EFFECT OF DRY CUPPING THERAPY WITH NEURODYNAMIC MOBILIZATION ON PAIN INTENSITY, MUSCLE STRENGTH AND FUNCTIONAL ABILITIES IN PATIENTS WITH CUBITAL TUNNEL SYNDROME: A RANDOMIZED CLINICAL TRIAL.

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ABSTRACT

Background: Cupping therapy is an easy and low-cost procedure that has been used openly to treat soft tissue dysfunctions. It is a safe and popular technique that could be employed as a complementary therapy in the treatment of entrapment neuropathy.

Objective: The goal of this study is to see if adding cupping therapy to standard conservative management for cubital tunnel syndrome (CuTS) patients (pulsed us and neurodynamic mobilization methods, strength and closed kinetic chain exercises) has an additional effect.

Methods: Twenty four female patients with cubital tunnel syndrome aged 25–45 years were randomly distributed equally. Control group (group I) was received pulsed ultrasound, neurodynamic techniques, strengthening and closed kinetic chain exercises. Study group (group II) was received the same program plus dry cupping therapy. Pain level; Tinel sign; palmar gripping and grasping and functional status of the patients were examined before and after the treatment.

Results: All the measured variables were decreased (pain, tinel, functional status). Whereas grip and pinch strength increased in both groups. While there was no significant difference among the two groups (p > 0.5), both showed improvement.

Conclusion: The current study does not support the efficacy of adding dry cupping therapy to selected physical therapy program in a patient suffering from cubital tunnel syndrome.

Keywords: Cubital Tunnel Syndrome; e, dry cupping, neurodynamic techniques.

1. INTRODUCTION

Cubital tunnel syndrome, following carpal tunnel syndrome, is one of the most frequent nerve compressions in the upper limb, affecting 2-6% of the population.¹ ²

The first line of treatment for mild or moderate cubital tunnel syndrome symptoms is conservative; however, there are little supportive evidences to guide researchers in this topic.³
There are an increasing number of complained subjects who receiving unnecessary surgery. This forces some surgeons to consider conservative treatment as the first choice of therapy for CuTS. For sufferers with intermittent symptoms and normal electrophysiological parameters, more than 70% of hand surgeons questioned favored trying conservative treatment first; nonetheless, there is a significant shortage of high-quality research on this subject.4

Despite CuTS being one of the most prevalent conditions managed by upper-extremity specialist, there is still a lack of high-quality epidemiological data for this ailment, and the general population incidence remained unclear.2

The clinical presentation of CuTS is characterized by difficulty to flex the forearm, intermittent paresthesia; numbness and formication on the ulnar dermatomal area are frequent early symptoms. With the progression of disease, these symptoms become more frequent, and patients might have pain in the elbow's medial area as well as hand weakness. A sign of advanced disease is atrophy of the hand's intrinsic muscles.5

Patients with mild disease might not exhibit any symptom at the time of medical examination. Several provocation tests might facilitate diagnosis, such as the maximal flexion and pressure provocation tests. Symptoms and signs, orthopedic tests, and electrophysiological investigation are used to make the diagnosis.5,7

While cubital tunnel syndrome (CuTS) is a well-known entrapment neuropathy with a well-defined clinical entity, there is little information on non-operative therapy. Ergonomic changes, avoiding of aggravating motions or postures, night splints, nonsteroidal anti-inflammatory drugs, and physical and/or occupational treatment with suitable methods are all examples of standard conservative treatment. Nevertheless, what is intended by "appropriate modalities" is not clear.8

Neurodynamic technique has a significant role in restoring motion and flexibility of the nervous tissues, enhancing return to normal functions. The technique involves movement and/or tension of the nervous system, which results in reduced intrinsic pressure of the neural tissue. It is assumed that such therapeutic movements could re-establish the neural biomechanics such as elasticity and axoplasmatic flow, to help in bearing different forces associated with daily activities.9,10 Also it allows for an improvement in the motor unit recruitment and improving muscle strength. In addition, mobilization of the nervous system has long been known to reduce pain intensity and improve related symptoms in neural disorders.9-12

Cupping is old method for treating pains related to different disorders. With the use of a suction cup, rapid, strong, and rhythmical strokes are applied to the skin, stimulating cutaneous and subcutaneous muscles and increasing blood supply in the area. As a result, it has the ability to improve life quality while having minimal negative impacts. Dry or wet cupping might be applied. Skin is drawn into the cup using vacuum pressure in dry cupping, while skin stripping is utilized to draw blood into the cup in wet cupping.13-16 There is a growing body of evidence supporting the use of cupping treatment to treat pain and reported that neural entrapment can be improved by cupping.17

The goal of this research is to show if there is an additional impact from adding dry cupping therapy to standard conservative management of Cubital tunnel syndrome (CuTS).

