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EFFECTIVENESS OF THERAGUN ON PAIN , FLEXIBILITY AND QUALITY OF LIFE AMONG PATIENTS WITH OA KNEE

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ABSTRACT

Background: According to the World Health Organization (WHO): Knee osteoarthritis (OA) is a degenerative joint disease characterized by the progressive deterioration of articular cartilage, changes in subchondral bone, synovial inflammation, and joint space narrowing, leading to pain, stiffness, reduced mobility, and functional disability. OA is an intricate disease that includes multiple related factors, including trauma, mechanical forces, inflammation, and pain. Therefore, changes to the non-cartilaginous components of the joint, such as the joint capsule, synovium, subchondral bone, ligaments, and periarticular muscles, are the primary cause of pain. According to its etiology, osteoarthritis (OA) can be classified as either primary (idiopathic or non-traumatic) or secondary (which is often followed on by trauma or mechanical misalignment).

Objectives: To determine the effect of Theragun on pain, flexibility and quality of life among patients with OA knee using VAS, Flexibility test and WOMAC questionnaire.

Methods: 40 patients within age group of 40-70 were recruited and who was having a VAS score between 3-7 . In this study out of 40 patients, 20 were recruited for Group A(Conventional group) and 20 for Group B (Percussion massage group).Age group was 40-70. The patients with mild to moderate knee OA were screened on the basis of inclusion and exclusion criteria and pre and post examination was done by using VAS, flexibility tests and WOMAC questionnaire.

Results: Results showed significant pain reduction, increased flexibility and good impact on quality of life of patients in Group B (percussion massage group) than Group A (Conventional group). The conventional therapy (stretching, strengthening exercises) in addition with percussion gun was beneficial for OA Knee.

Conclusion: The study concluded that conventional therapy in addition with percussion gun has good impact on reducing pain, increasing flexibility and good quality of life in patients with OA knee.

Keywords: Knee Osteoarthritis, percussion gun, strengthing exercises, WOMAC questionnaire, VAS, muscle flexibility.

INTRODUCTION

The knee joint is the largest synovial joint in the human body and is essential for load bearing-and lower extremity movement. Its complex structure and biomechanics are necessary to preserve limb functions1.

According to the World Health Organization (WHO): Knee osteoarthritis (OA) is a degenerative joint disease characterized by the progressive deterioration of articular cartilage, changes in subchondral bone, synovial inflammation, and joint space narrowing, leading to pain, stiffness, reduced mobility, and functional disability.

The world Health Organization (WHO) defines osteoarthritis as: "A degenerative joint disease characterized by the breakdown of joint cartilage and underlying bone, most often affecting the knees, hips and hands. It causes pain, stiffness, swelling and reduced motion in the joints." prevalence in OA Knee differs. People aged 15 and older had a global prevalence of knee OA of 16.0% (95% CI, 14.3%- 17.8%), whereas people aged 40 and older had a prevalence of 22.9% (95% CI, 19.8%-26.1%).Among those aged 20 and older, the incidence was 203 per 10,000 persons-years (95% CI, 106-331); the prevalence and incidence ratios for males and females were 1.69 (95% CI, 1.24-1.56,p< 0) and 1.69, respectively. At the continental level, Asians had a higher incidence than Europeans (19.2% [95% CI,15.7%]). The highest prevalence at the national level was among Indians (21.0% [95% CI, 11.0% 34%)2.

The most common form of joint disease is osteoarthritis of the knee. The gender disparity in prevalence has recently been brought to light by a meta-analysis that shows that women are more common than men. 11.4% as opposed to 6.83 . OA is an intricate disease that includes multiple related factors, including trauma,mechanical forces, inflammation, and pain. Therefore, changes to the non-cartilaginous components of the joint, such as the joint capsule, synovium, subchondral bone, ligaments, and periarticular muscles, are the primary cause of pain.As the disease progresses, these tissues are affected, and changes such as osteophyte production, bone remodeling, periarticular muscle weakness, ligament laxity, and synovial effusion may become noticeable. According to its etiology, osteoarthritis (OA) can be classified as either primary (idiopathic or non-traumatic) or secondary (which is often followed on by trauma or mechanical misalignment)4.

The primary warning sign of knee OA is pain, which is also the main cause of both immediate and chronic disabilities related to OA. Usually, knee OA pain gets worse with exercise and goes away with rest . World Health Organization (WHO) adopts the definition of pain provided by the International Association for the Study of Pain (IASP), which states: "Pain is an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.

When knee OA is followed by insufficient pain treatment, the quality of life is even worse. The symptoms of OA knee include pain, stiffness, and difficulty doing regular tasks. It is also associated with a notable adverse effect on quality of life connected to health5. The world health Organization (WHO) defines quality of life as: "An individuals perception of their position in life in the context of the culture and values systems in which they live and in relation to their goals, expectations, standards and concerns.

