotherapy. Each group joined for 6 sessions of treatment within three weeks in the Physiotherapy outpatient unit of CRP, Savar in order to exhibit the improvement and this is based on Tripathi & Hande, (2017) study.

The outcome was measured by using Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC) score for measuring the level of pain, stiffness and functional activities in several functional positions, Numeric Pain Rating Scale (NPRS) for evaluating pain intensity level, goniometer for assessing range of motion and manual muscle testing scale for measuring muscle power.

The male female ratio between 20 patients was 11:9 where 55% (n=11) were male and 45% (n=9) were female. Among them, In Control Group 30% (n=3) were male and 70% (n=7) were female and in Experimental Group 80% (n=8) were male and 20% (n=2) were female.

In this study, the mean age of experimental group was 57.7 years and the mean age of control group was 46.9 years.

Sarallahi et al., (2016) found in his study that average age in both in KT group and control group was 55.63 years; average height in KT and control group was 161.68 cm and 157.68 cm; average weight in KT and control group was 59 kg and 61 kg.

The analysis of significance was measured by using non parametric Mann-Whitney U test to compare the effectiveness of kinesiotape over knee joint along with conventional physiotherapy compared with only conventional physiotherapy for the management of osteoarthritis.

In pain intensity level, the researcher found improvement of pain. To measure the pain intensity level, researcher use numerical pain rating scale in pre-test and post-test intervention. The researcher found "p"=0.03 in experimental group on NPRS. In Experimental group, the pre and post-test mean on NPRS was 5.50 and 4.30. Here the mean difference was 1.2. The researcher found "p"=0.01 in control group on NPRS. In control group, the pre and post-test mean on NPRS was 6.60 and 5.10. In this case, mean difference is 1.5. Here, pain reduction level in experimental group is slightly less than control group.

In physical disability measurement, the mean pre and post WOMAC score in experimental group was 47.60 and 36.80 as well as mean difference was 10.8. In control group the mean pre and post WOMAC score was 58.80 and 44.00. Here mean difference was 14.8. Researcher found that physical disability reduces less in experimental group than the control group.

In range of motion measurement, in experimental group the post "p" value of active and passive knee flexion (p=0.15; p=0.35), active and passive knee extension (p=0.15; p=1.00) was not significant. Here, all "p" value was more than 0.05. In control group, post active knee flexion showed significant value (p=0.005) and passive knee flexion (p=0.15), active and passive knee extension (p=0.08; p=1.00) was not significant.

In muscle power measurement, manual muscle testing scale was used. In experimental group, the "p" value of post quadriceps muscle, hamstring muscle was "p"=0.05 and

“p”=0.01 and it was significant but the post “p” value of dorsiflexor and planter flexor (“p”=0.56, “p”=0.15) was not significant. In control group, the post “p” value of quadriceps, hamstring, dorsiflexor and planter flexor (“p”=0.01, “p”=0.01, “p”=0.02 and “p”=0.01) was significant.

Conventional therapy is effective in knee OA but Kinesiotaping and conventional therapy is more effective in decreasing the osteoarthritis knee pain (Tripathi & Hande, 2017).

Kinesiotape has a small beneficial effect on strength and active range of motion (Williams et al., 2011).Kocyigit et al., (2015) stated that Kinesiotaping is effective as adjunct therapy in the management of knee OA patients for activity and nocturnal pain control. Rahlf, Braumann & Zech, (2018) did not find the significant effect of kinesiotape in standing balance of knee osteoarthritis while there were no changes in knee extensor strength, walking speed and knee range of motion.

Quadriceps kinesiotape improves knee joint proprioception in knee osteoarthritis but does not cause significant changes in pain and functional ability (Sarallahi et al., 2016).

Saswadkar et al., (2016) stated that facilitatory kinesiotape on vastus medialis muscle improves spatio-temporal gait parameters but has no effects on strength and functional enhancements in knee osteoarthritis patients. Facilitatory KT did not improve muscle activity and inhibitory KT did not reduce muscle activity (Cai et al., 2015).

The result of the present study showed that the 6 session treatment brought less significant reduction in knee pain, improvement in function, range of motion and muscle power both the experimental group and control group. But the reduction in pain, improvement in function in the experimental group is less significant than control group, in range of motion both experimental and control group did not show significant improvement but in muscles power control group showed more significance than the experimental group.

LIMITATIONS OF THE STUDY

The study was accompanied with 20 patients of knee osteoarthritis. There were 10 patients in each group .It was a small size of samples in both groups and was not sufficient for the study to generalize the findings to the huge population of knee osteoarthritis. .As well as, the researcher did not get enough time for such a good study and this is the main limitations of the study. There was less amount of knee osteoarthritis patients so why researcher took a large age range of the patients. The patients did not take the treatment continuously. In some treatment sessions, KT was not applied due to excessive swelling of the knee joint. Actually, the treatment of knee osteoarthritis is done for a prolong period of time and it takes more time to come round and sometimes it is impossible to cure fully due to the severe conditions of the osteoarthritis in which case surgery is mandatory.

Here, physiotherapists could not be blinded to the interventions properly. This research was done in CRP, Savar which is not a big area, so it was quite tough to keep the confidentiality of the study for blinding procedure.

Therefore, single blinding method was used in this study. There are a few literatures about the effectiveness of kinesiotape in knee OA patients in the perspective of Bangladesh so it was quite difficult to compare the study with the other research.

CHAPTER-VI CONCLUSION AND RECOMMENDATION

6.1. CONCLUSION

The result of the study acknowledged that the effectiveness of kinesiotape over knee joint along with conventional physiotherapy was not better than only conventional physiotherapy for the patients of knee osteoarthritis in reducing physical disability of WOMAC score and pain intensity. Kinesiotape over knee joint in knee osteoarthritis was not effective in improvement of range of motion and in increasing muscle power. Hence, only conventional physiotherapy showed more effectiveness in increasing muscle power than kinesiotape over knee joint along with conventional physiotherapy. Kinesiotape has role in instable knee joint as supportive treatment.

