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Original Article

Is Cupping Therapy in Combination with Routine Physical Therapy Effective in the Management of Knee Osteoarthritis? A Randomized Controlled Trial

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ABSTRACT

Background: Osteoarthritis is a common form of arthritis accompanied by varying degrees of disability and reduced quality of life. Several management regimens are available to treat knee osteoarthritis. Cupping therapy is used to treat musculoskeletal disorders but its effects on knee osteoarthritis has remained unclear. The study aimed to compare the effectiveness of intermittent cupping therapy plus routine physical therapy with routine physical therapy alone in patients with knee osteoarthritis.

Methods: Twenty-six patients with knee osteoarthritis were randomly assigned into two groups: intermittent cupping therapy plus routine physical therapy (intervention group, n=13) and routine physical therapy alone (control group, n=13). In the routine physical therapy group, transcutaneous electrical nerve stimulation, hot pack, and ultrasound were used, while in the cupping therapy group, intermittent vacuum therapy was used together with routine physical therapy. Both groups received 10 treatment sessions over a period of 2 weeks. Pain intensity was measured via visual analog scale (VAS). Further, functional disability was assessed using the Persian version of Western Ontario and McMaster Universities (WOMAC) osteoarthritis index questionnaire. Finally, knee joint passive range of motion (ROM) was measured with photography pre- and post-intervention.

Results: At follow-up, both groups had significantly lower pain intensity and functional disability, and higher knee passive ROM compared to their respective pre-intervention values ($P<0.05$). However, no significant differences were observed between groups in pain intensity or passive ROM in the knee ($P>0.05$). Differences in total WOMAC scores between pre- and post-intervention were significantly greater in the control group than in the intervention group ($P<0.05$).

Conclusion: Based on the results, both interventions can be effective in relieving symptoms in patients with knee OA.

Introduction

Osteoarthritis (OA), one of the most common musculoskeletal disorders, is associated with varying degrees of pain, functional disability, and socioeconomic burden [1, 2]. The joints affected by OA include weight-bearing joints such as the hips, knees, feet, and vertebrae [2, 3]. Approximately 85% of people near 65 years of age demonstrate radiographic evidence of OA [3]. Knee osteoarthritis is the most common synovial joint disorder,

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affecting more than 250 million people worldwide, and is responsible for diminished quality of life and functional ability [4]. The aims of any treatment for knee OA include alleviating pain, delaying the progression of joint degeneration, improving joint stiffness and quadriceps strength [2], and improving everyday physical functions [5]. Currently, surgical and non-surgical strategies are used to treat the symptoms of knee OA [6-11], with physiotherapy being one the non-surgical procedures which provides benefits for these patients [3]. In this regard, dry cupping therapy is frequently used to treat various musculoskeletal conditions [12-14].

Cupping therapy can be divided into two general forms: dry and wet cupping. Dry cupping therapy is an ancient technique widely used in Asian, Middle Eastern, and European countries to treat musculoskeletal diseases [2, 15, 16]. This technique pulls the skin into cups through a suction-like force. Reddening and warming of the affected area occur due to increased perfusion. Intermittent cupping therapy is a novel technology which uses a mechanical device. This machine generates an intermittent vacuum with a pump. Traditional cups are used for cupping. However, they do not allow cupping of big joints such as knee. Nowadays, flexible silicon cups allow complete cupping for big joints [2]. In wet cupping, the skin is lacerated with needles or a scalpel whereby blood is sucked toward the cups [2, 16].

Cupping therapy has several benefits. First of all, by creating suction and negative pressure, it ameliorates blood stasis. It also stimulates local hemodynamic changes and improves tissue metabolism in the affected area [17]. Other therapeutic effects of cupping therapy include improvements in muscle pain and spasms [18], drainage of excessive fluids and toxins, release of adhesion, stimulation of blood flow with improved nutrient delivery in stagnant muscles and skin, activation of the lymphatic circulation, and improvement in varicose veins [19]. Further, cupping therapy can lead to relevant clinical benefits for persistent non-specific low back pain [19], neck pain [12], dysmenorrhea [20], and migraines [21].

