Comparison of Aerobic Strengthening Exercise Vs Conventional Exercise in Reducing Pain and Improving Balance in Osteoarthritis Knee Subject

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Abstract

Background: Osteoarthritis is a chronic knee disease that is caused due to wear and tear injury or inflammation in the joint causing pain and limiting ROM. The condition leads to joint stiffness which causes joint weakness and loss of stability and balance. The purpose of this study is to determine whether ASE or CE is effective in reducing pain and improving balance in an OA knee subject.

Purpose: To find out the effect of aerobic strengthening exercise and conventional exercise in reducing pain and improving balance in osteoarthritis knee.

Materials and Methods: 198 individuals aged from 55 to 70 of both genders suffering from pain and reduced balance in OA knee participated in the study taken from Dynamics physiotherapy and rehabilitation centre. The individuals were randomly assigned into two groups. Group A received ASE; Group B received CE for 4 weeks. The functional state of the subjects was evaluated pre and post using the NPRS and TUG test. The entire process was conducted from November 2022 to March 2023.

Results: Aerobic strengthening exercise was found to be effective compared to conventional exercise in improving balance and reducing pain in OA knee subjects.

Conclusion: Group A had better balance and seemed to have reduced pain in OA knee during ADL compared to Group B. It is concluded that ASE provides balance and reduces pain and is seen as an effective treatment in OA knee.

Key Words: Osteoarthritis, Range of Motion, Aerobic strengthening Exercise, Conventional Exercise, Numerical Pain Rating Scale, Time Up & Go, Activity of Daily Living

Introduction

Osteoarthritis is of two types Primary and Secondary, this is the most commonly occurring arthritis. Primary OA is idiopathic and has no exact cause. It can be caused due to wear and tear injury. The hyaline joint cartilage is the main cause of OA, the hyaline acts as a cushion between the bones it provides smooth gliding for the surface of the joint, when the cartilage breaks it allows the spurs to move around the joint causing pain and swelling and restricts movement of the joint. The inflammation leads to the process called cytokines and enzymes

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which leads to more wear and tear of the joint and damage of the joint.\textsuperscript{7,2,3,6} Joint osteoarthritis is the most common disease in adults and studies have shown that 6% of the adult population are diagnosed with knee OA, by the age of 60, 10% of men and 13% of women are diagnosed with symptomatic knee OA. The causes for the condition are ageing, obesity, repetitive use of knee, knee injury, muscle weakness, joint laxity and bone density. The process of the condition begins in the second decade of life but the degenerative changes and symptoms are not seen until middle age.\textsuperscript{8} Osteoarthritis being a disease of the joint involves and affects lifestyle of a particular individual and also has an impact on anxiety, depression, difficulty in activity of daily living, socializing, feeling helpless and unable to fulfil occupational needs.\textsuperscript{8} Aerobic exercise refers to cardio and conventional exercise refers to weight free exercise.\textsuperscript{1,7} Aerobic exercise is mostly cardio, this exercise helps keep the cardiovascular and respiratory system healthy.\textsuperscript{17,18,19} Aerobic exercise deals and targets more on the oxygen inspiration and expiration, during this activity or exercise raises the heart rate, blood pumps more and works the large muscle groups.\textsuperscript{15,16} The benefits of this exercise are improved cardiovascular health, lowered blood pressure, regulated blood sugar, aided sleep, weight management and better mood. Engaging in aerobic strengthening for individuals with OA knee helps in enhancing and improving joint mobility, reduction of pain, and also aids in overall health. For individual with OA knee aged from 55 to 75 it is essential to choose activities that are low impact and don’t stress the knee joint such as walking, slow cycling, water aerobics, elliptical training, rowing, low impact aerobics that are stepping, marching and side to side movement.\textsuperscript{13,14}

Aim

To determine the effect of aerobic strengthening exercise vs conventional exercise in reducing pain and improving balance in OA knee subject.

Materials and Method

It was a comparative study which included 198 subjects presenting with osteoarthritis knee aged 55 years and above. Convenient sampling with random allocation method was done in this study.

