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Research Article

Single Cupping Thearpy Session Improves Pain, Sleep, and Disability in Patients with Nonspecific Chronic Low Back Pain

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ABSTRACT

The objective of this study was to evaluate if a single session of real or placebo cupping therapy in patients with chronic low back pain would be enough to temporarily reduce pain intensity and functional disability, enhancing their mechanical threshold and reducing local skin temperature. The outcome measures were Brief Pain Inventory, pressure pain threshold, Roland–Morris disability questionnaire and low back skin temperature. This is an experimental clinical trial; after examination (AV0), patients were submitted to real or placebo cupping therapy (15 minutes, bilaterally at the points BL23 (Shenshu), BL24 (Qihaishu) and BL25 (Dachangshu) and were revaluated immediately after the session (AV1) and after one week (AV2). The patients showed a significant improvement in all pain severity items and sleep in the Brief Pain Inventory ($p < 0.05$) and a decrease in disability in Roland–Morris disability questionnaire ($p < 0.001$). No significant differences were found in pressure pain threshold or skin temperature. No significant differences were found in any outcome of the placebo cupping therapy group. Thus, the cupping therapy is effective in reducing low back pain and decreasing disability after one single session but not in changing skin mechanical threshold or temperature.

1. Introduction

Low back pain (LBP) is the most common clinical, social, economic, and public health problem that affects the population throughout the world, affecting up to two-thirds of adults at some point in their lifetime [1].

In the United States, low back pain affects between 15% and 30% of the population yearly and is the second leading reason for ambulatory care visits [2]. In Brazil, the major cause of chronic pain is low back pain [3]. As a multifactorial symptom, LPB is associated with reduced quality of life in the affected population, and causes limitation of activity, work absenteeism, functional impairment, fear of movement, stress, anxiety, depression, negative social relation, somatization, catastrophizing, among other symptoms [4,5]. Research on the efficacy of conservative, surgical, and pharmacological treatment of the low back pain has been ongoing for several years. Despite this, many of these approaches can be expensive and sometimes ineffective [6].

Cupping is a traditional Chinese medicine technique used for thousand years and is often useful for a wide range of conditions such as pain, hypertension and stroke [7–9]. However, its clinical efficacy remains uncertain and the mechanism of action is not yet fully elucidated, and the methodological quality of the research is poor presenting many research biases [7,10].

Although cupping was successfully used to treat pain and a wide variety of other complaints for thousands of years, the use of cupping is becoming increasingly diffuse only during the last decade since preliminary systematic clinical trials have suggested that cupping is effective in managing painful conditions [11,12]. In addition, cupping therapy have a wide indication, therapeutic properties, simplicity of application, low cost, low adverse effects, and fast result in the treatment of some diseases [9,13]. In clinical practice, cupping is regularly observed to bring about pain relief and to increase a patient's general feeling of well-being [14].

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We have a great variability in the application of the cupping therapy. At least five sessions are required for any significant effects of cupping therapy, and the cups need to be positioned in the skin for around 8 minutes in an interval of three to four days between the applications [15]. In the present study, we tested the hypothesis that a single session of cupping in patients with chronic LBP would be enough to temporarily reduce pain intensity and functional disability, enhancing their mechanical threshold and change the local skin temperature.

Therefore, the purpose of the present study was to analyze and perform the intragroup and intergroup comparisons of the immediate effect of the cupping therapy or placebo cupping in patients with chronic LBP.

2. Material and Methods

2.1. Study

This study was a placebo-controlled trial study approved by the research ethics committee (protocol study CAAE 67261017.2.0000.5142) and financed by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG). All participants were properly informed regarding the objectives and procedures and signed a statement of informed consent before testing.

2.2. Patients

2.2.1. Inclusion criteria

Patients were eligible for inclusion if they were 18–50 years old, with nonspecific chronic LBP for more than three months of duration and a minimum pain intensity score of 4 in the Visual Analog Score.