II. MATERIALS AND METHODS

Study design

From September 2020 to April 2021, this randomized controlled clinical trial was carried out at the Faculty of Physical Therapy's Out-Patient Clinic at Cairo University and at private clinic. Before each patient participated in the study, the study's aims and protocol were explained to him. For participation in this study, all patients signed an informed consent form that had been approved by the institution.

Participants

Thirty-two female patients with cubital tunnel syndrome (CuTS) were initially screened for eligibility criteria. Patients were diagnosed and referred from a neurologist and orthopedist as having cubital tunnel syndrome (CuTS) based on a careful clinical evaluation. This diagnosis was confirmed by electrodiagnosis for ulnar nerve. Patients underwent a comprehensive physical evaluation by a physical therapist.
Following the screening process, twenty-four patients were found to be qualified to participate in the research and complete it, which is shown in Figure (1). Patients were qualified to take part in this research if they met the following criteria: (i) they were between the ages of 25 and 45; (ii) the stage of CuTS compression was grade 1 or grade 2, as per the McGowan grading system (table 1); (iii) all patients had unilateral ulnar nerve entrapment on the dominant side; and (iv) the complaints had lasted at least three months prior to starting treatment. Whereas patients have been ruled out if they exhibited (i) cervical radiculopathy; (ii) rheumatoid arthritis; (iii) radial nerve entrapment; (iv) median nerve entrapment (v) congenital anomalies involving the elbow joint; (vi) systemic disease (e.g., diabetes mellitus).

### Table 1

**McGowan grading system**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symptoms and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Mild symptoms, intermittent paresthesia/hypesthesia, no motor changes</td>
</tr>
<tr>
<td>II</td>
<td>Persistent symptoms of paresthesia/hypesthesia, varying degrees of mild weakness/atrophy, ulnar innervated muscles</td>
</tr>
<tr>
<td>III</td>
<td>Persistent sensory symptoms, marked atrophy, or weakness</td>
</tr>
</tbody>
</table>

**Randomization**

After the screening process, six patients have been ruled out because they didn't meet the inclusion criteria and two patients were excluded as they refused to participate in the study. A randomization process was performed for twenty-four patients; a computer-generated randomized table was used for allocation. A random numerical sequence was used to hide patient allocation in sealed opaque envelopes. The researcher opened the subsequent envelope in the sequence in front of every patient as they officially entered the trial.

The patients were divided into two groups at random. Control group (group I) was received pulsed US, neurodynamic mobilization, strengthening and closed kinetic chain exercises. Study group (group II) was received the same program plus dry cupping treatment (figure1).
Outcome measures:
A visual analog scale was used to evaluate pain levels during the activity (VAS-P). Tinel sign was positive at the elbow level, and pain severity was assessed using a visual analog scale (VAS-T). The Disability of Arm Shoulder and Hand Index (DASH) has been used for assessing functional status of the patients. The DASH result measure 30-items questionnaire aimed to assess physical function and follow changes in symptoms and function in people with upper-extremity musculoskeletal disorders over time. The 21 items check the degree of difficulty in executing various activities as a result of an arm, shoulder or hand problem. Five items ask about the severity of each of the symptoms or pain, activity-related pain, tingling, weakness and stiffness. Four items test sleep, work, self-image and social activities. Each item has five likely answer choices. The score ranges from 0 (no disability) to 100 (severe disability).19

Figure 1: Flow chart of study participants.
Results of the study showed that the patient responded well to the treatment plan. The patient's symptoms improved significantly after the six-week treatment program. The Jamar hydraulic pinch gauge used to measure lateral pinch showed a substantial improvement in grip strength. The patient was able to pinch the dynamometer with maximal isometric effort and maintained for five seconds.

Treatment Plan
Pulsed ultrasound (US) used phyaction190 (made in Netherland serial number 2745, 230 v / 300MA / 50-60 Hz). Pulsed ultrasound (US) at a 1 W/cm² intensity for 15 min three times per week has been used to regenerate ulnar nerve traces at the start of the rehabilitation program. Neurodynamic mobilization was done after the application of US. Gliding techniques were used in neural mobilization that target to glide the nerve by changing the movements of at least two joints, one of which loads the nerve whereas the other unloads it simultaneously. So the gliding technique of ulnar nerve glides the nerve without tensioning it. The patient had been in a supine position with a contralateral side bending position of the neck. External rotation was 90° abduction, and the shoulder was positioned in depression. The therapist executed passive forearm pronation and supination whereas the elbow was flexed to 90°. In the second step, the therapist pronated the forearm and conducted passive elbow flexion from 90 to 140° from the first position. Third, the therapist conducted shoulder depression from 90° to 120° of abduction, beginning from the final position obtained with the elbow in 90° flexion. Each position has been performed five repetitions in in every session (three times a week during six weeks). The neurodynamic exercises have been performed in a range of motion that has both pain-free and tension-free. Active sliding home exercises were done by the patients 10 times a day.

