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# Decrease in Abdominal Diameter Using a High Power Radiofrequency Device in Women

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**Abstract:- The growing social acceptance of cosmetic procedures has resulted in a greater demand for procedures which will improve body image and quality of life. For our study, 15 women were selected, mean age 44.8 years. They all maintained their normal activities; they did not do any type of diet or physical exercise. For High Power Radiofrequency, Capenergy model C200 equipment was used, a device that uses frequencies of 0.8, 1 and 1.2 MHz, with two channels and high power applied with a 200 cm2 electrode that increases the treatment area. The average decrease in abdominal circumference was 4.17 cm, being a statistically significant difference of p = 0.001. When dividing according to age into two groups above and below 40 years, no statistically significant differences were found (such that p = 0.191 and p = 0.411, for each group respectively). 6 sessions have been enough to discover a statistically significant decrease in abdominal fat and decrease the abdominal circumference by more than 4 cm.**

***Keywords***:- *High Power Radiofrequency; Capenergy; Abdominal Diameter; Abdominal Fat; Women.*

## I. INTRODUCTION

The increasing social acceptance of cosmetic procedures has resulted in a greater demand for procedures which will improve body image and quality of life. The most frequent cosmetic requirement which patients request from doctors is the patient's desire to achieve a better body shape. According to the ASPS Annual Plastic Surgery Statistics Report, more than 17.7 million minimally invasive and surgical cosmetic procedures were performed in the United States in 2018, a number that has steadily increased over the past five years [1]. On the other hand, with the advent of less invasive dermatological procedures, non-surgical cosmetic procedures have increased greatly. In 2016, there were more than 11.6 million non-surgical patients. Cosmetic procedures performed in the United States included a 12% increase since 2015 in non-surgical skin tightening procedures [2]. The current options available for body contouring do not necessarily meet all patient needs. Liposuction may require general anesthesia, is uncomfortable, expensive, and can have long recovery periods. Even with newer and safer techniques, pain, bruising, and edema can occur after surgery [3-5]. Furthermore, the invasive nature of certain procedures contributes to doubts about their performance by the patient [6]. Radio Frequency Assisted Lipolysis is a recently developed alternative to liposuction where a radio frequency probe is inserted into the subcutaneous tissue and used to melt fat. While this alternative procedure has less risk and a faster recovery period, it is still an invasive procedure.

Alternative therapies to the invasive procedure include diet, exercise, lifestyle change, and mesotherapy. However, it is difficult to maintain a diet and exercise, and certain areas of the body are difficult to shape even with optimal diet and training regimens, such as the abdomen, flanks and thighs. Mesotherapy, on the other hand, is currently not approved by the US Food and Drug Administration. By presenting a novel non-invasive method for fat reduction and body contouring this method will therefore be a welcome procedure for patients seeking treatment with less risk, and with less pain and inactivity time.

A novel non-invasive therapeutic radiofrequency system has been developed (Capenergy C 200 Barcelona, Spain). This system uses high-power radiofrequency through two channels, with 50 Watts of output for each channel, allowing the coupling of the frequency of 0.8, 1 and 1.2 MHz, around 1 MHz which is the effective frequency to stimulate the cell because it overcomes its defense mechanisms [7], with the energy absorption visualized in each output channel. Added to this the electrode has been expanded to an area of 200 cm2 to increase the amount of energy and to reduce adipose tissue to improve the elimination of unwanted fat deposits without the inconvenience of invasive techniques. The radiofrequency system is designed to disrupt fat cells using energy and produce adipocytolysis: the cytolytic method to reduce localized fat by non-surgical techniques, in which lipids can be broken down or solubilized through the partial

or total breakdown of adipocytes, destroying their plasma membrane [8].

The objective of this study is to evaluate the effect of 2-channel high-power Radiofrequency on the reduction of abdominal fat and the improvement of Body Contour in women.

## II. SUBJECTS AND METHOD

For our study, 16 women, mean age 44.8 years, who signed the informed consent and passed the Ethics Committee of the Institute of Aesthetics and Well-being CES 2 Madrid were taken. All of them maintained their normal activity; they did not participate in any type of diet or physical exercise. For High Power Radiofrequency, Capenergy model C200 equipment was used, a device that uses frequencies of 0.8, 1 and 1.2 MHz, with two channels and high power applied with a 200 cm2 electrode that increases the treatment area.