2.2.2. Exclusion criteria

Patients were excluded if they were performing any kind of treatment for low back pain, had no preserved sensitivity, skin disease (dermatitis, psoriasis), neurological disease, cancer or using anticoagulants, nonsteroidal antidepressants and/or tricyclic antidepressants. We also excluded patients if they had previously surgery in the spinal column, known or suspected serious spinal pathology as fractures, tumors, inflammatory or rheumatologic disorders of the spine, severe cardiopulmonary disease, rheumatic disease, were pregnant, had a pacemaker or metal implants or did not understand the written consent form. All participants will be invited to sign the participant consent form.

2.3. Procedures

The methodology of this study was based on standards established by the Standards for Reporting Interventions in Clinical Trials of Acupuncture. The recruitment began on March 1, 2018, and the completion date was January 31, 2019. To examine the time course of the cupping intervention effects, measurements were taken before treatment (AV0), immediately after the cupping treatment (AV1) and the follow-up 1 week after the intervention (AV2). We recruited 60 patients at the Physiotherapy Clinics in Federal University. After extraction of inclusion and exclusion criteria, we evaluated 20 patients. Acupuncture points chosen were selected based on the characteristics of patients and the relevant literature [16]. The asepsis on the application sites was provided by 70% alcohol, and the skin was shaved when necessary. The cupping was made with the patient lying in the prone position and six to eight 50 mm diameter acrylic glass cups were placed on the skin bilaterally at the points BL23, BL24 and BL25, and the air was partially evacuated from the cups by means of a mechanical device (Dong Bang Cupping Therapy Set, China). The negative pressure was adjusted to a comfortable level, approximately 300 millibar by two manual pumpings, and after 15 minutes the cups were removed [17]. Cupping was performed by expert certified physicians, who regularly performed cupping therapy in the clinical setting and the disposable cups were used and a high-level sterilization process was required before reuse. Sham cupping was conducted using cupping glasses with a small hole in the cupping glass, causing evacuation of negative pressure. Patients were blinded to the fact that one of the groups received placebo and to whether they received real or sham cupping.

2.4. Outcome parameters

2.4.1. Pain intensity

Pain intensity was assessed using the Brief Pain Inventory (BPI) [18]. The BPI includes 4 items—(1) “pain now”; (2) “pain at its worst”; (3) “pain at its least”; and (4) “average pain” over the last 24 hours—that are used to assess pain severity and 7 items that are used to assess the degree of interference with functioning—(1) general activity; (2) mood; (3) walking ability; (4) normal work; (5) relationships; (6) sleep; and (7) enjoyment in life. Items are rated on a 0–10 (0 = no pain/no interference and 10 = most pain/most interference).

2.4.2. Pain threshold

Pressure pain threshold (PPT) was assessed by a pressure algometer (EMG 830C, EMG System, São José dos Campos, Brazil) applied to the skin [19]. PPT was measured at the following three points bilaterally: BL23 (Shenshu), BL24 (Qihaishu) and BL25 (Dachangshu). The participants were instructed, say ‘yes’ when you start feeling pain or discomfort. When said, ‘yes,’ the pressure was stopped, and the meter was removed from the skin. The threshold was evaluated in triplicates, with the final result being the mean ± standard error of the mean.

2.4.3. Disability

The Roland–Morris disability questionnaire (RMDQ) was used to assess functional disability owing to LBP. This questionnaire consists of 24 questions that focus on the regular activities of daily life. Each affirmative answer corresponds to 1 point, and the final score is determined by the total number of points – the total score ranges from 0 to 24, and higher scores reflect increased disability. Scores higher than 14 indicate severe impairment. The questionnaire was translated and validated by Monteiro et al. [20].

2.4.4. Skin temperature

Infrared thermographic camera ThermaCAM® (FLIR System, Wilsonville, USA), was used for the measurement of low back skin temperature [19]. The distance between the object (low back) and IR camera was 1 m, and it was constant during the experiment. Low back in orthostatic position was photographed after fifteen-minute air-conditioning (23°C). Furthermore, the following instructions were determined: (1) do not wear restrictive clothing, such as a bra, to the examination; (2) tie the hair up; (3) no prolonged sun exposure (especially sunburn) to the breasts 5 days before your examination; (4) no use of lotions, creams, powders, or makeup on the breasts the day of the examination; (5) no use of deodorants or antiperspirants the day of your examination; (6) no exercise 4 hours before the examination; (7) to avoid skin abrasions, no shaving, waxing, and so on on the day of the examination; (8) if bathing, it must be no closer than 1 hour before the examination; (9) do not drinking any hot beverages for 1-2 hours prior the

examination; (10) no smoking at least 1 hour before imaging. Software FLIR Tools Software for Mac and PC | FLIR Systems processed data.