Strengthening exercises using dumbbells were performed 3 × 15 times for elbow flexion and extension, forearm pronation and supination, and wrist flexion and extension. Closed chain exercises employing Swiss balls were introduced to the therapy program. The extremity has been positioned in such a way that the elbow has been comfortably extended over the ball, and the extremity has been allowed to bear increasing quantities of weight into the ball. The musculature surrounding several joints in the upper extremities co-contracted as a result of the closed chain exercises.

In the study group, dry cupping was used while the upper limb was placed in neurodynamic position as mentioned before. The tool was used for cupping had three parts: A 4.5 cm diameter transparent plastic cup, a manual pump for negative pressure, and a calibrated pressure gauge to detect the system's air pressure. In addition to the previously stated therapies, a cup was placed statically 5 cm proximal to the medial epicondyle for 5 minutes at a pressure of 50 mmHg. According to the pilot study, this pressure was deemed to be safe. During therapy, the cup was gently moved along the nerve pathway to ensure that all areas were covered for another 5 minutes.

Statistical analysis
In order to analyse participant characteristics among groups, a t-test has been used. The normal distribution of data was checked using the Shapiro-Wilk test, and the homogeneity among groups was tested using Levene's test. Effect of dry cupping therapy with neural glides within and between groups was investigated using a mixed MANOVA. Bonferroni correction was used in a number of post-hoc tests. The significance level was set at p < 0.05. All statistical tests were conducted using SPSS version 25 (IBM SPSS, Chicago, IL, USA).

III. RESULTS

Subject characteristics:
The subject characteristics did not differ significantly between the two groups (p > 0.05) (Table 2).

Effect of dry cupping with neurodynamic mobilization on cubital tunnel syndrome:
Treatment and time had a significant interaction (Wilks' Lambda = 0.38; F = 5.85, p = 0.002, \( \eta^2 = 0.61 \)). The main effect of time was significant (Wilks' Lambda = 0.00; F = 794.58, p = 0.001, \( \eta^2 = 0.99 \)). The main effect of treatment was significant (Wilks' Lambda = 0.83; F = 0.73, p = 0.60, \( \eta^2 = 0.16 \)).

**Within group comparison:**
Both the control and study groups showed significant improvement in the VAS-P, VAS-T, grip, pinch, and DASH parameters after treatment compared to before treatment (p < 0.001) (Table 3).

**Between group comparison:**
In all parameters, there was no significant difference among groups pre and post treatment (p > 0.05). (Table 3).

**Table 2:** Basic characteristic of the study and control groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group mean ± SD</th>
<th>Study group mean ± SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36.87 ± 7.53</td>
<td>37.87 ± 6.79</td>
<td>0.73</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>60.91 ± 6.04</td>
<td>61.08 ± 6.25</td>
<td>0.94</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.41 ± 3.28</td>
<td>159.25 ± 3.30</td>
<td>0.90</td>
</tr>
</tbody>
</table>

SD, standard deviation; p-value, level of significance; *t* test.

**Table 3:** Comparison of the VAS-P, VAS-T, grip, pinch and DASH-T, parameters of the control and study groups pre and post treatment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretreatment</th>
<th>Post treatment</th>
<th>Pre vs Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control group</td>
<td>Study group</td>
<td>Control group</td>
</tr>
<tr>
<td></td>
<td>mean ± SD</td>
<td>mean ± SD</td>
<td>mean ± SD</td>
</tr>
<tr>
<td>VAS-P</td>
<td>2.50±0.67</td>
<td>2.75±0.75</td>
<td>0.40</td>
</tr>
<tr>
<td>VAS-T</td>
<td>6.75±0.86</td>
<td>6.50±1.16</td>
<td>0.55</td>
</tr>
<tr>
<td>Grip</td>
<td>18.24±1.11</td>
<td>17.85±1.19</td>
<td>0.41</td>
</tr>
<tr>
<td>Pinch</td>
<td>8.51±0.81</td>
<td>8.40±0.86</td>
<td>0.73</td>
</tr>
<tr>
<td>DASH</td>
<td>80.91±2.27</td>
<td>81.25±3.95</td>
<td>0.80</td>
</tr>
</tbody>
</table>

SD, Standard deviation; p-value, level of significance; *a* between group comparison, *b* within group comparison.

