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# Effectivness of Ultrasound with Isometric Quadriceps Exercise and Retrowalking in Osteoarthritis

**Prajakta Gaikwad[1], Vaishali Kale[2]**

[1]BPT Intern, RJS College of physiotherapy, kopargaon,
[2]Assistant Professor, Department of Musculoskeletal Physiotherapy, college of Physiotherapy, kopargaon

**Abstract**

**Introduction:** Knee osteoarthritis is a non-inflammatory, painful and degenerative joint disease; pathologic changes in osteoarthritis involve progressive hyaline joint cartilage loss with concomitant changes in subchondral bone and development of osteophyte. About symptomatic knee osteoarthritis affect 13% of women and 10% of men aged 60 years and older. Men have a lower prevalence of knee osteoarthritis than women. The tool used to measure pain intensity, physical functions in this study is WOMAC scale and to assess the range of motion by Universal goniometer.

**Aim** : To Evaluate the Effectiveness of Ultrasound with Isometric quadriceps exercise and retro walking in osteoarthritis of knee.

**Method :** A Total 30 both male and female participants between 45 to 65 years of age selected from RJS Group of institute of kopargaon , Kothari hospital kopargaon by using purposive sampling method according to the inclusion criteria. The total duration of the study is 3 weeks .total 30 participants allocated into two groups A and B 15 in each group. In group A were intervention Ultrasound with isometric quadriceps exercise and group B Ultrasound with retro walking were given for 3 weeks. Pre intervention and post intervention by WOMAC score and universal goniometer were taken analyzed compared using paired' test.

**RESULT**: As per statistical analysis both groups shown significant improvement but group B ( Ultrasound with Retro walking )was having most significant improvement as compare to group A ( Ultrasound with Isometric quadriceps exercises).

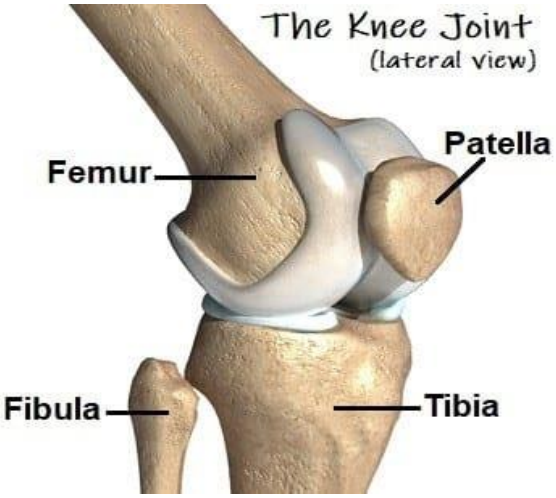
**CONCLUSION:** This study concluded that Ultrasound with Retro walking was effective in participants with Osteoarthritis of knee .Hence there is reduction of pain, improving range of motion at knee joint and functional mobility, Activity of daily living in participants with osteoarthritis of knee.

**Keywords**: Ultrasound, universal goniometer, WOMAC scale

## Introduction

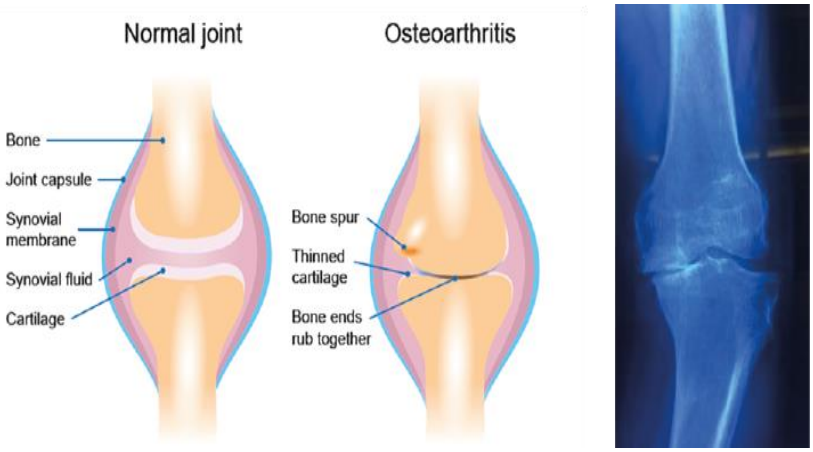
The knee is the largest and most complex joint of the body. The complexity is the result of fusion of three joint. It is formed by fusion of three joint in one. It is formed by fusion of the lateral femoro tibial, medial femoro tibial and femoro patellar joints. It is condylar synovial joint, inter -corporating of the femur and tibia and one saddle joint between the femur and the patella. It is also complex joint as the

cavity divided by the menisci.[1] Osteoarthritis is a systemic, chronic joint disorder classified into primary and secondary osteoarthritis depending on its etiology, characterized by the progressive breakdown of the articular cartilage (the end point of osteoarthritis) along with changes in the subchondral bone, synovium (synovial inflammation), meniscus, tendons/ligaments, and muscles.[2]