Patients with OA Knee often exhibit knee joint pain with disuse atrophy of the quadriceps femoris muscles,and there is decreased strength in the quadriceps, which can be attributed to both muscle atrophy and neuromuscular inhibition - the ability to fully and voluntarily activate the muscle. To maintain smooth and well-coordinated walking patterns involving the knee joint, the quadriceps and hamstring muscle groups must be flexible. The hamstring muscles often shorten in people with osteoarthritis in their knees, and this tightness can cause discomfort and decreased functional movement6.

The goals of knee osteoarthritis treatment should be to reduce disability, enhance function, and relieve pain. It can frequently be beneficial to use a variety of medications, such as NSAIDs (such as aspirin, naproxen, diclofenac, or ibuprofen) at therapeutic dosages. In the interdisciplinary management of patients with knee OA, physiotherapy interventions can be crucial.Exercise therapeutic recommendations promote exercise treatment as the cornerstone of conservative management due to the substantial body of evidence showing the positive therapeutic effects of exercise in individuals with knee OA of various severity. Strengthening exercises are widely advised. Patients with knee OA have lower muscle strength due to decreased physical activity and pain suppression7.

Theragun is portable mechanical devices that resemble little jackhammers. They can be driven by electricity or batteries and use various applicator tips, such as large and small balls, flat tips, bullet/pointy tips, and forks. These devices deliver bursts of pressure, vibration, or massages myofascial tissues (such as fascia, muscle belly, or tendon) using percussion therapy, accomplished by the rapid tip movement. It is believed that this improves range of motion, reduces myofascial restriction and tension, increases blood flow, eases pain, and breaks up trigger points. Because of its many uses, massage guns have grown in popularity recently. They can be used for pre-activity (warm-up), post-activity (recovery), or as part of a treatment in both clinical and athletic settings8.

Golgi tendon organ is stimulated, which improves blood flow and the tissue's supply of nutrients. Using a percussion massage gun also induces a calming reaction while relieving tension and increasing flexibility. Furthermore, it reduces the perception of pain by applying pain gate theory. Acute muscle strength, explosive muscle strength, and flexibility can all be enhanced with physical therapy administered with a massage gun. It can also lessen musculoskeletal pain9.

NEED:

1) Knee osteoarthritis commonly present with pain, which usually worsens with activity and improves with rest. It is a leading cause of disability and significantly impacts daily functioning in addition to pain. Individuals often experience difficulty in performing everyday task leading to a decline in health related quality of life5,10.
2) One of the earliest clinical manifestation of knee OA is muscle weakness specially in the quadriceps which has long been acknowledged as a defining feature of the disorder11.
3) Reduce flexibility can lead to higher chance of injury and problems with the musculoskeletal system which makes decreases or limits a person's range of motion.
4) Tightening of the hamstring muscle group, due to its tendency to shorten raises the pressure on the Patello-femoral joint and may result in Patello-femoral syndrome associated with knee osteoarthritis.
5) In individuals with knee osteoarthritis, tight hamstrings often lead to increased pain and limit their ability to move12.
6) Vibration therapy has been shown to be beneficial in promoting acute changes in pain relief, strength, and flexibility, after one or more treatment13.
7)There isn't much specific research on physical therapy provided by massage guns and its impact on physiological adaptations, despite a large amount of literature on the subject.so there is need to carry out a research on effects of theragun on patients with OA13 .

OBJECTIVES: To determine the effect of Theragun on pain, flexibility and quality of life among patients with OA knee using VAS, Flexibility test and WOMAC questionnaire.

MATERIALS:

- Informed consent
- Data collection sheet
- WOMAC Questionnaire
- VAS
- Test for tightness

METHODOLOGY

Source of data- Patients having knee OA in and around Belgavi city.
Method of data collection
Study design – Pre- post Experimental study
Study type – Randomized control trial
Target population – Patients with knee OA within the group of 40-70 years.
Sampling design – Non probability sampling design
Duration of study – 4 weeks
Sample size – 40

Inclusive criteria:
1. Individuals aged between 40 and 70 years.
2. Participants with a confirmed diagnosis of osteoarthritis (OA).
3. Patients experiencing knee pain with an intensity ranging from 3 to 7 cm on the Visual Analogue Scale (VAS)9.
4. Individuals who agree to take part by signing the informed consent form.

Exclusive criteria:
1. Individuals diagnosed with any musculoskeletal or autoimmune condition other than knee osteoarthritis.
2. Participants with wounds or scars at the treatment site.
3. Patients with any neurological, vascular, or infectious diseases.
4. Individuals experiencing referred pain originating from the lower back9.
5. Those unable to tolerate or receive vibration and percussion stimuli.
6. Participants who do not consent to take part in the study.

INTERVENTIONS:
EXERCISE PROTOCOL
The two groups received conventional physical therapy program of 12 sessions, over four weeks.

