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Original Research Article

SHOCK WAVE THERAPY VERSUS INTERFERENTIAL THERAPY IN KNEE OSTEOARTHRITIS

Tarek Ammar

Assistant Professor, Faculty of Physical Therapy, Cairo University, Cairo, Egypt.

ABSTRACT

Objective: The purpose of this study was to compare between the effects of extracorporeal shock wave therapy and interferential therapy in patients with knee OA.

Setting: A physical therapy outpatient clinic.

Participants: Twenty-five participants with knee OA completed the program and were randomly assigned into two groups. Pain Duration was more than 12 weeks.

Interventions: The first group (n=12, mean age=45.7±5.5 years) received ESWT and a conservative physical therapy program. The second group (n=13, mean age=43.1±6.1 years) received IFC and the conservative program.

Materials: Visual analogue scale, distance walked in 6 minutes and Western Ontario and M cMaster Universities Osteoarthritis (WOMAC) were used to measure pain, physical function and disability before and after 4 weeks of intervention.

Results: There were statistically significant improvements in the dependent variables of both groups when comparing their pre and post treatment mean values. Significant differences in the measured variables were also obtained in favor of the group (A) when compared with what of group (B).

Conclusion: ESWT improved pain, function and disability better than IFC in patients with knee OA.

KEY WORDS: Knee Osteoarthritis, Shock Waves, Interferential Current, Pain.

Address for correspondence: Tarek Ammar, Assistant Professor, Faculty of Physical Therapy, Cairo University, Cairo, Egypt. **E-Mail:** tarekphysicaltherapy@gmail.com

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INTRODUCTION

Knee Osteoarthritis (OA) is a complex progressive degeneration and alteration of the biomechanical properties of the subchondral tissues of articular and bone cartilage. OA results in pain, disability and physical function [1]. Age, genetics and obesity increases the risk of OA. It increases with age and it affects more women than men (10% versus 6%) [2]. It usually worsens over time resulting in significant disability [3].

Various physical therapy interventions are available to treat knee osteoarthritis include low level laser, ultrasound, water exercises, transcutaneous electrical nerve stimulation, therapeutic exercises, education, weight loss, kinesiotaping, social support……etc. [4-6]. However, pain and functional disability often persist despite the availability of multiple modalities for knee OA [7]. As such, research for new effective interventions for knee OA is warranted.

Extracorporeal shock wave therapy (ESWT) is used to treat many musculoskeletal disorders such as plantar fasciitis, calcific tendinitis of the shoulder, epicondylitis, patellar tendinopathy, Achilles tendinopathy, non-union and delayed union of long bone fracture(8). ESWT may impede progression of OA, improve function, and depress chondro protective effects in animals [9-10]. A few researchers elucidated that ESWT reduced pain and improved knee functions in patients with knee OA [11-12]. Therefore, ESWT has been suggested effective for knee OA.

Interferential current (IFC) has been used for treating musculoskeletal disorders for its analgesic, anti-inflammatory, sympatholytic, local vasodilating, and muscle stimulating effects [13]. IFC is also used to reduce pain in sports injuries, arthritis, low back pain, Osgood-Schlatter disease, rheumatoid arthritis, and muscular pain [14]. However, there has been little research comparing between ESWT and IFC in patients with knee OA. The purpose of this study was to determine the effectiveness of ESWT compared with IFC for patients with knee OA.

METHODS

Design: This study was a randomized trial with participants randomly assigned to one of two treatment groups: (1) group 1 received the ESWT plus the conventional physical therapy or (2) group 2 that received the IFC in addition to the same conventional program. The examiner made group comparisons at the initial visit and after 4 weeks. The duration of the interventions was 4 weeks per participant. Each participant received one session per week for 4 weeks and 3 sessions per week for four weeks in the second group. The therapist who did the testing and data analyses was not aware of group allocation. However, the treating therapist was aware of group allocation.

Participants: Forty-three participants with chronic knee pain who visited the outpatient setting for a minimum of 3 months pain duration participated in the study. All participants signed informed consent forms detailing procedure and risks involved with participating in this research.