There were some variables in experimental group which were significant in between and within group analysis but the number of the significant variables were less than the significant variables in control group in between and within group analysis. So, it is not necessary to use Kinesiotape in knee osteoarthritis but it may be helpful during activities as a protective regimen and to reduce the risk of further damage of the structure. It also reduces the characteristics of knee osteoarthritis. It is helpful in rehabilitation of knee osteoarthritis.

6.2. RECOMMENDATION

The researcher delivered only 6 sessions of treatment to both groups and measured physical disability, pain intensity level, range of motion and muscle power. Here, the researcher was unable to estimate the long term effect due to lack of time. If the treatment could be continued for more sessions it could estimate the long term effect.

Here, the researcher had collected only 10 patients in each group and it is very small in number to comprehensive the result. So, it is also recommended to increase the number of participants for further studies. In this study, treatment was given by different physiotherapist, so it is recommended to treat the patients by single physiotherapist to provide better treatment.

CHAPTER-VI REFFERENCES

Arden, N., Blanco, F. J., and Bruyère, O., (2018). Epidemiology of osteoarthritis. Atlas of Osteoarthritis:18.

Blalock, D., Miller, A., Tilley, M., and Wang, J., (2015). Joint instability and osteoarthritis. Clinical Medicine Insights: Arthritis and Musculoskeletal Disorder 8, CMAMD-S22147.

Brosseau, L., Taki, J., Desjardins, B., Thevenot, O., Fransen, M., Wells, G. A., and Gifford, W., (2017). The Ottawa panel clinical practice guidelines for the management of knee osteoarthritis. Part two: strengthening exercise programs. Clinical Rehabilitation,31(5):596-611.

Cai, C., Au, I. P. H., An, W., and Cheung, R. T. H., (2016). Facilitatory and inhibitory effects of Kinesio tape: Fact or fad? Journal of Science and Medicine in Sport,19(2):109-111

Cho, H. Y., Kim, E. H., Kim, J., and Yoon, Y. W., (2015). Kinesio taping improves pain, range of motion, and proprioception in older patients with knee osteoarthritis: a randomized controlled trial. American Journal of Physical Medicine & Rehabilitation,94(3):192-200

Cho HJ., Morey V., Kang JY, Kim KW., and KimTK.,(2015). Prevalence and Risk Factors of Spine, Shoulder, Hand, Hip, and Knee Osteoarthritis in Community-dwelling Koreans Older Than Age 65 Years. Clinical Orthopaedics and Related Research. 473(10):3307–3314

Csapo, R., and Alegre, L.M., 2015. Effects of Kinesiotaping on skeletal muscle strength—A meta-analysis of current evidence. Journal of Science and Medicine in Sport, 18(4):450-456.

Datta, A.K., (2007). Essentials of Human Anatomy-Superior and Inferior Extremities (reprint), Kolkata: Current Books International.

Felson, D. T., Niu, J., Neogi, T., Goggins, J., Nevitt, M. C., Roemer, F., and Group, M. I., (2016). Synovitis and the risk of knee osteoarthritis: the MOST Study. Osteoarthritis and Cartilage,24(3):458-464.

Foreman, S. C., Neumann, J., Joseph, G. B., Nevitt, M. C., McCulloch, C. E., Lane, N. E., and Link, T. M., (2019). Longitudinal MRI structural findings observed in accelerated knee osteoarthritis: data from the Osteoarthritis Initiative. Skeletal Radiology: 1-11.

Fransen, M., McConnell, S., Harmer, A. R., Van der Esch, M., Simic, M., and Bennell, K. L.,(2015). Exercise for osteoarthritis of the knee: a Cochrane systematic review. British Journal of Sports Medicine,49(24): 1554-1557.

Haq, S. A., and Davatchi, F., (2011). Osteoarthritis of the knees in the COPCORD world. International Journal of Rheumatoid Disease,14(2): 122-129.

Heiden, T.L., Lloyd, D.G., and Ackland, T.R., 2009. Knee joint kinematics, kinetics and muscle co-contraction in knee osteoarthritis patient gait. Clinical Biomechanics, 24(10):833-841.

Hicks, C.M., (2009). Research Methods for Clinical Therapists- Applied project design and analysis, 5th edition, London: Churchill Livingstone.

Landsmeer, M. L., Runhaar, J., van Middelkoop, M., Oei, E. H., Schiphof, D., Bindels, P. J., and Bierma-Zeinstra, S. M., (2019). Predicting knee pain and knee osteoarthritis among overweight women. The Journal of the American Board of Family Medicine, 32(4):575-584.

Jeanmaire, C., Mazières, B., Verrouil, E., Bernard, L., Guillemin, F., and Rat, A. C., (2018), Parry, E.L., Thomas, M.J., and Peat, G., 2018. Defining acute flares in knee osteoarthritis: a systematic review. British Medical Journal,8(7): p.e019804

Junker, S., Krumbholz, G., Frommer, K. W., Rehart, S., Steinmeyer, J., Rickert., and Neumann, E., (2016). Differentiation of osteophyte types in osteoarthritis–proposal of a histological classification. Joint Bone Spine, 83(1):63-67.

Kaufman, K.R., Hughes, C., Morrey, B.F., Morrey, M., and An, K.N., 2001. Gait characteristics of patients with knee osteoarthritis. Journal of Biomechanics, 34(7):907-915.

Kocyigit, F., Turkmen, M.B., Acar, M., Guldane, N., Kose, T., Kuyucu, E., and Erdil, M., 2015. Kinesio taping or sham taping in knee osteoarthritis? A randomized, double-blind, sham-controlled trial. Complementary Therapies in Clinical Practice, 21(4):262-267.

Lee KM., Chung CY., Sung KH., Lee SY., WonSH., and Kim TG.,(2015). Risk factors for osteoarthritis and contributing factors to current arthritic pain in south Korean older adults. Yonsei Medical Journal:56(1): 124–131

Lespasio, M. J., Piuzzi, N. S., Husni, M. E., Muschler, G. F., Guarino, A. J., and Mont, M. A., (2017). Knee osteoarthritis: a primer. The Permanent Journal:21

Ledingham, J., Regan, M., Jones, A., and Doherty, M., 1993. Radiographic patterns and associations of osteoarthritis of the knee in patients referred to hospital. Annals of the Rheumatic Diseases,52(7):520-526.