Some studies have suggested that cupping is effective in the management of diseases or clinical conditions [2, 17-19]. For example, a single application of cupping therapy may be effective in treating chronic nonspecific neck pain [22]. Furthermore, one previous study found an effect of cupping therapy on diminishing low back pain and disability [19]. Another recent study concluded that dry cupping can also be considered to reduce postpartum perineal pain [23]. Finally, dry cupping therapy revealed better results in terms of improvements in of pain, movement disability [2], crepitation, edema, joint inflammation, and morning stiffness in patients with knee OA [17].

Despite recent advances in OA treatment, few clinical studies have been published on the effectiveness of cupping therapy in knee OA. Accordingly, the purpose of this study was to compare the effectiveness of intermittent cupping therapy plus routine physical therapy with routine physical therapy alone in patients with knee osteoarthritis.

Methods

Participants

This randomized control trial was conducted between June and September 2016 at the Rehabilitation Sciences Research Center, Shiraz University of Medical Sciences, Shiraz, Iran (IRCT2015072016532N2). The sample size was calculated based on a previous similar study [2] considering an alpha level of 0.05 and beta level of 0.2. Twenty-six patients (17 women / 9 men) with knee osteoarthrosis (OA) between 45 and 65 years of age were enrolled in the study. Ethical permission for this study was granted by the Ethics Committee of Shiraz University of Medical Sciences in agreement with the standards of the Declaration of Helsinki (CT-P-9365-6665). The inclusion criteria were age between 45 and 65 years, unilateral or bilateral grade 2 to 3 knee OA in the tibiofemoral joint according to the Kellgren and Lawrence grading system [24], a history of continuous knee pain for at least 3 months, and signed informed consent from. Patients who had any history of low back pain, lower extremity fractures and surgery, hip joint osteoarthritis, knee joint mal alignment, Patella-femoral disorders, neuropathies, myopathies, autoimmune pathologies, use of anticoagulants, thrombocytopenia, or intra-articular administration of corticosteroids to the knee joint in the 6 previous months were excluded.

Group and Administration

Before initiating the treatment, the demographic characteristics were recorded (Table 1). Then, the participants were randomly assigned into two groups: intermittent cupping therapy plus routine physical therapy (intervention group, n=13) or routine physical therapy alone (control group, n=13). We randomly generated treatment assignments using a computer program with block sizes of 4. The random allocation sequence was implemented by a physiotherapist who was blinded to both the study assessment and intervention.

The routine physical therapy group received 20 min of transcutaneous electrical nerve stimulation (TENS, 2 Hz , 200 μs) (Stimulator 733X, Novin Medical Engineering Company, Iran) on both sides of the knee joints, 20 min of hot pack application, and 5 min of pulsed ultrasound (1MHz, 0.8 w/cm^2) (Ultrasound 215X, Novin Medical Engineering Company, Iran). Thereafter, they were asked to maximally activate their quadriceps muscles and hold the contraction for 10 seconds under supervision. Ten repetitions were performed per session.

In the intervention group, in addition to routine physical therapy, intermittent cupping therapy was administered with a vacuum device (Vacumed 577B, Novin Medical Engineering Company, Iran). Four flexible silicon cups measuring 60 mm in diameter were attached bilaterally to the skin of the knee joint. The device generated intermittent vacuum (vacuum: 150 mbar, interval: 2 s) for 10 min [2]. Both groups were treated with a frequency of 10 sessions during 2 weeks.

Measurement of Variables

The variables used for assessment were pain intensity, functional disability index, and knee passive range of motion (ROM). These data were recorded at baseline and the end of intervention sessions by an assessor who was blinded to the treatment. Pain intensity was measured via visual analog scale (VAS) which had already proved to have good reliability [25].