Inclusion Criteria

- Age – 55 or above
- Both male and female
- Subject should be diagnosed with OA knee grade I and II based on American college of Rheumatology
- Knee pain duration more than 3 months

Exclusion Criteria

- Age – 55 or above
- Both male and female
- Subject should be diagnosed with OA knee grade I and II based on American college of Rheumatology
- Knee pain duration more than 3 months

Outcome Measures

- Numerical Pain Rating Scale (NPRS)
- Time Up and Go Test (TUG)

Procedure

A sample size of 198 participants was included in this study. Prior to their involvement, subjects provided written consent by signing a consent form. The participants in group A received Aerobic Strengthening Exercise every day for a four-week period.

On the other hand, the participants in group B engaged in conventional exercises every day for 4 weeks, the same as group A.

Additionally, both the groups were given IFT for pain before every session for 12 mins, the base was set at 90Hz and the spectrum at 50hz with a frequency of 80-100 Hz. The program was fixed at 20 and a trapezoidal pattern was used.

Group A: Aerobic Strengthening Exercise

1. Ball squats – stand on the resistance band with the feet shoulder – width apart, hold the end of the band at shoulder height, maintain tension in the band while performing squats. (3x10)
2. Dumbbell step up – hold a pair of dumbbells by your side. Step on a stair with one foot, then bring the other foot up. step back down in the same order. (3x10)
3. Russian twist assisted with stability ball – rest yourself faced forward on a stability ball with your feet planted flat and comfortably on the ground, lean back gently and move your torso side to side. (3x10)
4. Seated marching – sit straight on a chair and perform the marching action. (3x10)
5. Seated leg extension – sit straight on a chair and extend your legs one by one. (3x10)
6. Heel to toe walk – walk on a straight line, placing one foot directly in front of the toes of the other foot with each step. Use a wall or support to prevent falls. (3x10)
7. Calf raises – stand near a wall or support, rise up onto your toes, lifting your heel off the ground, then slowly lower back down. (3x10)
8. Tandem walk – walk in a straight line (1x10)
9. Walking 15 minutes

**Group B: Conventional Exercise**

1. Quadricep isometrics – sit on a chair, place a rolled towel or small pillow under the knee and contract the quadricep muscle in front of the thigh by pressing the back of the knee down into the towel or pillow. (3x10)
2. Hamstring isometrics – sit on a chair with flat feet and knee at 90 degrees press the heel down into the floor, at the same time contract the hamstring muscle. (3x10)
3. SLR Straight leg raise – sit on a chair and extend the leg, lift the extended leg off the ground keeping the knee straight. (3x10)
4. Hamstring strengthening – stand behind a chair holding onto it for support. Flex the knee and bring your heel toward your hip region and gently lower your leg back down. (3x10)
5. Heel slide – lie on your back with both knee bent and feet flat on the floor. Slowly slide one heel along the floor, straightening the knee as much as possible. (3x10)
6. Calf raises – stand near a wall or support. Rise up onto your toes, lifting your heel off the ground, then slowly lower back down. (3x10)

Isometrics were applied with 6 second contraction and a rest period of 2 seconds.

**Data Analysis**

**Graph No. 1: Comparison of pre-test and post-test values of group A (aerobic strengthening exercise) using NPRS and TUG test**

**Graph No. 2: Comparison Of pre-test and post-test values of group B (conventional exercise) using NPRS and TUG test**

**Graph No. 3: Comparison of post-test values of group A (aerobic strengthening exercise) and group B (conventional exercise)**

**Result**

The statistical analysis of the data that was collected and evaluated revealed a statistically significant difference in the values between the group that received Aerobic Strengthening Exercise and the group that received Conventional Exercise.
**Graph 1:** The data obtained shows pre and post mean values of the group that received Aerobic Strengthening Exercise.

Mean values obtained for NPRS (cms) was 7.09 (SD 1.45) in pre and 2.81 (SD 0.09) in post. The t value was noted down to be 24.2551 with P value lesser to 0.0001.

Mean values obtained for the TUG test (secs) was 22.3 (SD 3.72) in pre and 9.288 (SD 0.05) in post. The t value was noted down to be 33.2167 with P value lesser to 0.0001.