Group A (conventional group):
For four weeks, the two groups underwent a 12-session, traditional physical therapy regimen. Group A (the traditional group): The patients in group A received standard lower limb strengthening and stretching activities, including resistance exercises for all the muscles surrounding the joint, throughout the course of 12 treatment sessions, three sessions per week. For three repetitions and three sets, several angle isometric seated quadriceps knee extension workouts (30°, 60°, and 90°) were carried out. Ten reps of straight leg raising with resistance, ten reps of ankle plantar flexion with resistance, thirty seconds of hamstring stretching, and ten reps of hip abduction and adduction with resistance (side lying) are all included in the three sets.

Group B (percussion massage group):
A conventional physical therapy program in addition to percussion massage with a massage pistol that pulses 40 times per second for five minutes at a time. The massage gun has four different head attachments. For this experiment, the round ball Attachment was used. This attachment can be used to target both large and small muscle groups. All of the complex's muscles received myofascial release following five minutes of pressing the percussion treatment gun to the subject's leg while moving the massage gun's head from proximal to distal. An extra thirty seconds of percussion therapy was applied to the participant's tight or sensitive knee complex muscles9.

OUTCOME MEASURES:
With the right outcome measurements, it is possible to comprehend how evidence-based management affects patients with knee osteoarthritis (PKOA) as they recover. Patients with knee OA have pain, functional limitations , and decreased ROM. It's critical to accurately determine the kind and degree of functional impairment and pain in individuals with knee OA14.

To Accurately assess those problem , Outcome measures for each were selected based on high reliability and validity value (from 0 to 1)
Reliability = Consistency of results
Validity = Accuracy of what is being measured

VAS for pain
WOMAC for functional limitations
Special test for muscle tightness or flexibility

1)VAS
The visual analogue scale appears to be the most sensitive of the different techniques for assessing pain15.
ICC 0.97
The visual analog scale (VAS) is a validated, subjective measure for acute and chronic pain. A handwritten note on a 10-cm line that runs from "no pain" to "worst pain" is used to record scores16.
Procedure: Examiner ask Patient to mark a point on the line that corresponds to the intensity of their pain.

2) WOMAC
Bellamy et al. created the WOMAC OA index in 1982 to evaluate the functional mobility, gait, general health, and quality of life (QoL) of people with PKOA. It was validated in 198817.
ICC: 0.74, 0.58, and 0.92 respectively for pain, stiffness and function
Procedure: Womac comprises 24 items in total, with three subscales—pain (5 items), stiffness (2 items), and function (17 things)—that are rated on a five-point ordinal scale18.
0- none
1-mild
2- moderate
3- sever
4- extremely severe
Higher WOMAC scores indicate worse pain, stiffness, and functional. Examiner ask question to patient about their symptoms and functional activities according to WOMAC and ticked on womac chart. Evaluation is done after asking all the questions.

Special test:
Five special test was selected for checking muscle tightness around knee

- Active knee extension test for hamstring Tightness
- Thomas test for hip flexor tightness test
- Passive hip abduction for hip adductor tightness
- Ober's test for hip abductors tightness
- Isolated gastrocnemius tightness test for calf muscle

1) Active knee extension test
The AKE test is a test frequently used in orthopaedic physical assessment to measure hamstrings tightness with normal values of knee movement within 20° of full extension19.
ICC: 0.870.94 .

Procedure

- Patient should be in supine position with both hips and knees flexed to 90° lumbar spine should be in neutral position
- The patient is then told to maintain this position
- Ask patient to actively extend the testing knee while maintaining lumbar spine position in neutral
- With goniometer angle between thigh and lower leg is measured Positive test (tight hamstrings): Extension of knee more than 20% with hip flexion 90° flexion→ indicates hamstring tightness.

2) Thomas test
Thomas test is commonly used in the clinical setting to assess flexibility about the thigh region20.
ICC: 0.60

Procedure:

- The patient lies in supine position hip over the end or edge of the examining table
- The patient flexes one knee onto the chest and holds it with both hands
- Testing or opposite leg is relaxed
- Examiner observes angle of hip and knee and angle is measured using goniometer

Positive test:

Raised thigh and or increase in knee angle Rom more than 90° indicates positive Sign21.

3) Passive hip abduction test
Passive hip abduction test tests the flexibility of the adductor thigh muscle that can be done quickly with minimal equipment using only tape.

Procedure:
- Patient on sitting position on the floor
- Bring patient's feet together and flat on the floor
- Bring feet together to groin region as near as possible
- Let knee fall towards the floor laterally until it reaches it's limit
- Ask patient to hold their feet together
- Measure distance from lateral condyle to floor using tape22.

4) Ober's test
Ober's test is a commonly used tool in physical therapy and sports training to evaluate the tensor fascia latae (TFL) and iliotibial band (ITB) tightness or flexibility23. .
ICC: 0.94

Procedure
- Patient lie on the examination bed in sideline position with testing leg facing upwards
- The examiner should be behind the patient
- The hip is abducted and extended passively by examiner and allowed to passively adduct
- toward the table.
- The knee can be in a flexed position (classic Ober’ s) or kept straight (modified Ober’ s).