The inclusion criteria were patients diagnosed with knee OA based on the clinical criteria of the American College of Rheumatology [15] and those who had tenderness in the medial tibial plateau. Exclusion criteria included history of neurologic diseases and those with external injuries, surgeries, cancer, and malignant tumors affecting the knees. Also patients who have received intraarticular injection on the affected knee within the past 3 months were excluded from the study. Participants were asked to refrain from receiving other forms of physical therapy and analgesics during the study.

Measurements: The tester measured pain by a 10 cm visual analogue scale (VAS). Pain intensity is classified using a range from 0 to 10, in which 0 = no pain at all and 10 = the worst possible pain. Patients were asked to sign the place on the VAS scale that corresponded to their pain level [16].

Distance walked in 6 minutes (DW6m) is used to measure the total distance a patient can walk over six minutes on a hard, flat surface. It is valid and reliable in evaluating physical function in different patient populations such as healthy older adults, people with knee or hip arthroplasty, osteoarthritis, fibromyalgia, and scleroderma [17-18].

The Western Ontario and McMaster Universities Osteoarthritis (WOMAC) subscale was used to measure functional disability. It is a validated disease-specific 24 item self-reporting questionnaire. Higher scores indicate greater functional disability [19].

The Shock Master was used to produce shock waves. It is a low to medium-energy range. Evotron RFL0300 (Swiss Tech Medical AG, Switzerland) was used to deliver shock waves. It has a depth of penetration between 0 to 30 mm. Pulse rates were 60, 120, 180, 240 impulses per minute. Also, the SONOSTIM (Class 1-type BF, Norm: 601-1) was used to produce IFC.

Interventions: All subjects signed a consent form and the research therapist examined all participants to check for inclusion and exclusion criteria and was not aware of the intervention assignments. He tested the participants at both the baseline and final sessions. Another therapist performed all interventions.

Patients in the first group received a total of four sessions of ESWT. They received one session a week for four weeks. The patient was placed in supine lying position with knees bent to 90^o. The therapist applied 1,000 pulses of shockwave with an energy dose of 0.05 mJ/mm^2. He directed it to the tender point of the medial tibial plateau area in the affected knee. The therapist asked the participants to refrain from physical activities such as jogging, lifting heavy objects for 48 hours following each session.

Participants in the second group received the IFC. The therapist placed the four electrodes around the knee so that each channel runs perpendicular to the other and the two current crosses at a midpoint in the center of the knee. He adjusted the intensity in the tactile sensation threshold. IFC was conducted with following characteristics: isoplanar vector field with 6:6 sweep mode; carrier frequency 4 kHz; beat frequency 100 Hz; and sweep frequency 150 Hz. The duration of the stimulation was 20 minutes. The therapist increased the current amplitude until the participant felt a strong but comfortable tingling. He increased the intensity until the participant reached the previous sensation in case of sensory habituation.

Participants of each group also received the conservative physical therapy program. It consisted of three sets of isometric exercises for the quadriceps, hamstrings and hip abductors with 10 seconds hold. Each sets consisted of 20 repetitions. They also received hot water fomentation for 15 minutes. The therapist gave each patient an exercise sheet and asked patients to do exercises as a home program in the days in which they do not come to the clinic and perform each exercise for 3 sets of 20 repetitions twice a day. The therapist asked participants to record frequency and repetition of each exercise to measure adherence to exercises.

Data Analysis:

All statistical tests were performed using SPSS for windows Version 20 (Chicago, IL, USA). The collected data of the pain, DW6m and total WOMAC scores of both groups were statistically analyzed to compare between the effects of ESWT and IFC in knee OA. Descriptive statistics (mean and standard deviation) were computed for all data. Paired t-test was conducted for comparing pre and post treatment mean values in each group. The authors used the unpaired t-test to compare pre and post treatment mean values of variables between both groups. A p value of <0.05 was considered statistically significant.

