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The Effect of Wet Cupping Therapy on Heavy Metal Levels: A Single-Arm Clinical Trial

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Abstract

Objectives: In this study on the steelworkers, we aimed to investigate the impact of wet cupping therapy (WCT) on heavy metal levels in the blood.
Methods: This single-arm clinical trial was performed at Karabuk University Training and Research Hospital from January to August 2018. All patients received three WCT sessions once every month. Venous blood specimens were drawn prior to the first WCT session (venous 1) and following the third session (venous 2). Cupping blood samples were also obtained during the first session of WCT. Heavy metal levels were assessed by inductively coupled plasma mass spectrometry (ICP-MS) device. Thirteen metals were subject to examination: aluminum (Al), antimony (Sb), arsenic (As), cadmium (Cd), chrome (Cr), cupper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), and zinc (Zn). Relationships between the blood samples were examined using Wilcoxon Signed Rank test by R statistical software.
Results: Forty-four subjects completed the study. The levels of Al, Cd, Cr, Cu, Mn, Mo, Ni, Sb ($P < 0.001$ in all), Hg ($P = 0.024$) and Pb ($P = 0.012$) were significantly lower in venous 2 samples compared to venous 1, while no significant changes were observed in the levels of Fe, Zn, and As ($P = 0.575$, $P = 0.090$ and $P = 0.195$, respectively). When compared to venous 1 the levels of Mn, Zn, As, Sb, Hg ($P < 0.001$ in all), Al ($P = 0.003$), Cr ($P = 0.004$), Cu ($P = 0.022$) and Mo ($P = 0.014$) were found significantly higher in cupping blood while Cd, Pb, and Ni were not at significantly different levels ($P = 0.160$, $P = 0.079$ and $P = 0.713$, respectively). Fe was found significantly lower in cupping blood ($P < 0.001$).
Conclusions: This study showed that WCT has significantly reduced heavy metal levels in the blood. It might be useful in workers who work in jobs where heavy metal toxicity can be seen.

Keywords: Complementary Therapies, Wet Cupping Therapy, Heavy Metals, Detoxification

1. Background

Traditional and complementary therapies (TCT) got in favor of health professionals throughout the last decade, and this tendency also led to an increase in researches on TCT. Cupping therapy (CT) can be considered among the deepest rooted and most widespread TCT methods that are used to serve as a treatment for thousands of years in a diverse range of cultures and regions. The remotest evidence of this remedy seems to be Ebers Papyrus, a medical textbook from way back as 1,550 BC which was found on the tomb of King Tut. We can easily conclude from the implementations used by Hippocrates and Galen that this art was adopted by Greeks and Romans as well (1).

There are two main categories under the title of CT: Dry and wet cupping therapy (WCT). Dry cupping (DC) is based on sucking the body fluids to the surface by placing the cups and generating negative pressure on the skin with no more intervention. In WCT, incisions are applied with a special lancet on the region with the ailment in approximately 1.5 mm depth and 1.5 mm width and therefore, the capillary blood in the region is removed with its purportedly hazardous content (1). While DC is more popular in Chinese tradition, WCT which is known as hijama, is in demand among Muslim communities.

Assumptions about the way how WCT cures have not resulted in a robust conclusion. Cupping Therapy used to be considered a detoxifier in ancient medicine. The time of Hippocrates, who developed the humoral theory, brought about balancing features of bloodletting. This insight put forward that diseases ensued from the imbalance of the humors which are four in number and named as blood, phlegm, yellow bile, and black bile. Therefore, any intervention that evacuates the excess liquid might restore the balance. Avicenna, in his far-famed book (Canon of medicine), went in detail on the mechanisms of WCT. He stated that humors in disturbed body parts explained the cause for the pain and inflammation, which needed to be sucked to the surface and evacuated from that point in order to relieve the discomfort. Among the scholars of his age considering WCT as a method that purges the body from dangerous material, Avicenna was not an exception (1).