Positive Test:
Leg remains elevated and does not adduct fully to the table.
Indicates tight IT band or TFL.

5) Isolated gastrocnemius tightness test
In order to evaluate MGT tightness, several examination methods have been described. However, there is still no standardized examination process for this muscle .Gastrocnemius tightness was defined as ≤10° maximal ankle dorsiflexion in knee 90° flexion24.

Procedure:
Non-weight bearing Measurement
- Two physician should perform the test, one helps in assessing the correct
- position of patient while other measures degree of ankle dorsiflexion
- Patient in supine position on examination couch
- Make sure the knee is fully extended by having the first investigator do so.
- Let the second investigator perform the measurement of the ankle dorsiflexion
- using a goniometer.
- Note the result on the documentation sheet.
- Have the first investigator place one hand on the distal dorsal aspect of the
- thigh and apply force to the plantar aspect of the forefoot. This will assure 90°
- of knee flexion and allow maximum ankle dorsiflexion
- Have the second investigator perform the measurement of the ankle
- dorsiflexion using a goniometer.
- .Note the result on the documentation sheet24.

RESULTS:
Statistical Analysis - Statistical analysis was done using Microsoft Excel version 2021 all data was first entered into excel sheet followed by MS Excel analysis. Mean Standard deviation was used to display the

mean and standard deviations of numerical data collected from each participant. To find out the effect of intervention unpaired t test was regarded as the Statistical significance level. To generate graph & tables Microsoft Excel is used.

Descriptive analysis-

Demographic data of subject Total 40 subjects were participated in the study out of which 20 were randomly selected for group A and treated with a standard physical regimen while other 20 were enrolled in group and treated with standard physical regimen along with percussion massage gun.

Table 1:Demographic data of both groups

Demographic data	Group A	Group B	t-value	p-value
Age (years)	58.85 ± 6.02	48.45 ± 7.31	4.91	<0.0001
BMI ($g/m^{2)}$	25.80 ± 4.13	24.82 ± 3.88	0.84	0.404
Sex Males Females	N(%) 8(45%) 12(55%)	N(%) 11(55%) 9(45%)	$X^2 = 0.902$	0.342

For group A pre treatment scores in relation to VAS , Active knee extension test , Thomas test (iliopsoas), Thomas test (Rectus femoris), Obers test , Passive hip abduction test , Isolated gastrocnemius test and WOMAC scores was ± SD of 4.45 ± 1.47, 38.05 ± 15.23 , 6.55± 1.84 ,48.95± 13.89 , 13.95± 12.94 , 15.35± 2.47, 13.05± 5.41, 34.65± 18.29 respectively.

And after treatment score for group A in relation to VAS , Active knee extension test , Thomas test (iliopsoas), Thomas test (Rectus femoris), Obers test , Passive hip abduction test , Isolated gastrocnemius test and WOMAC scores was 3.10 ± 1.29, 42.95 ± 15.41, 5.80 ± 1.66, 52.05 ± 14.47, 12.65 ± 2.91, 13.85 ± 2.42, 11.25 ± 4.31, 30.05 ± 15.46 respectively.

Similarly, For group B before treatment score in relation to VAS , Active knee extension test , Thomas test (iliopsoas), Thomas test (Rectus femoris), Obers test , Passive hip abduction test , Isolated gastrocnemius test and WOMAC was 5.15 ± 1.22, 39.15 ± 18.13, 9.00 ± 3.51, 44.70 ± 13.10, 13.65 ± 3.85, 14.55 ± 2.17, 13.10 ± 4.35, 45.05 ± 17.82 respectively .

After treatment score for group B in relation to VAS , Active knee extension test , Thomas test (iliopsoas), Thomas test (Rectus femoris), Obers test , Passive hip abduction test , Isolated gastrocnemius test and WOMAC was 1.55 ± 1.02, 50.05 ± 13.91, 4.05 ± 2.42, 61.95 ± 12.91, 4.15 ± 2.61, 4.05 ± 2.28, 6.85 ± 3.84, 19.85 ± 13.91 respectively. So the result showed that significant improvement in pain reduction, increase flexibility and good quality of life of patients in group B (percussion massage group) .Therefore theragun is effective for OA knee.

Figures are shown at the end of the article

DISCUSSION

This study evaluated the impact of percussion gun on pain, flexibility and quality of life in patients who are suffering from knee OA. 40 participants were randomly included based on inclusion and exclusion criteria, who were divided into 2 groups. Group A Conventional group and Group B percussion massage group. Pre and post examination was done by using VAS, WOMAC questionnaire, active knee extension test, Thomas

test, passive hip abduction test, obers test and then pre and post score were documented. We delivered treatment of conventional therapy which includes lower limb strengthing and stretching exercises to group A for three times weekly for a period of 4 weeks and for group B conventional therapy in addition with percussion gun was given for same period of intervention.