RESULTS

Thirty patients out of 43 participants eligible for inclusion were randomly assigned to one of the two groups: (1) ESWT and conservative program [n=15; 4 men, 11 women; mean (standard deviation) age 40.12 (5.45) y]; (2) IFC and conservative program [n=15; 9 men, 5 women; mean (standard deviation) age 43.62 (7.68) y]. However, three patients in the first group withdrew for knee trauma, effusion and allergic reaction. Also, two patients dropped out of group 2 for receiving other physical therapy modalities and refusal to continue. Patient flow through the study is shown in the CONSORT flow chart shown in figure 1

Fig. 1: Flow chart detailing the study.

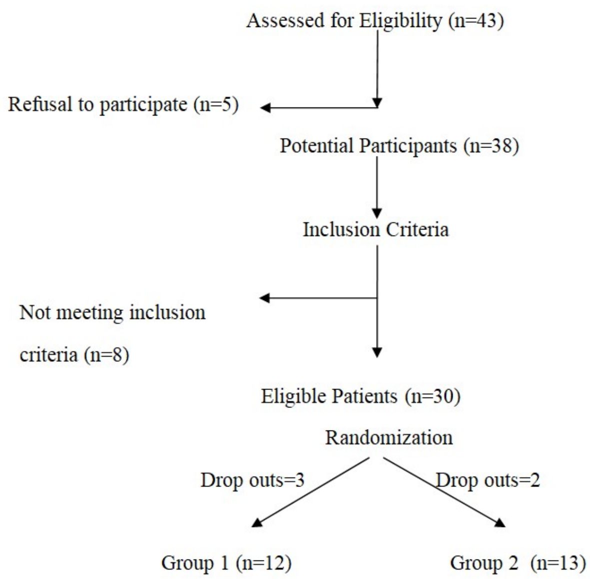

Table 1 shows characteristics of participants of both groups. It shows the mean ± standard deviation (SD) of age, weight, height, body mass index (BMI) and duration of pain of both groups. There were no baseline differences between groups (p> 0.05).

Table 1: The demographic and baseline characteristics of patients.

	ESWT	IFC	p-Value
Age (years)	45.7±5.5	43.1±6.1	0.81
Weight (Kg)	74.02± 10.23	75.17±6.38	0.82
Height (cm)	161.2±7.1	162.2±7.3	0.11
BMI (kg/cm2)	28.81± 5.23	29.24±2.48	11.09
Duration (mo)	17.2±11.4	18.7±13.1	0.6

X, Mean; SD, standard deviation; p-value, level of significance.

Table 2 shows VAS, DW6m and WOMAC scores pre- and post-treatment between groups. The results of pre and post treatment values were compared with each group. The results revealed significant improvement in mean values of pain, distance walked in 6 minutes and total WOMAC measured in both groups at the end of treatment as compared with the corresponding mean values before treatment p<0.05. It can be noted that group 1 had lower mean pain and disability scores and higher mean of distance walked in 6 minutes scores than group 2.

Table 2: Pain, DW6m and total WOMAC scores for both groups.

Measure	Group A	Group B	t-test	P value
Pain intensity				
Pre intervention	6.45 ± 1.29	6.03 ± 1.22	8.1	P > 0.05
Post intervention	3.37 ± 1.42	5.22 ± 1.31	5.3	P <0.05
DW6m				
Pre intervention	473.7±120.5	491.2±132.1	0.7	P > 0.05
Post intervention	681.2±133.1	538.6±132.2	3.6	P <0.05
WOMACK				
Pre intervention	48.3±13.2	53.1±12.1	0.04	P >0.05
Post intervention	18.1±11.2	32.2±14.05	17.26	P <0.05

DISCUSSION

In this randomized clinical trial, the author evaluated the efficacy of ESWT and IFC as electrotherapeutic modalities in patients with knee OA. The results of this trial are novel, as to date there have been no data investigating the effectiveness of ESWT versus IFC for knee OA. This study showed that patients in group 1 had significant reduction in pain intensity and disability and increase of physical function in both groups. However, group 1 showed more significant differences than group 2.

