Effect of Isometric Strengthening Exercise Combined with Interferential Current on Pain among Patients with Knee Osteoarthritis: Experimental Study

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Abstract

Background: Osteoarthritis, a degenerative disease, is the gradual breakdown of the articular cartilage in the joint. Knee osteoarthritis is more prevalent in women than men which causes pain and discomforts. The intention of this study is to find out the effect of isometric strengthening exercises combined with interferential therapy on pain in patients with knee osteoarthritis.

Purpose: To find out the effect of isometric strengthening exercises combined with interferential therapy in the management of knee osteoarthritis patients.

Materials and Methods: Thirty individuals aged above 45 years of both genders with mild or moderate osteoarthritis participated in the study. The individuals were assigned in single groups. They received interferential therapy and performed isometric strengthening exercises for 4 weeks. Pain, Active range of motion (AROM), Passive range of motion (PROM) and functional state of the subjects were evaluated by Numerical Pain Rating Scale (NPRS), universal goniometer and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), respectively. The entire process was performed from November 2022 to March 2023.

Result: The interventional group showed a considerable difference in each criterion (NPRS, AROM, PROM, and WOMAC). Isometric exercise and IFT was found to be effective in reducing pain in knee osteoarthritis.

Conclusion: At the commencement of the four-week intervention plan, isometric exercise and interferential therapy showed a marked outcome on pain and functional state of subjects with osteoarthritis in the knee.

Key Words: knee osteoarthritis, isometric strengthening exercise, interferential therapy, pain.

Introduction

Arthritis is described as the joint’s inflammation which is characterized by pain, swelling and restricted joint motion. Osteoarthritis (OA) is a degenerative disease. It is usually the consequence of erosion and gradual degradation of joint cartilage. It affects every articular surface, most usually the knees and hips. The most significant issue for an OA patient is pain, which must be treated while function is kept at a level consistent with habit.¹² There are

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three compartments in the knee namely: (i) medial tibiofemoral compartment; (ii) lateral tibiofemoral compartment and (iii) patellofemoral compartment. These compartments join to form a modified hinge joint that permits bending of knee, lengthen and rotate leg. Surplus weight could affect the efficiency of the knee articular surface. The diagnosis of OA-knee is initiated by clinical survey and verified by x-rays. The knee Osteoarthritis can be redivided into 5 degrees of grades: Grades 0-4 in which; 0 is denoted as normal - normal knee health, 1 as minor-minor growth in bone spur and without experiencing any pain or discomfort and, 2 as mild - greater bony spur growth and symptoms arises at this stage, 3 as moderate- pain during movement and greater joint stiffness and 4 as severe osteoarthritis – joint space reduced, high levels of pain and discomfort, cartilage damaged and synovial fluid will be reduced. 

Muscle weakness is a major risk factor in knee osteoarthritis. It has been proposed that weakened shock-absorbing and weight-bearing muscles may weaken joints and cause structural destruction to joint cartilage and subchondral bone which poses a risk for developing knee OA. Quadriceps weakness has been linked to worse self-declared assessments of function and impairment. The quad helps the knee joint absorb shock, therefore when this muscle group is weak, the body is put under more physical strain, which puts more pressure on the knee. Exercise has been demonstrated to be important for maintaining function and may even help people with OA of weight bearing joints feel discomfort. Isometric exercise may be the best option out of the three because it is suitable for patients, simple to learn, and safe to conduct at home with little to no equipment needed. Additionally, isometric exercise results in the least amount of bone loss and intra-articular pressure and inflammation.

IFT is a typical physiotherapeutic pain management treatment method. It’s distinguished by the interference of two medium frequency currents, which merge to create a new medium-frequency current whose amplitude is regulated at low frequency, resulting in lower resistance to skin and allowing profound infiltration into tissue. IFT is useful in the treatment of many pain syndromes, according to several research. In order to get past the skin’s impedance, it uses pulsed or sinusoidal currents with a kilohertz carrier frequency to send currents to deep tissues. When 2 medium-frequency currents are supplied out of phase, they can get in the way with one another in the tissues where they cross. This interference leads to the generation of a low-frequency current. It has been asserted that this amplitude-modulated frequency (AMF) is the primary analgesic element of IFC.

Aim

To investigate the effect of isometric strengthening exercises combined with interferential therapy on pain among patients with knee osteoarthritis.

Material and Method

This research is a Quasi Experimental study. The study was conducted with a sample of 30 participants. The participants were selected from Physio 360 clinic, according to inclusion and exclusion criteria. Participants received an extensive overview of the method, and a formal informed consent form was acquired. The materials used are towel and IFT (Interferential Therapy).


Inclusion Criteria

- Both male and females
- Aged 45 years and above
- Patients with mild and moderate osteoarthritis

Exclusion Criteria

- Patients with severe osteoarthritis
- lower limb fracture
- patients with other rheumatoid disease

Outcome Measures

Assessment was performed before and after four weeks of intervention. The examination of hip and knee osteoarthritis uses the WOMAC. It gauges function, stiffness, and pain as three distinct dimensions. NPRS is a unidimensional tool for the assessment of pain. NPRS is used to focus on patients and individuals with chronic back, knee, and hip pain.
**Procedure**

The study was conducted as a randomized study. The sample was collected at Physio 360 clinic. A total of 30 subjects were randomly selected based on the selection criteria and informed consent was acquired after explaining the safety and simplicity of the study. The subjects of age 45 years and above of both genders with knee osteoarthritis were obtained for the study. Pre-test values were recorded using the WOMAC questionnaire and NPRS scale. The subjects were assigned in a single group and given isometric strengthening exercises combined with interferential current for an interval of four weeks, five days per week, 5 repetitions and 3 sets. Following the training session, the post-test values were again recorded using the same outcome measure and significant differences were noted.

