Effects of Traditional Cupping Therapy in Patients With Carpal Tunnel Syndrome: A Randomized Controlled Trial

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§Karl and Veronica Carstens Foundation, Essen, Germany.

Abstract: We investigated the effectiveness of cupping, a traditional method of treating musculoskeletal pain, in patients with carpal tunnel syndrome (CTS) in an open randomized trial. n = 52 outpatients (58.5 ± 8.0 years) with neurologically confirmed CTS were randomly assigned to either a verum (n = 26) or a control group (n = 26). Verum patients were treated with a single application of wet cupping, and control patients with a single local application of heat within the region overlying the trapezius muscle. Patients were followed up on day 7 after treatment. The primary outcome, severity of CTS symptoms (VAS), was reduced from 61.5 ± 20.5 to 24.6 ± 22.7 mm at day 7 in the cupping group and from 67.1 ± 20.2 to 51.7 ± 23.9 mm in the control group (group difference −24.5 mm (95%CI −36.1; −2.9, P < .001)). Significant treatment effects were also found for the Levine CTS-score (−.6 pts: 95%CI −.9; −.2, P = .002), neck pain (−12.6 mm; 95%CI −18.8; −6.4, P < .001), functional disability (DASH-Score) (−11.1 pts: 95%CI −17.1; −5.1, P < .001), and physical quality of life (.3; 95%CI .0; .3, P = .048). The treatment was safe and well tolerated. We conclude that cupping therapy may be effective in relieving the pain and other symptoms related to CTS. The efficacy of cupping in the long-term management of CTS and related mechanisms remains to be clarified.

Perspective: The results of a randomized trial on the clinical effects of traditional cupping therapy in patients with carpal tunnel syndrome are presented. Cupping of segmentally related shoulder zones appears to alleviate the symptoms of carpal tunnel syndrome.

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Key words: Carpal tunnel syndrome, complementary medicine, cupping, double crush syndrome, randomized trial, treatment.

Carpal tunnel syndrome (CTS) is a common disorder with an estimated prevalence of 2.7% (clinically and electrophysiologically confirmed) in the general population.¹ Women are more frequently affected than men.¹⁴ CTS causes significant morbidity² and has, in addition to its potentially debilitating physical aspects, a negative financial impact resulting from time lost from work and increased medical expenses.⁴ Classic symptoms of CTS include numbness, tingling, burning, and pain in at least 2 of the 3 digits supplied by the median nerve (ie, thumb, index finger, and middle finger). These symptoms are highly prevalent (14.4%) in the general population.¹

CTS results from entrapment of the median nerve in the carpal tunnel of the wrist,³ pathologically the consequence of noninflammatory fibrosis of the subsynovial connective tissue surrounding the flexor tendons. Biochemical studies of surgical specimens suggest that a variety of regulatory molecules may induce the fibrous and vascular proliferation, possibly as a response to mechanical stress.⁵ But CTS is also related to systemic factors such as metabolic and endocrine disorders, obesity, and amyloid degeneration.⁶,¹⁴ Most cases of CTS have no readily...
Cupping (the candidates’ physical examinations, and each candidate filled out a questionnaire. Thereafter, each participant was randomly assigned to either the wet cupping or the local thermal therapy group, and the respective treatment started. All measurements were repeated on day 7 after the allocated treatment.

Study Participants
Patients of both sexes were eligible if they were between 18 and 70 years old and suffered from manifest CTS as confirmed by neurological examination and electromyography. Only patients who had connective tissue alterations in a predefined zone at the shoulder triangle overlying the trapezius muscle were included. Connective tissue was defined as altered if the consistency of the subcutis was hardened and folds of skin could not be lifted from the fascia without tissue resistance and some discomfort.

Patients were excluded if they were receiving anticoagulants or had hemophilia, anemia, polyneuropathy, or a coexisting serious illness. We also excluded patients if they were participating in another study, had undergone previous surgery for CTS, or had had intra-articular injections within the previous 3 months. Patients regularly taking NSAIDs or analgesics as rescue medication were not excluded if the mean weekly dosage and type of administration had not been altered during the preceding 3 months.

Randomization
Patients were randomly allocated to the 2 treatments by a nonstratified block-randomization with various block lengths and by preparing sealed, sequentially numbered opaque envelopes containing the treatment assignments. Randomization and the envelopes were prepared by the study biostatistician. When a patient fulfilled all enrollment criteria, the study physician opened the lowest-numbered envelope to reveal that patient’s assignment.

