

LETTER TO THE EDITOR**Microwaves in body sculpting: A prospective study**

To the Editor,

The body-shaping market has recorded a multimillion dollar growth trend in recent years due to the relentless evolution in noninvasive options for treating localized adiposities, cellulite, and skin laxity (Alizadeh, Halabchi, Mazaheri, Abolhasani, & Tabesh, 2016). Many companies propose radiofrequency systems (100 kHz–40 MHz) as valid and reliable alternatives to other technologies aimed at reaching the same clinical results. However, most energy-based devices (EBD) are unable to effectively target all three objectives (Friedmann, 2015; Jewell, Solish, & Desilets, 2011; Jovanović-Ignjatić & Raković, 1999). A new microwave technology has recently been developed to treat localized adiposities, edemato-fibro-sclerotic panniculopathy (cellulitis), and skin laxity. Microwaves are electromagnetic waves with a frequency range between 1 and 300 GHz. Thanks to delivering a controlled 2.45 GHz microwave radiation, the new technology is able to effectively interact with biological molecules and generates localized, controlled heat absorbed by selected biological targets, like water and fat, through a biophysical process called “dielectric heating.” Microwaves also seem to induce a specific activation of several transport mechanisms inside the adipocyte cell membranes. The main consequence of localized dielectric heating is immediate de-arrangement of adipocyte cytoplasm and irreversible damage to the cell membrane (Foster, Ziskin, & Balzano, 2016).

“Onda System” (Deka-El.En., Florence), an innovative microwave platform, has been produced that exploits the specific biological interaction of microwaves with subcutaneous adipocytes. Two handpieces allow for selectively concentrating the specific microwave dielectric heating in both deep and superficial subcutaneous tissues. An effective contact cooling system is implemented to avoid thermal damage to the superficial skin layers during the microwave transmission.

We report the clinical results of a pilot study conducted at the *Laser Cutaneous Cosmetic & Plastic Surgery Unit*, Villa Donatello Clinic, Florence, Italy, on a group of 12 volunteers with localized adiposities.

Patients with localized abdominal, upper lateral thigh, and/or trochanteric adiposities were enrolled in the study. Exclusion criteria included: age < 18 years, present or past history of oncological or systemic diseases, systemic infections and/or immunosuppression.

The study group consisted of 10 females and 2 males, mean age 44 years (29–55 years). Ultrasound B-scans confirmed the presence of localized abdominal adiposity in eight patients, trochanteric adiposity in four patients, and upper lateral thigh adiposity in four patients.

After signing the informed consent, each patient underwent a weekly treatment with the Onda System microwave for a total of four

sessions. Follow-up clinical assessment was performed at 4 and 8 weeks after the last treatment.

Anthropometric measurements, body mass index (BMI), digital photographic documentation and blood examinations were collected for each patient at baseline and follow-up (Figure 1).

Specific blood tests (including complete blood count, cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, creatine kinase, transaminases, creatinine, bilirubin, nitrogen) were performed immediately before starting the microwave treatment as well as at 4 weeks, and 8 weeks after its conclusion.

Patients comfort and satisfaction were evaluated using a five-point Likert scale questionnaire.

Patients with abdominal adiposities with a median circumference of 96.1 cm according to standardized landmarks before starting the study noticed a progressive reduction in their abdominal circumference during the microwave treatments. A median reduction of 3.90 cm (range 7–1.5 cm) was observed 4 weeks after the last session.

In volunteers with trochanteric adiposities with a median circumference of 59 cm before starting the seethe treatment, a median reduction of 2.8 cm (range 2.5–3 cm) was observed 4 weeks after conclusion of the treatment.

No volunteers showed any significant BMI variations.

When the blood tests were assessed, none of the values showed any significant modifications.

The results are reported in Table 1.

On a scale of 1–5, the patients agreed (4.1) that they were satisfied with the results of the treatment. No adverse events were reported.

