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RESEARCH ARTICLE

EFFECT OF CUPPING THERAPY ON NITRIC OXIDE LEVEL IN PATIENTS WITH CERVICAL SPONDYLOSIS

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ABSTRACT

Background: Cervical spondylosis is a generalized disease process affecting all levels of the cervical spine. Cupping Therapy (CT) is an ancient method and currently used in the treatment of a broad range of medical conditions such as cervical spondylosis. Nitric Oxide (NO) is a signaling gas molecule that mediates vasodilation and regulates blood flow and several lines of evidence have indicated that NO plays a complex and diverse role in the modulation of pain. **Purpose of Study** was to investigate the effect of cupping therapy on pain intensity, cervical range of motion, neck function and nitric oxide level in patients with cervical spondylosis. **Subjects and Methods**: Sixty Patients with cervical spondylosis from both sexes referred from the orthopedic clinics for this study. They received 3 sessions of cupping once per month and each patient was evaluated for Pain intensity by the numerical analogue scale, cervical ROM by Cervical Range of Motion goniometer, Function by neck disability index and NO levels by the spectrophotometer, just before the treatment and after the three sessions. **Results** There was a significant decrease of pain level, cervical ROM, and function in addition there wasa significant increase in NO level and a direct correlation between NO level and NDI score improvement ($p=0.037^*$) ($r= 0.270$). **Conclusion**: The findings of this study demonstrate that there is a direct effect of cupping therapy on reducing pain, improving cervical ROM and function, and increasing NO level in treating patients with cervical spondylosis.

INTRODUCTION

Cervical spondylosis are degenerative alterations in the intervertebral discs begin with the production of osteophytes and the involvement of neighboring soft tissue structures. Poor posture, anxiety, depression, neck strain, and sporting or occupational activities are all etiological causes that are poorly understood and generally complex (1). Even severe degenerative changes can go unnoticed, but they can cause neck pain, stiffness, and neurological consequences (2). Cupping Therapy (CT) is an ancient method and currently used in the treatment of a broad range of medical conditions such as cervical spondylos is along with acupuncture. Nonetheless the mechanism of action of (CT) is not fully understood (3, 4). Cupping can produce comfort and relaxation on a systemic level, and the consequent rise in endogenous opioid production in the brain leads to greater pain control, according to a growing body of data (3).

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According to several researchs, the primary effect of cupping therapy is to improve blood circulation and eliminate toxins and waste from the body (3) ·Improved microcirculation, capillary endothelial cell repair, and accelerated granulation and angiogenesis in localised tissues could help restore the patient's functional status and promote progressive muscle relaxation(5).Cupping is also reported to help pain relieve and reduce blood pressure, as well as modulating neurohormones and the immune system via the release of the inflammatory mediators such as bradykinin, prostaglandin, leukotriene, serotonin and histamine (4). Nitric oxide is a free radical gas that has recently been discovered to play critical physiological roles. It is produced enzymatically in a variety of tissues from the amino acid L-arginine, with three isoforms of nitric oxide synthase, one of which is inducible and capable of producing high levels of NO(6). Nitric Oxide (NO) is a signaling gas molecule that mediates vasodilatation and regulates blood flow and several lines of evidence have indicated that NO plays a complex and diverse role in the modulation of pain. Many theories may have been interacting to produce the beneficial effects of cupping in treating patients with various disease as Cervical spondylosis which is a generalized disease process

affecting all levels of the cervical spine[7]. The study tested the hypothesis if there is a significant effect of cupping therapy onpain intensity, cervical range of motion, neck function and nitric oxide level in patients with cervical spondylosiscases.

SUBJECTS AND METHODS

This study was conducted in Quesna central hospital in Menofya governorate in the period from August 2021 to Feb.2022 on sixty cervical spondylosis patients referred from the orthopedic clinics.

The study is a Quasi experimental; conducted from both gender, pain , range of motion, function and nitric oxide level were evaluated for each patient pre and post3 sessions of cupping treatment.

Subjects: Seventy-two patients were referred from the orthopedic clinic; four patients had covid, five patients unable to continue and three patients moved out of the town. The remaining 60 patients followed the instructions and continued until the end of the study.

