High Impact Exercise Training Versus Low Impact Exercise Training on Functional Outcome in Subjects with Knee Osteoarthritis: Experimental Study

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Abstract

Background: Exercise or physical exercise is suggested for subjects with arthritic knee to improve their pain and functional condition. These therapies, whose success is dependent on a few components, are commonly ignored. Therefore, the proper intensity or load needs to be specified. Depending on the therapy aim exercise intensity might be high or low.

Purpose: This study aims to modulate the patient’s pain and the secondary outcome was to improve functionality by evaluating high-impact exercise training with low-impact exercise training in subjects with symptomatic knee OA.

Materials and Methods: Subjects with OA Knee were selected based on selection criteria. All subjects were assigned to either of the groups; high-impact exercise and low-impact exercise by odd even randomization method. The pre-test values for pain and functional outcome are taken using NPRS and WOMAC questionnaire and the same were recorded for post-test after 8 weeks of intervention. The entire process was performed from November 2022 to March 2023.

Result: The statistical analysis reveals a lowering in the pain intensity and notable enhancement in functionality on high-impact exercise training when compared with low-impact exercise training in subjects with arthritic knee.

Conclusion: The study’s findings indicate that high-impact exercise training affects subjects with knee osteoarthritis by decreasing pain and improving function.

Keywords: Exercise training, chronic OA, high impact, low impact

Introduction

Osteoarthritis (OA) is a widespread illness that causes pain, functional restrictions, increased consumption of healthcare, and significant societal expenses.¹ Knee, a complex synovial joint, with bone components, infrapatellar pad, cartilage, ligaments and synovium. Synovial fluid lubricates the cartilage. The regular usage and excessive stress on this joint cause painful OA. OA disease assessment is sluggish and can gradually evolve; worsening the
illness’s severity and symptoms. Clinical signs are discomfort, stiffness, reduced ROM, quadriceps muscle weakness, and changes in proprioception. In persons over the age of 40, the prevalence of self-reported knee pain is between 20% and 28%, with nearly 50% claiming impairment as a result of their knee pain. Women have a considerably higher frequency and incidence of illness in these joints than males. Musculoskeletal, anatomical, biological, and ecological variables all have a part in onset and maturation of arthritic knee. Slow deterioration of cartilage in OA comes along with chondrocyte loss. Sensory nerve terminations in vascular channels innervate cartilage in articulations and trigger tibiofemoral discomfort. Bearing too much weight on the knee may compromise the functionality of the knee joint. “The Kellgren-Lawrence radiographic system grades OA into 5 stages from 0 to 4, describing OA by the detection of an osteophyte (2 Grade), and major grades by the presumed sequential manifestation of reducing joint space or sclerosis, deformity, and cysts. Rehabilitation and physiotherapy were frequently recommended to relieve pain and increase mobility. Exercise can help individuals with knee OA reduce pain, increase function, and improve their psychological status. Exercise is regarded as primary non-pharmacological therapy and is recommended by international recommendations for the treatment of OA patients. Exercises assist individuals improve their function and general health and are safer than pharmacological therapy. While treatment recommendations encourage strengthening exercise with specified proper intensity or load to be considered which either could be high or low. High-impact exercise training can be characterized as the extra period or strength necessary emphasizing more on pain alleviation, increased joint function, and joint stability. Several new clinical trials have recently indicated that a more rigorous exercise program aimed at improving muscular strength may be better for those with osteoarthritis. The primary goal is to regulate pain and the secondary objective was to improve functionality by using high-impact exercise training. In comparison to fewer repetitions, a high volume of repetitions appears to manage pain and enhance function. Theoretically, high-repetition, high-impact exercise activates the descending pain regulating system, lowering the sensitization. As a result, as the pain subsides, functionality improves. Thus an attempt is made in this study to analyze the effect of High impact and Low impact exercises training in subjects with OA Knee.

Aim
To evaluate the effect of High-Impact exercise training versus Low-Impact exercise training in subjects with OA knee.

Material and Method
Samples of 30 subjects were selected, aged between 45-65 years from Sri Thirumala Physiotherapy and Pain Relief Clinic. Convenient sampling with odd even randomization was used in this study.

Study Period: from November 2022 to March 2023

Inclusion Criteria
- Both gender
- Age between 45 to 65 years
- Unilateral medial tibiofemoral OA
- People with neutral to moderate varus alignment
- BMI of ≥ 20 kg m2 and ≤ 45 kg m2
- No strength training/ previous physical therapy in the past 6 months
- Arthritic knee with pain for the past 3 months
- Grade 2 osteoarthritis based on Kellgren and Lawrence classification

Exclusion Criteria
- Musculoskeletal injuries/deformities of the lower limb
- Knee arthroplasty
- Radiological End stage knee osteoarthritis (KL=4)
- Pain ≤ 2
- Associated Symptomatic patellofemoral OA
- Lateral tibiofemoral OA
- Rheumatoid arthritis
- Osteoporosis
- Recent fractures of the lower limb
- Patellofemoral pain syndrome

Outcome Measures
Assessment was performed before and after the treatment.