Meireles, S., De Groote, F., Reeves, N. D., Verschueren, S., Maganaris, C., Luyten, F., and Jonkers, I., (2016). Knee contact forces are not altered in early knee osteoarthritis. Gait & Posture,45:115-120

O'Neill, T. W., and Felson, D. T., (2018). Mechanisms of osteoarthritis (OA) pain. Current Osteoporosis Reports,16(5): 611-616.

Musumeci, G., 2017. Functional anatomy in knee osteoarthritis: Patellofemoral joint vs. Tibiofemoral joint.

Park, K.N. and Kim, S.H., 2018. Effects of knee taping during functional activities in older people with knee osteoarthritis: A randomized controlled clinical trial. Geriatrics & Gerontology International, 18(8):1206-1210.

Parry, E.L., Thomas, M.J., and Peat, G., (2018). Defining acute flares in knee osteoarthritis: a systematic review. British Medical Journal 8(7): p.e019804.

Parsons, C., Fuggle, N. R., Edwards, M. H., Goulston, L., Litwic, A. E., Jagannath, D., and EPOSA Research Group. (2018). Concordance between clinical and radiographic evaluations of knee osteoarthritis. Aging Clinical and Experimental Research, 30(1):17-25.

Perrot, S. 2015. Osteoarthritis pain. Best Practice & Research Clinical Rheumatology, 29(3): 90-97.

Peter, W. F., Hurkmans, E. J., van der Wees, P. J., Hendriks, E. J. M., van Bodegom-Vos, L., and Vliet Vlieland, T. P. M., (2016). Healthcare quality indicators for physiotherapy management in hip and knee osteoarthritis and rheumatoid arthritis: a Delphi study. Musculoskeletal Care,14(4): 219-232.

Rahlf, A.L., Braumann, K.M., and Zech, A., 2018. Kinesio Taping Improves Perceptions of Pain and Function of Patients With Knee Osteoarthritis: A Randomized, Controlled Trial. Journal of Sport Rehabilitation, (00):1-7.

Roos, E. M., and Arden, N. K., (2016). Strategies for the prevention of knee osteoarthritis. Nature Review Rheumatology,12(2): 92.

Sarallahi, M., Amiri, A., Sarafzadeh, J., and Jamshidi, A. A., (2016). The effect of quadriceps kinesio tape on functional disability, pain, and knee joint position sense in knee osteoarthritis patients. Journal of Clinical Physiotherapy Research,1(2):73-78.

Saxby, D. J., and Lloyd, D. G., (2017), Osteoarthritis year in review 2016: mechanics. Osteoarthritis and Cartilage,25(2):190-198.

Saswadkar, A. A., Shimpi, A. P., Shyam, A., and Sancheti, P. K., (2016). Short term effects of kinesio taping on Vastus Medialis in Patients with Osteoarthritis Knee for gait and joint function enhancement. Journal of Evidance –Based Physiotherapy and Research,(1): 27-30.

Schiphof, D., Waarsing, J., Oei, E., and Bierma-Zeinstra, S., (2019). Associations of progression of osteoarthritis MRI features with the course of knee pain over a five years period in an open female population. Osteoarthritis and Cartilage,27: 340-341.

Silverwood, V., Blagojevic-Bucknall, M., Jinks, C., Jordan, J.L., Protheroe, J. and Jordan, K.P., 2015. Current evidence on risk factors for knee osteoarthritis in older adults: a systematic review and meta-analysis. Osteoarthritis and Cartilage, 23(4):507-515.

Tani, K., Kola, I., Shpata, V., and Dhamaj, F., (2018). Evaluation of Gait Speed after Applying Kinesio Tape on Quadriceps Femoris Muscle in Patients with Knee Osteoarthritis. Open Access Macedonian Journal of Medical Science,6(8):1394.

Torres, R., Trindade, R., and Gonçalves, R.S., 2016. The effect of kinesiology tape on knee proprioception in healthy subjects. Journal of Body Work and Movement Therapies, 20(4):857-862.

Tripathi, B., and Hande, D., 2017. Effects of kinesiotaping on osteoarthritis of knee in geriatric population. International Journal of Applied Research, 3(2):301-305.

Vina, E. R., and Kwoh, C. K., (2018). Epidemiology of osteoarthritis: literature update. Current Opinion in Rheumatology,30(2): 160-167.

Wang, Y., Teichtahl, A. J., Abram, F., Hussain, S. M., Pelletier, J. P., Cicuttini, F. M., and Martel-Pelletier, J., (2018). Knee pain as a predictor of structural progression over 4 years: data from the Osteoarthritis Initiative, a prospective cohort study. Arthritis Research & Therapy,20(1): 250.

Walsh, N. E., Pearson, J., and Healey, E. L., (2017). Physiotherapy management of lower limb osteoarthritis. British Medical Bulletin, 122 (1): 151-153

Yeung, S. S., and Yeung, E. W., (2016). Acute effects of kinesio taping on knee extensor peak torque and stretch reflex in healthy adults. Medicine,95(4)

Zamri, N.A.A., Harith, S., Yusoff, N.A.M., Hassan, N.M., and Qian Ong, Y., 2019. Prevalence, Risk factors and primary prevention of osteoarthritis in Asia: A Scoping Review. Elderly Health Journal, 5(1):19-31.

Zhang J.F., Song L.H., Wei J.N., Zhang A.L., Dong H.Y., and Wen H.Y., (2016). Prevalence of and risk factors for the occurrence of symptomatic osteoarthritis in rural regions of Shanxi Province, China. International Journal of Rheumatic Diseases. 19(8): 781–78.

Appendix -I

CONSENT FORM (ENGLISH)

Title: Effectiveness of Kinesiotape over Knee Joint in Knee Osteoarthritis Patients.