The word "osteoarthritis" originated from the Greek word " Osteo " meaning of bone " Arthro " meaning "joint" and "Itis" meaning inflammation, although the "itis" of osteoarthritis is somewhat of a misnomer – inflammation Is not a conspicuous feature which is present in rheumatoid or autoimmune types of arthritis.[3] Osteoarthritis , which is a chronic degenerative disease characterized by wear on the cartilage structure, that causes pathological changes in the bone, subchondral bone, soft tissues and is the most common joint disease that affects patients more than other arthritis [4]

Knee osteoarthritis is a non-inflammatory, painful and degenerative joint disease, pathologic changes in the osteoarthritis involve progressive hyaline joint cartilage loss with concomitant changes in the subchondral bone and development of osteophyte.[5] About symptomatic knee osteoarthritis affect 13% of women and 10% of men aged 60 years and older. Men have lower prevalence of the knee osteoarthritis than women. [6] Gender has been main culprit in a wide array orthopedic conditions including Osteoarthritis. Although research continues into developing a better understanding of the relationship between genetics, genders several key features have already emerge. It is known that articular cartilage has estrogen receptors that osteoarthritis heritability is greater in women than men that certain genes may be the responsible for development of osteoarthritis in women.[7]




The clinical features of knee osteoarthritis include joint pain, Stiffness, muscle weakness, physical disability and significantly decreased in quality of life , while chronic pain can further lead to anxiety ,

depression and cognitive dysfunction ,severely impacting the daily life of patients.[9] and increasing socioeconomic burden there are five Risk factor include obesity, knee injury ,previous knee surgery and occupational bending and lifting.[10]Pain is most common symptom in knee osteoarthritis, a leading it cause of chronic disability, and a major source of the disability attributable to osteoarthritis. Pain severity ranging from barely perceptible to immobilizing . Pain, in knee osteoarthritis typically exacerbates by activity and relieves by rest. Tenderness to palpation of involved joints may be evident in physical examination. Joint effusions may be present, which typically exhibit a mild Pleocytosis , normal viscosity, and modestly elevated protein .Crepitus during joint motion or walking is a common .Limitation of range of motion are all common signs of osteoarthritis of the knee.[11]

Therapeutic ultrasound treatment which is the best physical therapy modality suggested for the management of pain and loss of function due to osteoarthritis. It is a form of mechanical energy consisting of high-frequency vibrations that can be continuous or pulsed. Pulsed ultrasound produces non-thermal effects and is used to aid in the reduction of inflammation, whereas continuous ultrasound generates thermal effects. Therapeutic ultrasound is also reported to reduce edema, relieve pain and accelerate tissue repair [12]. Therefore, considering the high prevalence of osteoarthritis in the elderly population and the daily use of Therapeutic ultrasound in clinical practice, the aim of the present study was to evaluate the effect of Therapeutic ultrasound applied to the medial and lateral compartments of the knee on pain intensity, joint Range of motion, muscle strength, function and quality of life of the participants. This study was proposed with the hypothesis that is relief of pain might increase knee range of motion and the strength of the quadriceps and ischio tibial muscles, and hence give rise to a positive change in function and quality of life of the participants.[13]

Isometric exercises help to aim at the surrounding muscles of the knee joint. An isometric exercise is a static form of exercise where the muscles contract producing force without any considerable change in the muscle length and without any visible joint movement [14]. Quadriceps muscle weakness is a common clinical sign associated with tibio femoral osteoarthritis [15] and is considered to be critical determinant of disability.[16]Adequate quadriceps strength in persons with knee osteoarthritis seems necessary to perform activities of daily living,[17]and quadriceps muscle strengthening has been shown to be capable of improving physical function in those suffering from the disease.[18] Quadriceps weakness not only leads to pain and disability in those with knee osteoarthritis but has also been recently linked with incident symptomatic knee osteoarthritis. Quadriceps isometric exercises performed in an extension of knee reduce the severity of pain, joint stiffness, and increase physical function more when performed in flexion of the knee in patients with knee osteoarthritis. [19]

