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Original Research

Cupping Therapy Does Not Influence Healthy Adult's Hamstring Range of Motion Compared to Control or Sham Conditions

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ABSTRACT

International Journal of Exercise Science 13(3): 216-224, 2020. Cupping therapy, a form of traditional Chinese medicine, has recently gained popularity as a therapeutic modality among sports medicine clinicians. While the use of cupping therapy to decrease musculoskeletal pain is supported by recent research findings, evaluations on the use of cupping therapy to influence range of motion (ROM) are limited. The purpose of the study was to identify if cupping therapy applied passively for 10 minutes increases flexibility compared to sham treatment or control conditions. Twenty-five participants with hamstring ROM less than 80° and no previous cupping therapy experience completed the study. Participants reported to the laboratory on three occasions for one of three randomly assigned treatment conditions (cupping, sham, or control) for 10 minutes while prone. Hamstring flexibility was evaluated three times (pre-treatment, post-treatment, and 10-minutes post-treatment) via ROM measured during an active straight leg raise. Participants returned on two other occasions to receive the remaining treatment conditions. A 3 (treatment condition) x 3 (time) repeated measures analysis of variance was utilized for statistical analysis. There was no interaction between condition and time (p = 0.78). Within-subjects effects for time (p = 0.76) was not significant. Post hoc pairwise comparison of treatment conditions found no differences between control and cupping (p = 0.36), cupping and sham (p = 0.35), or control and sham (p=0.98) conditions. Cupping therapy applied statically for 10 minutes does not increase hamstring flexibility compared to a sham treatment or control condition.

KEY WORDS: Myofascial decompression, alternative medicine, athletic training, flexibility

INTRODUCTION

Cupping therapy as a medical technique has been utilized worldwide, with historical accounts from Asia, Egypt, the Middle East, Europe, and the Americas (12). Cupping therapy uses glass or plastic cups, along with fire or a vacuum pump, to create a negative pressure on the applied body regions. Dry cupping techniques can be used as an alternative to acupuncture, eliciting similar neuroendocrine-immune system signaling cascades for therapeutic effects (3). During dry cupping the skin remains intact, thus eliminating the risk of blood-borne pathogen transmission (12). There is minimal risk of adverse reactions, other than the characteristic circular erythema lesion (12). The negative pressure during cupping therapy is theorized to elicit a vast array of physiological changes, including increases in local circulation (8) and skin temperature (8), and decreases in blood pressure (2). A systematic review of clinical research reported cupping therapy can be utilized as a treatment option for a wide variety of conditions, including musculoskeletal pain, cough, asthma, acne, and herpes zoster (1). Despite the wide variety of clinical uses, studies of cupping therapy with rigorous methodological quality, such as randomized controlled trials, are still needed to evaluate treatment effects (1).

Cupping therapy has seen a recent resurgence as a treatment modality for musculoskeletal conditions (12). While research explicitly evaluating cupping therapy for orthopedic conditions is sparse, its use to decrease musculoskeletal pain appears to be supported (2, 5, 15). Notably, Chi et al. determined skin surface temperature to be significantly increased, while subjective experiences of neck and shoulder pain were significantly decreased in experimental groups who received cupping therapy (2). In addition to treatment goals of decrease musculoskeletal pain, cupping therapy in sports medicine, sometimes referred to as myofascial decompression, is utilized to increase range of motion (ROM). Limited research evaluating the effects of cupping therapy on ROM indicates increased flexibility measures in injured participants (9, 16). Despite common clinical practice utilizing these techniques in healthy populations, current literature has not evaluated cupping therapy's use prophylactically in healthy populations to increase flexibility. Furthermore, initial studies indicate a potential treatment effect of increased ROM, neither employed a blinding process, a sham condition, or a control condition (9, 16), allowing for possible biases and placebo effects to be observed.

Therefore, the purpose of this study was to evaluate the effectiveness of cupping therapy on hamstring flexibility in healthy adults, when compared to a sham treatment and control. We hypothesized that the application of cupping therapy would result in a significant increase in hamstring flexibility, as measured via hip flexion ROM, when compared to both a sham cupping technique and control condition.