Karabuk Province is located in the western part of the black sea region of Turkey and is one of the cities of the country where the first industrial activities took place. A great majority of the people who live in the city work in iron and steel industry (2). It came to exist that steelworkers are exposed to many toxins and heavy metals such as aluminum, arsenic, cadmium, chromium, lead, nickel, mercury, and zinc. Significant increases in some diseases such as cardiovascular diseases, hypertension and rheumatoid arthritis (RA) were also reported in steel industry employees and it was suggested that heavy metal exposure might be the culprit. For example, cadmium exposure was found to be strongly related to RA in steelworkers (3, 4). As environmental pollution increases, heavy metal exposure is being linked with an increasing number of disorders not only in risky populations like steelworkers but also in general population. Therefore, awareness of health professionals about heavy metal exposure and its consequences as well as researches on prevention and treatment of toxic accumulation of those metals are also increased (5).

Data from a few clinical trials suggested that WCT might have therapeutic effects on migraine headache; neck, shoulder and non-specific low back pain; hyperlipidemia and hypertension (6-9). It has also been shown that WCT might be beneficial in healthy individuals from different aspects. Recent studies revealed that WCT reduced oxidative stress and removed free radicals from the body, improved health-related quality of life and increased sleeping quality in healthy participants (10-12). Yet, existing evidence is rather insufficient. Therefore, well-designed trials are urgently needed to investigate the underlying mechanisms and to evaluate the effectiveness of WCT.

2. Objectives

In this study that we conducted on the steelworkers in Karabuk, we aimed to investigate the efficacy of WCT on heavy metal levels in the blood so that we would be able to assess the capability of WCT in blood detoxification as it was pointed out as the therapeutic property of WCT in traditional texts.

3. Methods

The clinical trial which we performed in Karabuk University Training and Research Hospital (KUTRH) TCT Center between January and August 2018 was a single-arm, pre- and post-test interventional study. KUTRH is a general governmental hospital with 302 beds. It is a referral hospital containing 23 departments. Sixty steelworkers were recruited through advertisements on the notice board of the university hospital and the factories nearby. Potential participants were invited for an interview with the physician in charge to be assessed for eligibility through physical examination and relevant questionnaires. Inclusion criteria were being healthy individuals at the age of 18 to 55 years and to be working in steel industry. Exclusion criteria were as follows: Having any chronic disorder and being on daily medication, contraindication to WCT as determined in blood tests that were routinely performed before the application (INR > 1.2; Hgb < 9.5, etc.) and having received WCT in the last three months. Of the 60 recruited individuals 9 were excluded and 51 healthy steelworkers, who met the inclusion criteria, were included in the study. Following the first intervention, 7 of them dropped out and 44 subjects completed the study (Figures 1 and 2).

3.1. Ethical Considerations

The Clinical Trials Ethics Committee of Karabuk University approved the study on 09.01.2018 with no.: 1/5. Written informed consent was obtained from the participants before they were included in the study. All procedures performed were compliant with the 1,964 Helsinki Declaration and its later amendments. The study was registered to clinicaltrials.gov with ID no.: NCT03693079.

3.2. WCT Application

All subjects underwent 3 successive sessions once in a month throughout 2 months (on 0, 30, and 60 days). Vacuum cups were used on 5 different acupuncture points to perform WCT: the one on the posterior median line, in the depression below the processus spinosus of the 7th cervical vertebra, was DU 14 (Dazhui) point; the ones on the back, 3.0 cm lateral to the lower border of the processus spinous of the 3rd thoracic vertebra interscapulum region were UB 42 (Pohu) bilateral points; and the ones on the back, 3.0 cm lateral to the lower border of the spinous process of the 7th thoracic vertebra were UB 46 (Geguan) bilateral points. The technique we used was triple S (sucking, scarification, and sucking) in all sessions. The WCT applications were performed in three phases:

Primary Sucking: Locations were determined and disinfected with povidone-iodine, the cup was placed on the skin and the air was sucked out of the cup manually. The