Retro-walking is one of the new interventions which is beneficial in treating osteoarthritis knee. Since the compressive forces at the patellofemoral joint are diminished, it is considered a healthy closed kinetic chain exercise. Quadriceps eccentric feature is reduced by retro-walking, but isometric and concentric quadriceps powers are maintained. Quadriceps ability has been found to improve with retro - walking training programs [20]. Furthermore, during retro-walking, the cardiopulmonary demand is higher [21] Therefore, Retro-walking is a safe and efficient part of rehabilitation services for osteoarthritis.[22]Retro walking increases stride rate, decreases stride length and increases support time. Back ward walking reduces overall range of motion of knee thereby increase active functional range. Muscular structure supporting ankle and knee reversed their role during retro walking. It provides the primary power producer and ankle plantar flexors shock absorber. Direction of knee joint shear force directed forward initially during retro walking whereas backward in forward walking.[23]

## NEED OF THE STUDY

Approximately 250 million people suffering from knee osteoarthritis. It's a complex condition that affect millions of people worldwide. As a prevalence of disease still increases further it is a need of treatment to come up with a highly reliable exercise protocol which is beneficial for patient along with lack of studies .It can lead to better pain management, improved mobility and enhanced overall wellbeing for individuals with osteoarthritis.

## MATERIALS:

1. Ultrasound:
2. Universal goniometer:
3.WOMAC Scale

## METHODOLOGY

1. **Source of Data:** SJS Hospital Physiotherapy OPD
2. **Study Design :** Pre and post interventional Study
3. **Sample Population :** Middle Adulthood
4. **Sampling Method:** Convenient Sampling
5. **Sample Size:** 30 Participants
6. **Study Duration** : 6 Months with Intervention of 3 Weeks

**Inclusion criteria:**

1. Age 45 years to 65 years
2. Both male and female gender
3. Grade 2 and 3 (kellagren –Lawrence classification of knee osteoarthritis)
4. Willing to participate

**Exclusion criteria:**

1. Traumatic knee pain, fracture or ruptured ligament, meniscopathy of knee joint.
2. Any recent surgery of knee joint or those who had undergone arthroplasty surgery in knee joint.
3. Tumors of knee joint
4. Neurological conditions
5. Cardiological conditions

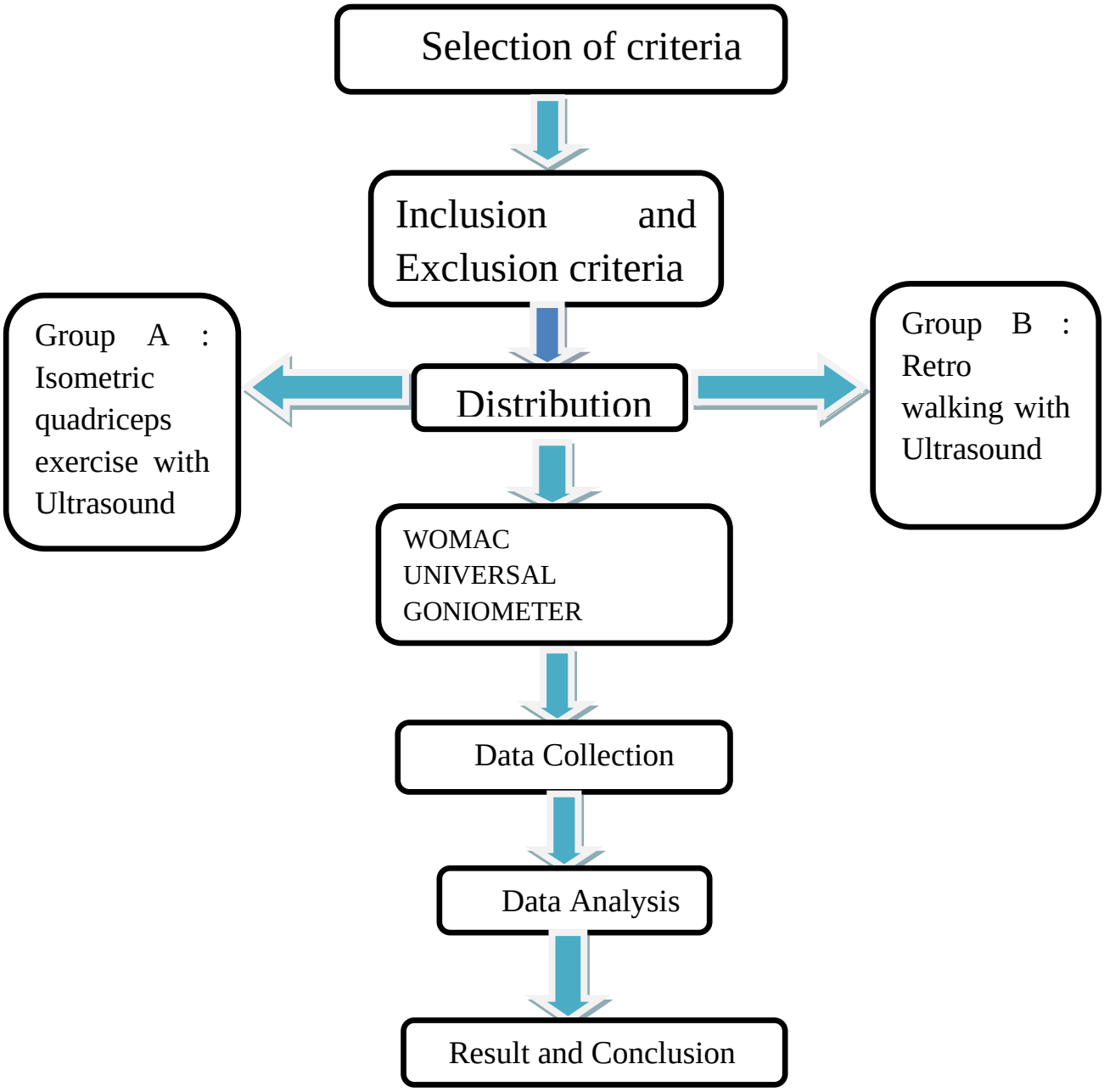
## OUTCOME MEASURES:

