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# Effectiveness of Pilates versus Otago exercise program on functional improvement in patients with osteoarthritis of knee joint: A comparative study

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**Abstract**
**Aim:** To find out the effectiveness of Pilates vs Otago exercise program on functional improvement in patients with osteoarthritis of knee joint.
**Material and Method:** This experimental study had 60 participants including both male and female with age group of 50 to 60 yrs of age, having bilateral knee pain and preobese patients were included. Whereas traumatic injury, vascular injury, neurological conditions were excluded. Material required were chair, mat and weight cuffs.
**Result:** Data analysis was done using paired t test and unpaired t test.
The present study showed significant effect of Pilates exercise program on comparison with Otago exercise program on functional improvement in patients with osteoarthritis of knee joint using WOMAC scale.
**Conclusion:** The Study concluded that Pilate's exercise is more effective than Otago exercises on functional improvement in osteoarthritis of knee patients.
On the basis of statistical analysis we conclude that single intervention of self myofascial release is effective in improving score of sit and reach test as flexibility of outcome measure. So, we conclude that self myofascial release might be effective treatment to reduce tightness of hamstring muscle in badminton players and improve their performance.

**Keywords:** osteoarthritis [OA], Pilates exercises, Otago exercises, WOMAC scale

## Introduction

Osteoarthritis is prevalent [28.7%] disease characterized by structural changes in cartilage, bone and synovial and other joint structures [1].
Osteoarthritis is second leading cause of disability among lders [1].
The strong and stretchy cartilage act as cushion between bones. When this material breaks down or wears out bone rubs against bone. As a result, the OA sufferer experiences mild to severe pain, morning stiffness, joint tenderness, joint instability, swelling and sometimes bony enlargements that can reduce joint motion [1].
Adults suffer from knee osteoarthritis, which can limit the ability to climb Stairs, stand comfortably, walk & even complete regular activities of daily living [1].
Joseph Pilates was creator of Pilates a German –born emirge to Britain and then America, he advised Pilate's method as a new approach to exercise and body conditioning in the early decade of the last century.
Pilate's method can be defined as a comprehensive body - mind conditioning, with main goals which are efficient movement, core stability and enhanced performance.
Pilates have become a popular exercise and fitness level that combines strength flexibility, and movement coordination along with rhythmic respiratory training [6].
Pilates offers endless possibilities with its scores of exercises based on six principles.
There are six basic principles includes control, breath, flow of movement, centering, precision, stability [6].
Pilate's focus on balance and strengthening of ligaments tendons and joints, older adults have the opportunity to increase their level of functional strength and improve the efficiency of daily life [6].
The otago exercise program was developed and tested in four controlled trials by a research team at the University of Otago Medical School, New Zealand led by professor John Campbell.
Otago exercise program' (OEP) is a strength and balance retraining program designed to prevent falls in older people living in the community [7].
Otago exercise programs consist of lower extremity muscle strengthening and balance-retraining exercises.
Otago exercises include the use of weight cuffs during lower extremity exercises to improve overall muscle strength.
Otago exercise program include exercises that challenge balance and use a high dose of exercise [7].
Otago exercise has better effect on mobility in older adults [2].

## Material and Method

Study design: experimental study
Sample size: 60
Study setting: clinics in and around Pune.
Study duration: 8 weeks (3 times a week)
Material to be used: chair, Mat, weight cuffs, pen, paper.

Outcome measure: WOMAC scale
Inclusion criteria: age group 50 to 60 yr, both male and female, knee pain from last 3 months, preobese patient, OA knee grade 1 and 2 according to Kellegren and Lawrence classification, bilateral OA knee, DM and HTN patient on medication.
Exclusion criteria –patient suffering from any traumatic injury hip, knee, ankle and back, vascular injury, neurological conditions.

**Procedure**
Ethical clearance was taken from the Modern College of Physiotherapy.
Consent was taken from participants.
All the participants will be explained about the purpose of the study.
The subjects will be screened for inclusion and exclusion criteria by the primary investigator and then the baseline measurements will be taken. Eligible subjects will be allocated into two groups.
Group A: participants receiving Pilates exercise program.
Group B: participants receiving Otago exercise program.
Participants will be randomly allotted in these groups (odd and even method).
Outcomes will be taken pretreatment session.
Therapy will be given 3 times per week for 1 treatment session of 60 minutes per day for 8 weeks including 10 min warm up session, 40 min exercise program and 10 min cool down exercises.
Outcomes will be taken at the end of the session to see the progression.

