Original Article

Efficacy of Modified Progressive Resistance Training on Knee Strength in Women with Early Onset of Knee Osteoarthritis

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Abstract

Background: The synovial joint capsule, subchondral bone, and joint cartilage are all impacted by the gradual degenerative condition known as OA. This research work is designed to check the efficacy of modified progressive resistance training for OA knee patients.

Purpose: To compare the effectiveness of modified progressive resistance training and conventional treatment on knee strength in early onset knee OA.

Materials and Methods: 370 subjects were screened for study from GNK physiotherapy clinic according to inclusion and exclusion criteria from november 2022 to june 2023. Patient's authorization was acquired after the procedure was completely clarified to them. They were divided into two categories: Group A (n=185) and Group B (n=185). The pre and post-test values measured by WOMAC questionnaire and MMT. Group A received conventional treatment that is strengthening and stretching exercises and Group B received modified progressive resistance training using Thera band along with conventional treatment. Both training programs were given for 4 weeks, weekly 5 days

Results: A statistically important distinction <0.0001 between groups A and B was found via statistical analysis of information that was quantitative**.**

Conclusion: Modified progressive resistance training using Thera band of group A were proven to be more successful than group A Traditional therapy

Key Words: Osteoarthritis, Knee, Thera band, Resistance, Strengthening exercises.

Introduction

Osteoarthritis is a progressive, degenerative joint condition that affects about 60% of people over 50.[1] The knee's tibiofemoral joint, specifically the medial section, is commonly impacted by OA, causing pain, stiffness, and difficulties with daily activities. Early OA shows symptoms like joint pain, stiffness,

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and soreness. It affects the knee joint's structure and function, impeding movement and exercise capability.[2]

According to some research, decline in tibio-femoral motion is a probable cause for the progression of cartilage degeneration at the knee, which frequently occurs before degenerative changes. Particularly in elderly persons where their cartilage could be resistant to heavy loading, chronic kinematic changes might result in degenerative changes in the cartilage.[3]

Patients with EOA are able to take part in an RT program without spotting an adaptive decline in their total MVPA scores levels. RT has been shown to increase energy expenditure in adults, improve muscular strength and physical function in OA of the knee patients, and decrease pain, making it a crucial component of treatment.[4]

Strengthening the function of patient's lower limbs is crucial for enhancing their quality of life. This objective can be accomplished by strengthening muscles and improving limb function through exercising with resistance.[5] The best workout for increasing muscle strength is resistance training. Hence this research is hypothesized to analyze the results of modified progressive resistance training for OA knee.,

Aim

The aim of this study is to evaluate the efficacy of modified progressive resistance training for OA knee patients

Materials and Methods

An experimental study conducted on 370 subjects with early knee osteoarthritis age between 35-45 was taken from GNK physiotherapy clinic and the study has been conducted from November 2022 to June 2023.Convenient sampling was used in this study.

Inclusion Criteria:

- Based on the American College of Rheumatology's specified medical and imaging standards.
- Females age between 35-45
- At least two episodes lasting for 10 days in the previous year.
- Kelgren Lawrence grade 0 or 1 or 2 osteophytes only
- Meniscal pathology
- Postmenopausal women

Exclusion Criteria:

- Knee surgery or physical treatment (within the last 12 months)
- Lower limb replacement within the last six months
- Administration of steroid into the joint
- Heart and lung diseases

Outcome Measures:

Assessment taken before and after 4 weeks of study

- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
- Manual muscle testing

Procedure

370 subjects were divided into two categories: Group A (n=185) and Group B (n=185). The pre and post-test values were measured by WOMAC questionnaire and MMT. Group A received conventional treatment that is strengthening and stretching exercises and Group B received modified progressive resistance training using Thera band along with conventional treatment. Both training programs were given for 4 weeks 5 days in a week for 30 minutes.

Control Group: (Group A) Conventional Treatment

- **Straight Leg Raises:**

The patients were asked to lie on their back with one leg straight and the other bent. Lift the straight leg slowly off the floor, hold for a moment, and then bring it gently down. Start with a few repetitions and gradually increase over time. Repeat with the other leg.

- **Quadriceps Sets:**

The patients to take a seat on a chair with their back straight and extend one leg in front of you. Tighten the muscles on the front of their thigh and hold for a few seconds. Relax and repeat for several repetitions. Switch to the other leg and repeat.