Assalamualaikum / Namashker,

I am Md.Zahid hasan, the final year B.Sc. (Hon's) in physiotherapy student of Bangladesh Health Professions Institute (BHPI) under Medicine faculty of University of Dhaka .To obtain my Bachelor degree, I shall have to conduct a research and it is a part of my study .The participants are requested to participate in the study after reading the following .My research title is **"Effectiveness of Kinesiotape over Knee Joint in Knee Osteoarthritis Patient" .**Through this study I will find the effect of kinesiotape over knee joint in osteoarthritis patients. If I can complete the study successfully, the patient may get the benefits of improve musculoskeletal outdoor physiotherapy service .To implement my research project, I need to collect data from the musculoskeletal patients .Therefore, you could be one of my valuable subjects for my study.

I am committed that the study will not pose any harm or risk to you .You have the absolute right to withdraw or discontinue at any time without any hesitation or risk. I will keep the information confidential which I obtained from you and personal identification of the participant would not be published anywhere. If you have any query about the study, you may contact with me or my supervisor Md.Zahid Hossain, Lecturer in Physiotherapy Department, BHPI, CRP, Savar, Dhaka-1343.

Date and signature of participant: ……...

Date and signature of researcher: ……...

Date and signature of witness…….

APPENDIX-II

Research Title: Effectiveness of Kinesiotape over Knee Joint in Knee Osteoarthritis Patients.

Questionnaire (English)

Part-I: Socio-demographic information

Patient Id No: **Code No:**

1.Name of patient	
2.Age	
3.Sex	Male ☐ Female☐
4.Address	Village/Area: P/O: P/S: District:
5.Contact no	
6.Weight	.....Kg
7.Height	…….Cm
8. Dominant side	Right☐ Left☐
9.Affected side	Right☐ Left☐
10.Education	
11.Occupation	
12.Start time of intervention	
13.End time of intervention	
14.Concent taken	Yes ☐ No☐

Pre-Test Data

Part-II: Physical disability questionnaire

This questionnaire is developed according to, "The Western Ontario and Mac Master Universities Osteoarthritis Index (WOMAC SCORE)" for measuring the pain and disability of the patient with knee osteoarthritis.
Each question has 4 score. Total questions are 24. Total number is 96.

Pre - test score of the patient is _____ / 96.

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

0 = None

1 = Slight

2 = Moderate

3 = Very

4 = Extremely

Circle one number for each activity

A) Pain:

1. How much pain do you feel during walking?	0	1	2	3	4
2. How much pain do you feel during stair climbing?	0	1	2	3	4
3. How much pain do you feel during sleeping at night?	0	1	2	3	4
4. How much pain do you feel during resting time?	0	1	2	3	4
5. How much pain do you feel during weight bearing?	0	1	2	3	4

B) Stiffness:

1. How much stiffness do you feel in knee joint in the morning?	0	1	2	3	4
2. How much stiffness do you feel in knee joint later in the day	0	1	2	3	4

C) Physical Function:

1. How much problem do you feel during descending stairs?	0	1	2	3	4
2. How much problem do you feel during ascending stairs?	0	1	2	3	4
3. How much problem do you feel during rising from sitting?	0	1	2	3	4
4. How much problem do you feel during standing?	0	1	2	3	4
5. How much problem do you feel during bending to floor?	0	1	2	3	4
6. How much problem do you feel during walking on flat surface?	0	1	2	3	4
7. How much problem do you feel during getting in/ out of car?	0	1	2	3	4
8. How much problem do you feel during going shopping?	0	1	2	3	4
9. How much problem do you feel during putting on socks?	0	1	2	3	4
10. How much problem do you feel during lying in bed?	0	1	2	3	4
11. How much problem do you feel during taking off socks?	0	1	2	3	4
12. How much problem do you feel during rising from bed?	0	1	2	3	4
13. How much problem do you feel during getting in/ out of bath?	0	1	2	3	4
14. How much problem do you feel during sitting?	0	1	2	3	4
15. How much problem do you feel during getting on/ off toilet ?	0	1	2	3	4
16. How much problem do you feel during doing heavy domestic duties?	0	1	2	3	4
17. How much problem do you feel during doing light domestic duties?	0	1	2	3	4

Result of patient before taken treatment _____ /96

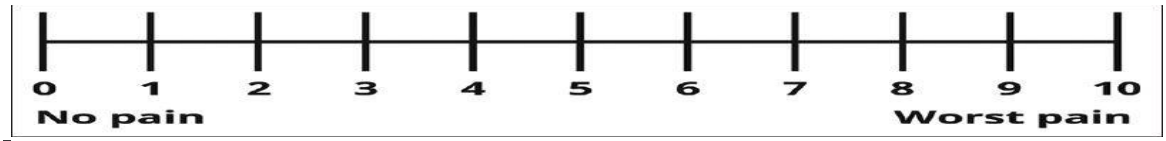
Part-III: Pain Intensity

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

Instructions:

0=No pain 1-3=Mild pain 4-6=Moderate pain 7-10=Severe pain

How intense is your pain now?



Part-IV: Estimate the Range Of Motion

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

Goniometer is used for taking measurement.

Instructions:

0=Normal 1=Mild loss 2=Moderate loss 3=Severe loss

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

Part-V: Estimate Muscle Power

According to Manual Muscle Testing Scale how much muscle power in knee will be measured

Instructions:

Code	Grade	Points
0	0	No visible or palpable contraction
1	1	Visible or palpable contraction
2	2-	Partial ROM, gravity eliminated
3	2	Full ROM, gravity eliminated
4	2+	Gravity eliminated /slight resistance or <1/2 range against gravity
5	3-	>1/2 but <Full ROM, against gravity
6	3	Full ROM against gravity
7	3+	Full range of motion against gravity, slight resistance
8	4-	Full ROM against gravity, mild resistance
9	4	Full ROM against gravity, moderate resistance
10	4+	Full ROM against gravity, almost full resistance
11	5	Normal, maximal resistance

Name of muscle	Action \movement	Muscle power
Quadriceps	Knee extension	
Hamstring	Knee flexion	
Dorsi flexor muscle	Dorsi flexion of foot	
Planter flexor muscle	Planter flexion of foot	

Post-Test Data

Part-II: Physical disability questionnaire

This questionnaire is developed according to, "The Western Ontario and MacMaster Universities Osteoarthritis Index (WOMAC SCORE)" for measuring the pain and disability of the patient with knee osteoarthritis.
Each question has 4 score. Total questions are 24. Total number is 96.