Samuel and Kanimozhi summarized the available outcome measure for patient with knee OA covering tools for diagnosis, prognosis and rehabilitation. The analysis highlighted that WOMAC possess both excellent reliability and good validity.In earlier research conducted by Ragia M. Kamul et al used WOMAC to evaluate patients with knee OA. Patient was instructed to complete
17 items physical function subscale. The subscale measuring pain, stiffness (2 items). In our study the total WOMAC score is calculated by adding the components for each of the three subscales. This study includes, WOMAC as outcome measure, each of the component has different treating. To rate pain, to rate stiffness and to rate difficulties while doing activities. The scoring was according to none (0), slight (1), moderate (2), severe (3) and extreme (4). According to patients rating score was added and out of 96 total WOMAC score was documented

In present study it was found that Group B that received percussion massage gun in addition with conventional therapy was found to have better Range of Motion after a treatment of 4 weeks than Group A which received only conventional therapy .This shows the correct use of percussion massage gun not only helps in reducing pain but also reduces muscle tightness. This finding were in line with other previous studies .In Jack Martin's study Compared to foam rolling and other self-myofascial techniques, it was discovered that the most efficient way to improve lower limb range of motion was with a portable percussion massage gun. Delays in the onset of muscular pain can be minimized by using portable percussion massagers right after working out.

Another study was done by Shingo Matsuo, where sixteen healthy young men participated in the study. On four different days, in a random order, percussion massage therapy was applied to the right plantar flexors for 60, 180, and 300 seconds. They assessed the passive stiffness, PPT, and range of motion during passive ankle dorsiflexion. Prior to and following the intervention, the maximum voluntary isometric ankle plantar flexion force was also measured. All percussive massage treatment sessions resulted in a significant decrease in passive stiffness and a significant increase in range of motion and PPT (all $p < 0.05$), although isometric muscular force remained unchanged. Between the therapies and the relative change in ROM ($\rho = 0.670$, $p < 0.01$) and PPT ($\rho = 0.566$, $p < 0.01$), there were both strong and somewhat positive relationships. According to these findings, percussive massage therapy for longer than 60 seconds enhances passive stiffness, ROM, PPT, and flexibility without altering isometric muscular force. Additionally, prolonged sessions of percussive massage therapy can increase flexibility even more.

The finding of this study shows that there was a better result in group B's WOMAC score after treatment than group A . This shows percussion massage therapy helps in improving overall Quality of Life The above study on the effectiveness of percussion massage therapy in improving better quality of life were consistent with the findings of Heba Mohamed El-berkawy's study.For five minutes, the subject's leg was massaged with a percussion massage gun using normal ball head, which moved its head from proximal to distal. The trigger point, or area where the patient felt tight or sensitive, also received additional 30 seconds of treatment. Prior to treatment, there was no significant change in the mean WOMAC score between the two groups (p=0.978); however, the post treatment score favoured group B showing a mean difference score (P=0.001) between two group .

Pre and post treatment score was done for both group A and B using VAS for pain assessment and it shows that group B has significant improvement compared to group A which also shows some improvement. This shows the effect of percussion massage gun in reducing pain. The findings of impact of percussion massage gun on pain reduction were in alignment with the findings of Seyedeh Zohreh Hosseini's study. In their study, 45 amateur athletes between the ages of 18 and 30 were enlisted and randomly assigned to 15-person in shock wave, massage gun, and control groups (three groups received electrotherapy and stretching as part of their regular treatment) each. Patients were given single-session treatment and reassessed right away following initial assessments of their range of motion (ROM), pain intensity, pain pressure threshold (PPT), and

isometric muscular strength. Even though it didn't alter PPT or maximal isometric gastrocnemius muscular strength, one massage gun session was found to instantly decrease pain in the gastrocnemius muscles.

CONCLUSION

The present study concluded that with the addition of a percussion massage gun to a conventional physical therapy program is effective in significantly increasing flexibility of the muscles around the knee joint ie. Hamstring, quadriceps, adductors, abductors and calf muscles and also helps in reducing pain, and positively impacting the quality of life of patients with OA knee compared to standard therapy alone.

