Original Article

Effectiveness of Eccentric Strengthening Exercises and Concentric Strengthening Exercises with IFT in Alleviating Symptoms Associated with Osteoarthritis Knee Patients

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Abstract

Background: The most prevalent condition that affects the articular cartilage and subchondral bone is osteoarthritis of the knee. Most cases of knee osteoarthritis are seen in the medial tibiofemoral compartment. There is currently no complete recovery for knee osteoarthritis.

Purpose: The purpose of this study is to evaluate the effect of eccentric strengthening exercise and concentric strengthening exercise with IFT in alleviating symptoms associated with OA knee patients.

Materials and Methods:36 patients with osteoarthritis of the knee are included in the trial. Before beginning the study, an informed permission form was obtained from the subjects. Using the WOMAC scale, the pre- and post-test values were calculated.The Concentric group with IFT and the Eccentric group with IFT were created. The subjects received concentric exercises and eccentric exercises for 3 days a week and it was continued for 4 weeks. For each session,3 sets and 10 repetition was given.

Result: The collected data was statistically analysed using a paired and unpaired t-test. When comparing the eccentric group with the concentric group, the eccentric group indicates significant ($p<0.0001$)effect in lowering the pain and improving the function of the knee as assessed by WOMAC scale.

Conclusion: According to the research, eccentric strengthening exercises combined with IFT are superior than concentric strengthening exercises for lowering pain and enhancing patients' functional activity.

keywords: Eccentric strengthening exercise, Concentric strengthening exercise, IFT, WOMAC scale, Osteoarthritis knee

Introduction

The most prevalent joint condition is degenerative joint arthritis.[1] It has been demonstrated that one intrinsic element that has an impact on how well the knee joint operates is the quadriceps muscle strength.[2] Leg muscle weakness, particularly in the quadriceps, is present in osteoarthritis of the knee patients.[3] It is brought on by metabolic stressors that impact the subchondral bone as well as the

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articular cartilage.[4] Osteoarthritis can be classified into two categories: primary osteoarthritis and secondary osteoarthritis. With an aging population, an increase in the incidence of sedentary lifestyles, and an increase in life expectancy, musculoskeletal disorders like osteoarthritis are projected to represent an increasing economic burden.[5] There is no full recovery from the ailment, and approximately one-third of persons with knee osteoarthritis will see a decline in their structural health, with many of them ultimately needing knee replacement surgery.6 The medial tibiofemoral compartment is where knee osteoarthritis is most common to occur.[7]

Articular cartilage weakening, ulceration, and localized disintegration are pathological alterations seen in late osteoarthritis. Inflammation of the synovium can also happen.[8] Additionally, joint stiffness and a reduction in range of motion (ROM) for daily tasks are frequently brought on by muscular weakening in the knee OA.[9] Pain is a common clinical sign, especially after heavy lifting and prolonged exertion. when stiffness is felt following inactivity.[10]

The severity of quadricep muscular insufficiency is correlated with gonalgia and functional impairment.[11.] These two elements have been demonstrated to be improved by exercise and muscle growth. On the other hand, we are dubious of the best technique for muscular development.[12] For the past few years, federal research projects have focused on identifying the processes underlying the benefits of physical activity for health and the prevention of disease states.[8] It is known that eccentric and concentric muscle motions are used in RT exercises from a mechanical perspective. For standing up, getting out of a chair, and mounting stairs, concentrated motions are necessary. Despite the fact that RT is routinely used to treat knee OA.[8]

Eccentric exercise actions have low energy cost, high force production, and hypertrophic effects, and they also have a beneficial impact on fall risk and physical function.[5] It is said that exercise regimens with a high enough intensity are an efficient way to help healthy persons increase their muscle strength and endurance.[5] In OA, eccentric resistance exercise may be more effective than concentric training at increasing volitional drive and reducing corticospinal inhibition to muscle.[6]

Aim

To evaluate the effect of eccentric strengthening exercise and concentric strengthening exercise with IFT in alleviating symptoms associated with osteoarthritis knee patients.

Materials and Methods

A total of thirty-six subjects were selected from Rajesh Physiotherapy Clinic, Nagercoil.Convenient sampling method was used to gather the sample.The study was done for four weeks in the month of july 2023.

Inclusion criteria:

- Both men and women**.**
- Age between 40 to 60 years
- WOMAC score between 75 to 90

Exclusion criteria:

- Subjects with recent trauma over the knee**.**
- Any other chronic musculoskeletal and neurological disorders
- Chondromalacia
- Recent surgery to the knee.
- Lumbar radiculopathy

Outcome measures:

Western Ontario McMaster Universities Arthritis Index (WOMAC) were used as outcome measures which measures pain, stiffness and physical function respectively.

Procedure

Total of 36 participants were selected according to the inclusion and exclusion criteria and the participants were explained about treatment safety and simplicity of the procedure and written consent was obtained. Subjects willing to participate were randomly allocated into two main groups Eccentric strengthening group with IFT and Concentric strengthening group with IFT. All subjects were undergone pre-test measurement with WOMAC scale and same repeated for post-test at the end of 4 weeks.