METHODS

Participants

Using published findings (16), an effect size of 0.49 was utilized for power analysis. Results of the power analysis, using an alpha-level of 0.05 and beta-level of 0.80, indicated a sample size of 24 individuals would be sufficient. A sample size of 25 was desired to account for attrition. Individuals, ages 18-30 years old, were recruited for this study. Inclusion criteria for the participants included being semi-active (exercising ≥ 2 times a week) and having active straight leg raise ROM less than 80°. Exclusion criteria for participants included any injury or illness during treatment time, ROM greater than 80°, allergies to adhesives, any injury to the lower extremity in the past six months and any contraindications for cupping therapy such as: pregnancy, cancer, bone fracture, deep vein thrombosis, sunburn, abrasion, rash, or contusion (12). Participants with previous cupping therapy experience were excluded from participation.

Participants read and signed an Institutional Review Board approved informed consent form prior to participation in this study. A written questionnaire focused on participant demographics, health history, lower extremity injuries and contraindications of cupping therapy, ensured participants met the inclusion criteria. Any participants with contraindications to the treatments were not allowed to participate. If participants began to experience adverse reactions to any of the treatments, they were disqualified from continuing. Participants completed each of the treatment conditions with at least one week between conditions.

Protocol
A double-blinded, repeated measures, randomized control design was conducted to evaluate the effectiveness of cupping therapy on hamstring flexibility. This research was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science (11). The independent variables were treatment conditions and time. The dependent variable was hamstring flexibility, measured by ROM achieved during an active straight leg raise. Treatment conditions were cupping therapy, sham cupping, and control. Hamstring flexibility was measured pre-treatment, immediately post-treatment, and 10 minutes post-treatment. Two investigators, both of which were certified athletic trainers, were utilized to maintain blinding throughout the study. The primary investigator, who had received formal training in cupping therapy, performed all treatments and the secondary investigator collected all ROM measurements.

Each participant reported three times (corresponding to each intervention condition) to the research laboratory, dressed in athletic shorts allowing for access to the hamstrings. During the first data collection, participants completed the Institutional Review Board approved informed consent form, activity questionnaire, and performed ROM measurements to screen for inclusionary criteria. Those who qualified for the study were randomly assigned to an initial treatment, which was performed during the first data collection session. Participants then subsequently returned to the laboratory to complete the second and third conditions, with one week's time between conditions.

The participants were randomly assigned for their first condition to one of three groups: cupping therapy, sham cupping, or control. Randomization was achieved through a random number generator (one for cupping, two for sham, and three for control). In subsequent visits, the treatment was randomized again, by randomly drawing the higher or lower of the two remaining conditions. The third treatment was the final remaining treatment. The intervention leg for all data collection sessions was initially selected by a random number generator of one or two (one - left leg, two - right leg). The intervention leg remained consistent throughout all three data collection sessions.

For all ROM measurements, the primary investigator covered the intervention leg's hamstring with a stockinette. The use of stockinnette allowed for coverage of the characteristic marks following a cupping therapy session to maintain blinding of the second investigator, who performed all ROM measurements. A hinge knee brace locked into extension (Donjoy, DJO Global, Vista, CA) on the intervention leg maintained knee extension. A rubber band was placed above the knee to keep the digital inclinometer (Baseline, Fabrication Enterprises, White Plains, NY) in place until the second investigator entered the room (Figure 1). The digital inclinometer was held by the second investigator just superior to the superior pole of the patella and zeroed before each straight leg raise. Previous authors found the Baseline® digital inclinometer to be accurate (± 0.5°), with an intraclass correlation of 0.84-0.95 (4). The participant was secured to the treatment table using two belts, one at the anterior superior iliac spine and the other secured the non-intervention leg at mid-thigh. A pre-treatment ROM measure was taken on the intervention leg with the participant laying supine and performing four active straight leg raises. Active straight leg raises, as opposed to passive, were selected for ROM measurements to improve ecology validity. The average of the last two trials were used for analysis. Participants were instructed to dorsiflex their ankle and keep their toes moving toward the ceiling to avoid any hip rotation during testing.

