

Aesthetic Nonthermal Ultrasound and Electric Current Combination Therapy for Body Sculpting

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Abstract

Introduction: Nowadays, there is an increased female demand for nonsurgical procedures for body contouring with shorter recovery time and fewer side effects. In Brazil, the combined use of ultrasound and electric current has been used as treatment for localized fat. However, there is few studies showing its effects. Thus, the aim of this study is to evaluate the immediate effects of ultrasound/electric current combination therapy in the treatment of localized abdominal fat.

Methods: A randomized, double-blind, placebo-controlled study was conducted to assess the immediate effects of the use of an ultrasound/electric current combination therapy device. Twenty female volunteers were enrolled in the study. Efficacy parameters evaluated included comparison of before and after abdominal circumference measurement, subcutaneous adipose tissue thickness and percent fat mass. In addition, total cholesterol, high-density lipoprotein and triglycerides serum levels were assessed.

Results and Discussion: The use of an ultrasound/electric current combination therapy device was effective in reducing abdominal and suprailiac subcutaneous fat thickness. Levels of triglycerides and high-density lipoprotein were comparable with baseline values. However, total cholesterol levels were increased after treatment. This study demonstrated that the use of ultrasound plus electric current might be a good alternative for non-invasive treatment of localized abdominal fat with immediate effects on fat thickness.

Keywords: Subcutaneous Adipose Tissue; Ultrasound; Alternating Current; Combination Therapy; Blood Lipids

Introduction

Currently, females desire methods and techniques for localized fat reduction that provide fast results without great efforts and few side effects [1]. Nonsurgical treatments currently used for aesthetic body sculpting includes radiofrequency, cryolipolysis, low-level lasers and ultrasound (US) [2-6].

Aesthetic nonthermal US is considered a potent device used in the treatment of adiposity and for body contouring. Its effects are enhanced when used as combination therapy (i.e. with other aesthetic technologies). The combination therapy of US and an alternating current is widely used in Brazil for lipolysis, body sculpturing and reduction of cellulite without causing discomfort. The device (Manthus™, KLD Biosistemas Equipamentos Eletrônicos, Brazil) induces localized fat elimination due to the US waves that promote the adipocyte membrane permeability integrity in association with an electric current that stimulates local blood and lymphatic flows, enhancing the metabolic effects of the US [7,8].

Although safe, the combination of US and alternating current lacks studies showing its effects in reducing localized fat [8]. Based on these premises, the present study aims to evaluate the immediate effects of ultrasound/electric current combination therapy on localized abdominal fat reduction.

Material and Methods

Patients

This randomized, double blind, placebo-controlled study was approved by the Ethics Research Committee of Univates (Coep/Univates) under protocol number 071492/2014. Twenty healthy female subjects aged 19 to 32 years were enrolled in this study upon signed informed consent. The inclusion criteria was abdominal fat and fasting for at least 8 h. Exclusion criteria were as follows: continuous use of medication (except contraceptive pill), current pregnancy and chronic disease. Patients were also excluded if they were on a diet or performing intense physical activity during the study.

Treatment

The device used in the study consisted of a combination of nonthermal US and a medium-frequency alternating current (Manthus™, KLD Biosistemas Equipamentos Eletrônicos). A standard parameter

protocol (20% pulsed US, 3 MHz, intensity of 22 W, in association with a quadratic wave current delivering 10 Hz with 6% intensity) was used.

Volunteers were randomly divided into two groups to receive a single treatment session for non-invasive abdominal fat disruption and body contouring. In the first group (n=10), volunteers underwent a sham therapy, in which the device remained off, just simulating the procedure. In the second group (n=10), volunteers received US/electric current combination therapy. For the session, the subject was placed in dorsal decubitus position and an area of 300 cm² was delineated in the abdominal region; the anatomical reference point was the umbilical scar. After demarcation, the therapy was applied with neutral conductive gel on the selected area for 20 min.

