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Use of lipocavitation in the treatment of localized adiposity: a review

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Abstract

With the growing demand for body, contouring, non-invasive devices for reducing localized fat have become increasingly popular and have grown exponentially in the last decade. The Lipocavitation technique has been used recently for this purpose and has been evaluated as a method for the selective destruction of adipose tissue. This work has as main objective, to bring up the practice, the mechanism of action in the body and the effects of the use of lipocavitation in the treatment of localized adiposity. This is an exploratory study of bibliographic review, with consultation in the databases of the VHL (Virtual Health Library), PUBMED and MEDLINE and SciELO. The results showed that the lipocavitation technique used in aesthetics to reduce adipocytes allows the destruction of localized fat, facilitating its elimination and contributing to the reduction of localized measures. With the current technological advances, a variety of techniques can be used, or even combined, allowing innovation to professionals, bringing improvement and well-being to each individual.

Keywords: Lipocavitation, Localized Adiposity, Aesthetic Biomedicine, Non-Invasive Procedures

Introduction

With the advancement of technology, there was an expansion in the therapeutic resources used in order to reduce localized adiposity. It is known that there is a concern with physical appearance, either by fear of the signs of aging or some aesthetic dysfunction. In this way, aesthetic health provides individuals with an improvement in the quality of life and well-being not only in physical aspects, but also in emotional and social aspects, through beauty [1].

In this context, there is a preference for less invasive treatments and techniques, as mentioned by Jewell et al [2]. When he says that the introduction of non-invasive resources, with minimal side effects, allows the individual to leave the procedure and resume life normally, without restrictions. In this context, aesthetic imperfections such as localized fat, cellulite and sagging skin stand out and make the aesthetic segment become one of the most attractive, gaining prominence on the world stage.

The possibility of offering minimally invasive procedures in relation to plastic surgery has made these techniques considered the most interesting today; it is a list of techniques that alleviates the difficulty of having time, since the recovery is fast and has no drastic impact on the routine, since there is no demand for the postoperative period [3].

Recent data from the American Society for Aesthetic Plastic Surgery (ASAPS) [4], show the increase in demand for cosmetic procedures over a period of 9 years; it is observed that surgical procedures had an increase of 219%, while non-surgical ones had an increase of 1576%.

For Moreno [5], the desire for a “harmonious” body, within the standards required by society, has been linked to feelings of anguish and low self-esteem, where the search for perfect aesthetics also has psychological consequences, in an attempt to be approved in the face of society's expectations.

To resolve such issues of aesthetic dissatisfaction, the Lipocavitation process is used, this resource is indicated to reduce excess body fat and aims to increase cellular and body metabolism, promoting the lysis of accumulated local fat or the implosion of adipocytes [6].

Fillipo et al., [7] describes lipocavitation as a physical phenomenon produced by ultrasonic waves of low frequencies (from 20 to 70 KHz) and high amplitudes. In other words, lipocavitation produces vacuum microbubbles, which get bigger and implode. The microbubbles produced from lipocavitation have a high level of energy producing shock between adipocytes; the adipocyte membranes are very thin and do not resist this shock, and consequently break.

Aim of the Work

This work had as main objective, to bring up the practice, the mechanism of action in the organism and the effects of the use of lipocavitation in the treatment of localized adiposity. An analysis was carried out regarding the use of this aesthetic procedure, namely it was intended to identify the indications and contraindications, describing the actions of the method.

Methodology

The research

This is an exploratory study of bibliographic review, where according to Gil (2010) exploratory research is developed with a view to providing an overview of the problem, and the bibliographic research aims to provide greater familiarity with the problem, with a view to to make it more explicit or to make hypotheses. It can be said that these researches have as main objective the improvement of ideas or the discovery of intuitions. Its planning is, therefore, very flexible, so that it allows the considerations of the most varied aspects related to the studied fact.

Data collection

Data collection was carried out by consulting the bibliographic database of the VHL (Virtual Health Library), PUBMED and MEDLINE (Medical Literature Analysis and Retrieval System Online) and included the articles indexed in the Scientific Electronic Electronic Library Online databases. (SciELO).