With a tape measure, the Abdominal Circumference (AC) is measured, the vertical average distance of the right side is taken, and then the same is done on the left side; once the average is marked on both sides, the tape is placed without tightening it to avoid compressing the skin and having measurements with errors. An anthropometric tape was used to measure the body diameters for greater precision of the measurement.

### 2.1 Ultrasound.

The ultrasound was performed before the first session and in the last session an ALPINION i7 ultrasound was used in the same area of the abdomen by the same sonographer. The thickness of the subcutaneous abdominal fat was measured at the same location, but in a transverse plane, and was defined as the depth from the cutaneous limit to the alba line. The image was captured when the transducer had just made contact with the skin to avoid compressing the subcutaneous fat fascia [9].

### 2.2. Photography

All the photographic shots were taken with a Canon D5 III, before and after each treatment session. They were taken in the same place, with the same lighting, using an Elichrom D-LITE RX4 lamp, with the same distance and with the same location and pose as the patient in each shot.

### 2.3. Radiofrequency treatment

The abdomen was performed with automatic plates in moderately thermal mode for 15 minutes. The active plates were placed in the abdominal area, in a vertical axis and in the center without the plates having contact with each other. At seven and a half minutes, they slid into the flank area, until the end of the remaining time. Passive plates parallel to the spine were placed between the scapulae and the kidneys.

Subsequently, it was performed in a frankly thermal mode for 15 minutes with the two active electrodes at the same time, one capacitive and the other resistive, in each outlet channel, covering the entire abdomen with both. The passive plates were placed parallel to the spinal column between the scapulae and the kidneys.

Finally, 20 minutes of lymphatic drainage were performed, placing the active plates on the foot area and the passive one on the lumbar region, on the same side.

### 2.4. Satisfaction

5 questions were asked from the Body Image Questionnaire validated in Spain [10], which are the ones that best adapt to our research. The questions will be asked before and after the treatment. The answer is either YES or NO.

Authors should also disclose any conflict of interest that may have influenced either the conduct or the presentation of the research to the editors, including but not limited to close relationships with those who might be helped or hurt by the publication, academic interests and rivalries, and any personal.

## III. RESULTS

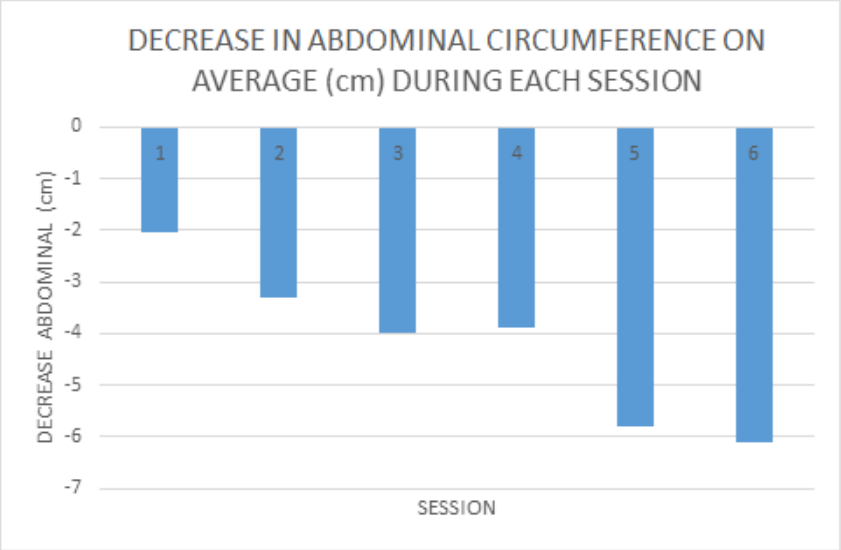
The average values of the characteristics of the sample are presented in table 1.