**Quadriceps Strengthening Exercise**

- subjects were asked to lie on their back with extended knee
- roll a towel and place under the thigh (above knee)
- the subjects were then asked to push the knee into the towel to tighten quadriceps
- hold for 10 seconds.
- Repeat 5 times and 3 sets.

**Straight Leg Raise**

- subjects were asked to lie on their back with extended knee
- Slowly Raise the involved leg without bending the knee
- Hold for 10 seconds
- Repeat 5 times and 3 sets

**IFT**

- Four padded electrodes are applied with ultrasound gel placed around the involved knee and fastened with straps. The electrodes are aligned diagonally.
- A base is set at 90 Hz and spectrum at 50 Hz with a frequency of 80-100 Hz. Program fixed at 20 and a trapezoidal pattern is used.
- The subjects described experiencing a tingling sensation unescorted by inducing muscular spasm, the current intensity was adjusted.
- Throughout treatment, subjects were asked to inform if any adjustments were required to change the current intensity to maintain a potent but optimal degree of stimulation.
- Each session of treatment was given for 12 minutes.
- Ift was given before the exercise session.

**Data Analysis**

Descriptive and inferential statistics were used to analyze the study’s data. Standard deviation (SD) and mean were applied to all parameters. The significant variations in outcome measure were examined using a paired t-test.

**Graph-1 Pre-Test and Post-Test using WOMAC**

**Graph-2 Pre-Test and Post-Test using NPRS**

**Result**

A statistical report of quantitative data established a statistically significant difference in values in the intervention group. Subjects of 30 members with knee osteoarthritis are assessed for pre- and post-tests using the NPRS scale and WOMAC questionnaire.

Graph 1 represents the comparison of the pre-tests and post -tests values of isometric strengthening exercise and IFT using the WOMAC questionnaire.
The mean value of the pre-test is 55.1 and the post test is 26.87. Graph 2 represents the comparison of the pre-tests and post-tests values of isometric strengthening exercise and IFT using NPRS scale. The mean value of pre-test is 7 and the post-test is 3. As a result, the findings are considered statistically significant when the p-value is <0.0001.

This shows that the isometric strengthening exercise combined with IFT gives beneficial results to reduce pain.

**Discussion**

The motive of this study is to show the efficacy of isometric strengthening exercise and interferential therapy in reducing pain for subjects with knee OA. Knee OA rates are increasing due to aging and obesity problems which are less prevalent in men than women. The symptoms of pain, stiffness and other discomforts may lead to disability. Therefore, focusing on exercise and physiotherapy treatment is an important way to prevent disability. The Effects of isometric strengthening exercise have been studied by Chinelo N. Onwunzo (2021), who took effort to analyze the reduction of pain in knee osteoarthritis. The author found that the intervention showed greater outcome on pain intensity, discomfort, ROM and functional capacity among the subjects. In addition to strengthening exercise, interferential therapy also has beneficial effects on knee osteoarthritis. Meltem Gundog et al (2012) concluded that the research demonstrated that an intervention for knee arthritis was effective, yielding favorable results in terms of pain reduction and improved disability outcomes.

Rufus A. Adedoyin et al (2005) conducted a randomized control trial on knee osteoarthritis to find out the effects of IFT current and TENS. 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 outcome. 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.

According to Jun Iwanoto study on effectiveness of exercise for knee osteoarthritis, there will be improvement of functional state and pain on performing aerobic and strengthening exercise. In the findings of Aline Mizusaki Imoto, neuromuscular electrical stimulation was effective in reducing pain, function and ADL for knee osteoarthritis. One hundred subjects were randomly taken into two groups and evaluated for pain, function and ADL activities. Then he concluded that the neuromuscular electrical stimulation when included in the rehab protocol for knee osteoarthritis, is effective for improving pain, function and ADL. Effectiveness and safety of strengthening, aerobic and coordination exercise have been studied by Heike A Bischoff, who took effort to find the effectiveness of strengthening, aerobic and coordination exercise in regard to pain and function with knee osteoarthritis. From the assessment, the interventions were effective and gave better pain relief. In 2014 Mohammad H Ebrahimzadeh et al in his study concluded that WOMAC is a routinely used tool for estimating patients with knee OA. He concluded that the WOMAC index is a valid and reliable instrument for knee osteoarthritis. From the assessments the interventions are given and the questionnaire is used to estimate the scores of pains, stiffness and functional state.

With the conclusion of all the above-mentioned studies, we designed a protocol involving isometric strengthening exercise along with interferential therapy for the patients with mild and moderate knee osteoarthritis to reduce pain and improve functional state. With this attempt, the pre- and post-tests measures of both groups were analyzed and tabulated in the result column. Thus, the results concluded that isometric exercise combined with interferential therapy is effective in reducing pain, discomfort and disability in patients with knee OA. The subjects who had profound knee osteoarthritis were not included in the recruitment of participants, which was the best way to enhance the sample size. Future studies may concentrate on the long-term impact of these interventions, as this study only did a four-week follow-up. The present study concluded that isometric strengthening exercise combined with interferential therapy were effective for knee osteoarthritis patients. However, the WOMAC score and NPRS score indicated a substantial change in the post-tests analysis for the interventional group. The interventional group which received isometric
exercise combined with interferential therapy had more significant changes.

**Conclusion**

The aim of the study is to evaluate the effect of isometric exercise training combined with IFT on pain in patients with knee osteoarthritis. The research work concluded that isometric exercise combined with IFT was found to be more effective and reduces pain in knee osteoarthritis patients.

**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 03/073/2022/ISRB/SR/SCPT).

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

**References**