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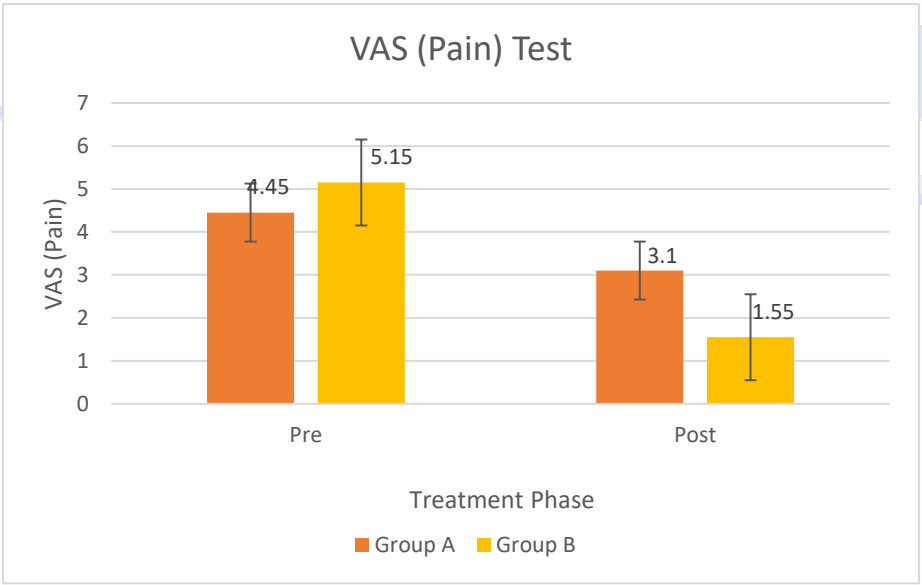


Figure (1): Mean values of pain pre and post treatment.

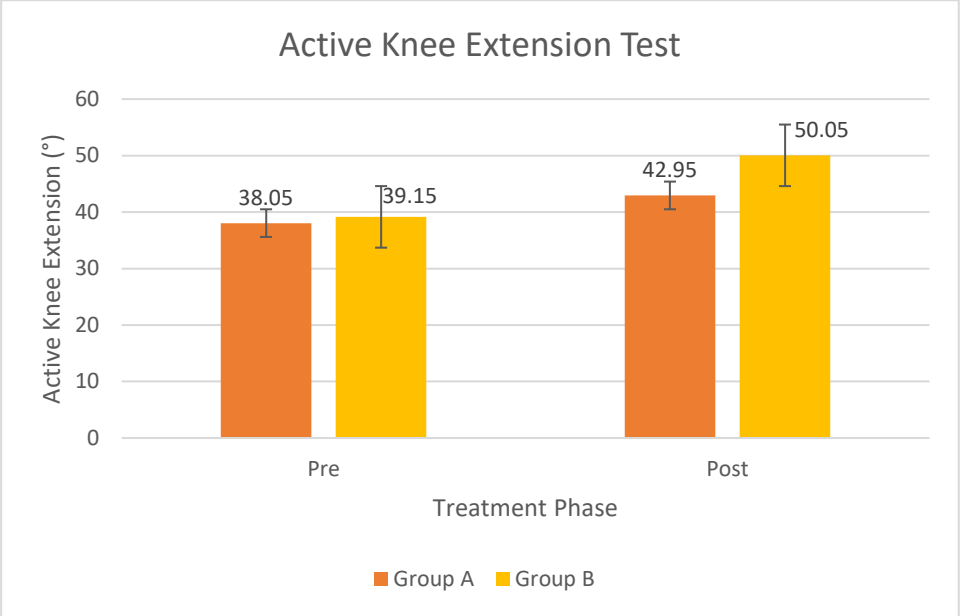
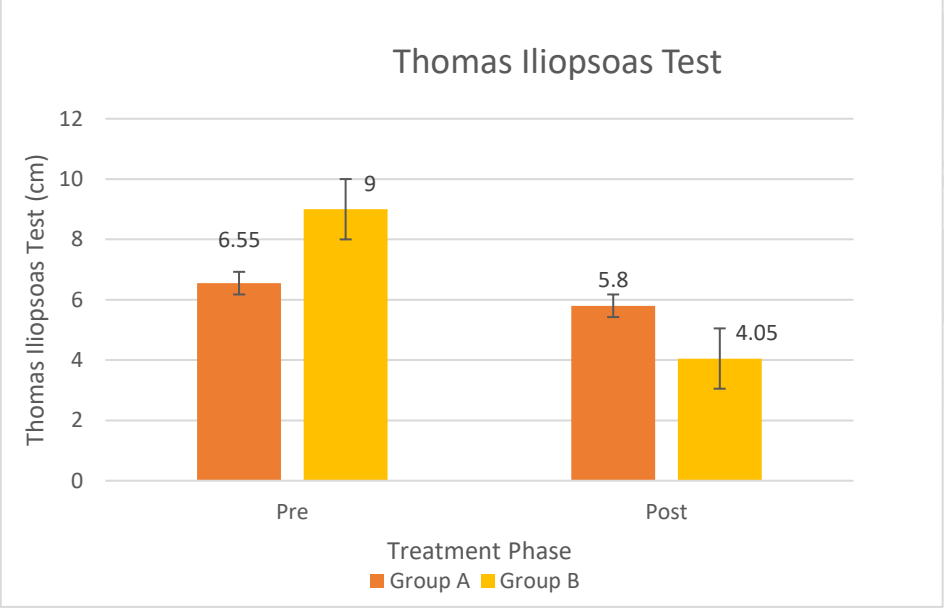