Post - test score of the patient is _____ / 96.

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

5 = None

6 = Slight

7 = Moderate

8 = Very

9 = Extremely

Circle one number for each activity

A) Pain:

1. How much pain do you feel during walking?	0	1	2	3	4
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3. How much pain do you feel during sleeping at night?	0	1	2	3	4
4. How much pain do you feel during resting time?	0	1	2	3	4
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1. How much stiffness do you feel in knee joint in the morning?	0	1	2	3	4
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C) Physical Function:

1. How much problem do you feel during descending stairs?	0	1	2	3	4
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4. How much problem do you feel during standing?	0	1	2	3	4
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6. How much problem do you feel during walking on flat surface?	0	1	2	3	4
7. How much problem do you feel during getting in/ out of car?	0	1	2	3	4
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12. How much problem do you feel during rising from bed?	0	1	2	3	4
13. How much problem do you feel during getting in/ out of bath?	0	1	2	3	4
14. How much problem do you feel during sitting?	0	1	2	3	4
15. How much problem do you feel during getting on/ off toilet?	0	1	2	3	4
16. How much problem do you feel during doing heavy domestic duties?	0	1	2	3	4
17. How much problem do you feel during doing light domestic duties?	0	1	2	3	4

Result of patient after taken treatment _____ /96

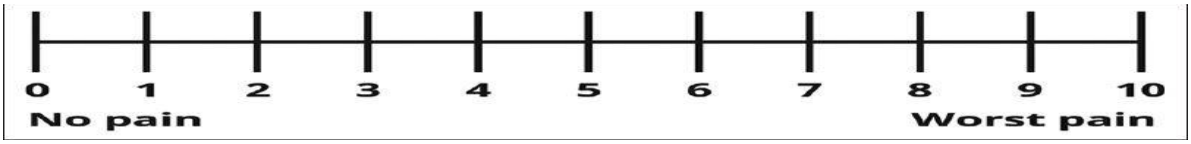
Part-III: Pain Intensity

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

Instructions:

0=No pain 1-3=Mild pain 4-6=Moderate pain 7-10=Severe pain

How intense is your pain now?



Part-IV: Estimate the Range Of Motion

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

Goniometer is used for taking measurement.

Instructions:

0=Normal 1=Mild loss 2=Moderate loss 3=Severe loss

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

Part-V: Estimate Muscle Power

According to Manual Muscle Testing Scale how much muscle power in knee will be measured

Instructions:

Code	Grade	Points
0	0	No visible or palpable contraction
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2	2-	Partial ROM, gravity eliminated
3	2	Full ROM, gravity eliminated
4	2+	Gravity eliminated /slight resistance or <1/2 range against gravity
5	3-	>1/2 but <Full ROM, against gravity
6	3	Full ROM against gravity
7	3+	Full range of motion against gravity, slight resistance
8	4-	Full ROM against gravity, mild resistance
9	4	Full ROM against gravity, moderate resistance
10	4+	Full ROM against gravity, almost full resistance
11	5	Normal, maximal resistance

Name of muscle	Action \movement	Muscle power
Quadriceps	Knee extension	
Hamstring	Knee flexion	
Dorsi flexor muscle	Dorsi flexion of foot	
Planter flexor muscle	Planter flexion of foot	

এপেন্ডিক্স-৩	মৌখিক সম্মতি পত্র

শিরোনামঃ হাঁটুর অস্টিওআর্থ্রাইটিস এ হাঁটুর উপর কাইনেসিও টেপ এর কার্যক্ষমতা।

আসসালামুআলাইকুম / নমস্কার

আমি মোঃ জাহিদ হাসান ,শেষ বর্ষ , ঢাকা বিশ্ববিদ্যলয়ের মেডিসিন অনুষদ অধীনে বাংলাদেশ হেলথ প্রফেশন্স ইনসটিটিউট (বিএইচপিআই) এর বি.এস.সি. ফিজিওথেরাপি বিভাগ এর ছাত্র । আমার ব্যাচেলর ডিগ্রী অর্জনের জন্য একটি গবেষণা করতে হবে এবং এটা আমার অধ্যয়নের একটি অংশ। অংশগ্রহণকারীদের নিম্ন লিখিত অংশ পড়ার পর গবেষণায় অংশগ্রহনের জন্য অনুরোধ করা হল। আমার গবেষণার শিরোনাম "**হাঁটুর অস্টিওআর্থ্রাইটিস এ হাঁটুর উপর কাইনেসিও টেপ এর কার্যক্ষমতা**"। এই গবেষনার মাধ্যমে আমি হাঁটুর অস্টিওআর্থ্রাইটিস এর রোগীদের উপর প্রচলিত থেরাপির সাথে কাইনেসিও টেপ এর কার্যকারিতা খুজে বের করার চেষ্টা করব। আমার গবেষণা সঠিকভাবে শেষ করতে পারলে মাস্কুলস্কেলিটাল বহির্বিভাগ ফিজিওথেরাপি সেবার মাধ্যমে রোগী উপকৃত হবেন। আমার গবেষনা প্রকল্প বাস্তবায়নের জন্য সম্মানিত অংশগ্রহনকারী হতে পারেন।

আমি প্রতিশ্রুতিবদ্ধ যে ,আমার গবেষণায় আপনার কোন ক্ষতি বা গুরুতর বিপদ হবে না। আপনার যেকোন দ্বিধা বা ঝুকি ছাড়াই যে কোন সময় নিজেকে এ গবেষণা থেকে প্রত্যাহারের অধিকার আছে। আমি প্রতিশ্রুতি বদ্ধ যে, আপনার সকল নিজস্ব সনাক্ত করন কোথাও প্রকাশ করা হবে না, প্রাপ্ত তথ্য গোপনীও রাখা হবে। যদি গবেষণা সম্পর্কে আপনার কোন জিজ্ঞাসা থাকে তবে আপনি অনুগ্রহ পূর্বক আমার সাথে অথবা আমার নির্দেশক মোঃ জাহিদ হোসেন, লেকচারার ,ফিজিওথেরাপি বিভাগ ,বিএইচপিআই,সিআরপি, সাভার ,ঢাকা-১৩৪৩ এর সাথে যোগাযোগ করতে পারেন।

অংশগ্রহনকারীর স্বাক্ষর ও তারিখঃ……..…

গবেষকের স্বাক্ষর ও তারিখঃ……

স্বাক্ষীর স্বাক্ষর ও তারিখঃ……...