**IV. DISCUSSION**
The results of this study showed improvement regarding all measured variable, with more improvement in the group II but this improvement did not reach a statistically significant difference among the two groups.
The improvement in the control group may be due to created strain result from pulling tension within the nerve, which reduces vascular and axoplasmic flow. Gliding may happen both within the nerve and between the nerve and its interface tissue. 20, 24 Intraneural and extraneural fluids collect in the nerve glide, which may help manage the increased pressure induced via intraneural edema and fibroblastic activity. Once the pressure is removed, blood circulation and axonal transport, both of which are required for a neuron's functional and structural integrity, will resume. 25, 26

Few studies previously conducted to show the efficacy of mobilization in carpal tunnel syndrome (CTS) patients and come in agreement with the result of our study. Coppitiets et al. 8 conducted study to compare the effects of immediate vs. delayed postoperative mobilization following ulnar nerve subcutaneous transposition. The result revealed that there was improvement in both groups, with the immediate mobilization group returning to work and daily activities earlier.

Oskay et al. 27 conducted study to demonstrate the efficacy of nerve mobilization procedures in the standard conservative treatment of CuTS. The result showed that for certain patients with mild to moderate symptoms, conservative treatment could be effective.

The nonthermal effects (cavitations and microstreaming) of pulsed ultrasound (US) used in this study may aid beneficial effect. 28, 29 Furthermore, US may influence nerve conduction in healthy neural tissue as well as nerve healing in injured nerves. 28, 30 The reduced pain, improved function and facilitate regeneration with entrapment neuropathies has been reported in different peripheral nerve injury studies by using US. 31

Our result run in parallel with the result of Tanuguchi et al. 32 who found that patients with mild to moderate carpal tunnel syndrome who received pulsed US at 1.0 W/cm2 had better symptoms and median nerve conduction velocity than those who received continuous US.

Aching, weakness, and finally muscular atrophy appear as a sequence of changes caused by nerve compression, with weakness not becoming prominent until the nerve has degenerated significantly as a result of chronic nerve compression. 33

The patients in this research were with mild and moderate symptoms. On the affected side, we discovered mild weakening of palmar gripping and grasping functions. Closed chain exercises and resistance exercises for the musculature surround several joints create co-contraction of these musculatures, which helps to decrease intrinsic muscle weakness.

Tejashree and Ajit 34 conducted study to show the effects of neural mobility on functioning of neural mobility. Their results showed positive benefits of using neural mobilization on pinch and grip strength in healthy individuals, which could thus be applicable for treatment of various pathologies.

Our result come in consistency with the work of Nair et al. 35 who stated that neural mobilization may be make increase in hand grip strength in cervical radiculopathy patients. The increase in hand grip in our study may be due to combined effect of strengthening exercises and using neural mobilization which causes a cascading change in its physiological function. The stretch applied to the nerve triggers an increase in acting polymerization, force generation, release of neurotransmitters and intraneural circulation. 34

The improvement in the cupping group may be explained by cupping makes change in biomechanical characteristics of the skin to alleviate the pain, muscle relaxation, immunomodulatory, blood detoxification effects which are explained by different theories. 14, 16

In consistency with the result of this study, there is a growing body of evidence supporting the use of cupping therapy in the treatment of pain disorders in general and reported that neural entrapment can be improved by cupping. 17

The improvement in the cupping group is corroborated by the findings of Mohammadi et al. 36 who claim that incorporating cupping treatment into a regular physical therapy can decrease the intensity of symptoms and alleviate distal sensory disruption of the median nerve. They concluded that cupping, as easy and cheap method, may be utilized in the treatment of carpal tunnel syndrome as a complementary therapy.

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The improvement in cupping group was consistent with the work of Benli et al. 37 who found that dry cupping therapy combined with adjunctive electrostimulation accelerated radial nerve functional recovery and provided a suitable alternative therapy for postoperative radial palsy.

This come in agreement with the results of Benjamin and Sucher 38 who stated that self-administered cupping therapy for the carpal tunnel could be a potential alternative therapy option for those with mild CTS.

**Limitations:** The present study had several limitations. First, it only investigated changes in pain and functional activity while, it did not measure NCV. The participants were all females. So further studies are recommended to include both men and women, the number of patients was small. There was difficulty to find and collect the cases.

**Conclusion:** The current study does not support the efficacy of adding cupping therapy to selected conservative physical therapy program in patient with cubital tunnel syndrome.

**REFERENCES:**