All the participants included in the study were diagnosed with (cervical spondylosis) from both sexes Ages ranged (24-60) in chronic stages [8]. Their BMI ranged from 20-25 kg/m^2 [9]**.** All patients road and signed the consent form before the treatment. While Morbid obese patients (BMI exceeded the 25 kg/m^2) ,the patients didn't take any medications known to affect the pain level ,patients having systemic illness, dermatological problems, skin allergy, local ischemic problems ,myelopathy or cervical headache/vertigo without neck pain [9]were excluded. Sixty patients in the study were received 3 sessions of cupping each patient was evaluated just before the treatment and at the end of the three sessions for the Pain level using (NRS), ,neck range of motion using the cervical range of motion goniometer in six directions (flexion, extension right side bending ,left side bending ,right rotation and left rotation),neck functional level using (neck disability index) and nitric oxide by spectrophotometer using (Sandwich - ELISA method).

Sample size: The sample size was calculated using the G*Power software (version 3.0.10). F-test MANOVA repeated measures within factors effect were selected. Considering a power of 0.95, an α level of 0.05 (2 tailed) and effect size of 0.277; one group and response variables of four, a generated sample size of at least 60 participants was required.

Statistical analysis: Data were supplied to the computer and analyzed by IBM SPSS software package version 20.0. **(**Armonk, NY: IBM Corp**).** Number and percent were used to describe qualitative data..The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation. Significance of the obtained results was judged at the 5% level.

The used tests were One way MANOVA; used to compare between two periods**,**

Pearson coefficient: used to correlate between two normally distributed quantitative variables and Spearman coefficient: used to correlate between two distributed abnormally quantitative variables

RESULTS

Table (1) represents the mean values of demographic data among groups. The mean values of age, weight, height and BMI of study group were 39.7 ±14 years, 81 ±12 kg, 167.6±10.6 cm and 29.3±5.7 kg/m^2, respectively. Data were screened, for normality assumption test and homogeneity of variance. Normality test of data using Shapiro-Wilk test was used, that reflect the data was normally distributed.

Table 1. Demographic data of study group

Study group (n = 60)	Mean ±SD	
Age (year)	39.7 ±14	
Weight (kg)	81 ±12	
Height (cm)	167.6 ±10.6	
BMI (kg/m^2)	29.3 ±5.7	
Gender	No	percentage
Male	30	50%
Female	30	50%
Smoking	No.	percentage
No	51	85%
Yes	9	15%

SD: standard deviation No: number

Table (2) showed that the mean values of pain pre and post study were 8± 1.3 and 2.5 ± 1.5 respectively with improvement (decrease) 68.7% .The mean values of NDI pre and post study were 31.7 ± 10.5 and 16.9 ± 6.2 respectively with improvement (decrease) 46.7% Table (3) showed the mean values of neck flexion pre and post study were 35.6 ± 7.6 and 67.2 ± 7 degrees respectively with improvement 88.8%.The mean values of neck extension pre and post study were 40.4 ± 8.1 and 79.1 ± 9.6 degrees respectively with improvement 95.8%.The mean values of neck right side bending pre and post study were 36.3 ± 5.3 and 57.1 ± 3.4 degrees respectively with improvement 57.3%. The mean values of neck left side bending pre and post study were 36.8 ± 5 and 57.8 ± 3.8 degrees respectively with improvement 57.1% .The mean value of neck right rotation pre and post study were 56.6 ± 8 and 87.7 ± 5.2 degrees respectively with improvement 54.9%.The mean value of neck left rotation pre and post study were 54.5 ± 6.5 and 90.2 ± 4 degrees respectively with improvement 65.5%

Table (5) represent the effect of gender and **(**pain, NDI score and NO) in both pre- and post-study, the mean values of pain pre-study of male and female were 8.1 ± 1.3 and 7.9 ± 1.3 and post study 2.8 ± 1.7 and 2.2 ± 1.2 with improvement (decrease) 65.4% and 72.1% respectively . The mean values of NDI score pre-study of male and female were 29.7 ± 10.5 and 33.7 ± 10.2 and post study 17.2 ± 4.7 and 16.9 ± 6.2 with improvement (decrease) 42.1% and 49.8% respectively. The mean values of NO level pre-study of male and female were 51.1 ± 18 and 45.7 ± 23 and post study 59 ± 23 and 60.6 ± 26 with improvement (increase) 15.5% and 32.6% respectively (figure 27). There was no statistically difference between males and females regarding (pain, NDI score and NO.) in both pre- and post study (P> 0.05). Table (6) showed Correlation between age and pain, NDI score and NO level, there was significant inverse correlation between age and NDI score in post study (p=0.049*) (r= -0.255). Figure (1) represent Correlation between age and NDI score post study. Table (7) showed Correlation between NO level with pain and NDI score: there was significant direct correlation between NO level and NDI score improvement (p=0.037*) (r= 0.270).