এপেন্ডিক্স- ৪	প্রশ্নোপত্র (বাংলা)

গবেষণার বিষয়ঃ "হাঁটুর অস্টিওআর্থ্রাইটিস এ হাঁটুর উপর কাইনেসিও টেপ এর কার্যকারিতা"

অংশ-১: সামাজিক প্রেক্ষাপটের তথ্যাবলী

রোগী নাম্বারঃ কোড নাম্বারঃ-

১।রোগীর নাম	
২।বয়স	.....বছর
৩।লিঙ্গ	পুরূষ□ মহিলা□
৪।ঠিকানা	গ্রাম/এলাকাঃ ডাকঘরঃ থানাঃ জেলাঃ
৫।যোগাযোগ নাম্বার	
৬।ওজন	.....কে.জি.
৭।উচ্চতা	.....সে.মি.
৮।প্রধান পাশ	ডান □ বাম□
৯।আক্রান্ত পাশ	ডান □ বাম□
১০।শিক্ষাগত যোগ্যতা	
১১।পেশা	
১২।হস্তক্ষেপের সময় শুরু	
১৩।হস্তক্ষেপের সময় শেষ	
১৪।অনুমতি গ্রহন	হ্যা □ না □

চিকিৎসা পূর্ববর্তী তথ্য

অংশ-২: শারীরিক অক্ষমতার প্রশ্নাবলী

এই প্রশ্নপত্রটি তৈরি করা হয়েছে ওয়েস্টার্ন অন্টারিও ও ম্যাকমাস্টার ইউনিভার্সিটি অস্টিওআর্থ্রাইটিস ইনডেক্স (ওম্যাক স্কোর) অনুযায়ী অস্টিওআর্থ্রাইটিস রোগীদের হাটুর ব্যাথা ও অক্ষমতাজনিত তথ্যাবলী পরিমাপের জন্য ।

প্রতিটি প্রশ্নের চারটি স্কোর আছে, সর্বমোট প্রশ্ন ২৪ এবং সর্বমোট ফলাফল ৯৬
চিকিৎসার পূর্ববর্তী রোগীর প্রাপ্ত নাম্বার_____ / ৯৬.

নির্দেশনাবলীঃ দয়া করে প্রত্যেক ধরনের কাজকে নিচের কাঠিন্যের মাপকাঠি অনুযায়ী নির্ধারণ করুন

০ = নাই ১ = অল্প ২= মাঝারী ৩= অনেক ৪=সর্বাধিক

প্রতিটি কাজের জন্য একটা সংখ্যায় গোল দাগ দিন

ক) ব্যথা

১ । হাটাহাটি করার সময় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
২ ।সিড়ি দিয়ে উঠার সময় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
৩ । রাতের বেলায় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
৪ । বিশ্রামের সময় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
৫। যখন ওজন বহন করেন তখন আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪

খ) শক্ত হওয়া

১ । সকালে আপনার হাটুর শক্ত হওয়ার মাত্রা কেমন?	০	১	২	৩	৪
২ । দিনের অন্য সময় আপনার হাটুর শক্ত হওয়ার মাত্রা কেমন?	০	১	২	৩	৪

গ) শারীরিক কাজ

১। সিঁড়ি দিয়ে নামার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
২। সিঁড়ি দিয়ে উঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৩। বসা থেকে উঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৪। দাঁড়িয়ে থাকা অবস্থায় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৫ ।সমতলে হাটূ ভাজ করে বসার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৬। সমতলে হাঁটার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৭। যানবাহনে উঠার সময় বা যানবাহন থেকে নামার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৮। কেনাকাটা করার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৯। মোজা পরার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১০। বিছানায় শুয়ে থাকা অবস্থায় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১১। মোজা খোলার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১২। শোয়া থেকে ওঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৩। গোসলে যাওয়ার সময় /বের হওয়ার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৪। বসে থাকা অবস্থায় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৫। টয়লেটে বসা বা উঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৬। বাসার ভারী কাজ করার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৭। বাসার হালকা কাজ করার করার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪

চিকিৎসার পুর্বে রোগীর প্রাপ্ত নাম্বার_____ / ৯৬

অংশ ৩: ব্যথার তীব্রতা

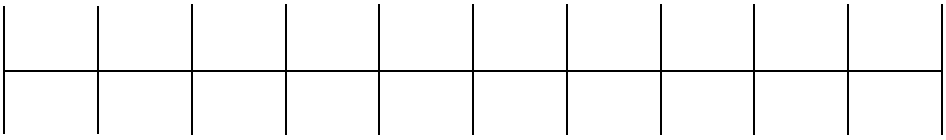
নীচের স্কেলে গোল দাগ দিয়ে বুঝিয়ে দিন আপনার ব্যথা কতটা তীব্র।

নির্দেশনাবলীঃ

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

আপনার ব্যথা এখন কতটা তীব্র?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০



কোনো ব্যথা নাই তীব্র ব্যথা

অংশ-৪: গতির পরিসীমা নির্ণয়

তথ্য সংগ্রহ পত্রের এই অংশটি হাটুর গতির পরিসীমা নির্ণয় করার জন্য তৈরী করা হয়েছে । পরিমাপক যন্ত্র হিসেবে গোনিওমিটার ব্যাবহার করা হয়েছে ।