**Pilates exercise protocol**

**Table 1**

| | Exercises |
|---|---|
| Week 1 | Hundreds 1/2/3 |
| Week 2 | Week 1 + One leg stretch 1, Double leg stretch 1/2, Clam |
| Week 3 | Week 2 + One leg stretch 2, Shoulder bridge 1 |
| Week 4 | Week 3 + Shoulder bridge 2, Hip twist |
| Week 5 | Week 4 + Scissors 1, One leg kick |
| Week 6 | Week 5 + Scissors 2, Side kick 1 |
| Week 7 | Week 6 + Side kick 2, One leg circle ½ |
| Week 8 | Week 7 |

**Otago exercise program**
Front knee strengthening
Back knee strengthening
Side hip strengthening
Calf raise withhold support and no support
Toe raise withhold support and no support.
Knee bend withhold support and no support
Backward walking and turning around
Sideways walking
Heel toe standing. Withhold support and no support
One leg stand withhold support and no support
Heel toe walking withhold support and no support
Sit to stand withhold support and no support
Stair walking.

**Result**
**Statistical Analysis**
**Gender Distribution**

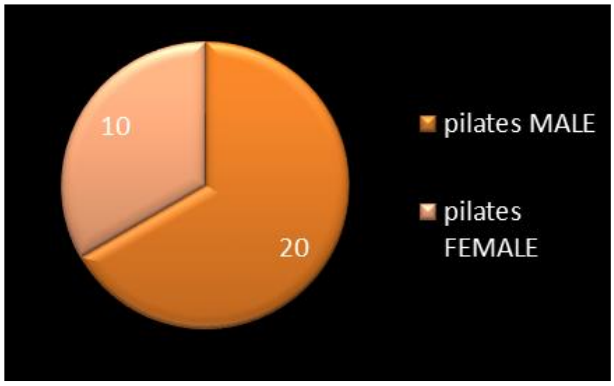


**Fig 1**

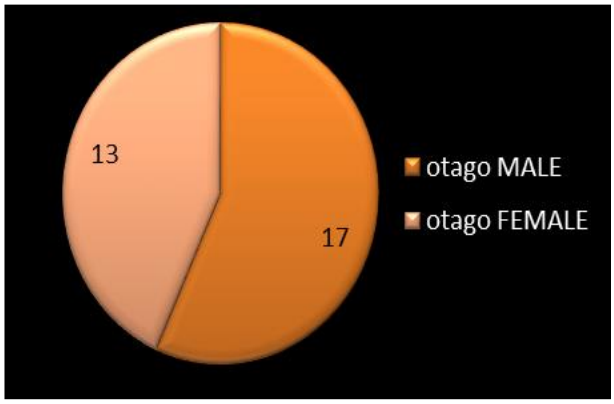


**Fig 2**

**Table 2**

| | Male | Female |
|---|---|---|
| Pilates | 20 | 10 |
| Otago | 17 | 13 |

**Interpretation:** total 60 participants 30 in pilates group in which 20 males and 10 females 30 in otago group in which 17 males and 13 females

**Table 3**

| | Pre Pilates | Pre Otago |
|---|---|---|
| Mean | 54.23 | 53.9 |
| SD | 3.59 | 3.90 |

P Value IS 0.73

**Interpretation:** table 3 shows pre pilates and pre otago comparison using unpaired t test which shows not significant result.

**Pre & post Pilates and pre & post otago**

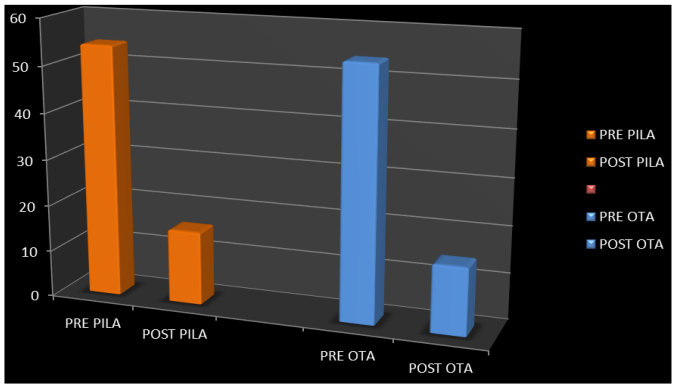


**Fig 3:** Pilates Graph Otago Graph

**Table 3**

| PILATES | PRE | POST | DIFF |
|---|---|---|---|
| MEAN | 54.5 | 15.8 | 38.43 |
| SD | 3.5 | 2.4 | 3.21 |

**Table 4**

| OTAGO | PRE | Post | DIFF |
|---|---|---|---|
| MEAN | 53.9 | 14.5 | 39.33 |
| SD | 3.9 | 1.8 | 3.1 |

P value <0.0001 P value - <0.0001

**Interpretation-** fig 2 shows pre and post analysis was done within the groups using paired t test which showed extremely significant results.