Table 2. Comparison between pre and post study of mean values of pain and NDI

Study group (n = 60)	Pre-study Mean ± SD.	Post study Mean ± SD.	% of Improvement (decrease)	f-value	p
Pain	8 ± 1.3	2.5 ± 1.5	68.7%	448.3	0.001*
Neck disability index score	31.7 ± 10.5	16.9 ± 6.2	46.7%	87.4	0.001*

SD: Standard deviation *: significance

Table 3. Comparison between pre and post study mean values of neck ROM

Neck ROM Study group (n = 60)	Pre-study Mean ± SD	Post study Mean ± SD	% of improvement	f-value	p
Flexion	35.6 ± 7.6	67.2 ± 7	88.8%	558.9	0.001*
Extension	40.4 ± 8.1	79.1 ± 9.6	95.8%	569.8	0.001*
Rt side bending	36.3 ± 5.3	57.1 ± 3.4	57.3%	647.3	0.001*
Lt side bending	36.8 ± 5	57.8 ± 3.8	57.1%	660.5	0.001*
Rt rotation	56.6 ± 8	87.7 ± 5.2	54.9%	638.4	0.001*
Lt rotation	54.5 ± 6.5	90.2 ± 4.4	65.5%	1228.7	0.001*

SD: Standard deviation *: significance

Table 4. Comparison between pre and post study mean values of nitric oxide

Study group (n = 60)	Pre-study Mean ± SD	Post study Mean ± SD	% of Improvement (increase)	f-value	p
Nitric oxide level	48.4 ± 21	59.8 ± 25	23.5%	7.15	0.009

SD: Standard deviation *: significance

Table 5. Effect of gender on (PAIN, NDI score and NO level)

	Study group (n = 60)	Gender		Mean difference	p
		Male (n = 30)	Female (n = 30)		
Pain	Pre-study	8.1 ± 1.3	7.9 ± 1.3	0.167	0.364
	Post study	2.8 ± 1.7	2.2 ± 1.2	0.567	0.122
	% of Improvement (decrease)	65.4%	72.1%		
NDI	Pre-study	29.7 ± 10.5	33.7 ± 10.2	-4	0.074
	Post study	17.2 ± 4.7	16.9 ± 6.2	-5	0.822
	% of Improvement (decrease)	42.1%	49.8%		
NO level	Pre-study	51.1 ± 18	45.7 ± 23	5.4	0.375
	Post study	59 ± 23	60.6 ± 26	-1.6	0.796
	% of Improvement (increase)	15.5%	32.6%		

SD: Standard deviation

Table 6. Correlation between age and (pain, NDI score and NO levels)

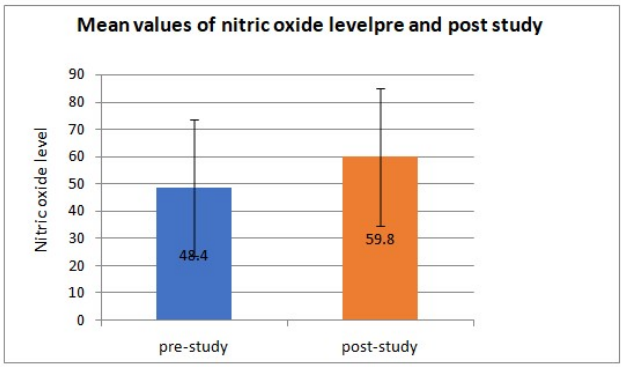
Study group(n = 60)	Age (years)	
	r	p-value
Pain pre	0.103	0.432
Pain post	-0.178	0.173
Pain improvement	0.236	0.069
Neck disability index score pre	-0.008	0.950
Neck disability index score post	-0.255	0.049*
Neck disability index score improvement	0.163	0.212
NO level pre	-0.150	0.252
NO level post	-0.004	0.974
NO level improvement	0.119	0.367

r: Pearson coefficient *: Statistically significant

Table (7): Correlation between NO level with pain and neck disability index score

		NO level	
		r	p
Pain	Pre	0.036	0.785
	Post	-0.164	0.210
	Improvement	0.207	0.112
Neck disability index score	Pre	0.046	0.726
	Post	-0.117	0.373
	Improvement	0.270	0.037*

r_s: Spearman coefficient *: Statistically significant



Mean values of NO level score pre and post study

Figure (2) represent Correlation between improvement of NO level with improvement of NDI score.