- Numerical Pain Rating Scale (NPRS)
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

Procedure

Subjects participating in the study were briefly explained about the study and informed consent was obtained. The subjects were assigned either to High-impact exercise training group (HIET) and the Low-Impact exercise training group (LIET) by an odd even randomization method. The pre-test values for pain and functional outcome were recorded using the NPRS and WOMAC questionnaire and the same were recorded for post-test after 8 weeks of intervention.

High-Impact Exercise Training Group (HIET)

Global aerobic exercise

Ask the subject to perform stationary cycling. This helps to utilize the body and stimulate pain systems. They are done three times per treatment regimen for 20+10+10 minutes respectively.

Semi-global exercise

1. Closed chain squat - The subject is to be in a standing position. The TRX band is held with hands to deload the body and perform squats. The goal is to activate the knee joint in a kinetic chain.

2. Closed chain squat with weights - The above exercise is progressed without the TRX band. The subject holds dumbbells (2kg) in each hand and is made to squat.

3. Step up - Place one foot on the stepper and step up holding the TRX band. The later is progressed by stepping up from the stepper without the support.

4. Step down - Place one foot on the stepper and step down holding the TRX band. The latter is progressed by stepping down from the stepper without support.

Local open chain exercise

1. Deloaded knee extension - Ask the subject to sit in a chair facing the ladder and place feet flat on the floor. The theraband is tied to the ankle of one leg and the other end is tied to the ladder from above. Now, active knee flexion is followed by deloaded knee extension. The goal is to dynamically activate the knee joint.

2. Knee extension - Ask the subject to sit in a chair facing opposite to the ladder and place feet flat on the floor. The theraband is tied to the ankle of one leg and the other end is tied to the ladder from below. Now, active knee extension is followed by knee flexion. These local exercises are performed for 3-5 minutes × 1 set per regimen.

Low-Impact Exercise Training Group (LIET)

1. Global aerobic exercise: Stationary cycling
2. Semi-global exercise: Closed chain squat
3. Semi-global exercise: Closed chain step up
4. Semi-global exercise: Closed chain step down
5. Local open chain exercise: Knee extension

Treatment protocol

The treatment exercise was on alternate days for 8 weeks. The subjects in HIET performed with 30 repetitions of 3 sets each and LIET Low-impact exercise training performed with 10 repetitions of 2 sets each.

Data Analysis

![Fig - 1 Pre and Post-test values of HIET](image-url)
Result

As needed descriptive statistics, mean and SD were calculated. All p values were considered as statistically significant using paired t-test. The statistical analysis compares the post-test mean values of NPRS with 3.67 and 4.67 in HIET and LIET respectively and post-test mean values of WOMAC with 45.67 and 58.93 in HIET and LIET respectively. As a result of statistical analysis, the p value shows high-impact and low-impact exercise training are effective, however the effect of high-impact exercise training was found to be slightly higher and showed significant effect of pain and function outcome when compared with LIET in subjects with knee OA.

Discussion

This present analysis aims towards evaluating the practicality of high-impact exercise training in arthritic knee patients. It has been classified as a pathological issue established by loss of cartilage in the articular region inside synovial joints, as well as bone hypertrophy and capsule thickening. According to appearing data by Torstensen et al., (2018), pain of arthritis in the knee is caused by distal and centralized nervous system sensitization. MET “medical exercise therapy” is built on a bio-psycho-social paradigm since the workouts are self-paced, pain-free, or near pain-free. Carlino et al., (2014) study supports the Tailoring of exercise regimen to the subject’s clinical context along with their desires and requirements. It also backed this study’s supervised program where those sessions helped the patient feel protected, increasing the anticipated benefit from the regime and diminishing the possibility of nocebo effects.

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Conclusion

The finding from this study implicated the advantage of high-impact exercise training over low-impact exercise training to enhance physical function and alleviate pain in adults with OA knee.

Ethical Clearance: The ISRB committee of a private hospital and institution in Chennai has

Fig - 2 Pre and Post-test values of LIET

Fig - 3 Post-test values of HIET & LIET
provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/069/2022/ISRB/SR/SCPT). **Funding:** This study is a self-funded study.

**Conflict of Interest:** Nil

**References**