IFT: IFT electrodes were placed over the knee using a premodulated bipolar method with the

carrier frequency of 4kHz.Two electrodes were placed over the knee.IFT was given approximately for 20 minutes.The intensity must be maintained at a strong but comfortable level.

Concentric group with IFT: Subjects in Concentric group began with their Concentric strengthening exercises and also IFT is applied to the patients for 20 minutes. The Concentric exercises includes:

- Long arc quadriceps exercises
- Standing leg curl

Long arc quadriceps exercise:

The patient is asked to sit at the edge of the chair with their knees flexed to 90 degree for long arc quadriceps exercise, Fully extend the knee joint during the long arc quadriceps exercise,the leg was raised.At each session,the patient is instructed to complete 3 sets of 15 repetitions.

Standing hamstring curl:

The patient was asked to be in a standing position. The patient was instructed to flex their knees. At each session, the patient is instructed to complete 3 sets of 15 repetitions.

Eccentric group with IFT:

Subjects in eccentric group began with their Eccentric strengthening exercises and also IFT is applied to the patients for 20 minutes.

The eccentric exercises includes:

- Eccentric squat exercise
- Single leg eccentric step down

Eccentric squat exercises:

Ask the patient to slowly flex their knee joint to 90 degrees of flexion. They were then instructed to use both legs to slowly return to the beginning position. At each session patients performed eccentric squats in 3 sets of 15 repetition.

Single leg eccentric step down:

Ask the patient to keep the hip straight and ask them to slowly bend the planted knee, lowering the other leg towards the ground. At each session, the patient was instructed to perform the single leg eccentric step down for 3 sets and 15 repetitions.

Data Analysis

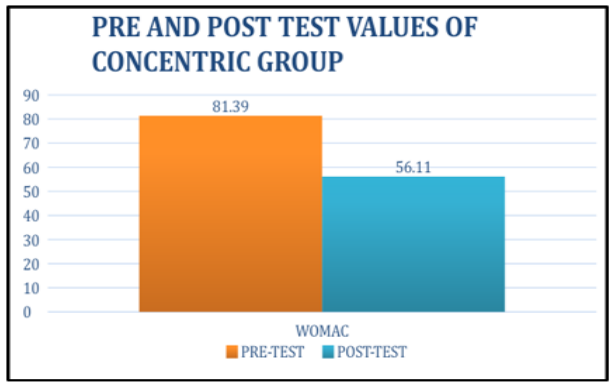

Fig 1: Shows the comparison between pre-test and post-test of concentric group-WOMAC scale

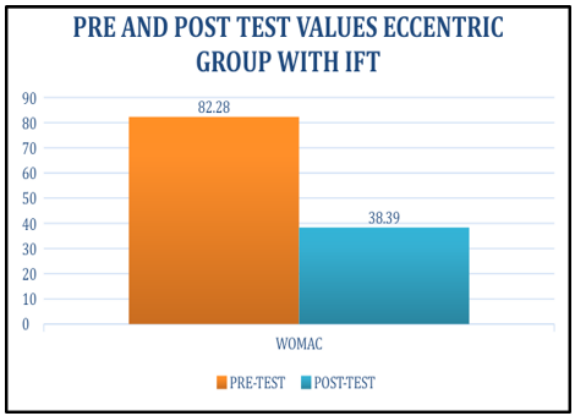

Fig 2: Shows the comparison between pre and post-test values of eccentric group -WOMAC scale

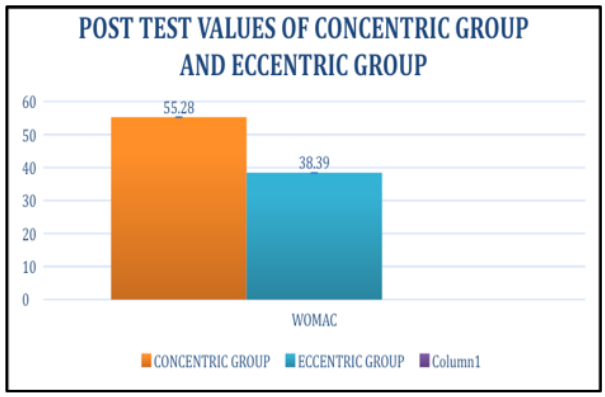

Fig 3: Shows that eccentric strengthening group is more effective than concentric strengthening group in reducing pain and in improving functional activity-WOMAC scale.