Interventions
Cupping
There are 2 main types of cupping: dry and wet cupping. While dry cupping simply involves stimulation of the skin by suction, wet cupping includes some scarification of the skin before applying the cupping glasses. A partial vacuum can be produced by electromechanical or manual suction or by heat production within the cupping glass after it is applied to the skin. Mechanical suction was preferred in this study to avoid burning the skin. The protocol for performing cupping was as follows: The skin overlying the trapezius muscle was disinfected; scarification (puncturing) of the skin was carried out by repeatedly puncturing it superficially with sterile 20-gauge microlancets (number of incisions: 5 to 10); the vacuum cups (size 75 and 100 ccm) were applied and the air within the cup was rarefied by manual mechanical suction; the cupping glasses were removed after 5 to 10 minutes (or when they became partially

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Study Procedures
We recruited participants by means of a press release. Potential participants were screened for eligibility by telephone interview, and eligible candidates were scheduled for enrollment visits. A study physician performed
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filled with capillary blood); and the treated area was then bandaged. Each patient was cupped only once at each of 2 locations. The area overlying the trapezius muscle with the poorest microcirculation by inspection and the area where subcutaneous adhesions were most pronounced and/or discomfort was greatest when the examiner lifted the skin and rubbed it between his fingers were chosen for cupping.

Control Treatment

The control group treatment consisted of applying heat by means of a heating pad (Zapp sack, Fa COOC, Bön en, Germany) once for 15 minutes to the shoulder areas bilaterally with the patient in the supine position. A thermal treatment was selected as the control because in Germany, locally applied heat is frequently prescribed for and well accepted by patients with musculoskeletal pain. Patients with connective tissue alterations in the triangle very frequently experience neck pain and commonly apply heat locally to relieve it.31 Evidence from randomized clinical trials (RCTs) documenting the efficacy of locally applied heat in chronic pain conditions is limited.9,34 However, local heat causes vasodilation, increases analge sia, and reduces muscle spasm, all of which would support its use in patients with chronic pain conditions.25,33

Outcome Measures

The primary outcome measure was the change in total CTS symptom severity from day 0 to 7 as derived from the mean of the patients’ single 100-mm Visual Analog Scale (VAS) symptom scores (global pain, tingling, and numbness). Two additional 100-mm VAS scores were used to assess pain in the arm and hand with either movement or gripping. These were defined as secondary endpoints. All VAS scores were assessed daily and recorded in a diary by the participants for 7 days after randomization.

Other secondary outcomes included functional impairment as measured by the DASH questionnaire (Disabilities of the Arm, Shoulder and Hand) developed by the Upper Extremity Collaborative Group (UECG),18 the symptom severity score of CTS as measured by the questionnaire of Levine,21 the intensity of coexisting neck pain as derived from a 100-mm VAS and by the Northwick Park neck pain questionnaire,20 and quality of life as assessed by the Medical Outcomes Study 36-Item Short-Form (SF-36).32 SF-36 scores were expressed as standard deviations from the mean of the normal German population. All questionnaires were filled in at baseline and 1 week after randomization.

Patients were asked to keep a diary from day 0 to 7, recording any adverse effects of their treatment and their use of oral rescue medication. To control for nonspecific effects of treatment, patients were asked to rate their expected outcomes on a 5-point Likert scale ranging from 4 (expecting considerable pain relief) to 0 (expecting no pain relief) immediately after they had been informed as to which treatment group they had been assigned. Trained, unblinded research assistants collected patient-reported data, and research personnel blinded to group allocation entered and monitored the data.

Sample Size Determination and Statistical Analysis

The study was powered to detect a change of 20 mm on the main outcome criterion between both treatment groups with 80% power on the basis of a standard deviation of 25 mm and a 2-sided significance level of $\alpha = 5\%$. This yielded a total of 52 patients.

All outcome criteria were analyzed by intention-to-treat with repeated measurement analyses of covariance (ANCOVA), which took time as the within-subject factor, group as a between-subject factor, and the respective baseline value as a linear covariate. Missing data were replaced by taking the last observation forward. Treatment effects were estimated within these models and reported as adjusted mean differences, including respective 95% confidence intervals (CI) and $P$-values from adequate 2-sided $t$-tests. Ancillary analyses were done to adjust for the effects of possibly confounding variables, namely outcome expectation. Here, we added these variables as covariates to the ANCOVA models and estimated the group differences in the presence of these covariates.