**TABLE No. 1 Patient demographics for the 19 female patients**

| | Min. | Max. | Mean | ± DS. |
|---|---|---|---|---|
| AGE (YEAR) | 21,0 | 71,0 | 44,813 | 17,0772 |
| HEIGHT (cm) | 147,0 | 169,0 | 159,625 | 6,4897 |
| WEIGHT BEFORE (Kg) | 46,4 | 101,0 | 70,941 | 15,4100 |
| WEIGHT AFTER (Kg) | 46,5 | 100,8 | 70,481 | 15,8603 |
| WATTS | 14,0 | 32,0 | 22,488 | 4,7622 |
| ABDOMINAL DIAMETER B (cm) | 70,5 | 118,00 | 91,5700 | 13,29489 |
| ABDOMINAL DIAMETER A (cm) | 73,1 | 112,00 | 87,3933 | 12,06971 |

Table No. 2 presents the decreases in abdominal diameter by sessions

| Patient | Basal | 1 week | Net Change | 2 week | Net Change | 3 week | Net Change | 4. week | Net Change | 5. week | Net Change | 6. week | Net Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 98,20 | 96,10 | -2,10 | 94,5 | -3,70 | 92,5 | -5,70 | 94,4 | -3,80 | 96 | -2,20 | 95 | -3,20 |
| **2** | 94,30 | 93,20 | -1,10 | 95,1 | 0,8 | 94,5 | 0,2 | 92,5 | -1,8 | 94 | -0,3 | 92 | -2,3 |
| **3** | 82,35 | 80,25 | -2,10 | 77,22 | -5,13 | 80 | -2,35 | 75,2 | -7,15 | 76 | -6,35 | 75,5 | -6,85 |
| **4** | 85,70 | 83,60 | -2,10 | 82,4 | -3,3 | 84,5 | -1,2 | 81,5 | -4,2 | 83 | -2,7 | 83 | -2,7 |
| **5** | 91,80 | 90,90 | -0,90 | 86,2 | -5,6 | 86,5 | -5,3 | 86 | -5,8 | 86,4 | -5,4 | 89 | -2,8 |
| **6** | 113,5 | 111 | -2,5 | 110,5 | -3 | 110,5 | -3 | 111 | -2,5 | 106 | -7,5 | 106 | -7,5 |
| **7** | 117,9 | 118 | 0,1 | 107,5 | -10,4 | 107 | -10,9 | 103,5 | -14,4 | 102 | -15,9 | 100,6 | -17,3 |
| **8** | 86,2 | 84 | -2,2 | 84,5 | -1,7 | 82,5 | -3,7 | 84,5 | -1,7 | 82,5 | -3,7 | 80,5 | -5,7 |
| **9** | 86,5 | 84 | -2,5 | 84 | -2,5 | 83,5 | -3 | 83,5 | -3 | 80,4 | -6,1 | 80,5 | -6 |
| **10** | 97,3 | 96 | -1,3 | 96,1 | -1,2 | 96 | -1,3 | 96,5 | -0,8 | 87,5 | -9,8 | 92,5 | -4,8 |
| **11** | 79 | 70,5 | -8,5 | 73,5 | -5,5 | 73 | -6 | 75 | -4 | 72 | -7 | 73,1 | -5,9 |
| **12** | 81,5 | 77 | -4,5 | 79 | -2,5 | 78 | -3,5 | 81 | -0,5 | 74 | -7,5 | 74 | -7,5 |
| **13** | 91,6 | 88 | -3,6 | 87,5 | -4,1 | 84,5 | -7,1 | 88 | -3,6 | 84 | -7,6 | 76,2 | -15,4 |
| **14** | 90,1 | 90 | -0,1 | 88,5 | -1,6 | 83,5 | -6,6 | 83,5 | -6,6 | 80,5 | -9,6 | 81 | -9,1 |
| **15** | 109,5 | 111 | 1,5 | 109,9 | 0,4 | 109 | -0,5 | 110 | 0,5 | 112 | 2,5 | 112 | 2,5 |
| | Average Change | | -2,05 | | -3,30 | | -3,99 | | -3,89 | | -5,79 | | -6,12 |




Graph No 2 presents the results of the decreases in the 6 sessions. This results are statistically significant differences p = 0.155 while the average decrease in abdominal circumference was 4.17 cm. These differences being statistically significant p = 0.001.