2.5. Statistical Analysis

After tabulating the results, a Shapiro–Wilk normality test was applied to all variables. For variables with normal distributions, the Student's *t*-test or an analysis of variance for repeated measures and Tukey's test were applied, for two or more groups respectively. For data that were not normally distributed, a Mann–Whitney test or a Kruskal–Wallis test and Dunn's test were used, for two or more groups, respectively. The data were processed using SPSS 20.0 software (IBM, Armonk, New York, USA) and significance was set at a level of 5% ($p < 0.05$).

3. Results

Sixty individuals were contacted and came to the testing sites. Forty did not meet the inclusion criteria and two were lost in follow-up (Fig. 1). Thus, twenty participants were submitted to one session of cupping and eighteen were re-evaluated after one week.

Patients were 27.16 ± 8.43 years on average; and 15 men and three women were included, Table 1.

A significant reduction in RMDQ was observed one week after cupping treatment (Table 2). For the BPI, patients also exhibited a significant reduction in the "Pain now" item after one session of cupping, and this effect was maintained after one week. In addition, a significant reduction in others pain severity domains of the BPI was observed one week after cupping treatment. Although in the domains of the BPI of the degree of interference with functioning, we observed a reduction along time, only the "Sleep" item had a significant reduction after one week.

Table 1
Characteristics of participants.

Characteristics	(n = 18)
Age	**Years ± SD**
	27.16 ± 8.43
Gender	**% (n)**
Male	16.6% (3)
Female	83.3% (15)
Physical practice	**% (n)**
Yes	33.3% (6)
No	66.6% (12)

Data are presented as mean ± SD or percentage (n).

Table 2
Pain intensity and disability.

	AV0	AV1	AV2	*p*
RMDQ	7.5 ± 3.51	-	4.77 ± 3.67*	< 0.001[a]
BPI				
Pain now	4.22 ± 2.53	1.66 ± 1.97*	2.38 ± 1.85*	< 0.05[c]
Pain at its worst - 24 hours	5.61 ± 2.25	-	4.33 ± 2.63*	< 0.05[a]
Pain at its least - 24 hours	2.27 ± 1.84	-	1.11 ± 1.27*	< 0.05[a]
Average pain - 24 hours	6.16 ± 1.42	-	3.61 ± 2.03*	< 0.05[b]
General activity	2.77 ± 2.83	-	1.33 ± 2,08	> 0.05[a]
Mood	2.33 ± 2.91	-	1.22 ± 1.55	> 0.05[a]
Walking ability	2.55 ± 2.87	-	1.05 ± 1.60	> 0.05[a]
Normal work	2.66 ± 2.61	-	1.38 ± 1.78	> 0.05[a]
Relationships	1.27 ± 2.02	-	0.44 ± 0.92	> 0.05[a]
Sleep	3.27 ± 3.06	-	1.33 ± 2.37*	< 0.05[a]
Enjoyment in life	1.33 ± 2.19	-	0.38 ± 0.84	> 0.05[a]

Data are presented as mean ± SD; RMDQ, Roland–Morris disability questionnaire; BPI, Brief Pain Inventory; AV0, First evaluation; AV1, Evaluation immediately after cupping; AV2, Evaluation one week after cupping. [a]Mann–Whitney Test; [b]Student *t*-test; [c]Kruskal–Wallis followed by Dunn. *$p < 0.05$.