- **Hamstring Curls:**

The patients were asked to stand behind a chair and hold onto it for support. Slowly bend one knee and bring foot up toward their buttocks, as if they were trying to kick their own buttocks. After a brief period of holding, lower the foot back down. The other leg, and repeat.

- **Wall Squats:**

The patients were instructed to stand with their feet approximately shoulder-width apart and their backs against a wall. By folding the knees, as if they were seating back into a chair, one can slowly slide down the wall. Keep the knees aligned with the toes and hold the posture for a moment before standing up again. Start with a partial squat and gradually work toward a deeper squat as the strength improves.

- **Step Ups:**

Use a step or a sturdy platform. Step up with one leg and bring the other leg up to meet it. Step back down with the same leg and repeat for several repetitions. Switch to the other leg and repeat.

- **Mini Squats:**

Patients were asked to stand with their feet shoulder-width apart and slightly turned out. Slowly lower the body into a partial squat, keeping the knees aligned with their toes. Remain for a short while before standing back up. Continue to repeat multiple times.

- **Calf Raises:**

Patients were asked to stand behind a chair or use a wall for support Lifting their heels off the ground, they stand up onto their toes. Hold for a few seconds while bringing their heels back down. Continue to repeat multiple times

- **Hamstring Stretch:**

Stretching increases possibilities for motion and maintains flexibility. When it was time to stretch their hamstrings, the patients were instructed to lie down. Bedsheet is wrapped around their right ankle. The straight leg was raised using the sheet. Lower the leg after 20 seconds of holding. the legs changed then.

- **Calf Stretch:**

The patients were asked to use a chair as a balance aid. Stepping back with their left leg gently straightened behind them, they bend their right leg. The left heel exerted downward pressure. It should feel stretched. Maintain for 20 seconds. The legs changed after two repetitions.

- **Protocol:**

The subjects were instructed to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

Experimental Group: (Group B) Modified Progressive Resistance Training

- **Quadriceps Strengthening:**

The patient were asked to sit in a chair and Thera band is placed in their ankle and other end is knotted to lateral side with the help of adjacent couch's rod placed over there. Then the patient is asked to perform knee extension.

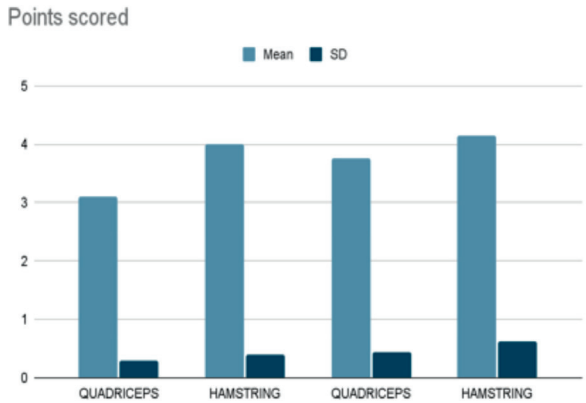
- **Hamstring Strengthening:**

The patient should be positioned prone, and the Thera band should be applied is placed by using the same procedure. Then the patient is asked to perform knee flexion. All the colors of the resistance band can be used and additional weights are added for progression. The exercises mentioned in the conventional group were also performed along with these exercises.

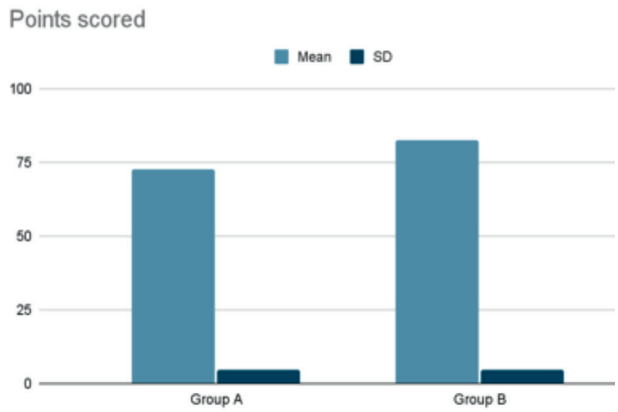
- **Protocol:**

The subjects were instructed to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

Data Analysis:



Graph 1- shows the post test values of quadriceps and hamstring for both the groups



Graph 2: Post test values of group A and B using WOMAC.