Of the individuals initially screened by phone, 58 were invited to be further assessed. Of these, the first 52 that fulfilled all study criteria and agreed to participate in the study were included, 26 being randomly assigned to the wet cupping group and 26 to the locally applied heat group. All patients had neurologically confirmed CTS for which they had previously received treatment. The most frequent treatment, a wrist splint, had been applied in 70% of the patients in each group. The right side of the body was affected in 61.5% of the cupping therapy group. All patients had neurologically confirmed CTS for which they had previously received treatment.

Results

Outcome Measures

Cupping therapy was more beneficial than heat, according to the primary outcome measure, change in the total symptom score after day 7. The average ($\pm SD$)
symptom score was reduced from 61.5 ± 20.5 to 24.6 ± 22.7 mm at day 7 in the cupping group and from 67.1 ± 20.2 to 51.7 ± 23.9 mm in the control group (Fig 2), with a highly significant between-group difference of -24.5 mm [CI: -36.1; –12.9; \( p < .001 \) (repeated measurement ANCOVA)].

Comparably significant group differences favoring the cupping therapy were found with all 3 subscales of the symptom score, the 2 additional CTS pain scales, and the Levine questionnaire severity score and physical dimension of quality of life improved only for the cupping group at day 7 with a highly significant between-group difference of -20.5 to 51.7 in the cupping group and from 67.1 to 51.7 in the control group. A regular minor adverse effect was a hematoma at the site of application of a cupping glass. All scarified wounds healed without complication. None of the patients rated the cupping procedure as painful, and all patients in both groups perceived their study treatment as very tolerable.

### Discussion

Symptomatic CTS is highly prevalent in European populations. Since conservative options for treatment are limited, new therapeutic approaches need to be considered. It has recently been proposed that cupping, a traditional method of treatment, may be beneficial in symptomatic CTS when applied to referred connective-tissue zones at the shoulder-neck region. Cupping is used to treat pain syndromes in various different ethnomedical systems, and a recent randomized study suggested that cupping alleviates low back pain.

In this study, patients with CTS who were treated with wet cupping experienced a highly significant decrease in pain and other symptoms. Moreover, a single treatment improved functional ability and quality of life, and reduced associated neck pain for at least 1 week. The observed improvements are most likely attributable to the therapeutic intervention, confirming the results of the recent pilot study.

According to a recent CONSENSUS statement, pretreatment vs posttreatment changes of approximately 2 points (or 30 to 36%, using a NAS or VAS) show that subjects reported feeling “much better” or “meaningfully improved;” a decrease between 40 to 50% represents a “very much improved” status. Baseline ratings of outcome expectation did not differ significantly between the 2 groups. Of the patients in the cupping group, 81% expected their assigned treatment to be efficacious, as did 84% of patients in the control group. Higher outcome expectation was not associated with study outcome (Fig 3), and statistical adjustment of the treatment effects for baseline outcome expectation did not affect the overall results. Thus, there was no indication that outcome was largely affected by the patients’ expectations.

### Safety

There were no serious adverse events in either study group. A regular minor adverse effect was a hematoma at the site of application of a cupping glass. All scarified wounds healed without complication. None of the patients rated the cupping procedure as painful, and all patients in both groups perceived their study treatment as very tolerable.
improved. In this trial, the mean pain score at rest decreased by 59%, and the mean symptoms score decreased by 60%. Both scores reflect substantial improvement. Moreover, the magnitude of the cupping intervention was 1.2 points, which is a large and clinically relevant effect.

At the outset, the symptom scores of the patients in the control group were slightly higher than those in the cupping group, which may bias the results. But with the exception of pain with motion, the baseline differences were not significant. Since the study was randomized, these differences must have occurred by chance. Higher scores for numbness and tingling in the control group may reflect that this group had a poorer prognosis. Since the higher scores were offset by lower pain-at-rest scores, using the average score as a covariate in the analysis may not have adequately reflected prognosis. We therefore conducted an additional analysis in which the single scores (pain, tingling, and numbness) were used as covariates. This analysis resulted in even larger posttreatment group differences, thus corroborating our main results.