Body Measurements

Efficacy parameters included comparison of before and after subcutaneous adipose tissue thickness, percent fat mass and abdominal circumference measurements. Suprailiac and abdominal subcutaneous adipose tissue thickness were assessed by a spring-loaded skin fold calipers. Measurements were taken from the right side of the body and at the level of the umbilicus with the patient in standing position.

Lipid Panel

Blood samples were obtained before and right after treatment. Serum samples were used to analyze lipid panel values (total cholesterol, high-density lipoprotein [HDL] and triglycerides).

Statistical Analysis

Statistical analysis was performed using GraphPad Prism 6.0 (GraphPad Software, Inc). Data were expressed as mean ± SEM of percentages to normalize individual differences. Statistical significance was evaluated using repeated measures one-way ANOVA, with the Greenhouse-Geisser correction followed by Sidak's multiple comparisons test, with individual variances computed for each comparison. A *P* value <0.05 was considered statistically significant.

Results

The treatment was well tolerated by all participants. Individuals treated with the combination nonthermal US/electric current device demonstrated significant decreases (*p*<0.01) in abdominal and suprailiac

subcutaneous fat thickness following a single treatment session while those of control group remained unchanged. However, there were no changes in

abdominal circumference at the level of the umbilicus in either group (Figure 1). A complete overview of biometric data is presented in Table 1.

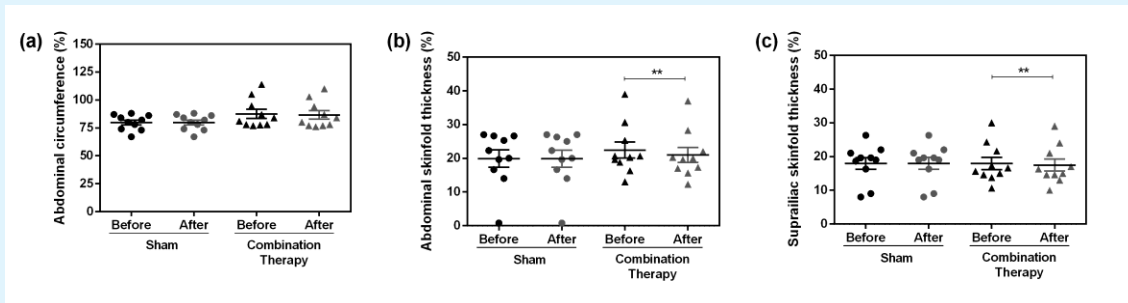


Figure 1: Percentage difference of abdominal measurements after combined nonthermal ultrasound/alternating electric current device treatment. (a) Abdominal circumference of umbilical area. (b) Thickness of subcutaneous fat on abdominal and supriliac areas. Data are expressed as mean \pm SEM (n = 10). **p < 0.01.

The lipid metabolism of subjects was checked through analysis of total and HDL cholesterol and triglycerides. Figure 2 shows the results of the lipid panel, which presented stable levels of triglycerides and HDL, with no

statistical differences of control and treated group compared with baseline values. However, a significant increase (p<0.05) in total cholesterol was seen in subjects treated with the combination therapy device.

ID	Session	(%)						
		Water	Lean mass	Fat	Weight	Fat weight	Lean mass weight	
SHAM	1	Before	54	74	26	51	13.5	37.5
		After	54	74	26	51	13.5	37.5
	2	Before	54	74	26	67	17.6	49.4
		After	54	74	26	67	17.4	49.6
	3	Before	53	73	27	52	14	38
		After	53	72	28	52	14.6	37.4
	4	Before	47	64	36	68	24.5	43.5
		After	47	64	36	68	24.5	43.5
	5	Before	50	68	32	65	20.8	44.2
		After	49	67	33	65	21.4	43.6
	6	Before	53	73	27	57	15.7	41.3
		After	52	72	28	57	16.2	40.8
	7	Before	52	71	29	61	17.7	43.3
		After	52	71	29	61	17.8	43.2
	8	Before	45	62	38	68	25.9	42.1
		After	45	61	39	68	26.4	41.6
	9	Before	47	64	36	77	28	49
		After	46	64	37	77	28.6	48.4
	10	Before	54	73	27	52	13.9	38.1
		After	53	73	27	52	14.2	37.8