Photo No. 1 Shows the frontal view of the abdomen of 4 patients where the improvement of the abdominal contour is appreciated

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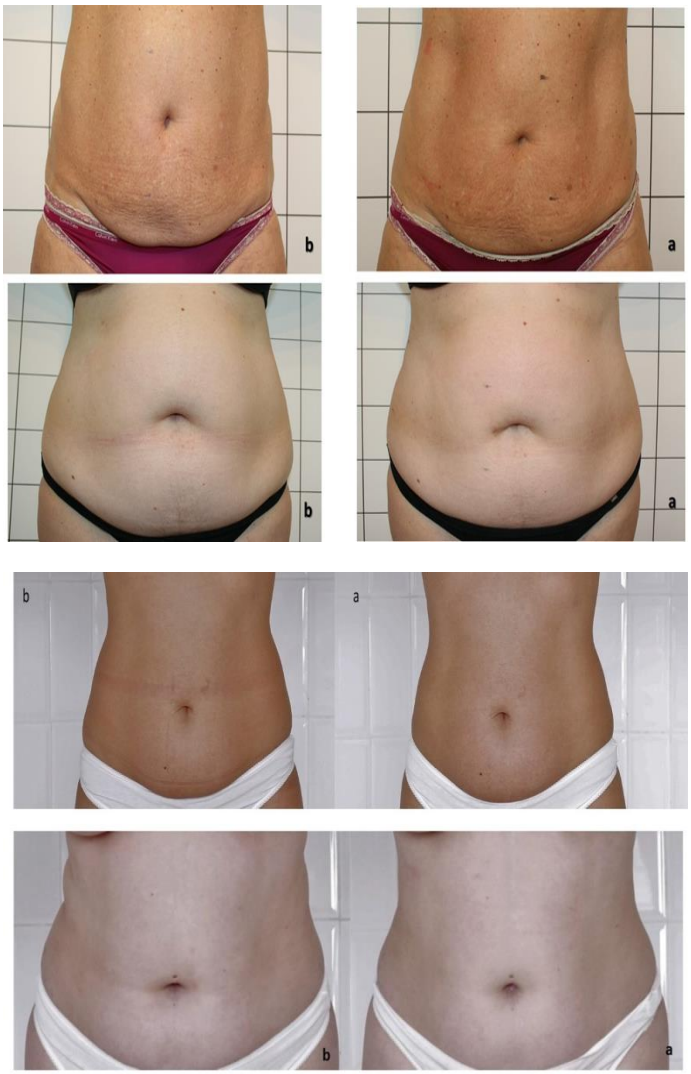

In the photos you can see the decrease in the abdominal diameter after the treatment: notice how the skin fold is lost and the body is contoured.

In Photo No 2 an example of the decrease in the thickness of the abdominal wall by Ultrasound is presented. Note the decrease in abdominal wall thickness after treatment. The mean initial measurement was 5.8 mm and that after treatment 2.2 mm (p = 0.001)

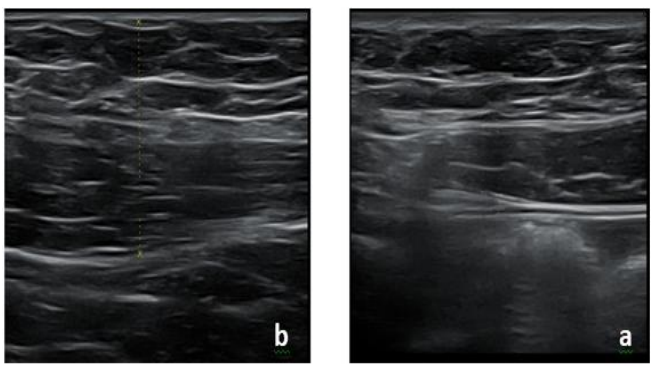

Photo No. 2 Ultrasound of abdominal fat before and after treatment.

A single factor ANOVA test was performed to find out if there are differences between the decrease in abdominal diameter according to the age of the patients, dividing them into more than 40 years and less than 40 years. No statistically significant differences were found p = 0.191 and p = 0.411, for each group respectively.