To measure passive knee ROM, the participants were positioned prone on a plinth with white markers with radius of 2 cm attached on body landmarks including the greater trochanter, lateral femoral condyle, and lateral malleolus. To record knee joint angle(s), a digital camera was set up 50 cm from the plinth. Images were obtained from the lateral aspect of the knee joint, where image J software (National Institutes of Health website [http://rsb.info.nih.gov/ij]) was used to quantify the knee joint angle from the images. Maximum passive knee ROM (in both flexion and extension directions) was performed by the assessor. The loss of knee extension ROM was expressed as a flexion contracture (Figure 1A, 1B).

Functional disability was measured using the Persian version of Western Ontario and McMaster Universities Osteoarthritis Index Questionnaire (WOMAC). The reliability and validity of the Persian version of WOMAC had been obtained as satisfactory [26].

Data Analysis

Statistical analyses were conducted by SPSS version 16 software (IBM SPSS, Inc., Chicago, IL, USA) with the significance level set at $P<0.05$. All data were tested for normality via the Kolmogorov-Smirnov test. The Mann-Whitney test was used to calculate differences between groups in changes in each variable, while the Wilcoxon test was employed to compare pre- and post-intervention data in each group.

Results

A total of 40 participants were enrolled, with 13 participants included in each study group (Figure 2).