ESWT consists of bursts of the same alternating high frequency current, interspersed with a cut off phase, during which heat can be dissipated in the tissues. ESWT uses electrical energy to direct a series of magnetic pulses through injured tissues whereby each magnetic pulse induces a tiny electrical signal that stimulates cellular repair [20]. ESWT is effective for healing soft-tissue wounds; suppressing inflammatory responses at the cell membrane level to reduce pain and increase mobility [20].

The exact ESWT mechanism for treating symptoms of Knee OA is not clear. However, Hurley et al. postulated that ESWT improved the articular cartilage regeneration on eight New Zealand rabbits. ESWT may stimulate the release of growth-inducing substances such as basic fibroblast growth factor, ILGF-I and TGF- β 1is [21]. Moreover, Zhao et al. showed that applying ESWT to rabbits with knee OA reduced nitric oxide in the synovial cavity of the knee joint and inhibited chondrocyte apoptosis. Therefore, it led to reduced the catabolic rate within the osteoarthritic joint [22].

The curative effects of ESWT on knee OA corresponded to the results found in previous studies. Zhao et al. reported improvement of pain and function in patients with knee OA in comparison to a placebo at 12-week follow-up after ESWT [23]. Kim et al. also reported that ESWT improved pain and function in patients with knee OA, and that both medium-energy ESWT (0.093 mJ/mm^2) and low-energy ESWT (0.040 mJ/mm^2) were effective [24].

ESWT may alleviate pain by over stimulating the axons (gate-control theory) and increasing the pain threshold [25]. Also it may induce the release of endorphins [26].

Besides, it may reduce substance P in the β target tissue and the dorsal root ganglia cells and selective destruction of unmyelinated nerve fibers within the focal zone of ESWT [27].

In this study, patients in group 2 (IFC and conservative program) showed improvement in all parameters. There is widespread use of electrical stimulation to reduce pain. However, there are a few researches for using IFC. IFC is based on the creation of a low frequency current effect in deep tissues by two medium-frequency alternative currents at different frequencies. Since the skin resistance decreases with the increasing current frequency, IFC may exert its effect on deeper tissue planes without patient discomfort [28].

IFC allows an increased dosage applied in a greater depth because of the body tissue's better tolerance of medium-frequency currents. IFC could stimulate local nerve cells that can have an analgesic effect due to blocking the transmission of the pain signals or by stimulating the release of endorphins [29].

IFC has been used for patients with low back pain and OA. However, Fuentes et al. conducted a meta-analysis and found that IFC is not better than placebo or any other modality when presented as an isolated treatment in musculoskeletal pain [30]. They proposed that therapists may use it as part of a multi-modal treatment plan. Therefore, the author used exercises along with the IFC for participants with knee OA.

The present study findings agreed with those of Cheing et al. who found significant improvement in patients with frozen shoulder [31]. Also, the results are in accordance with those of Burch et al. who reported a reduction of more than 20% in the WOMAC pain subscale in patients with Osgoodd Schlatter disease who received IFC and muscle stimulation after 2 weeks of treatment [32]. Burch et al. said that IFC provides better pain relief and allows the underlying OA condition to be more comfortably treated with patterned muscle stimulation.

Furthermore, Atamaz and colleagues showed that IFC would reduce pain more effectively than other electrotherapy modalities [33]. The beneficiary effects of IFC in improving pain and disability have been evaluated in some other disease and have been demonstrated [34-35].

On the other hand, our results did not concur with those of Nazligul et al. who failed to find any additional benefit for IFC in treating subacromial impingement syndrome m[36]. Our results also disagreed with Gundog et al. who stated that IFC were not effective for pain relief in Osgood Schlatter disease of the knee at one month and 3 months follow up [37].

This study has some limitations. Placebo effects were not evaluated since no control groups were included in this research. The sample size was relatively small to detect differences between groups. Further, the follow-up period was short to demonstrate whether the improvements in each group are sustained in long-term.. The author did not evaluate parameters such as intensity and treatment intervals affecting the treatment effects. Based on the results of this randomized, clinical trial, ESWT may be more effective than IFC in reducing pain and disability and improving function in patients with knee OA.

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Conflicts of interest: None

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