**1. WOMAC: -** Western Ontario and McMaster Universities Arthritis (R-0.7)

It is widely used in the evaluation of knee osteoarthritis. It is a self – administered questionnaire consisting of 24 items divided into 3 subscales: Pain ,Stiffness, Physical functions

**2.Universal goniometer:** To Measurement knee joint range of motion in participants of osteoarthritis.

- In this, the instruction given to participants about study and its benefit.
- Procedure will be explained to all participants.
- A written consent will be obtained from all participants.
- All the participants will be screened and Divided into 2 groups of 15 subjects each.
- Group A will be given Ultrasound with Isometric quadriceps exercise.
- Group B will be given Ultrasound with Retro walking.
- All the participants will be introduces and will be given a briefing about procedure.
- Pre and post intervention assessment checked by WOMAC Scale, Universal goniometer.




**Flow chart: Procedure**

**Intervention:**

**Group A: Ultrasound with Isometric quadriceps exercise**

- **Ultrasound:**

In this group were given Ultrasound therapy In supine position, over painful knee region with Intensity of 1 mzh, 1.5 watts/ $cm^2$, with ultrasonic gel in a small concentric circle movements for 5 minutes.

- **Isometric Quadriceps exercise :**

Sitting on a floor with two rolled towel under the thigh and toes pointed upward, the patient underwent contraction of the knee and put pressure on the back of the leg directed on the floor, a position that was maintained for 5 sec. followed by relaxation and a return to the original position , this activity was repeated 10 times and then starting a new series on the opposite leg ; between each set there was a time

for rest 45 sec.


**Group B : Retro walking with Ultrasound**

- **Ultrasound:**

In this group were given Ultrasound therapy In supine position, over painful knee region with Intensity of 1 mzh, 1.5 watts/ $cm^2$, with ultrasonic gel in a small concentric circle movements for 5 minutes.

- **Retro waking:**

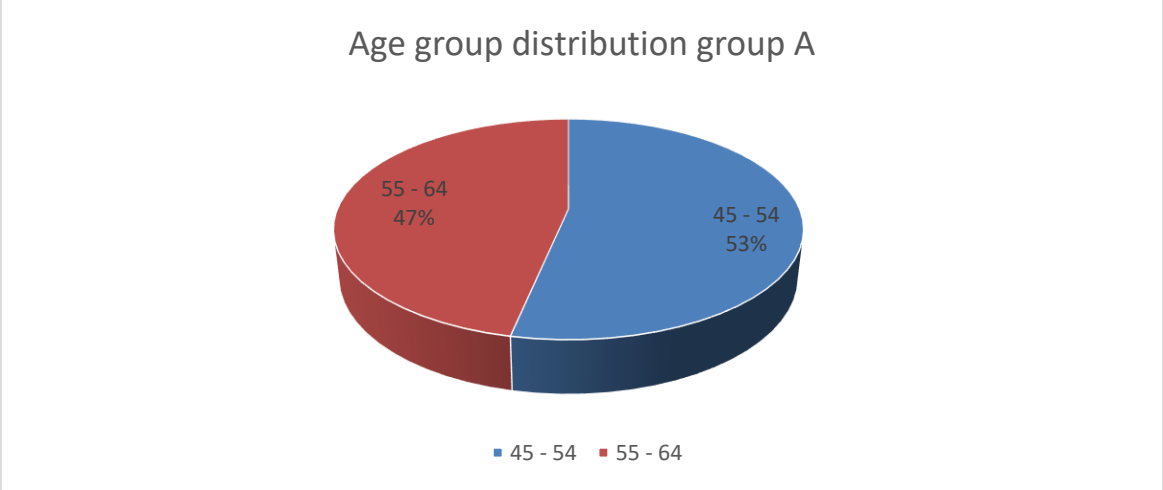
The participants initially were made to walk 5 steps forward and 4 step retro walk and were observed for any discomfort. If no discomfort then, participant was made to retro walk for 10 minutes per session. The participants will be first familiarized with retro walking on flat surface (distance 20 meter) such that during retro walking, the toes strike the ground first instead of heel. Practice session was made for retro walking with support of wall. The participant received retro walking on flat surface (distance 20 meter) at the maximum pace with support of the wall for 10 minute per session. The session includes 4 min of retro walking following 2 minute of rest time and then again 4 minute of retro walking. The therapist was walking beside the participant. The protocol followed was retro walking 10 minute.