Table 1 presents the demographic characteristics of

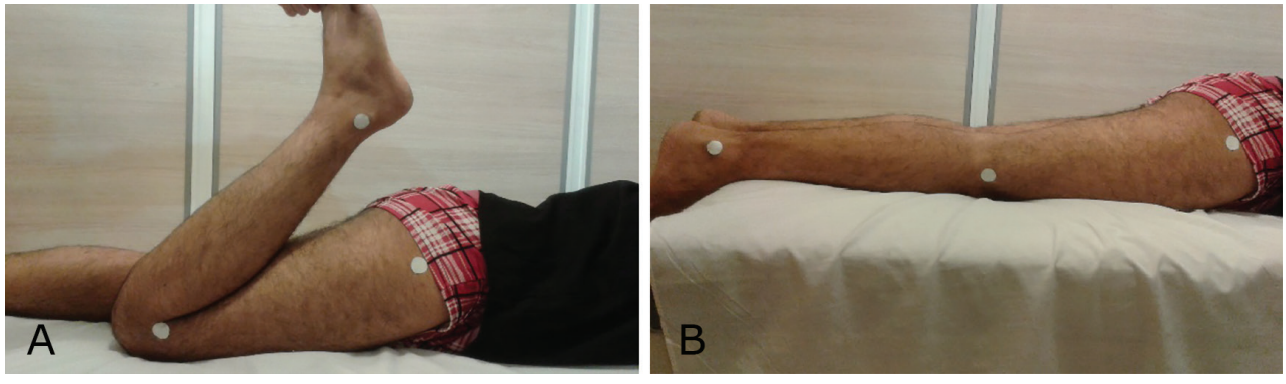

Figure 1: Measurement of passive knee ROM; A) flexion, B) extension

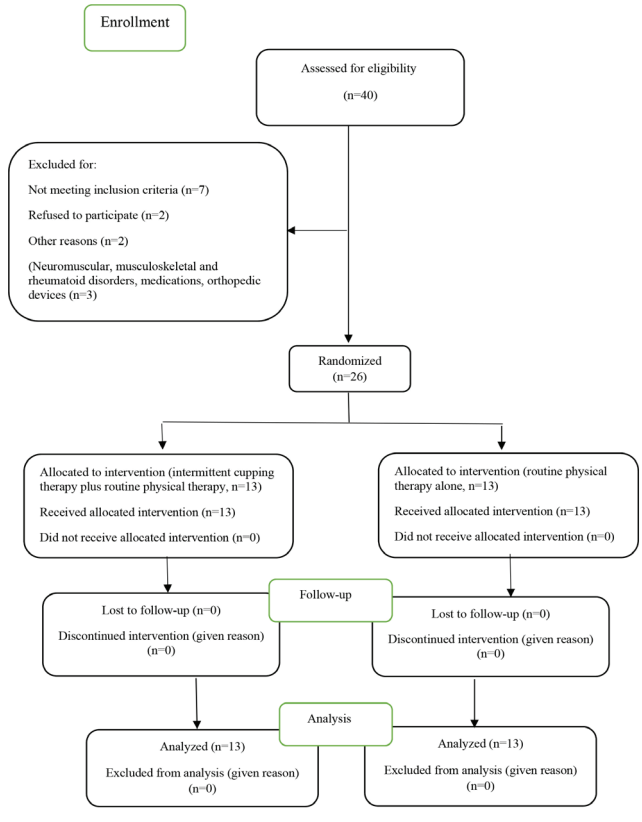

Figure 2: Flow diagram of the process for participants' enrollment, random allocation, follow-up, and analysis

participants. There were no significant differences in any of the demographic characteristics between intermittent cupping therapy plus routine physical therapy group and the routine physical therapy alone (control) group.

As reported in Table 2, there were statistically significant changes in pain intensity, functional disability, and passive range of knee motion in both groups after the interventions (P=0.001).

The outcomes in the cupping (intervention) and control groups after treatment are compared in Table 3. No significant differences were observed between groups in pain intensity or passive ROM in the knee. Therefore, neither of the two types of treatment were found to be superior. Differences in total WOMAC scores between pre- and post-intervention were significantly higher in the control group than in the intervention group (Table 3).

Discussion

This study was conducted to evaluate the effects of intermittent cupping therapy plus routine physical therapy and routine physical therapy alone in management of knee OA.

Effect of intermittent cupping therapy in combination with routine physical therapy or routine physical therapy alone on pain level and disability

Both interventions were considerably effective in improving pain and functional disability of knee OA in this study. Our results are consistent with previous studies on musculoskeletal pain [2, 12, 27]. Lauche et al. reported that dry cupping therapy may be effective in pain relief in patients with chronic non-specific neck pain [12]. In addition, dry cupping was efficacious in relieving signs and symptoms of knee OA [2, 28, 29], dysmenorrhea [30], lumbago [31], and pelvic congestion syndrome [32]. Cupping therapy, by generating a vacuum or suction-like force inside the cups, causes negative pressure on the capillaries and lymphatic vessels in in the underlying tissue, thereby promoting local blood circulation and perfusion in the affected area. This effect, in turn, facilitates the extravasation of blood from the capillaries and withdrawal of toxins, waste substances, and morbid humors from the joint towards skin and subcutaneous tissue in the painful area. Cupping thus promotes microcirculation and capillary endothelial cell repair, and accelerates granulation and angiogenesis in the affected tissues [33].

Analgesia is another effect of dry cupping. This result is obtained through affecting three neurological systems: 1) the analgesic system of the brain and spinal cord, 2) the opiate system in brain, and 3) inhibition of tactile sensory inputs in the pain transmission system [34]. Another mechanism of pain relief with cupping is the vacuum effect, which stimulates cutaneous baroreceptors and leads to the release of endorphin, serotonin, and cortisol. The secretion of these endorphin-like substances can lead to pain relief [28].

Further, deformation or injury induced in the skin by dry cupping therapy stimulates Aβ fibers in both painful and distal skin regions. Multi-receptive dorsal horn neurons at the level of the spinal cord send inhibitory signals towards the affected areas. In light of these phenomena, tactile inputs stimulated by dry cupping therapy may contribute to its analgesic effects at the treated sites [35].