Figure (2): Mean values of active knee extension pre and post treatment

Figure (3): Mean values of illiopsoas tightness pre and post treatment



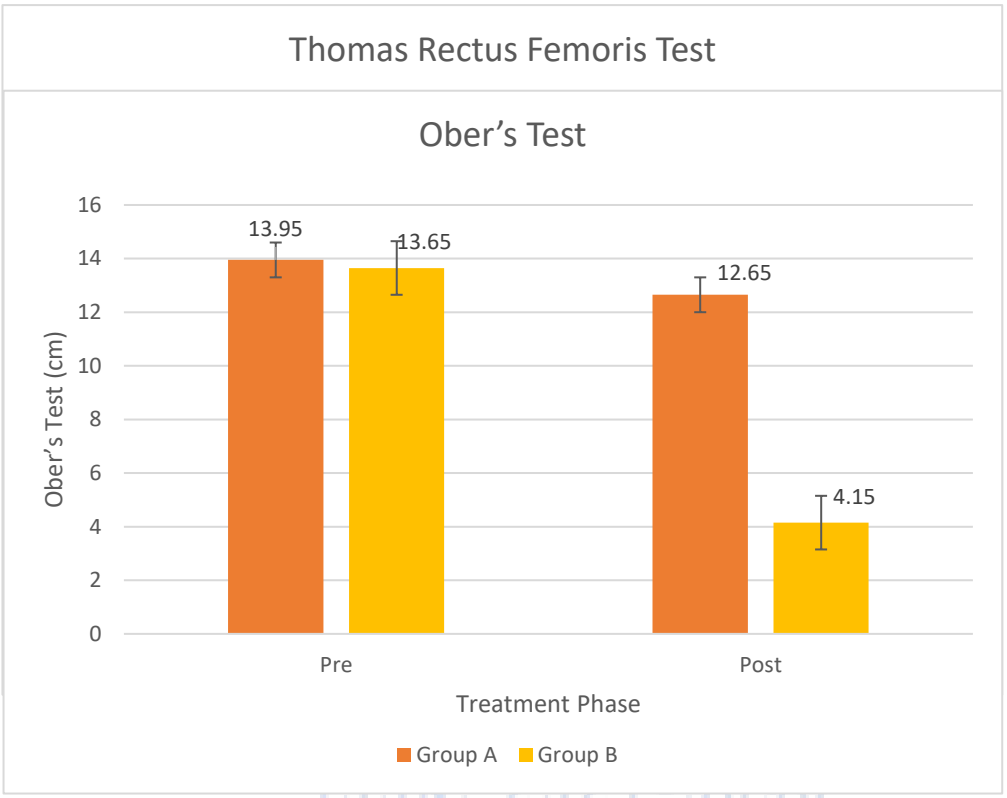
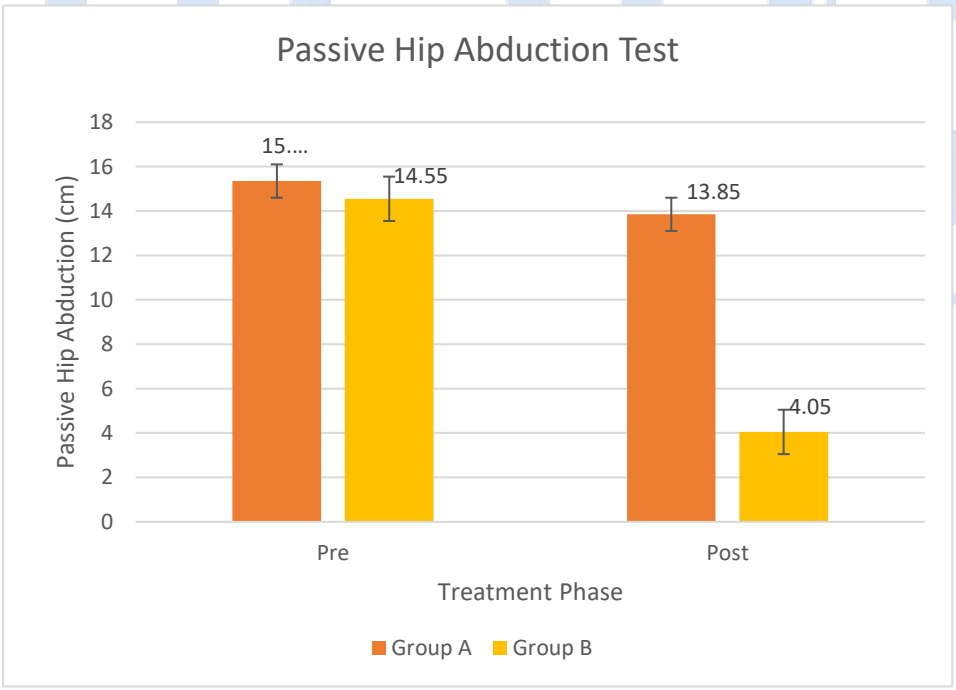
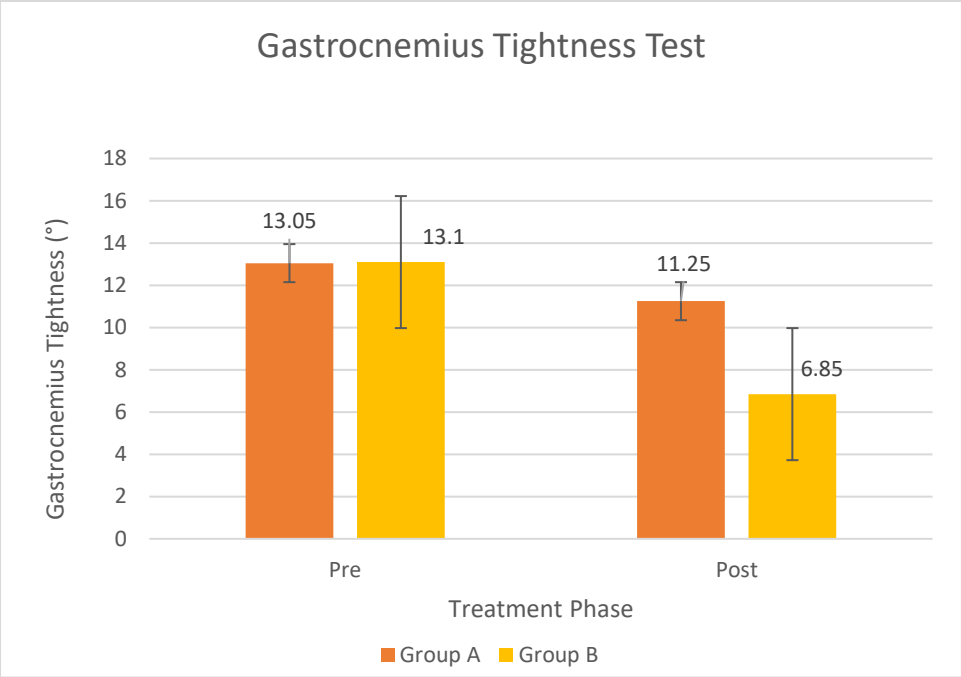