The data analysis was performed using Statist XL version 2.0. Paired' test was used for all intergroup comparison (pretest and posttest). Unpaired' test was utilized to compare the intra group scores (pretest scores comparison between group A and B.

**Table 4.1: Distribution of participants according to age (Group A)**

| AGE | PERCENTAGE OF GROUP A |
|---|---|
| 45-54 | 53 % |
| 55-64 | 47 % |

**Graph 4.1 age wise distribution of participants group A**

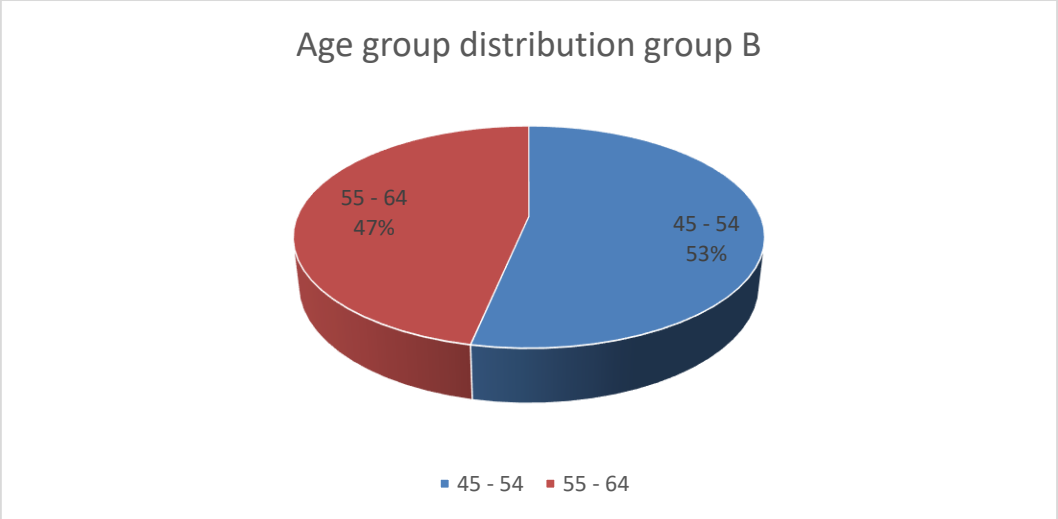



Out of 30 participants included in study in theses 15 participants randomly divided in group A .53% were from age group of 45-54 years, 47% were from age group of 55-64.