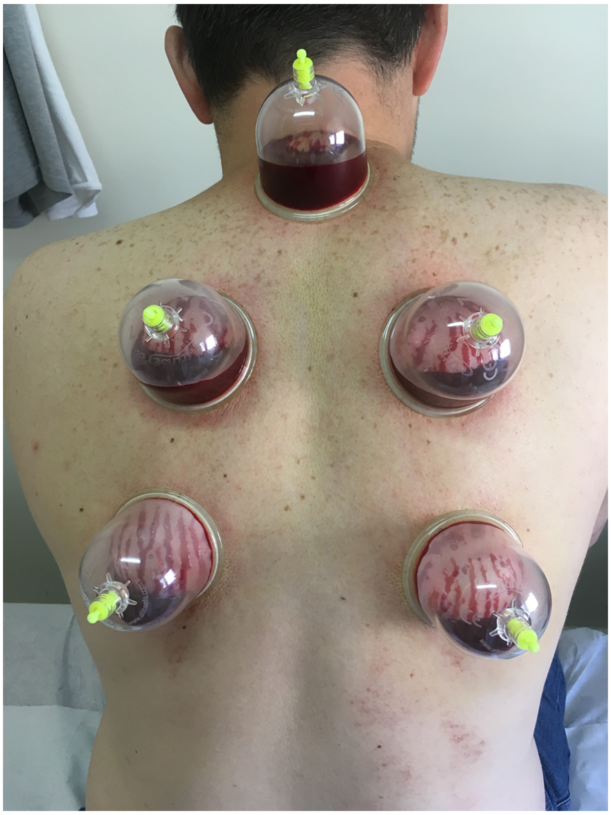

Figure 1. Wet cupping therapy application is shown.

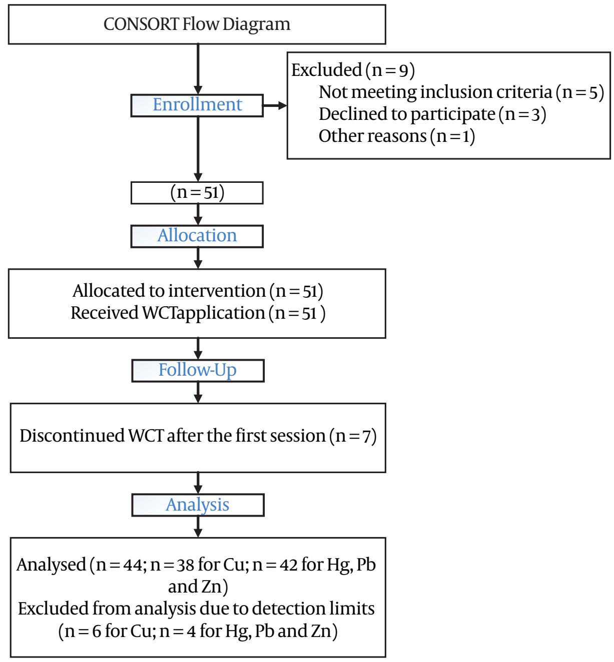

Figure 2. CONSORT flow diagram is shown.

cups were kept on the skin for 3 to 5 minutes. Scarification: Superficial incisions in 2 - 3 mm depth and 3 - 5 mm length were made on the skin using a no.: 11 sterile surgical blade. Secondary sucking and blood withdrawal: The cups were replaced in their former places and kept there until it was filled with capillary blood. At the last step, the cups were removed with their content and disposed of medical waste. Incised sites were covered using sterile sponge pads (6). Following every application, all patients were told to rest for 5 minutes without exception. No adverse effects occurred in any session.

3.3. Sample Collection and Biochemical Analysis

Venous blood specimens were drawn just before the first WCT session (venous 1) and one day after the third session (venous 2). Besides, samples from cupping blood were also obtained during the first session of WCT. We assessed the heavy metal levels in all specimens by using Inductively coupled plasma mass spectrometry (ICP-MS) device. These are the 13 metals which were subject to examination: aluminum (Al), antimony (Sb), arsenic (As), cadmium (Cd), chrome (Cr), cupper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), and zinc (Zn). The concentration units of the metals were calculated as ppb (μg/liter).

3.4. Statistical Analysis

Anderson-Darling test was used to examine the distributional properties of the data before statistical analyses. Data did not show normal distribution and transformation was not enough. Consequently, median (Q1-Q3) was used as descriptive statistics. Wilcoxon Signed Rank test was employed to compare heavy metal contents of blood samples collected from venous before and after WCT treatment and collected from cupping blood during WCT. Moreover, R statistical software was used to carry out the analyses (13). P values less than 0.05 were considered to be significant.