Figure (4): Mean values of rectus femoris tightness pre and post treatment

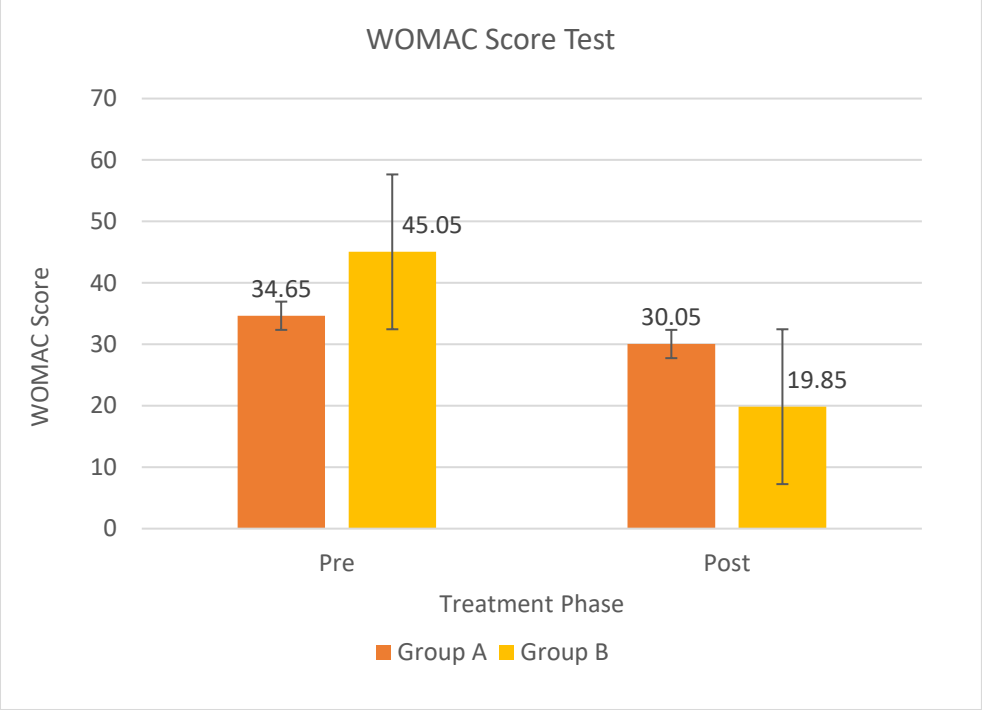
Figure(5): Mean values of hip abductor tightness (obers test) pre and post treatment



Figure(6): Mean deviation of hip adductor tightness pre and post treatment



Figure(7): Mean deviation of gastrocnemius tightness pre and post treatment



Figure(8): Mean deviation of WOMAC pre and post tratment.