নির্দেশনাবলীঃ

০=স্বাভাবিক ১=অল্প হ্রাস পেয়েছে ২=মাঝারি হ্রাস পেয়েছে ৩=অনেক খানি হ্রাস পেয়েছে

নড়াচড়া	**গতির পরিসীমা**
হাটু সংকোচন(সক্রিয়)	
হাটু প্রসারণ(সক্রিয়)	
হাটু সংকোচন(পরোক্ষ)	
হাটু প্রসারণ(পরোক্ষ)	

অংশ-৫: মাংসপেশীর শক্তির পরিমাপ

ম্যানুয়াল মাসল টেস্টিং অনুযায়ী হাটুর মাংসপেশীতে কতখানি শক্তি আছে তা পরিমাপ করা হবে।

নির্দেশনাবলীঃ

কোড	গ্রেড	টীকা
০	০	কোন দৃশ্যমান বা অনুধাবনযোগ্য সংকোচন নেই
১	১	দৃশ্যমান বা অনুধাবনযোগ্য সংকোচন বিদ্যমান
২	২-	মধ্যাকর্ষন এর সাথে অল্প গতিসীমা বিদ্যমান
৩	২	মধ্যাকর্ষন এর সাথে সম্পূর্ণ গতিসীমা বিদ্যমান
৪	২+	মধ্যাকর্ষন এর সাথে অল্প বাধাতে সম্পূর্ণ গতিসীমা অথবা মধ্যাকর্ষন এর বিপরীতে <১/২ গতিসীমা বিদ্যমান
৫	৩-	মধ্যাকর্ষন এর বিপরীতে অর্ধেক এর বেশী অথবা সম্পূর্ণ এর কম গতিসীমা বিদ্যমান
৬	৩	মধ্যাকর্ষন এর বিপরীতে সম্পূর্ণ গতিসীমা বিদ্যমান
৭	৩+	মধ্যাকর্ষন এর বিপরীতে হালকা বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
৮	৪-	মধ্যাকর্ষন এর বিপরীতে অল্প বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
৯	৪	মধ্যাকর্ষন এর বিপরীতে মাঝারি বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
১০	৪+	মধ্যাকর্ষন এর বিপরীতে প্রায় পূর্ণ বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
১১	৫	স্বাভাবিক,সর্বোচ্চ বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান

মাংসপেশীরনাম	কাজ/নড়াচড়া	মাংসপেশীর শক্তি
কোয়াড্রিসেপ্স	হাটু প্রসারণ	
হ্যামস্ট্রিং	হাটু সংকোচন	
ডরসিফ্লেক্সর	পায়ের ডরসিফ্লেক্সন	
প্লান্টারফ্লেক্সর	পায়ের প্লান্টারফ্লেক্সন	

চিকিৎসা পরবর্তী তথ্য

অংশ-২: শারীরিক অক্ষমতার প্রশ্নাবলী

এই প্রশ্নপত্রটি তৈরি করা হয়েছে ওয়েস্টার্ন অন্টারিও ও ম্যাকমাস্টার ইউনিভার্সিটি অস্টিওআর্থ্রাইটিস ইনডেক্স (ওম্যাক স্কোর) অনুযায়ী অস্টিওআর্থ্রাইটিস রোগীদের হাটুর ব্যাথা ও অক্ষমতাজনিত তথ্যাবলী পরিমাপের জন্য ।

প্রতিটি প্রশ্নের চারটি স্কোর আছে, সর্বমোট প্রশ্ন ২৪ এবং সর্বমোট ফলাফল ৯৬
চিকিৎসার পরবর্তী রোগীর প্রাপ্ত নাম্বার_____ / ৯৬.

নির্দেশনাবলীঃ দয়া করে প্রত্যেক ধরনের কাজকে নিচের কাঠিন্যের মাপকাঠি অনুযায়ী নির্ধারণ করুন

০ = নাই ১ = অল্প ২= মাঝারী ৩= অনেক ৪=সর্বাধিক

প্রতিটি কাজের জন্য একটা সংখ্যায় গোল দাগ দিন

ক) ব্যথা

১ । হাটাহাটি করার সময় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
২ ।সিড়ি দিয়ে উঠার সময় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
৩ । রাতের বেলায় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
৪ । বিশ্রামের সময় আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪
৫। যখন ওজন বহন করেন তখন আপনার ব্যথার মাত্রা কেমন?	০	১	২	৩	৪

খ) শক্ত হওয়া

১ । সকালে আপনার হাটুর শক্ত হওয়ার মাত্রা কেমন?	০	১	২	৩	৪
২ । দিনের অন্য সময় আপনার হাটুর শক্ত হওয়ার মাত্রা কেমন?	০	১	২	৩	৪

গ) শারীরিক কাজ

১। সিঁড়ি দিয়ে নামার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
২। সিঁড়ি দিয়ে উঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৩। বসা থেকে উঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৪। দাঁড়িয়ে থাকা অবস্থায় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৫ ।সমতলে হাটূ ভাজ করে বসার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৬। সমতলে হাঁটার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৭। যানবাহনে উঠার সময় বা যানবাহন থেকে নামার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৮। কেনাকাটা করার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
৯। মোজা পরার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১০। বিছানায় শুয়ে থাকা অবস্থায় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১১। মোজা খোলার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১২। শোয়া থেকে ওঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৩। গোসলে যাওয়ার সময় /বের হওয়ার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৪। বসে থাকা অবস্থায় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৫। টয়লেটে বসা বা উঠার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৬। বাসার ভারী কাজ করার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪
১৭। বাসার হালকা কাজ করার করার সময় আপনার কতটুকু সমস্যা হয়?	০	১	২	৩	৪

চিকিৎসার পরে রোগীর প্রাপ্ত নাম্বার_____ /৯৬

অংশ ৩: ব্যথার তীব্রতা

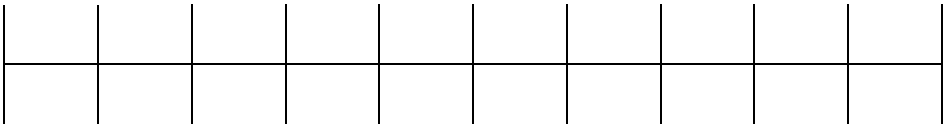
নীচের স্কেলে গোল দাগ দিয়ে বুঝিয়ে দিন আপনার ব্যথা কতটা তীব্র।