In this study, patients who were treated with routine physical therapy alone experienced significant decrease in pain and functional disability. Prior research demonstrated significant improvements with regard to

Table 1: Demographic characteristics of participants

Variable \ Group	Intervention group (n=13)	Control group (n=13)	P value
	Mean±SD	Mean±SD	
Age (years)	60.53±8.47	55.61±8.18	0.380
Height (cm)	166.22±45.23	161.15±6.97	0.072
Weight (kg)	69.30±12.20	70.61±14.87	0.801

Interventional group=Intermittent cupping therapy plus routine physical therapy, Control group=Physical therapy alone, *Significance level <0.05

Table 2: Pre- and post-intervention pain intensity, functional disability, and passive range of knee motion in the intervention and control groups

		Intervention group (n=13)		Control group (n=13)		P value
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Pain intensity (VAS)		7.61±1.31	4.46±1.19	7.23±2.19	3.92±1.65	0.001*
Functional disability (WOMAC)		71.61±18.30	56.07±17.26	67.07±33.29	45.76±27.08	0.001*
KPROM (Degrees)	F	128.50±6.89	134.36±6.67	126.16±9.99	131.7±8.46	0.001*
	FC	7.58±3.64	2.52±2.53	7.00±4.08	2.44±2.40	0.001*

KPROM: Knee passive range of motion, F: Flexion, FC: Flexion contracture, *Significance level <0.05

Table 3: Differences in outcomes between the intervention and control groups after the treatment

		Intervention group (n=13)	Control group (n=13)	P value
		Mean±SD	Mean±SD	
Pain intensity (VAS)		3.23±1.23	3.30±1.09	0.930
Functional disability (WOMAC)		15.53±2.72	21.30±0.58	0.027*
KPROM (Degrees)	F	5.71±1.91	5.53±1.96	0.980
	FC	5.06±1.83	4.56±1.87	0.490

KPROM: Knee passive range of motion, F: Flexion, FC: flexion contracture, *Significance level <0.05

clinical symptoms [36, 37]. Low frequency electrical stimulation such as TENS induces endogenous opioids secretion and modulates ascending nociceptive pathways. In addition, superficial and deep heaters increase blood flow in the painful area. This leads to better tissue perfusion, increased metabolic activity, and muscle relaxation [36].

The relationship between pain, disability, and pain-related fear is well established [38]. Individuals with musculoskeletal pain may generate catastrophic ideation about their potential injury which increases functional incapacity and pain. These erroneous beliefs interfere with the clinical course and treatment adherence [39]. It seems that reductions in pain intensity are in line with reduction of pain catastrophizing and disability. In this study, we found that intermittent cupping therapy plus routine physical therapy led to improvement in functional disability, although differences were not statistically significant. One possible explanation for this result is that the interventional group had greater disability levels than the control had before the treatment.

Effect of Intermittent Cupping Therapy Plus Routine Physical Therapy or Routine Physical Therapy Alone on ROM

There was a significant increase in passive ROM after the intervention in both groups.

This study found similar results as the preceding research, implying that cupping therapy has a positive impact on elevation of joint ROM [40]. Cupping therapy may induce changes in soft tissue flexibility and generates free movement of deep fascia and muscles by activating lubrication of superficial fascia. Also, cupping therapy enhances neurological activity at the levels of nociceptors, spinal cord, and the other nerves, thereby inducing significant relaxation [40].

In this study, physical therapy program improved passive knee ROM. In the literature, there were studies reporting improvements of ROM in knee OA with physical therapy modalities [41, 42]. Acupuncture-like TENS could raise endorphin levels in the spinal fluids [43]. In addition, application of local heat increases regional blood flow and connective tissue extensibility [41].

Note that at the end of the study period, no significant differences were observed between treatment with and without dry cupping in the outcomes of pain intensity and knee passive ROM. To explore which intervention had a greater effect, further study is required.

A few limitations must be acknowledged. First, this work was performed on patients aging between 45 and 65 years, so our results cannot be extended to other age groups. The lack of follow-up was the second limitation. The long-term effects of cupping therapy should also be investigated further.

Conclusion

Our results suggested that intermittent cupping therapy together with routine physical therapy was not more effective than routine physical therapy alone for improving clinical outcomes in patients with knee osteoarthritis.

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