4. Results

All 44 subjects who completed the study were males. Median (min-max) age was 40.3 (18 - 56) years, and the average working years were found 14.21 (6 - 22). The demographic features of the participants were shown in Table 1. Owing to the detection limits of the ICP-MS device, the calculations of the related heavy metal levels, which were above or below the limits, were excluded. Among the 13 heavy metals that have been assessed, 10 were found lower in venous 2 samples compared to venous 1. The levels of Al, Cd, Cr, Cu, Mn, Mo, Ni, Sb ($P < 0.001$ for all), Hg ($P = 0.024$), and Pb ($P = 0.012$) were significantly lower in venous 2. No significant changes were observed in the levels of Fe, Zn, and As ($P = 0.575$, $P = 0.090$, and $P = 0.195$, respectively) (Table 2).

Table 1. Demographic Characteristics of the Participants[a]

Variable	Participants (N = 44)
Age, y	40.3 ± 9.4
Gender	
Male	100%
Education	
Primary	9%
Secondary	73%
University	18%
Marital status	
Married	95%
Single	5%
Duration of working (years)	14.21 (6 - 21)
Smoking	
Smoker	55%
Non-smoker	45%

[a] Values are expressed as median (range) or mean ± SD.

Besides, heavy metal levels in the first cupping blood samples of the participants (cupping) were also compared with initial venous values (venous 1). Of the 13 heavy metals, 9 were found significantly higher in cupping blood, including Mn, Zn, As, Sb, Hg ($P < 0.001$ for all), Al ($P = 0.003$), Cr ($P = 0.004$), Cu ($P = 0.022$), and Mo ($P = 0.014$). These metals were not at significantly different levels in cupping blood compared to venous 1: Cd, Pb, and Ni ($P = 0.160$, $P = 0.079$, and $P = 0.713$, respectively). As for Fe, it was found significantly lower in cupping blood ($P < 0.001$) (Table 3). No adverse reactions were reported by any of the participants.

5. Discussion

In the current trial, we investigated the efficacy of WCT on the levels of the selected heavy metals in the blood samples obtained from healthy volunteers who work in steel and iron industry. Significant reductions were seen in the great majority of the selected heavy metals in venous blood samples obtained after WCT applications (venous 2) compared with initial values (venous 1). Additionally, the samples obtained from the cupping blood (cupping) had significantly elevated levels of heavy metals compared with initial venous samples (venous 1). Our measurements suggest that WCT might dispose of the heavy metals from body; hence, hinder the toxic effects incidental to excessive accumulation. It is also important not to overlook the fact that as all the subjects were active workers in this industry and exposure to heavy metals went on during the study period. Despite this inconvenience, significant declines were detected in 10 out of the 13 metals that were assessed.

Metal ions can bind to several molecules in body tissues such as proteins and polysaccharides by entering the body from the environment. Moreover, a large number of these metals are biologically active, participate in a variety of different physiological and pathophysiological reactions and may lead to different chronic disorders. For example, Pb is known to be the most common toxic element whose elevated levels were accounted for increased cardiovascular mortality (14). Pb exposure is associated with hypertension, which is one of the best-established cardiovascular impacts of this metal. Its exposure is also associated with atherosclerosis and dyslipidemia (15, 16). Other than Pb, Cd, As, and Hg exposure also has been reported to be associated with increased cardiovascular mortality and morbidity (16). Mn is also among the heavy metals we evaluated in the current study and it is known to be not only toxic to cardiovascular system but also neurotoxic since it has been shown that Mn exposure induces signs and symptoms similar to Parkinson's disease (17).

Almost all heavy metals are known to induce chronic diseases and organ damage when they accumulate in the human body. Chelation has been the therapy of choice in removing the toxic metal ions from the vulnerable regions in the critical organs. Chelation is a process in which the organic chelator molecules are introduced into the blood and bind the target metal ions here with higher affinity. The complex of chelator and metal ion remains in the blood compartment until they are filtered by the kidney or excreted by the liver, and thus the metal ions are removed from the body (18). However, chelation therapy has its own handicaps. To begin with, all chelating agents may have side effects such as sweating, fever, hypertension, headache, nausea, vomiting, and palpitations, which had been reported in various trials. Additionally, in some cases, chelating agents may redistribute heavy metals to vital organs like the brain rather than excreting from the body. Therefore, it was advised that their use should be limited to manifest metal poisonings that were diagnosed by appropriate clinical and laboratory evaluation (15).