The descriptors used in this research were consulted in the list of Health Sciences (DECs), in order to use the appropriate keywords for bibliographic research. To identify the articles, the following were used: Lipocavitation, Localized Adiposity, Aesthetic Biomedicine, Non-invasive procedures.

Inclusion and Exclusion Criteria

From this search, an exploratory reading was carried out that consisted of checking the abstracts in order to select the articles related to the object of study, and reading the articles in full, with analysis of the same.

Inclusion criteria: articles in the area of health and aesthetics; published between 2000 to 2020; available in full; presented in languages between Portuguese, English and Spanish.

Exclusion Criteria: incomplete articles or that presented only the abstract; published articles that did not address the theme of the subject in question.

Theoretical References

Obesity

Obesity has become a major social and health problem and is a risk factor for many diseases, such as diabetes mellitus, hypertension, coronary heart disease, airway obstruction and malignant tumors. Obesity or overweight depends mainly on the amount of body fat present in layers of adipose tissue, and not on body weight (AHMED et al., 2018).

Localized Fat

Localized fat represents an important social problem, where society and its prototypes built over time present a body requirement within the standards of beauty. Both men, as well as women have a desire for a perfect body, but that do not compromise time or health, and for this purpose, several therapeutic procedures available today are presented. The use of techniques through non-invasive, modern and safe treatment are in evidence for the treatment of localized fat (FILIPPO et al., 2012).

The distribution of Localized Fat

The central accumulation of fat is a determining risk factor for possible health complications. Studies have identified numerous sites associated with the distribution of body fat, where they show that the genetic sites linked to the distribution of fat may be related to the size and number of adipose cells (morphology) and / or the function of adipose tissue. In this study, 114 women were analyzed, and almost half of the 96 genes in these sites are actually associated with parameters of abdominal subcutaneous adipose tissue. It is believed that the genetic influence on body fat distribution can be mediated by several specific changes in the morphology and function of adipose tissue (DAHLMAN et al., 2016).

Epidemiological Data on Obesity in Brazil and in the World

Obesity, among the pathologies currently of most concern, deserves attention because it is considered one of the biggest public health problems in the world today and is strongly associated with the increase in cardiovascular mortality, causing enormous health costs (REZENDE et al., 2015).

Adipose tissue

Adipose tissue is the body's main energy reservoir. Adipocytes are the only cells specialized in storing lipids in the form of triacylglycerol (TAG) in their cytoplasm. They have all the enzymes and regulatory proteins necessary to synthesize fatty acids (lipogenesis) and store TAG in periods when energy is abundant, and when there is a caloric deficit (FONSECA-ALANIZ et al., 2006).

As shown in Figure 3, according to Junqueira et al., (2013), unilocular adipose tissue originates from lipoblasts. The adipose panicle refers to a uniformly thick layer on the skin. The unilocular tissue loses its fat, becoming a tissue with polygonal or spindle cells. The multilocular adipose tissue is the smaller cells, in polygonal form, and the reddish color is due to the abundant vascularization and a large number of mitochondria; these cells have the thermogenic protein that does not tend to grow, they are located in limited areas (JUNQUEIRA et al., 2013).