**Table 4.2 Distribution of Group B:**

| AGE | PERCENTAGE OF GROUP B |
|---|---|
| 45-54 | 53 % |
| 55-64 | 47 % |

**Graph 4.2 age wise distribution of participants of group B**

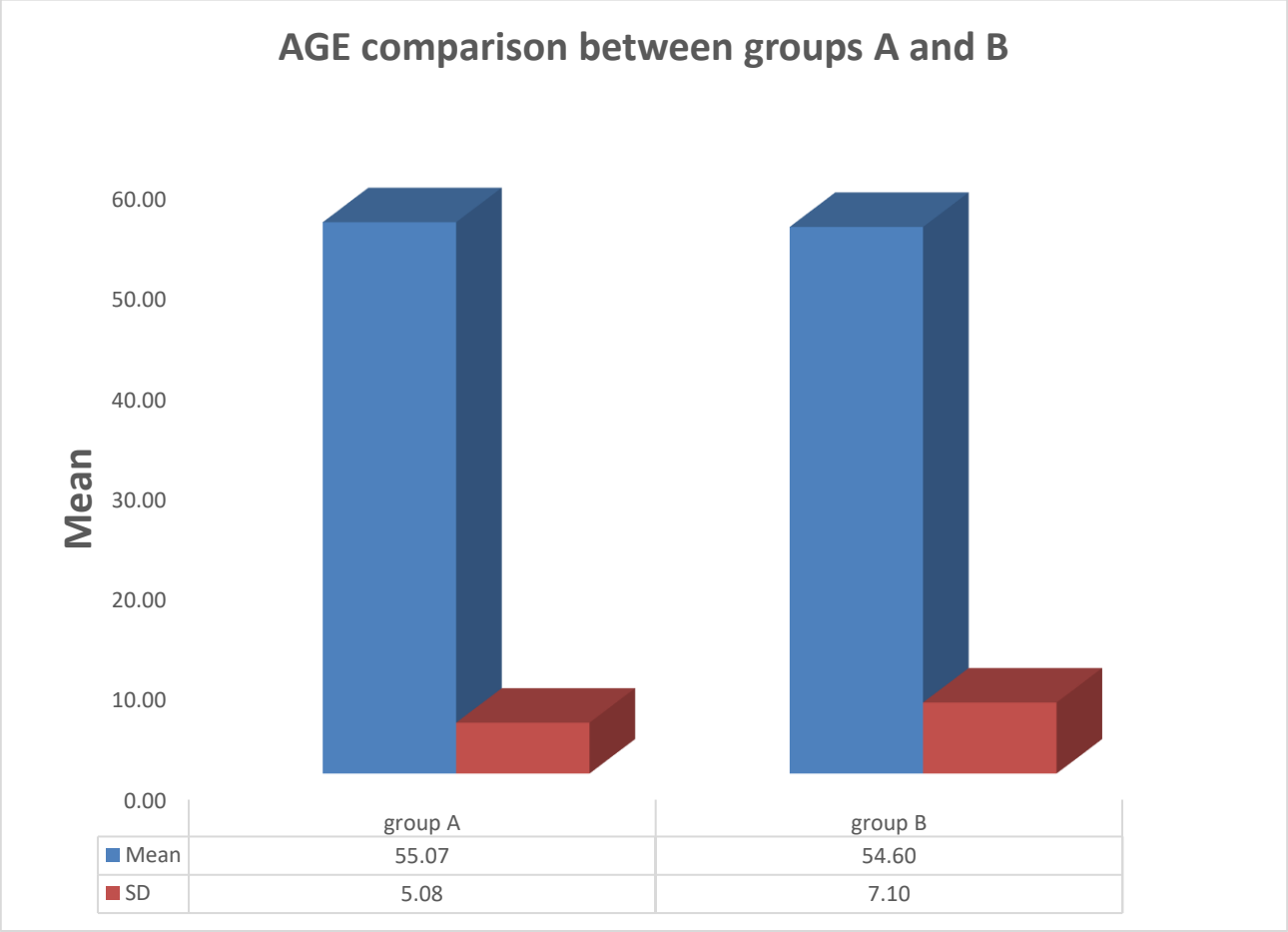


Out of 30 participants included in study in theses 15 participants randomly divided in group B .53% were from age group of 45-54 years , 47% were from age group of 55-64 years.

**Table 4.3 AGE COMPARISION BETWEEN GROUPS:**

| | Mean | Standard Deviation |
|---|---|---|
| Group A | 55,08 | 5,08 |
| Group B | 54,60 | 7,10 |

**Graph 4.3 age comparison between both groups A and B**




Out of 30 participants included in these Randomly divided 15 participants in group A and 15 in group B.Group A Mean is 55,08 and standard deviation is 5,08.
Group B Mean is 54, 60 and standard deviation is 7, 10.

**Table 4.4.Goniometer Ranges**

| **Goniometer Ranges** | | | | |
|---|---|---|---|---|
| | Group A | | Group B | |
| | **Pre** | **Post** | **Pre** | **Post** |
| Mean ± SD | 101,20 ± 7,23 | 11500 ± 7,79 | 100,00±7,90 | 121,33±6,11 |