In traditional Ottoman medicine like ancient Greco-Roman medicine and Islamic Medicine in medieval time, WCT has been widely used for detoxifying purposes. The WCT was defined as "a thorough purge" by Ibn Shareef, an outstanding Ottoman author of medicine, in his well-

Table 2. Levels of Selected Heavy Metals Before (Venous 1) and After (Venous 2) WCT Applications[a]

Metal	Number	Venous 1, ppb	Venous 2, ppb	P
Al	44	13.06 (8.62 - 27.57)	7.68 (4.85 - 14.11)	< 0.001[b]
Cr	44	1.32 (0.61 - 2.37)	0.82 (0.57 - 1.35)	< 0.001[b]
Mn	44	11.29 (7.54 - 16.77)	9.48 (5.90 - 13.56)	< 0.001[b]
Fe	44	353924 (176371 - 641800)	235550 (177225 - 486386)	0.575
Ni	44	1.93 (1.38 - 2.76)	1.48 (1.00 - 2.78)	< 0.001[b]
Cu	38	1159 (610 - 1472)	1048 (678 - 1200)	< 0.001[b]
Zn	42	4986 (4201 - 8125)	5952 (4508 - 7697)	0.090
As	44	2.92 (2.06 - 3.95)	3.98 (2.69 - 4.39)	0.195
Mo	44	4.86 (3.80 - 5.40)	3.73 (2.27 - 4.19)	< 0.001[b]
Cd	44	1.03 (0.70 - 1.49)	0.83 (0.51 - 1.45)	< 0.001[b]
Sb	44	9.57 (7.33 - 11.70)	6.32 (5.47 - 7.52)	< 0.001[b]
Hg	42	0.20 (0.14 - 0.27)	0.17 (0.13 - 0.24)	0.024[b]
Pb	42	45.86 (22.83 - 57.66)	39.79 (27.51 - 48.56)	0.012[b]

[a]Values are expressed as median (range).
[b]Relationship is statistically significant in Wilcoxon Signed Rank test ($P < 0.05$).

Table 3. Levels of Selected Heavy Metals in Venous and Cupping Blood Samples[a]

Metal	Number	Venous 1, ppb	Cupping, ppb	P
Al	44	13.06 (8.62 - 27.57)	29.52 (20.30 - 45.01)	0.003[b]
Cr	44	1.32 (0.61 - 2.37)	2.85 (1.71 - 3.59)	0.004[b]
Mn	44	11.29 (7.54 - 16.77)	45.90 (27.78 - 60.28)	< 0.001[b]
Fe	44	353924 (176371 - 641800)	142647 (110475 - 172790)	< 0.001[b]
Ni	44	1.93 (1.38 - 2.76)	1.98 (1.23 - 2.83)	0.713
Cu	38	1159 (610 - 1472)	1186 (1013 - 1350)	0.022[b]
Zn	42	4986 (4201 - 8125)	8240 (6218 - 9288)	< 0.001[b]
As	44	2.92 (2.06 - 3.95)	4.10 (3.19 - 5.36)	< 0.001[b]
Mo	44	4.86 (3.80 - 5.40)	6.28 (4.10 - 10.14)	0.014[b]
Cd	44	1.03 (0.70 - 1.49)	1.31 (0.60 - 2.19)	0.160
Sb	44	9.57 (7.33 - 11.70)	11.45 (8.69 - 15.37)	< 0.001[b]
Hg	42	0.20 (0.14 - 0.27)	0.29 (0.21 - 0.57)	< 0.001[b]
Pb	42	45.86 (22.83 - 57.66)	43.69(30.03 - 60.31)	0.079

[a]Values are expressed as median (range).
[b]Relationship is statistically significant in Wilcoxon Signed Rank test ($P < 0.05$).

known textbook Yadigar. He also pointed out that it was better than any other purge technique since it enables clearance of all excess humors in the body (19). Our current knowledge from literature does not refute this argument. Instead, detoxification of body regions is the most popular explanation among several theories, which tried to elucidate the underlying mechanisms of WCT.