Result

Statistical analysis of quantitative data showed statistically significant differences not only in the

Eccentric group but also in the Concentric group. The WOMAC pre-test mean value in Concentric group was 81.39(+3.47) and the post-test mean value was 56.11(3.25).The T-value of concentric group was 26.2566 and the P value (<0.0001) which is statistically significant(Table-1).The WOMAC pre-test mean value in Eccentric group was 82.28(+4.50) and the post-test mean value was 38.39(+2.38).The T-value of Eccentric group was 64.9376 and the P-value(<0.0001) which is statistically significant(Table-2).The WOMAC post-test mean value in concentric group was 56.11(3.25) while it was 38.39(2.38) in Eccentric group. This indicates that the concentric group WOMAC score was significantly higher than the Eccentric group, with p<0.0001(Table-3). Statistical analysis of the WOMAC post-test results revealed that the Concentric and Eccentric group showed similar statistically significant differences. As a result, the Eccentric group exceeds the concentric group statistically.

Discussion

The goal of the present study is to compare the effectiveness of concentric strengthening exercises and eccentric strengthening exercises with IFT in alleviating symptoms associated with OA knee patients. This comparison is demonstrated for a duration of 4 weeks.

An early study by Nigobamm Amit Kumar en et al (2015) has conducted study on isometric exercise versus combined concentric-eccentric exercise training in patients with osteoarthritis knee in terms of lowering pain and functional impairment, both groups made significant improvements. The mean ratings of knee osteoarthritis patients in Group B, in contrast to Group A, revealed a significant reduction in pain and functional impairment. The results suggest that combined concentric-eccentric workouts are more effective at lowering pain and functional impairment in knee osteoarthritis than isometric exercises. In this study total of 36 participants with OA knee were selected and divided into eccentric group(eccentric strengthening exercises) and concentric group(concentric strengthening exercises) concludes that eccentric group is more effective than concentric group in reducing pain and improving functional activity.[15]

An early study by Marie Charlotte Trojanien et al (2022) was conducted on concentric or eccentric physical activity for patients with symptomatic OA of the knee using WOMAC score for physical function was only significantly improved by concentrated activities has concluded that there was no discernible difference between the groups. Compared to concentric workouts, eccentric exercises helped patients to achieve larger improvements in performance and muscle volume, particularly of the vastus medialis.This study concludes that in reducing pain and improving functional activity eccentric strengthening exercise is more beneficial than concentric strengthening exercise.[11]

An early study by Kevin R V incenten et al (2019) conducted on eccentric and concentric resistance comparison for knee osteoarthritis has evaluated that the effectiveness of ECC RT over conventional CNC RT on knee pain, perceived function, and leg maximum strength over a 4-month period in comparison to a control group. With both resistance exercise programs, maximum strength increased, although the CNC RT group experienced a faster rate of strength improvement. The ECC RT was safe and well-tolerated. These results suggest that, when compared to CNC RT for 4 months, ECC RT offers equal strength advantages to strength or pain reduction. This study was done for four weeks in OA knee patients between two groups : eccentric group(eccentric strengthening exercise) and concentric group(concentric strengthening exercise).The outcome measure was taken by WOMAC questionnaire and concludes that eccentric strengthening exercises good at improving functional activity and in reducing pain.[12]

Ehab Ali Abdallah en et al 2023 has conducted study on effectiveness of eccentric strengthening exercises on pain and functional abilities in patients with knee OA and concluded that Studies have demonstrated that eccentric and concentric workouts strengthen the flexion and extension muscles while also enhancing function and reducing pain. Eccentric muscles must be engaged for the majority of daily activity in order to provide support and absorb shock. More torque is produced when a muscle contracts eccentrically as compared to concentrically. Therefore, unexpected eccentric exercises run the

risk of injuring muscles or causing delayed pain. In this study WOMAC questionnaires were taken as an outcome measure for OA knee patients. The eccentric strengthening exercise was given to one group and concentric strengthening exercise was given to another group. This study concludes that eccentric strengthening exercise was more beneficial than concentric strengthening exercise.[13]

Hafiz Hamza Saeedenen et al 2021 conducted study on eccentric versus concentric isotonic resistance training of quadriceps muscle for treatment of knee OA and discussed that the functional capability of the knee and muscular strength were both positively impacted by the programs used in this study. Because extending contractions were more advantageous than shortening contractions, IERT programs for strengthening muscles were more successful than ICRT programs. In this study the improvement of functional activity and reduction of pain in OA knee were discussed. As discussed in the above study, extending contractions were more beneficial than shortening contractions. Therefore , eccentric strengthening exercise is more successful in reducing pain and in improving functional activity than concentric exercises.[14]

Conclusion

The study found that the symptoms of OA knee are lessened by both eccentric and concentric strengthening exercises. According to the research, eccentric exercise outperforms concentric exercise in terms of easing symptoms and enhancing functional activity in OA knee patients. Eccentric exercises can help osteoarthritis patients with their knee discomfort by reducing their pain and improving their functional activity**.** Awareness programs can be conducted about the eccentric exercises to reduce pain and improve functional activity in osteoarthritis knee patients.

Ethical Clearance: Approved by Institutional Scientific Review Board. ISRB number - 03/ 007/ 2022/ ISRB/ SR/SCPT

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Conflict of Interest: Nil

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