নির্দেশনাবলীঃ

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

আপনার ব্যথা এখন কতটা তীব্র?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০



কোনো ব্যথা নাই তীব্র ব্যথা

অংশ-৪: গতির পরিসীমা নির্ণয়

তথ্য সংগ্রহ পত্রের এই অংশটি হাটুর গতির পরিসীমা নির্ণয় করার জন্য তৈরী করা হয়েছে । পরিমাপক যন্ত্র হিসেবে গোনিওমিটার ব্যাবহার করা হয়েছে ।

নির্দেশনাবলীঃ

০=স্বাভাবিক ১=অল্প হ্রাস পেয়েছে ২=মাঝারি হ্রাস পেয়েছে ৩=অনেক খানি হ্রাস পেয়েছে

নড়াচড়া	**গতির পরিসীমা**
হাটু সংকোচন(সক্রিয়)	
হাটু প্রসারণ(সক্রিয়)	
হাটু সংকোচন(পরোক্ষ)	
হাটু প্রসারণ(পরোক্ষ)	

অংশ-৫: মাংসপেশীর শক্তির পরিমাপ

ম্যানুয়াল মাসল টেস্টিং অনুযায়ী হাটুর মাংসপেশীতে কতখানি শক্তি আছে তা পরিমাপ করা হবে।

নির্দেশনাবলীঃ

কোড	গ্রেড	টীকা
০	০	কোন দৃশ্যমান বা অনুধাবনযোগ্য সংকোচন নেই
১	১	দৃশ্যমান বা অনুধাবনযোগ্য সংকোচন বিদ্যমান
২	২-	মধ্যাকর্ষন এর সাথে অল্প গতিসীমা বিদ্যমান
৩	২	মধ্যাকর্ষন এর সাথে সম্পূর্ণ গতিসীমা বিদ্যমান
৪	২+	মধ্যাকর্ষন এর সাথে অল্প বাধাতে সম্পূর্ণ গতিসীমা অথবা মধ্যাকর্ষন এর বিপরীতে <১/২ গতিসীমা বিদ্যমান
৫	৩-	মধ্যাকর্ষন এর বিপরীতে অর্ধেক এর বেশী অথবা সম্পূর্ণ এর কম গতিসীমা বিদ্যমান
৬	৩	মধ্যাকর্ষন এর বিপরীতে সম্পূর্ণ গতিসীমা বিদ্যমান
৭	৩+	মধ্যাকর্ষন এর বিপরীতে হালকা বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
৮	৪-	মধ্যাকর্ষন এর বিপরীতে অল্প বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
৯	৪	মধ্যাকর্ষন এর বিপরীতে মাঝারি বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
১০	৪+	মধ্যাকর্ষন এর বিপরীতে প্রায় পূর্ণ বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান
১১	৫	স্বাভাবিক,সর্বোচ্চ বাধাতে সম্পূর্ণ গতিসীমা বিদ্যমান

মাংসপেশীরনাম	কাজ/নড়াচড়া	মাংসপেশীর শক্তি
কোয়াড্রিসেপ্স	হাটু প্রসারণ	
হ্যামস্ট্রিং	হাটু সংকোচন	
ডরসিফ্লেক্সর	পায়ের ডরসিফ্লেক্সন	
প্লান্টারফ্লেক্সর	পায়ের প্লান্টারফ্লেক্সন	

APPENDIX-V **PERMISSION LETER**

May 28th, 2019

The Head of the Department,

Department of Physiotherapy,

Centre for the Rehabilitation of the Paralysed (CRP), Chapain, Savar, Dhaka - 1343.

Through: Head of the Department, Department of Physiotherapy,

Bangladesh Health Professions Institute (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. Zahid Hasan , student of 4th professional B.Sc in physiotherapy at Bangladesh Health Professions Institute (BHPI) under University of Dhaka. According to the course curriculum, I have to conduct a research project for the partial fulfillment of the degree. My research project entitled on "**Effectiveness of Kinesiotape Over Knee Joint in Knee Osteoarthritis Patients** '".To conduct my research, I need to collect data from your musculoskeletal unit of physiotherapy department, CRP, Savar. 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 to *collect data from your department and complete the research project successfully.*

Yours faithfully,

Md. Zahid Hasan

Md. Zahid Hasan

Student of 4th Professional B.Sc.in Physiotherapy

Roll:23, Session:2014-2015

Bangladesh Health Professions Institute (BHPI)

(An academic institute of CRP)

CRP, Savar, Dhaka-1343.

Forwarded to Head of PT 25/05/19

MD. ZAHID HOSSAIN
Lecturer
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343

Approved 30/05/19

Mohammad Anwar Hossain
Associate Professor & Head
CRP

Recommended 30.05.19

Prof. Md. Obaidul Haque
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Savar, Dhaka-1343

APPENDIX-VI **Permission Letter from Institutional Review Board**

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)

BANGLADESH HEALTH PROFESSIONS INSTITUTE (BHPI)

(The Academic Institute of CRP)

CRP-Chapain, Savar, Dhaka-1343. Tel: 02-7745464-5, 7741404

Ref: CRP-BHPI/IRB/7/19/1355 Date: 24/09/2019

To
Md. Zahid Hasan
4th professional B.Sc. in Physiotherapy
Session: 2014-15, Student ID:112140255
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Kinesiotape Over Knee Joint in Knee Osteoarthritis Patients"** by ethics committee.

Dear Md. Zahid Hasan,

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

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

The study involves use of a WOMAC Questionnaire, NPRS Scale, Manual Muscle Testing Scale and measuring Joint Range of Motion to explore effectiveness of Kinesiotape over knee joint in knee osteoarthritis patients that may take 25 to 30 minutes. Since there is 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 9 AM on 11th August, 2018 at BHPI.

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

Best regards,

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