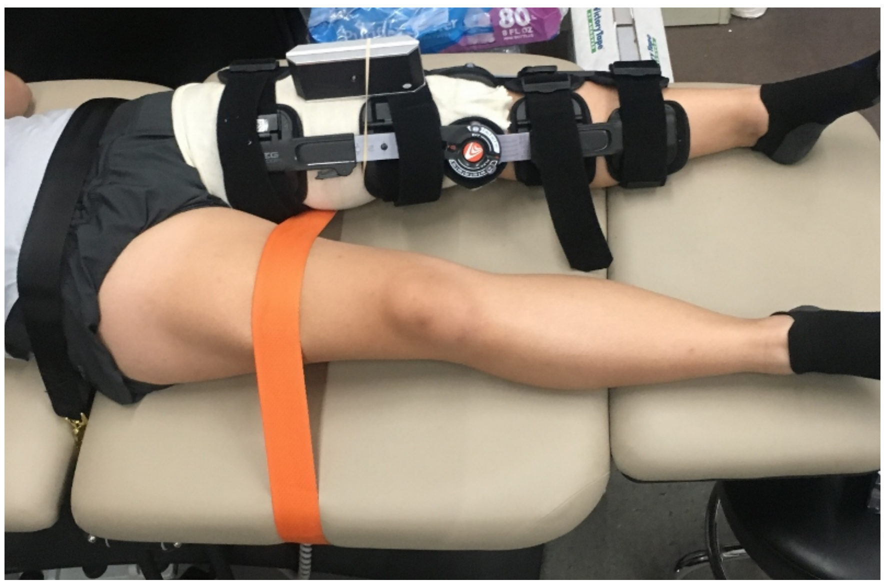

Figure 1. Participant set up for active straight leg raise to measure range of motion

Following the pre-treatment measurement, the primary investigator administered treatment after the secondary investigator left the room. Cupping therapy was performed with the subject lying prone and four cups (Kangzhu, Beijing, China) applied to the midline of the participant's posterior thigh with 0-2 centimeters between each cup. Cups were placed along the path of the biceps femoris, beginning beneath the gluteal fold, with the final cup placed above the lateral condyle of the femur (Figure 2, below). The largest cups which stayed in contact with the hamstring surface before depressurization were utilized. Selection of the largest cups possible given the participants' unique anatomy provided the greatest decompressive stress (14). Cup size was unique to each participant and was documented to maintain consistency between the cupping and sham treatment sessions for each participant. The pressure of the cups was constant, with three full pumps from the handheld vacuum pump (Kangzhu, Beijing, China). The participant remained prone with the cups in place for 10 minutes. The sham cupping treatment was identical to the cupping treatment in cup selection and placement. The only difference was the use of a set of sham cups with a 0.325 mm hole drilled into them for the vacuum pressure to be released and adhesive (Tuf-Skin®) placed along the rim to maintain skin contact during treatment (7). The control condition required the participant to lay prone on the treatment table for 10 minutes, while instructed to remain still.