Results

A statistically significant difference between groups A and B as well as within each group was found by statistical analysis of quantitative data.

The post-test values of manual muscle testing for quadriceps muscle in both the groups are mentioned subsequently. The post-test value with a mean and SD of 3.1 and 0.3 in group A and 3.76 and 0.43 in group B with t value of 17.28 with significance of 0.001 for quadriceps muscle.

The post-test values of manual muscle testing for hamstring muscle in both the groups are mentioned subsequently. The post-test value with a mean and SD of 4.00 and 0.39 in group A and 4.14 and 0.63 in group B with t value of 2.57 with significance of less than 0.001 for hamstring muscle using T test calculator.

The post- test values of WOMAC for both the groups are mentioned subsequently. The post-test value with a mean and SD of 72.61 and 4.55 in group A and 82.34 and 4.64 in group B with t value of 20.4 with significance using T-test calculator.

And this suggests that group B performed considerably better than group A. This strongly suggests that modified progressive resistance training is effective in improving knee strength and reducing pain and thus improves quality of life and function in OA.

Discussion

There is evidence that muscle impairment has a role in the onset of OA knee. The innate bracing for the knee joint is provided by the lower leg muscles. The quadriceps muscle has been seen to be weak. Risks associated with American Academy of Orthopaedic Surgeons said that knee joint structural deterioration is a factor. In order to stop degeneration from progressing further, genu varum must be treated as soon as possible. The modified progressive resistance exercise was used in this study to increase muscular strength. The benefit of this exercise was that it increased joint space in OA patients and prevented further deterioration of the medial condyle when the Thera band was tied to the lateral side. The goal of the study was to determine how modified progressive resistance training with thera bands affected individuals with OA knees. Research studies stated that elastic band exercises have significant improvement in patients with knee osteoarthritis.

Mei Hua Jan, Jiu jeng Lin concluded that patients with knee OA benefitted from greater and low-resistance workouts, which improved function and decreased pain. Despite the fact that the advantages of high-resistance strength training tend to outweigh those of low-resistance strength training by a small margin.[5]

NavidKalani, Shahnazshahrbanian shows that Theraband resistance training combined with medication treatment had beneficial benefits on knee sufferers' pain and quality of life osteoarthritis.[6]

Favero M et al stated the idea behind OA has undergone a significant transformation in the last ten years. This is connected to the advancement of increasingly sophisticated imaging methods like MRI, which can spot changes in the structure and makeup of an of every joint tissue in addition to bone and cartilage.[7]

Kogilavani Krishnan, Fariba Hossein Abadi stated in comparison between aquatic and Theraband exercises on pain and endurance that effective and advantageous choices to reduce pain intensity include Aquatic Exercises and Theraband exercises. In discomfort, adequate TBE is probably a straightforward substitute for hydrotherapy.[8]

Ji Yeong Yun and Jong Kyung Lee came to the conclusion that the Theraband exercise program offered patients who had undergone total knee arthroplasty an additional benefit above the traditional CPM exercise.[9]

Emmanuel Gomes Ciolac et al (2015) stated that resistance exercise partially corrected impairments in lower limb loading, working and equilibrium. These findings may imply that resistance training may be a key strategy to combat the widespread mobility issues in this population.[10]

JN Farr (2010) stated that Patients with early-onset knee OA might take part in an RT program without seeing a compensating decline in their total MVPA levels. As RT has been shown to enhance adult consumption of energy, it is an effective treatment for those with OA of the knee, to improve muscular strength and physical performance, and to lessen discomfort essential element in knee OA treatment.[11]

One of these advantages of exercising is that thera band that is affordable and feasible to carry it wherever you go and practice the activity.There have not been any reported adverse consequences from employing this kind of workout for them is therefore it is recommended for individuals with knee arthritis.

Conclusion

The study shows that modified progressive resistance training combined with conventional therapy is effective for managing knee osteoarthritis. It resulted in significant improvements in muscle strength, pain levels, stiffness, knee alignment, and postural stability. This combination was more effective than conventional therapy alone in improving function and overall well-being in people with knee osteoarthritis. However, further research and long-term follow-up studies are needed to validate and assess the lasting effects of this approach.

Ethical Clearance: The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/097/2022/ISRB/SR/SCPT).

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Conflict of Interest: The authors state that there is no conflict of interest

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