Table 2. Severity of Carpal Tunnel Syndrome Symptoms Assessed With Visual Analog Scale Subscales and Levine Questionnaire in Study Groups With Group Differences for Change on Treatment

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Day 7</th>
<th>Group difference (95% CI)</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>Pain at rest</td>
<td></td>
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<tr>
<td>Cupping therapy</td>
<td>61.5 ± 24.9</td>
<td>25.2 ± 25</td>
<td>-22.9 (−35.3; −10.5)</td>
<td>&lt;.001</td>
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<tr>
<td>Thermal therapy</td>
<td>58.6 ± 25.1</td>
<td>47 ± 27.7</td>
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<tr>
<td>Numbness</td>
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<tr>
<td>Cupping therapy</td>
<td>61.1 ± 28</td>
<td>21.4 ± 24.6</td>
<td>-28.8 (−42.5; −15.1)</td>
<td>&lt;.001</td>
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<tr>
<td>Thermal therapy</td>
<td>72.9 ± 22.6</td>
<td>54.4 ± 25.5</td>
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<tr>
<td>Tingling</td>
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<tr>
<td>Cupping therapy</td>
<td>61.3 ± 22.4</td>
<td>24.3 ± 23.7</td>
<td>-25.2 (−37.8; −12.6)</td>
<td>&lt;.001</td>
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<tr>
<td>Thermal therapy</td>
<td>70 ± 20.5</td>
<td>52.9 ± 25</td>
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<tr>
<td>Pain movement</td>
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<tr>
<td>Cupping therapy</td>
<td>64 ± 23</td>
<td>29.2 ± 28.2</td>
<td>-32.4 (−45.5; −19.3)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Thermal therapy</td>
<td>60.1 ± 28.1</td>
<td>60.5 ± 28.8</td>
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<tr>
<td>Pain with pressure</td>
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<tr>
<td>Cupping therapy</td>
<td>41.1 ± 25.2</td>
<td>24.0 ± 26.1</td>
<td>-26.5 (−38.2; −14.7)</td>
<td>&lt;.001</td>
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<tr>
<td>Thermal therapy</td>
<td>38.2 ± 25.9</td>
<td>49.3 ± 29.7</td>
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<tr>
<td>Levine CTS Score</td>
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<tr>
<td>Symptom severity</td>
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<tr>
<td>Cupping therapy</td>
<td>3.1 ± .6</td>
<td>2.4 ± .8</td>
<td>-0.6 (−0.9; −0.2)</td>
<td>.002</td>
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<td>Thermal therapy</td>
<td>3.2 ± .8</td>
<td>3.0 ± .7</td>
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<tr>
<td>Functional status</td>
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<tr>
<td>Cupping therapy</td>
<td>2.5 ± .8</td>
<td>1.9 ± .6</td>
<td>-0.6 (−0.8; −0.3)</td>
<td>&lt;.001</td>
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<tr>
<td>Thermal therapy</td>
<td>2.6 ± .8</td>
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</tbody>
</table>

NOTE. Mean values ± SD and estimated group difference (95% CI).

Table 3. Dash Score and Neck Pain Assessed With Northwick Pain Questionnaire (NPQ) in Study Groups With Group Differences for Change on Treatment

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Day 7</th>
<th>Group difference Mean (95% CI)</th>
<th>P-value</th>
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<tbody>
<tr>
<td>DASH score</td>
<td></td>
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<tr>
<td>Cupping therapy</td>
<td>36.3 ± 13.3</td>
<td>23.7 ± 14.2</td>
<td>-11.1 (−17.1; −5.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Thermal therapy</td>
<td>44.5 ± 19</td>
<td>43.4 ± 19.9</td>
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<tr>
<td>Neck pain</td>
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<tr>
<td>NPQ sum score</td>
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<tr>
<td>Cupping therapy</td>
<td>39.3 ± 11.7</td>
<td>22.6 ± 13.8</td>
<td>-12.6 (−18.8; −6.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Thermal therapy</td>
<td>44.2 ± 15.3</td>
<td>39.4 ± 16.6</td>
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<tr>
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<td></td>
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<tr>
<td>Cupping therapy</td>
<td>49 ± 48.2</td>
<td>21.4 ± 21.6</td>
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<tr>
<td>Thermal therapy</td>
<td>52.2 ± 27.1</td>
<td>47.8 ± 23.4</td>
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<tr>
<td>Neck pain with hand movement</td>
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<tr>
<td>Cupping therapy</td>
<td>56.8 ± 28.8</td>
<td>25.9 ± 25.9</td>
<td>-26.2 (−38.2; −14.2)</td>
<td>&lt;.001</td>
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<tr>
<td>Thermal therapy</td>
<td>64.9 ± 26.1</td>
<td>56.5 ± 24.6</td>
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</table>

NOTE. Mean values ± SD and estimated group difference (95% CI).
in relieving pain than a placebo pill. Therefore, the randomized trial, a sham device was more effective treatments may have relevant placebo effects. In a re-
placebo effect. In fact, all invasive or nonpharmacologi-
induces such mechanisms.

Therefore, it remains unclear whether cupping works statistically adjusted for baseline differences; thus, the bias due to group differences at baseline can be re-
garded as negligible.