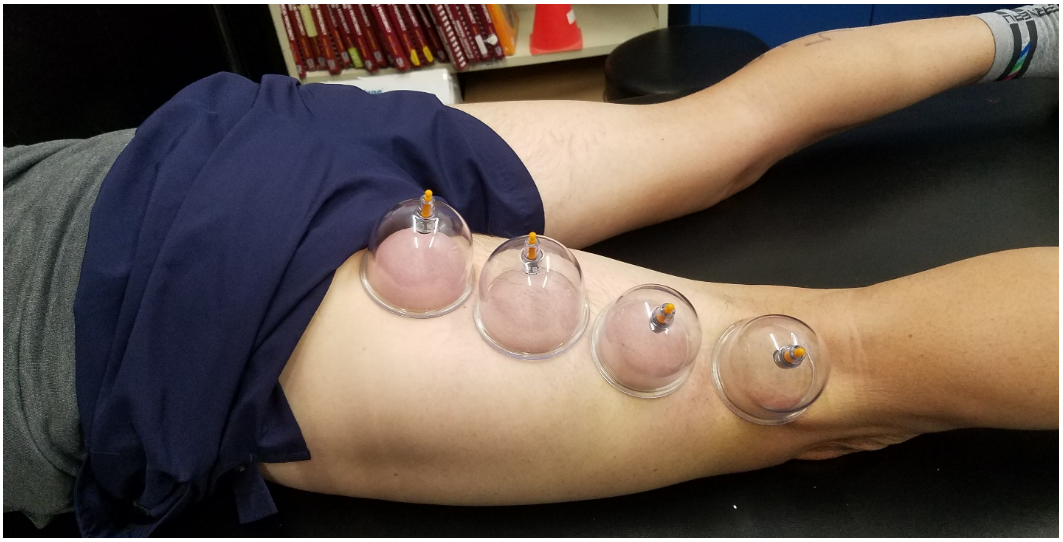

Figure 2. Cup placement for cupping treatment

Following treatment, the participant was placed supine and positioned for the ROM measurements. The primary investigator secured the participant and replaced the stockinette, knee immobilizer, and digital inclinometer. The second researcher then returned to perform ROM of the intervention leg immediately post-treatment. Participants remained in the ROM measurement apparatus for 10 minutes, and then a third measurement was collected. Participants returned one week later at approximately the same time of day, and with instruction to not deviate from their normal activities in between sessions, to perform the remaining conditions. The cupping sets were sterilized after each treatment application.

Statistical Analysis

The mean of the last two active straight leg raise measurements was used for statistical analysis. A 3x3 repeated measures ANOVA was performed to evaluate the three treatment conditions (cupping, sham, and control) and the three times of hamstring ROM measurements (pre, post, and 10 minutes). An *a priori* alpha level was set to $p \leq 0.05$. All statistical measures were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (SPSS Inc., Chicago, IL).

RESULTS

Thirty-five individuals (female n = 16, male n = 19) were recruited for the study. Twenty-five (female n = 10, male n = 15) met inclusion and exclusion criteria, and subsequently completed the study (age: 23.52 ± 3.50 years, height: 171.89 ± 9.23 cm, body mass: 72.86 ± 14.90 kg, exercise per week: 4.22 ± 0.31 hours). Of the ten participants who did not qualify, nine were excluded due to flexibility baseline measures not meeting inclusion criteria and one because they had already had cupping therapy performed. All 25 included participants completed all three data collection sessions.

Means and standard deviations of the hamstring ROM measurements for each treatment condition and at each time can be found in Table 1. For the 3x3 (Condition x Time) repeated measures ANOVA, Mauchly's Test of Sphericity was not significant for condition or time. Therefore, sphericity was assumed. The interaction effect for Time and Condition was not significant (p = 0.78). The within-subjects main effect for Time was not significant (p = 0.76). Pairwise comparisons for Time found no statistical difference between pre-treatment and post-treatment (p = 0.48), pre-treatment and 10 minutes post-treatment (p = 0.80), and post-treatment and 10 minutes post-treatment (p = 0.61). The main effect for condition was also not significant (p = 0.56). Post hoc pairwise comparison of treatment conditions found no statistically significant difference between control and cupping (p = 0.36), cupping and sham (p = 0.35), or control and sham (p = 0.98) conditions.

Table 1. Hamstring range of motion (Mean ± SD).

	Baseline (°)	Immediately Post-Intervention (°)	10 Minutes Post-Intervention (°)
Cupping	69.38 ± 11.36	70.88 ± 12.64	70.40 ± 12.62
Sham	67.08 ± 13.95	66.51 ± 14.68	67.05 ± 15.52
Control	66.83 ± 10.63	67.57 ± 12.67	66.47 ± 13.21

DISCUSSION

The results of our study indicated that a single use of stand-alone cupping therapy does not increase hamstring flexibility when compared to a sham cupping treatment or control condition in healthy participants with limited ROM. This study was unique due to the use of a validated sham condition in comparison to cupping therapy, and double-blinded randomized control trial research design. Previous research evaluating cupping therapy as a treatment to improve ROM has not utilized a blinded study design (9, 16). We hypothesized that cupping therapy would result in a significant increase in flexibility, compared to the sham and control conditions, both immediately and 10 minutes post-treatment. We retained the null hypotheses, as was no significant difference in hamstring flexibility with cupping therapy compared to the sham cupping or control conditions, at either time point.