**GRAPH 4.4 Graph representing goniometer score comparison**

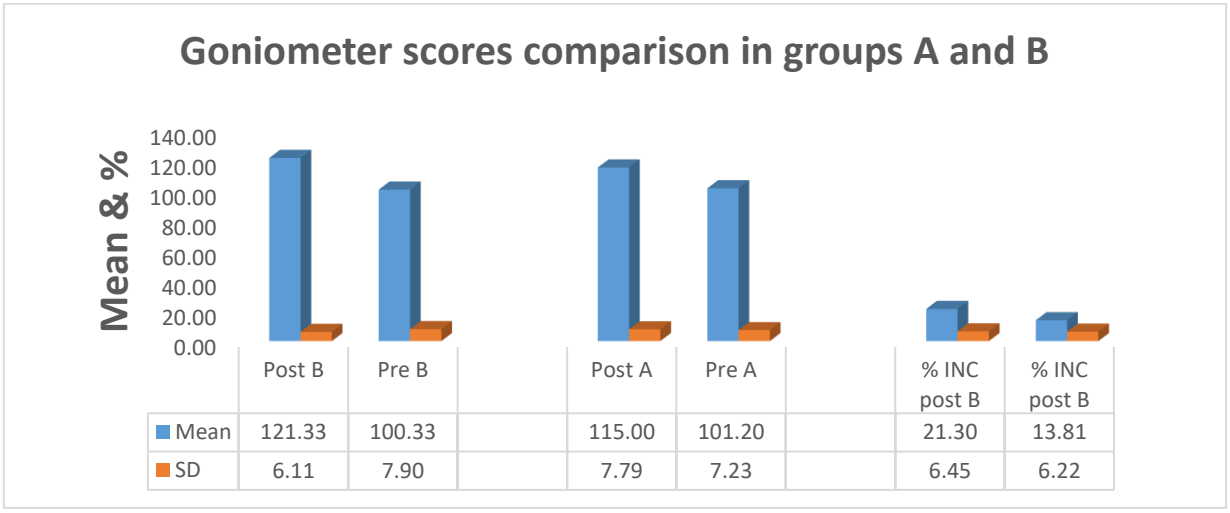



Table 4.4 and graph 4.4 shows that for Group B Post goniometer mean value 121,33 is significantly greater than the pre goniometer mean value 100,33 't' value 16.0391 is significant ['p' < 0.01].Therefore pre and post goniometer mean values differ significantly . For Group A Post goniometer mean values 115,00 is significantly greater than the pre goniometer mean value 101,20 ‘‘t’ value 8.835 is significant (‘P’ < 0.01).Therefore pre and post goniometer mean values differ significantly.Mean percent decrease decreases in post goniometer of group B (21,30) is significantly greater than that of Group A (13,81) . 't' value 8.835 is significant ['p' < 0.01]. Therefore mean % decrease in post goniometer values differ significantly between group A and B.

**Table 4.5 WOMAC SCALE**

| WOMAC Score | | | | |
|---|---|---|---|---|
| | Group A | | Group B | |
| | **Pre** | **Post** | **Pre** | **Post** |
| Mean ± SD | 64,93±10,44 | 5053±7,91 | 63,00±14,49 | 35,47±11,29t |