For example, El Sayed et al. (20) put forward that WCT acted like kidney in removing several agents of disease from blood as well as other tissues like lymph, as part of a theory called Taibah. Skin, already a natural excretory body part, was used even more efficiently using this surgical procedure. This application also allows both capillary ends to drain more efficiently. Thus, correction and maintenance of physiological equilibrium are enhanced while immunity is promoted.

Based on its detoxifying potency WCT might be an alternative treatment to chelation therapy in metal intoxication as it is much more economic, easy to apply and fewer side effects are seen. To the best of our knowledge, current literature has only one pilot study of a limited scale which evaluated WCT on heavy metal levels in the blood. In that study, only three metals (Al, Zn, and Cd) were calculated before and after one session of WCT application in venous blood samples and it was concluded that WCT reduced all of the three metals significantly (21). In the current study, we included a greater amount of participants all of whom were from a risky area and three sessions of WCT were applied. Furthermore, we were able to measure the levels in the cupping blood samples and compare them with venous samples as a secondary outcome measure and revealed significantly elevated levels of heavy metals in the samples obtained from cupping blood, a finding that supports our primary outcome assessments. Our study is also the first one to examine the effects of WCT on toxicities of 13 different metals. Besides, WCT was found significantly effective on most of them. Therefore, we put forward that our study provides evidence for the reduction of heavy metals in blood by WCT. The authors of the clinical trials performed on WCT generally explained their findings by the detoxifying effects of WCT. As an example, one of the recent studies reported that WCT improved liver enzymes and 21 HOMA-IR in patients with non-alcoholic fatty liver disease (NAFLD) and it was suggested that the positive effects of WCT in this study might be due to the removal of excess iron from body (22). The authors discussed that WCT can decrease oxidative stress through decreasing the iron stores, resulting in improved insulin resistance that may lead to a decreased production of liver glucose, which is one the mechanisms for developing steatosis in NAFLD. Our study also supports this point of view, as it reveals the detoxifying and excretory potency of WCT.

5.1. Limitations

We would like to declare some limitations to our study. Above all, this study has no control arm, despite commonly held strongest evidence is randomized clinical trials that used placebo or sham intervention control groups. However, developing a genuine sham cupping procedure is still a challenge, especially for WCT. As for dry cupping, some authors proposed a sham cupping device, which has little or no negative pressure (23, 24). Potency of this sham method is already debatable, as subjects who are familiar with this traditional procedure -which is the case in countries where cupping is common- can easily tell the difference between real and sham interventions. Talking about WCT, a sham intervention with no blood withdrawal would not be convincing at all. An intervention in which blood was withdrawn would not be ineffective considering the purported effects of bloodletting. So, we settled down a self-controlled study design with no control arm. This kind of studies hopefully will pioneer more improved ones in TCT align with scientific standards more accurately.

5.2. Conclusions

Wet cupping therapy application may be useful in workers who work in jobs where heavy metal toxicity can be seen, based on our results. It has been observed that WCT can reduce mercury and lead toxicity, which may be more frequent, and detoxification can be better achieved by planning therapy sessions more regularly. The potential effect of WCT was to provide detoxification, which led to the emergence of curative effects. The fact that the mechanisms used in complementary therapies cannot be clearly expressed such as conventional western medicine treatments, may cause hesitations about their use. Conventional western medical analyzes used in this study showed that WCT has significantly reduced toxic elements. Our study supports the use of WCT for detoxification purposes. Further randomized controlled trials of WCT, not only in heavy metal detoxification but also in different indications, are needed and will reduce prejudices about its use.

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Footnotes

Authors' Contribution: Study concept and design: Suleyman Ersoy and Ali Ramazan Benli. Analysis and interpretation of data: Suleyman Ersoy. Drafting of the manuscript: Suleyman Ersoy. Critical revision of the manuscript for important intellectual content: Suleyman Ersoy and Ali Ramazan Benli. Statistical analysis: Ali Ramazan Benli.

Clinical Trial Registration Code: Clinicaltrials.gov registration ID was NCT03503903, date: 30.09.2018.

Conflict of Interests: The authors declare no conflict of interest in this study.

Ethical Approval: The study has been approved by Karabuk University Clinical Trials Ethics Committee (no.: 1/5; 09.01.2018).

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Informed Consent: All participants were included in the study after the trial was explained to them in brief and their written informed consent was obtained.

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