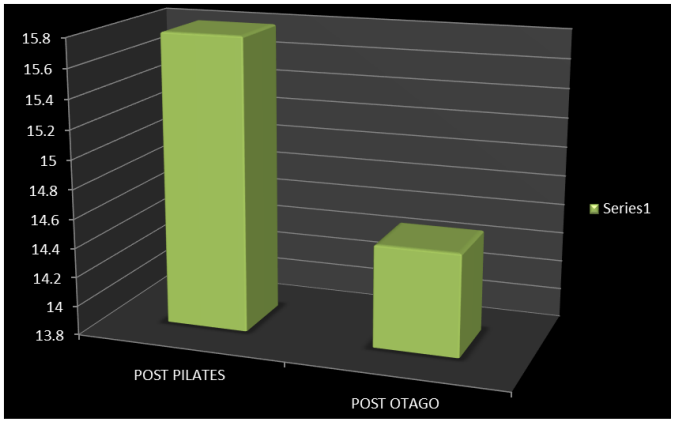


**Fig 4**: Post Graph

**Table 5**

| POST | PILATES | OTAGO |
|---|---|---|
| MEAN | 15 | 14 |
| SD | 2.4 | 1.8 |

P value is 0.0338
Mean difference is -1.233

**Interpretation:** fig 3 shows that post Pilates and otago analysis was done using unpaired t test which shows p value 0.0338 which considered significant and mean difference – 1.233 which means Pilates exercise is more effective than Otago exercises.

**Discussion**

This study was designed to check functional improvement in OA knee patients. The data showed 8 week Pilates and Otago exercise programme led to significant functional improvement on WOMAC outcome measure.

In group A Pilates exercises were given it shows significant improvement in functions after giving interventions.

In group B Otago exercises were given it shows significant improvement in functions.

In our study Pilates exercises are more significant than Otago exercises.

In Pilates exercise we work with core muscles as well as body mobilizers and stabilizers. Pilates works on six principles centering, breath, and control flow of movement, precision and stability [6].

Core muscle endurance deficient lead to an increase in loading of the knee, as well as in knee joint contact force during dynamic movement. Core muscles comprised of plantar flexor evertor, soleus, gluteus maximus, gluteus medius, transversus abdominis, multifidus, rectus abdominis and oblique abdominals were found consistently activated before any limb movements.

Reduction in physical activity will potentially also lead to core muscles weakness over time due to muscles disuse. The core muscles involved in supporting body weight and decreases loads of the knee joint [13].

Pilate's exercises improve physical and mental conditioning thorough increasing strength, flexibility, balance and postural awareness by stretching and strengthening exercises [5].

Pilate's exercises improve proprioception via mental effort, focuses on activating specific muscles at correct speed, quality, precision and control of movement with specific joint awareness.

Previous studies suggested that, muscle strength and proprioception need to be improved first to have improvement in functional performance.

During the physical activity increase in muscle spindle output through the gamma routes observed, which facilitate the cortical projection of proprioception.

Thus, by increasing the output of the muscle spindle over time, it is possible to induce plastic changes in the central nervous system, such as increased strength of synaptic connections and/or structural changes in the organization and number of connections among neurons.

These repetitive afferent inputs from mechanoreceptors induce plastic changes in the cortex would modify the cortical maps of the body overtime, increasing the cortical representation of the joints and leading to enhanced joint proprioception [8].

Pilates focus on balance and strengthening of ligaments tendons and joints, older adults have the opportunity to increase their level of functional strength and improve the efficiency of daily life.

In our study, from functional assessment on WOMAC scale, Pilates exercises shows more significant improvement than Otago exercises as Pilates exercises improve strength lower

limb muscles as well as core muscles and improve joint proprioception which gives more functional improvement in OA knee patients.

**Conclusion**

Pilate's exercises show more significant functional improvement in knee osteoarthritis than otago exercises.

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