## IV. DISCUSSION

Radiofrequency generates heat in different tissues by transforming energy through three basic mechanisms from the electromagnetic field [11]. These mechanisms include (i) orientation of electric dipoles that already exist in the atoms and molecules in the tissue; (ii) polarization of atoms and molecules to produce dipole moments; and (iii) displacement of conduction electrons and ions in the tissue. The frequency of an RF device ranges between 3 kHz and 24 GHz, and the monopolar and the bipolar configurations are used commonly in medicine [12]. But as already pointed out, it is the 1 MHz frequency that best interacts with the membrane, triggering cell signaling mechanisms [7].

The principal findings of our study are threefold: the efficacy of selective-field radiofrequency treatment in terms of reduction of waist circumference. It does not depend on the age of the patient. The treatment is safe, as no clinically relevant side-effects were observed. The field of non-invasive body contouring is booming; many patients notice a lower result than they could achieve with a single session of liposuction or dermolipectomy, but that procedure is invasive, and invalidating during the recovery period. The length of a series of non-invasive fat reduction treatments can be daunting. Patients have questioned the value of these procedures when the expected benefit is modest and the time spent on the project is significant. A mini-study of eight patients was conducted to see if two or three 'mega-sessions' could be substituted for eight weekly sessions of fat reduction treatments, but the results were not statistically significant [13]. The results affirm the need to apply several sessions to achieve the objectives based on radio frequency. In this study, 6 sessions were enough to find a statistically significant decrease in abdominal fat.

Clinical studies have demonstrated similar efficacy and safety of the radio frequency system in different anatomical locations, including the abdomen, thigh, and flank regions. With Radio Frequency systems an electrode emits energy onto the skin. The current disperses into the tissue and flows into a receptor pad attached to the patient [14], to achieve sufficient heat at the desired depth, thereby reducing body fat and decreasing abdominal diameters.

Previous studies have shown that single or multiple treatments with these devices are effective, safe, and comfortable for the abdomen, flanks, and thighs. The average girth reduction of three treatment regimens ranges from 2.9 to 3.95 cm [15, 16]. Thermal stimulation of adipocyte metabolism through lipase-mediated enzymatic degradation of triglycerides and apoptosis and breakdown of adipocytes are the putative fat reduction mechanisms after RF [12]. In other studies, the average circumferential

reduction was 3.58 cm, with a range of 1.5 cm - 4.4 cm, for this reason, but it is a combined treatment with Heating and High Voltage Ultra-Short Electrical Pulses. In our study, applying only RF the decrease is greater. In obese women, a decrease of 5.6 cm has been reported [18].

In a study using pulsed ultrasound treatment, ultrasound images showed that the thickness of the fat layer decreased by 2.6 mm. In our study, the decrease was 3.6 mm [19], which allows us to affirm the benefits of the treatment.

The increase in power, the amplitude of the size in the area of the electrodes and the possibility of regulating the amount of energy delivered, according to the needs of the patient, highlights this new generation of TECAR. Increased signaling of cells, especially the calcium ion, the production of growth factors, among which is vascular, improves blood circulation permanently. Additionally, energy in the form of heat dissolves fats, which reduces the thickness of the abdominal wall.

The effect of RF on abdominal fat does not appear to depend on age. So, it can be used both in young people and in older people. This, together with acceptance by the patients and the perception of improvement, allows a spectrum of possibilities in the improvement of the non-invasive body silhouette.

## V. CONCLUSIONS

Minimally invasive modalities, to decrease abdominal circumference and body silhouette, have gained significant attraction, and the arsenal for targeting focal fat deposits increases every day. The use of high-power radiofrequency, two channels and a larger electrode area, is effective to reduce abdominal fat. Our analysis provides a proof of concept for safety and efficacy of selective field RF treatment using the standard 6 × 30 minutes protocol for moderate reduction of subcutaneous fat tissue. These results are not related to age. It is safe, with few side effects, which allows an alternative for those who want to reshape their body without going through surgery, without days of convalescence and without stopping their daily activities. As biochemical and peripheral fat measurements are easy to perform, we suggest that a study be carried out in the future measuring these parameters to evaluate what actually happens in the subcutaneous abdominal fat.

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