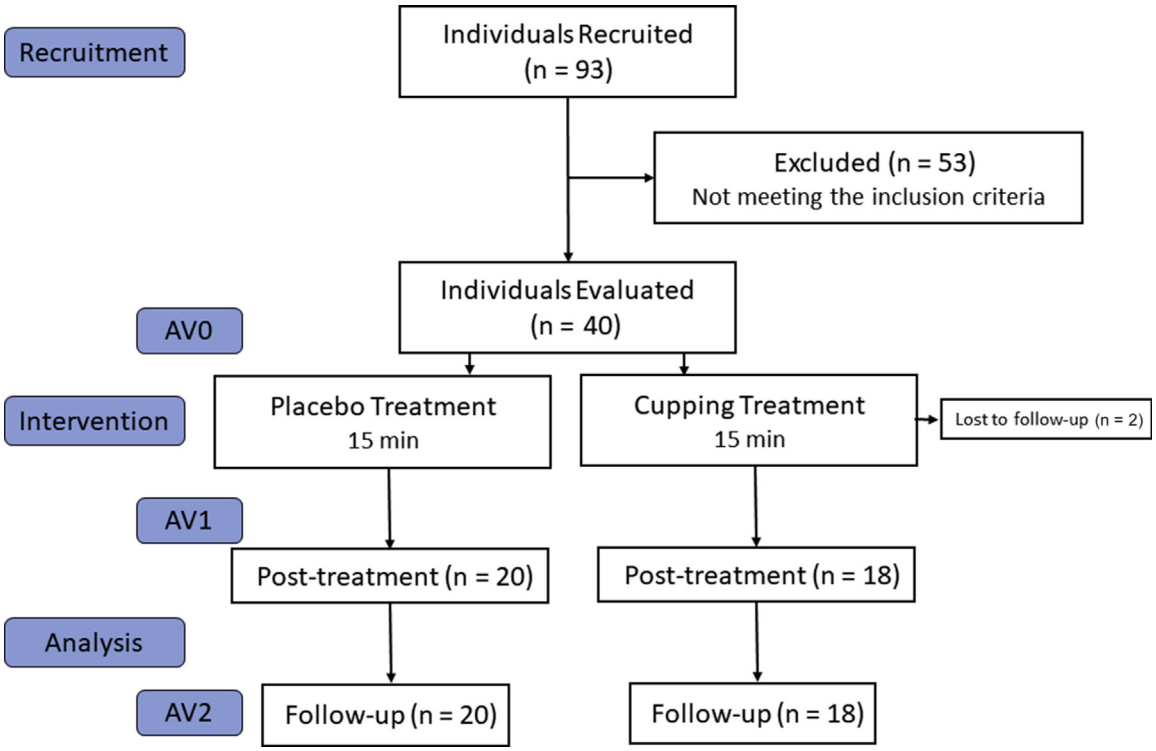

Figure 1. Flowchart of patient recruitment and study flow.

Table 3
Pain threshold.

Acupuncture point	AV0	AV1	AV2	*p*
BL23 Right	7844 ± 1869.9	7273 ± 1785.7	8263 ± 1702.1	> 0.05[a]
BL23 Left	7025 ± 2203.6	7451 ± 1611.7	7613 ± 1626.6	> 0.05[a]
BL24 Right	7285 ± 1818.2	7611 ± 1429	7942 ± 1920.2	> 0.05[a]
BL24 Left	7258 ± 2106.7	7582 ± 1618.8	7936 ± 1681.3	> 0.05[a]
BL25 Right	7173 ± 2365.7	7248 ± 1647.2	8113 ± 1871.3	> 0.05[a]
BL25 Left	6445 ± 2300.6	7310 ± 1576.5	7551 ± 1819.2	> 0.05[a]

Data are presented as mean ± SD; AV0, First evaluation; AV1, Evaluation immediately after cupping; AV2, Evaluation one week after cupping. [a]Kruskal–Wallis followed by Dunn. $p > 0.05$ Not significant.

Table 4
Skin temperature.