There are a multitude of physiological changes speculated to occur with cupping therapy that would influence flexibility and ROM. Cupping therapy has been theorized to loosen connective tissue, which could result in increased flexibility (12). Due to the limited research assessing orthopedic cupping therapy, previous studies using other techniques could be used to develop theoretical frameworks on the effects of cupping therapy. Increases in blood flow and tissue temperature have been the proposed mechanism for ROM increases following other soft tissue mobilization techniques (6, 10). Multiple studies have found other soft tissue mobilization techniques, such as instrument-assisted soft tissue mobilization and self-myofascial release, result in increased flexibility (6, 10, 16). Decreased pain and increased tissue temperature and localized circulation, all of which have been attributed to cupping therapy (8, 13, 15), are theoretical mechanisms for increased ROM. Although the current study did not find an acute increase in ROM following cupping therapy, previous research has indicated a treatment effect in pathologic populations (9, 16). As the results of the current investigation indicate no effect of a single cupping therapy session, future research should evaluate whether repetitive application induces physiological adaptations resultant in increased ROM in healthy populations.

In contrast to the current findings, studies utilizing injured populations report flexibility increases after cupping therapy application (9, 16). Markowski et al. (9) applied a single bout of static cupping therapy on the low back and found an increase in both hamstring and lumbar flexibility in participants with chronic low back pain. Warren et al. (16) compared self-myofascial release using a foam roller to cupping therapy, which utilized both static and dynamic cupping techniques, in participants with self-reported hamstring injuries. They reported an increase in hamstring flexibility in athletes with hamstring injuries following cupping therapy (16). Based upon the current study's finding of no ROM changes, compared to the positive response in previous literature (9, 16), it could be speculated that cupping therapy increases ROM secondary to injury, but not in healthy individuals with flexibility deficiencies. However, the evaluation of healthy individuals was necessary due to cupping therapy being utilized clinically in healthy populations with the treatment goal of increasing ROM.

In addition to population demographics, other methodological differences existed between the current study and previous orthopedic research reporting increased ROM following cupping therapy. Previous studies did not have a placebo intervention condition, nor did they utilize a control condition (9, 16). Methodology used by Warren et al. (16) had participants receive both a static cupping treatment and dynamic cupping treatment (active knee flexion and passive straight leg raise with cups in place) prior to post-treatment measurements. While clinically realistic, it is difficult to ascertain the treatment aspect that contributed to the significant increase in flexibility. The incorporation of dynamic movement, either passive or active, during a cupping treatment is often utilized clinically, and warrants evaluation in its own right.

The current study had limitations attributed to the sham cupping condition, which was comparable to a previously utilized methodology (7). Some participants anecdotally noted the sham treatment's decreased pressure. Participants particularly noted the change of pressure if they had the cupping therapy treatment as a previous condition. The goal of the sham treatment was to have the participant feel the negative pressure at the beginning of the application and for the pressure to gradually decline without being recognized. A second limitation was the cup size had to be limited during cupping treatment to cups were small enough to maintain full contact with the participant without suction during sham treatment. Limiting the size of the cups in the cupping therapy condition limited the amount of negative pressure the cups exerted on the soft tissue, a proposed mechanism for treatment effect (14). However, keeping the cup sizes constant was essential to maintaining the legitimacy of the sham treatment.

In conclusion, the current study found that the use of static cupping therapy did not increase ROM in healthy individuals with hamstring flexibility deficits. In addition, the current study reports no placebo effect with the sham cupping therapy condition. Static cupping therapy did not result in increased flexibility, therefore the clinical use of static cupping therapy as a standalone treatment to increase ROM is not supported. There is a need for further studies exploring the effects of cupping therapy combined with motion. These dynamic cupping therapy techniques, with the anatomical location of interest moving through ROM or with the clinician moving the cup over the involved soft tissue, are common practice in sports medicine clinics. Future clinical practice-based research should investigate the effects of dynamic cupping therapy, as the current study found no changes in hamstring flexibility with static cupping therapy in healthy adults.

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