Our preliminary study has demonstrated the potentially promising role of microwaves in treating localized subcutaneous adiposities. We hypothesize that microwaves act directly on the subdermal fatty tissue, promoting adipocyte cells heating with no interest of the upward dermo-epidermal layers. As a consequence, it leads to macrophage adipolysis with reduction of subdermal fatty tissue and reduction in circumference. The ergonomic solutions adopted by the innovative microwave platform used in our study, plus its extreme tolerability and absence of side effects and complications, might offer a new, interesting alternative to EBD systems currently used to treat the same clinical indications.

Interestingly, our study showed a great improvement in the patients' skin tone and texture. It could be the result of the action of microwaves on collagen septa. Controlled hyperthermia could cause solubilization of the deeper collagen fibers and activate fibroblasts, remodeling collagen fibers. As a result of heating an improvement on skin's external architecture could be induced.



FIGURE 1 (a) Abdominal adiposity in a 46-year-old female patient before and 4 weeks after Onda system treatment; (b) Trochanteric adiposities in a 54-year-old female patient before and 4 weeks after Onda system treatment

TABLE 1 Anthropometric data at time 0 (T0) and 4 weeks (TFU) after Onda system treatment

Patient	Sex	Age	Anatomical sites	Measures T0 (cm)	Measures TFU (cm)
1	F	32	Abdomen	80	73
			Upper lateral thigh	53	51
2	F	33	Abdomen	111	107
			Upper lateral thigh	108	107
3	F	29	Abdomen	95	89
			Upper lateral thigh	61	60.5
4	F	54	Trochanter	65	62
5	F	55	Trochanter	47	44
6	F	50	Abdomen	92	88
7	F	40	Trochanter	59	57.5
8	F	30	Trochanter	65	62
9	M	52	Abdomen	107	102
10	F	46	Abdomen	87	85.5
11	F	53	Abdomen	94	92
12	M	50	Abdomen	103	101
			Upper lateral thigh	104	102


However, further studies are needed to evaluate the role of microwaves in treating cellulitis and skin laxity and to evaluate the long-term efficacy of localized microwave treatment.

CONFLICT OF INTEREST

None of the authors has any potential financial conflict of interest related to this manuscript.

ORCID

Paolo Bonan  <https://orcid.org/0000-0003-2635-6497>

Paolo Bonan¹ 

Leonardo Marini²

Torello Lotti³

¹Laser Cutaneous Cosmetic & Plastic Surgery Unit, Villa Donatello Clinic, Florence, Italy

²The Skin Doctors' Center Trieste, Trieste, Italy

³Department of Dermatology and Regenerative Medicine, CSRMR,
University of Rome Guglielmo Marconi, Rome, Italy

Correspondence

Paolo Bonan, Laser Cutaneous Cosmetic & Plastic Surgery Unit, Villa
Donatello Clinic, Viale Giacomo Matteotti, 2, 50132, Florence, Italy.

Email: paolob376@gmail.com

REFERENCES

Alizadeh, Z., Halabchi, F., Mazaheri, R., Abolhasani, M., & Tabesh, M. (2016). Review of the mechanisms and effects of noninvasive body

contouring devices on cellulite and subcutaneous fat. *International Journal of Endocrinology and Metabolism*, 14, e36727.

Foster, K. R., Ziskin, M. C., & Balzano, Q. (2016). Thermal response of human skin to microwave energy: A critical review. *Health Physics*, 111, 528-541.

Friedmann, D. P. (2015). A review of the aesthetic treatment of abdominal subcutaneous adipose tissue: Background, implications, and therapeutic options. *Dermatologic Surgery*, 41, 18-34.

Jewell, M. L., Solish, N. J., & Desilets, C. S. (2011). Noninvasive body sculpting technologies with an emphasis on high-intensity focused ultrasound. *Aesthetic Plastic Surgery*, 35, 901-912.

Jovanović-Ignjatić, Z., & Raković, D. (1999). A review of current research in microwave resonance therapy: Novel opportunities in medical treatment. *Acupuncture & Electro-Therapeutics Research*, 24, 105-125.