Acupuncture point	AV0	AV1	AV2	*p*
BL23 Right	32.85 ± 1.81	33.27 ± 1.84	33.06 ± 1.81	> 0.05[a]
BL23 Left	32.96 ± 1.86	33.23 ± 1.91	33.07 ± 1.89	> 0.05[a]
BL24 Right	32.84 ± 1.89	33.61 ± 1.90	32.98 ± 1.80	> 0.05[a]
BL24 Left	32.93 ± 1.93	33.5 ± 1.78	33 ± 1.86	> 0.05[a]
BL25 Right	32.75 ± 2.09	33.2 ± 1.88	33.04 ± 1.94	> 0.05[a]
BL25 Left	32.82 ± 2.06	33.4 ± 1.83	32.99 ± 1.85	> 0.05[a]

Data are presented as mean ± SD; AV0, First evaluation; AV1, Evaluation immediately after cupping; AV2, Evaluation one week after cupping. [a]Kruskal–Wallis followed by Dunn. $p > 0.05$ Not significant.

Tables 3 and 4 shows the PPT and the skin temperature outcomes, respectively, and no significant differences were found ($p > 0.05$).

No significant differences were found in any outcome of the sham cupping therapy group.

4. Discussion

We tested the hypothesis that a single session of cupping would be enough to reduce pain and improve disability in individuals with LBP temporarily. The results partially confirmed the hypothesis. Although a single session of cupping was effective to reduce pain intensity momentarily and improve disability, one session of cupping did not improve pain threshold or changed the skin temperature. No significant differences were found in the sham cupping therapy group.

The first question to be elucidated is the initial improvement of all pain severity domains of the BPI after a single session of cupping. As a result, the patients presented a reduced BPI and RMDQ after one session of cupping. The reason why this could occur may be suggested because cupping blocks pain sensory afferents [21].

The evidence of cupping in the treatment of pain seems positive [22]. The data suggest effectiveness of cupping reducing pain perception and enhancing function, and the benefits unexpectedly extend for one week. From the clinicians view cupping may be seen as a less inive form of reflex therapy compared to acupuncture with needles. The potential effects of cupping were suggested by Musial et al. [23] who generally proposed three potential mechanisms of action for reflex therapies such as cupping: (1) pain reduction could be caused by deforming the skin which may stimulate Aβ fibers in painful skin regions, (2) manipulations may stimulate inhibitory receptive fields of the multireceptive dorsal horn neurons, and (3) the setting provides a feeling of relief from physical and emotional tensions and socially comforting effect. Cupping have effect on disturbed neurovegetative functions and diseased viscera and may affect the immune system in 2 ways: by irritating the immune system, which causes local inflammation, and subsequently activates the complement system, and increasing the level of interferon and tumor necrotizing factor; or by increasing the lymph flow, in which protein biosynthesis plays an important role [24].

There is evidence of a higher prevalence of sleep disorders in patients with LBP, and most of these studies indicates that more than 50% of patients have sleep-related problems [25,26]. The pathological basis of insomnia, no matter it is from deficiency or excess, is the restlessness. Excess-induced insomnia is caused by disturbance of mental activities, and deficiency-induced insomnia is caused by hypofunction of mental activities [27]. Besides, cupping stimulating the Bladder acupuncture points (BL23, BL24 and BL25) can regulate the functions of *Zang* and *Fu* organs and provide tranquilization and allay excitement. Furthermore, sleep disturbance was found to be dependent on pain intensity, reducing pain intensity must decrease the reporting of sleep disturbance.

Although some evidences showed higher PPT, with less sensitivity in patients with LBP after cupping therapy [9,28,29], our data showed no difference in pain threshold in any point or any time evaluated.

Finally, there was no difference in surface temperature after cupping treatment evaluated at any time. A reduction of the lumbar temperature throughout the treatment time was found in previous work [30], probably owing to the fact of that cupping therapy can increase the blood flow at the immediate time of cupping removal [31]. Therefore, either cupping therapy is unable to alter temperature data, either when performed uniquely, or the changes induced by cupping therapy are deeper and impossible of being detected by thermography.

In the present study, sample size and the treatment of patients with LBP may have been a limiting factor. Given these limitations, a larger sample size and a study in healthy volunteers or with another condition must be evaluated in future researches.

In conclusion, the findings showed that cupping is effective in temporarily reducing pain intensity and improve disability or maintain the effects for a long time. In addition, cupping showed effects in PPT and skin temperature after acute treatment.

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Declaration of competing interest

The authors declare that there is no conflict of interest.

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