Various mechanisms have been considered to explain the observed effects. First, the cupping may have been effective due to its direct effect on the patients’ cervicothora-
ic lesions, in accord with the double-crush hypothesis. This hypothesis was first proposed in 1973 by Upton and McCo-
as, who observed that the majority of patients with CPS or an ulnar neuropathy also had electrophysiological evidence of cervicothoracic lesions. According to the dou-
ble-crush hypothesis, proximal lesions (such as those of cer-

cervical radiculopathies or musculoskeletal pain syndromes in referred zones) may predispose patients to neural injury at distal sites; accordingly, nonsymptomatic impairment of axoplasmic flow along a nerve might eventually cause a symptomatic neuropathy.

Wet cupping applies negative local vacuum pressure to subcutaneous muscle and tissue, causes local bloodlet-
ting, and has lymph-flow modulating effects. In this trial it may have altered tissue perfusion and metabolism in the cervical and brachial plexus regions, and may have subsequently affected median nerve function. However, to date, neurophysiological trials to test the double-

crush hypothesis have produced conflicting results. Therefore, it remains unclear whether cupping works via its effects on proximal nerve function.

Second, nociceptive activation contributes to chronic pain, and wet cupping may alleviate pain by means of antinociceptive effects and by counterirritation. How-
ever, at present, it is unclear to what extent cupping induces such mechanisms.

Third, cupping therapy may simply have a powerful placebo effect. In fact, all invasive or nonpharmacologi-
cal treatments may have relevant placebo effects. In a re-
cent randomized trial, a sham device was more effective in relieving pain than a placebo pill. Therefore, the nonspecific and placebo effects of cupping therapy may result from the fact that it is an uncommon proce-
dure. However, this is relevant only if placebos are indeed effective in treating chronic pain syndromes, which remains unproven.

This study is limited because it is an open trial. Placebo-
like and unspecific treatment effects cannot be well con-
trolled and precisely assessed. To date, it has not been possible to blind for complex procedures like wet cup-
ing. Furthermore, since most German patients are fa-
miliar with cupping, they may be able to guess which treatment they received, thus compromising study re-

ts. For these reasons we first assessed the effectiveness of cupping in an open trial.

Since the effect of the cupping intervention in a popu-
lation with chronic pain was large (d = 1.2), it seems un-
likely that it can be fully explained by unspecific effects with nonblinding. Furthermore, we assessed outcome expectation in order to approximate the placebo effects. Scores did not indicate that the cupping group had higher expectations, and overall results did not change after adjustment for the confounding effect of outcome expectation. Therefore, although a relevant effect of cupping is very likely an unspecific one, our results indi-
cate that this treatment may also have a specific effect. To better assess the nonspecific treatment effects of cup-
ning, a sham cupping procedure should be developed for future trials.

This study is also limited by its brief duration. Yet, we did show that cupping of a referred zone for CTS results in relevant symptomatic relief. In clinical practice, cup-

ping is conveniently and easily performed and thus suit-
able for repetitive treatments. Further studies are needed to assess the long-term value of cupping in the management of CTS.

The therapeutic effect of cupping may seem greater because of the control treatment to which it was com-
pared. CTS is not usually treated by heat applied to the shoulder triangle. However, for the present study, locally applied heat was chosen over other established CTS treatments in order to compare 2 modalities of locodis-
tant treatment. In addition, we chose locally applied heat because patients with neck pain—who comprised most of our patients—usually perceive intensive locally applied heat as pleasant and beneficial. The notion that local treatment within the shoulder triangle might result in the relief of CTS symptoms—the primary as-
sumption of this study—was communicated to both study groups. The outcome expectation score in the con-
trol group suggests these participants expected their treatment to be effective. Future trials should also com-
pare cupping for CTS with other standard treatments, eg, splinting and steroid injections.

Finally, the study is also limited by the sample size of the study population. Although the effects of treatment were consistent and the observed group differences were highly significant, the magnitude of the effects may be overestimated due to the small sample sizes.

Cupping therapy as applied in this study was safe and very well tolerated. A common minor adverse effect was a local hematoma, but wound healing after cupping was uncomplicated.

In conclusion, a single course of wet cupping of the shoulder triangle overlying the trapezius muscle

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**Figure 3.** Change of overall symptom score (study day 7) and patients’ expectations at baseline. Negative values indicate an improvement.
appears to be effective in relieving symptoms and pain for at least 1 week in patients with manifest CTS. The efficacy of this treatment and its related mechanisms should be further studied in blinded, randomized trials of longer duration using other treatments as controls.

References