TREATMENT									
		Before	After	Before	After	Before	After	Before	After
1	Before	51	70	30	62	18.7	43.3		
	After	53	72	28	62	17.5	44.5		
2	Before	41	56	44	100	43.6	56.4		
	After	40	55	45	100	45.2	54.8		
3	Before	53	72	28	65	18.3	46.7		
	After	52	71	29	65	19	46		
4	Before	50	68	32	68	22	46		
	After	51	70	30	68	20.5	47.5		
5	Before	45	61	39	69	27	42		
	After	44	60	40	69	27.6	41.4		
6	Before	41	56	44	93	41.4	51.6		
	After	38	52	48	93	45	48		
7	Before	48	65	35	68	23.8	44.2		
	After	47	64	36	68	24.3	43.7		
8	Before	57	78	22	52	11.4	40.6		
	After	57	78	22	52	11.7	40.3		
9	Before	50	68	32	62	19.8	42.2		
	After	49	67	33	62	20.3	41.7		
10	Before	48	66	34	62	21.3	40.7		
	After	47	64	36	62	22.1	39.9		

(n=20).

Table 1: Subjects' biometric data.

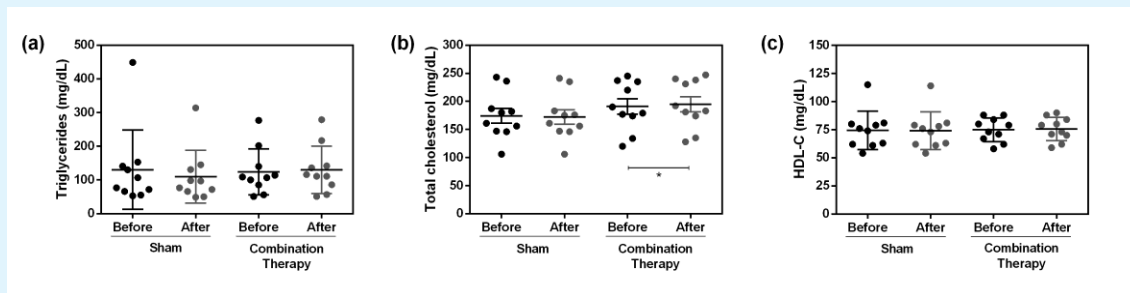


Figure 2: The effects of combined nonthermal ultrasound/alternating electric current device treatment on serum lipids parameters. Data are expressed as mean \pm SEM (n = 10). *p < 0.05. HDL-C, high-density lipoprotein cholesterol.

Discussion

Combination therapy with nonthermal US and an alternating medium-frequency electric current simultaneously through a single transducer may amplify the effect of either modality. Thereby, this device is capable of selectively disrupting Adipocyte membrane integrity, without causing significant damage to nearby cells [7,8].

The present work showed that a single session treatment with this combination device was able to

reduce abdominal subcutaneous adipose tissue thickness in young female subjects. To confirm a possible immediate effect of this technology on subcutaneous adipose tissue, the subjects' serum lipids levels were analyzed before and after treatment. Females who underwent treatment had an increase in total cholesterol levels when compared with the sham group, suggesting that fatty acids were released via fat cell lipolysis [9]. Catecholamines such as epinephrine and norepinephrine act on voltage-dependent channels in the adipocyte cell membrane, causing mobilization of the adipocyte content [10]. Thus, our results may be related to a possible effect

of the US waves and electrical stimulation on increased norepinephrine release in the extracellular fluid. In addition, previous studies showed an increase of free fatty acids after the application of US, although the parameters and protocols used were different from ours [11,12].

Limitations of this study included a relatively small number of patients and short-term evaluation. Future studies addressing the long-term effects of this combination therapy might further support the results of this study.

Conclusion

The present study showed that the combined nonthermal US/alternating electric current device was safe and effective in reducing abdominal subcutaneous fat thickness immediately following a single treatment.

Disclosure

The authors report no conflicts of interest in this work.

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