**Table 4.5 Graph representing WOMAC score comparison**

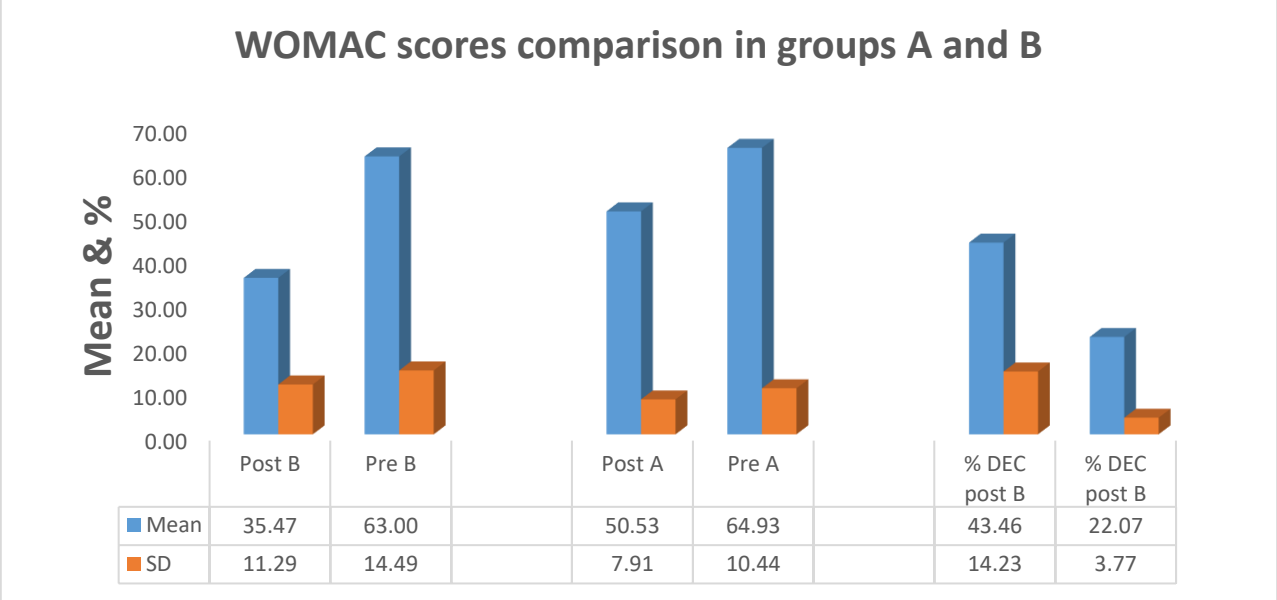


Table 4.5 and graph 4.5 shows that for group B Post WOMAC mean values 35, 47 is significantly less than pre WOMAC mean value 63, 00. 't' value 9.555 is significant ['p' < 0.01]. Therefore pre and post WOMAC mean values differ significantly. For group A Post WOMAC mean values 50,53 is significantly less than pre WOMAC mean value 64,93. 't' value 14.483 is significant ['p' < 0.01] .Therefore pre and post WOMAC mean values differ significantly. Mean percent decrease in post WOMAC group B 43.46 is significantly greater than that of group A 22,07 't' value 14.483 is significant ['p' < 0.01] .Therefore more % decrease in post WOMAC values differ significantly between groups A and B.

As per statistical analysis both groups shown significant improvement but group B( Ultrasound with Retro walking) was having most significant improvement as compared to group A.(Ultrasound with isometric quadriceps exercises).

**DISCUSSION**

Osteoarthritis is a very common case and is regularly physiotherapy clinics. Mostly the affected population is elderly in whom prominent weakning and wasting of quadriceps muscle is seen.as the affected population is mostly aged, they can't bear heavy weight which is needed for strengthening.[24]

The present study aimed at finding out the effectiveness of Ultrasound with Isometric quadriceps exercise and Retro walking in Osteoarthritis. In this study 30 participants of osteoarthritis of knee were divided in to group A and group B respectively, each group consisting of 15 participants. There are 53% participants in group A and 53% participants in group B with their age group ranges between 45-54 years. The age group between 54-64 years has 46% participants in group A and 46% participants in group B.

As per the study by mirsad muftic et al the application of continuous ultrasound in patients with chronic pain caused by degenerative changes in musculoskeletal system lead to significant reduction in pain.[25]

Using a Universal goniometer to assces (the range of motion of knee flexion ) as 1st outcome measure for both groups and found that there is significant improvement in group B participants (with pre intervention mean value of knee flexion 100,33 and standard deviation is 7,90 ) and the post intervention mean value of knee flexion 121,33 and standard deviation is 6,11by the end of 3rd weeks) compared with group A participants (with pre intervention mean value of knee flexion 101,20 and standard deviation is 7,23) and the post intervention mean value of knee flexion 115,00 and standard deviation is 7,79 by the end of 3rd weeks)

Using a WOMAC scale ( Assessment of physical function ) as 2nd outcome measure for both the groups and found that there is significant improvement or Reducing the womac score group B participants (with pre intervention mean value 63,00 and standard deviation is 14.49) and the post intervention mean value 35,47 and standard deviation is 11,29 by the end of 3rd weeks) compared with group A participants (with pre intervention mean value of 64,93 and standard deviation is 10,44) and the post intervention mean value of 50,43 and standard deviation is 7,91 by the end of 3rd weeks)

The result of study showed that Ultrasound is effective in reducing pain and Both Isometric quadriceps exercise and Retro walking are effective in improving knee range of motion, reduce stiffness and improving quality of life in participants with osteoarthritis. Then after data analysis result of present study showed that Ultrasound with Retro walking technique is more effective in knee joint range of motion, reduce stiffness, improving quality of life and reduction in WOMAC score (Assessment of physical function) in osteoarthritis.

Ahmed H. Alghandir et al conducted a study in which he concluded that in people with knee osteoarthritis, a 6 week retro walking program reduces pain and physical weakness and increase quadriceps muscle strength and efficiency as compared to forward walking or control classes.[26]
The study by F Tascioglu et al 2010 found that there was significant improvement in total WOMAC score and walking speed in patient those who received both continuous and pulsed ultrasound therapy.[25]
The similar study Somashekar, R. Raja, et al, Conducted a study on compare the effectiveness of transcutaneous electrical nerve stimulation with retro walking verses ultrasound with retro walking in chronic osteoarthritis. They conclude that TENS with retro walking and therapeutic Ultrasound with retro walking showed effectiveness in reducing the pain intensity , improving the functional outcome and range of motion but ultrasound therapy with retro walking showed superior hand over than TENS with retro walking.

## CONCLUSION

Hereby the study concludes that group B(Ultrasound with Retro walking) was more effective in reduce pain , stiffness improving range of motion of knee joint, reduce womac score as compared to group A ( Ultrasound with Isometric quadriceps exercise).

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