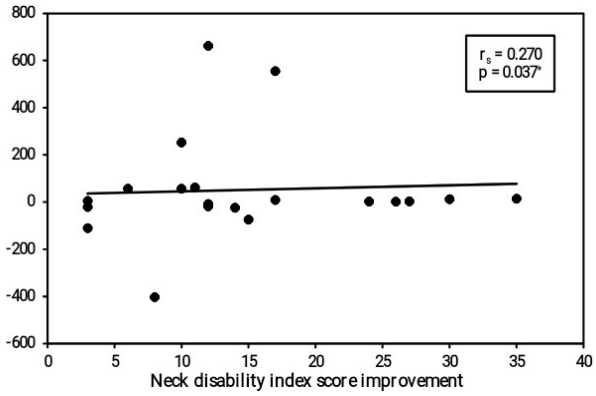


Fig 2. Correlation between improvement of NO level with improvement of NDI score

DISCUSSION

The goal of this research was to study the effects of cupping therapy on the level of nitric oxide in patients with cervical spondylosis.Sixty patients in the study received 3 sessions of cupping. Each patient was assessed just before the first session and after the third cupping session with assessment for pain level using (numerical rating scale), range of motion using (cervical range of motion goniometer), function using(neck disability index), and nitric oxide level using (spectrophotometer device). Comparing the results before to the results afterthe cupping treatment, our results revealed that there was a significant improvement of pain values post treatment.Choi *et al*., 2021(10) were in line with our study as Cupping (both dry and wet) has been asserted to remove excessive fluids and toxic metabolites, loosen adhesions and boost connective tissue, brought blood flow to stagnated skin and muscles, and enhance the peripheral nervous system, resulting in pain relief and the modulation of neurohormones and the immune system, as well as reducing pain and high blood pressure(11).

The results of our study came in the same line with the reported data conducted by Castro-Sánchez *et al*., 2011(12) whom investigated the effect of cupping therapy on the cervical spondylosis showing an evidence that cupping can induce comfort and relaxation on a systemic level and the resulting increase in endogenous opioid production in the brain leads to improved pain control (3). This improvement in range of motion values could be due to The ROM of the cervical vertebrae in the cupping group increased significantly with flexion, extension, and right and left lateral flexion, which may be attributed to the mechanical effects of the cupping (13). It was reported that, Many of the therapists have developed cupping therapy for the treatment of musculoskeletal disorders through diverse studies that expected to be a new trend in the field of sports medicine when applied in conjunction with movement patterns or functional exercises.[13]

Also Cao *et al*., 2012 (14) revealed that wet cupping can relieve pain of lumbar disc herniation, herpes zoster, cervical spondylosis and Rheumatoid Arthritis. Comparing the results pre and post cupping treatment, our results revealed that there was a significant improvement of function values post treatment.Also our results came in the same line with [14]who found that the disability due to non-specific neck pain was between mild to moderate i.e. themean score of NDI at baseline was 15.34 ± 4.63 (mean±SD) which was reduced to 3.83 ± 2.93 after treatment.NDI showed 75.03% decrease after cuppingtherapy (15). On the other side, the study of Almaiman, 2018 (16) was disagreed with our results inthat there were no significant effects observed for disability index, mechanical detection, pain related to movement, and vibration detection. Significantly higher PPT at pain-areas were noticed among the treated group compared to control group (p<0.01). It was concluded that single application of wet cupping therapy (WCT)could exert significant effects on quality of life and body pain**(16)**. Nitric oxide is one of the most abundant free radicals in the body. Both cytoprotective and cytotoxic effects of NO have been reported. Interaction of O2 and NO leads to the production of more reactive oxidant. We observed that in wet cupping blood the level of nitrite was significantly higher than the venous one (17).

Cupping helps to remove interstitial fluids, extra intravascular fluid, and damaging of dangerous compounds from the body, according to the "Taibah Theory,": a published theory about the likely mechanism of cupping decreasing blood pressure. Cupping, according to this idea, causes the removal of free radicals and vasoactive fluids. Furthermore, the generation of nitric oxide is stimulated, which helps to maintain the equilibrium between antioxidants and free radicals(16).Furthermore, several investigations attempted to observe the effects of wet cupping therapy (WCT) after just one treatment. Cupping has previously yielded positive results following a series of treatments. However, because of a lack of evidence, it is impossible to say whether wet cupping has therapeutic effects. Before drawing any conclusions, it is necessary to verify both the short- and long-term effects of the intervention, as well as the amount of blood obtained during the treatment(18)Conclusively, Cupping therapy is effective treatment in improving pain, range of motion ,function, and the nitric oxide level in patients with cervical spondylosis.

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