**Graph 2:** The data obtained shows pre and post mean values of the group that received, Conventional Exercise.

Mean values obtained for NPRS (cms) was 8.20 (SD 1.62) in pre and 4.23 (SD 1.06) in post. The t value was noted down to be 20.4037 with P value lesser to 0.0001.

Mean values obtained for TUG test (secs) was 18.5 (SD 3.70) as pre and as 6.48 (SD 2.64) in post. The t value was noted down to be 26.3124 with P value lesser to 0.0001.

**Graph 3:** The data obtained shows post values of both Aerobic Strengthening Exercise and Conventional Exercise.

Mean values obtained for NPRS (cms) was 2.81 (SD 0.09) in post for group one and as 4.23 (SD 1.06) for the other group. The t value was noted down to be 9.7412 with P value lesser to 0.0001.

Mean values obtained for TUG test (secs) was 9.288 (SD 0.05) in post in group one and 6.48 (SD 2.64) for the other group. The t value was noted down to be 12.8119 with P value lesser to 0.0001.

The data obtained shows that Aerobic Strengthening Exercise has more effect than Conventional Exercise on the subjects with pain and decreased balance due to osteoarthritis.

**Discussion**

The goal of the above conducted study is to find the efficacy for individuals with grade I and grade II Osteoarthritis by treating them with aerobic strengthening exercise and conventional exercise.

Osteoarthritis is a common and active condition that occurs in almost more than half of the population when they cross the age of 50, the population the experience osteoarthritic knee have various symptoms which comprises pain, joint instability, loss of range of motion, limitation of movement and loss of balance and coordination.

Osteoarthritis occurs due to multifactorial reasons; studies show that any past medical history of knee trauma increases the risk of the knee OA 3.86 times. Mechanical forces that act on the knee are also a reason that leads to Osteoarthritis knee.

Osteoarthritis develops due to interactions between systematic and local factors. The progression of the condition may be due to risk factors, advancing age, genetics, trauma, knee malalignment, increased biomechanical loading due to obesity, bone density and imbalance in physiological processes.

Lucie Brosseau et al showed that aerobic strengthening exercise in general is more beneficial for OA patients and is equivalent to strengthening exercise further more Linda Mclean et al showed that a short-term aerobic exercise program with or without muscle strengthening exercise has been promising for reducing pain and improving physical functional and overall health in individuals with OA.

World J Orthop et al reported that aerobic exercise has the efficacy in reducing pain and improving physical and overall function in OA individuals. Sumaiyah Mat et al showed that aerobic exercise improved balance and fall risk in older individuals with knee OA.

K La Mantia and R Marks et al showed that aerobic strengthening has been actively effective in reducing pain in OA individuals, further Ryo Tanaka concluded that showed in a study that both muscle and aerobic strengthening has been effective in reducing pain in OA knee individuals.

Later Vahid Mazloum concluded the same as the previous authors that aerobic strengthening has been shown to be effective in reducing pain and improving balance in OA individuals, which was later confirmed by Nader Rahnana in a study that was conducted by her on OA individuals to show that aerobic exercise is effective in reducing pain and improving overall health in the individuals.
In the later years a study showed that aerobic strengthening in cooperation with other kinds of exercise has also been proven to show results in reducing pain and symptoms in OA individuals, Betsy Denisse Perez-Huerta confirmed this in practical research which was conducted by her and her team.\textsuperscript{15}

Rufus A. Adedoyin et al (2005) conducted a randomized control trial on knee osteoarthritis to find out the effects of interferential current and transcutaneous electrical nerve stimulation. The subjects improved significantly over a period of 4 weeks, but there were no additional effects of interferential current or transcutaneous electrical nerve stimulation on pain and function.\textsuperscript{18} With the consideration of the results, we made an attempt to combine the strengthening exercise with the interferential therapy to show improvement in the functional state and reduce pain in the subjects with knee osteoarthritis.\textsuperscript{19}

**Conclusion**

According to the research that was conducted on patients with I and II-degree OA knee for improving balance and reducing pain using Aerobic Strengthening Exercise and Conventional Exercise, it is analysed from the data obtained from the individuals after the period of intervention and concluded that Aerobic Strengthening Exercise has significant result in reducing pain and improving balance.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number- 03/035/2022/ISRB/SR/SCPT

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**Conflict of Interest:** NIL

**References**