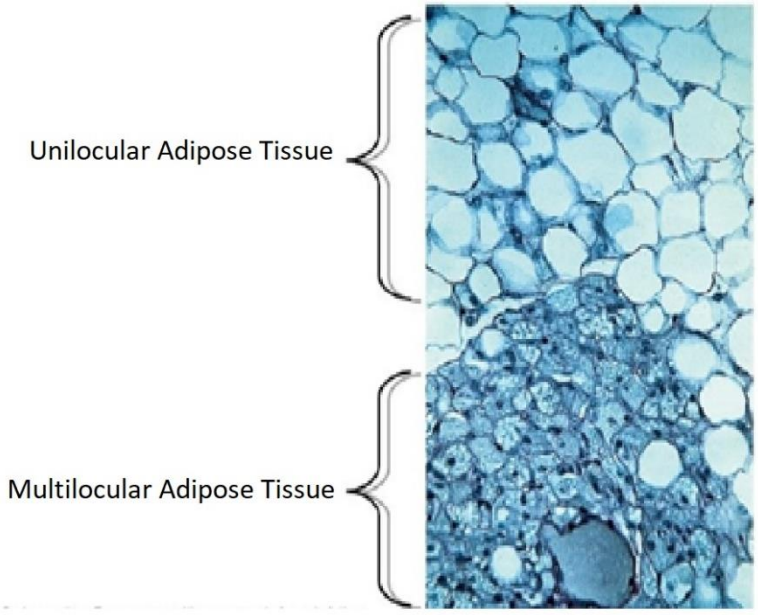

Figure 1: *Unilocular and Multilocular Adipose Tissue*

Source: Junqueira et al., (2013)

The disposition and accumulation of adipocytes vary according to the individual's age and sex, as well as by the action of sexual and adrenocortical hormones (GUYTON, 2011).

Sung and colleagues (2016), claim that adipose tissue is a central metabolic organ in the regulation of energy homeostasis of the whole body, where white adipose tissue functions as an essential energy reservoir for other organs, while brown adipose tissue accumulates lipids for cold-induced adaptive thermogenesis.

Metabolism of adipose tissue

In obesity, the expansion of adipose tissue occurs by two different mechanisms: Hypertrophic adipose expansion by increasing the size of adipocytes is associated with harmful phenomena such as increased release of basal fatty acids, proinflammatory release of cytokines, recruitment of immune cells, hypoxia, fibrosis, decreased adiponectin and decreased insulin sensitivity. On the other hand, adipose expansion hyperplasia, although the increased number of adipocytes is linked to beneficial phenomena, such as increased adiponectin, decreased release of basal fatty acids, release of pro-inflammatory cytokines, recruitment of immune cells, hypoxia, fibrosis and improvement insulin sensitivity (SUNG et al., 2016).

Lipocavitation

What is the Lipocavitation technique?

The use of ultrasonic cavitation or lipocavitation is known as the non-invasive treatment that helps to reduce localized fat deposits. This method is used for people who are dissatisfied with a certain area of fat, but who do not want to undergo any invasive surgical treatment such as liposuction among others. It is a treatment in which there is no need for recovery as in the surgical removal of fat (AHMED et al., 2018).

According to Borges (2006), it is a treatment used by men and women who intend to decrease measures without undergoing surgery. The treatment and sessions vary according to each individual, as well as can be lasting and in other definitive cases.

Lipocavitation is a new treatment, however it is very efficient in reducing localized and superficial fat. To accomplish it, it uses a technology ultra s s the m on the surface of the skin that change the pressure and temperature of the fatty tissue and thus destroys fat by breaking the membrane of adipocytes (LACRIMANTE, 2008).

According to Haar et al. (2003), ultracavitation is a wave of ultrasound that frequently includes the vibration of adipose tissue. These ultrasonic waves will produce bubbles of gas or vapor that will be subjected to considerable negative or positive pressures. The bubbles are close to the subcutaneous tissue that also respond to frequency of ultrasound, suffering disruption and for being close to the adipocyte will make this shred your membran the promoting the extravasation of fat.

As shown in Figure 2, the procedure performed with low-frequency ultrasound is indicated for patients who have more than 4 cm of fat, as it acts on the densest layers of adipose tissue, and thereby generates a type of vibration in the cells. As a result, there is an increase in heat and collagen stimulation, which helps to reduce sagging in the area to be treated. It states that the focused ultrasound can be controlled by reaching the fat, through the choice of the ideal handle, acting mechanically, compressing and "pulling" the fat cells alternately, which causes them to break. The interval for each session is fifteen days (HAAR et al., 2003).

Figure 2: *Low frequency ultrasound effect High ultrasound effect*

Fonte: *Roratto (2018)*

Products used in the lipocavitation technique

The device used in Lipocavitation is a microcontrolled equipment of high intensity focused ultrasound (HIFU) in the frequency of 1.8 MHz ± 10%. U sing the shooting of in aesthetic treatments, it has a non - invasive body contouring modeling. The cavitational and thermal mechanical energy produced by the equipment is transferred to the adipose tissue through a curved transducer coupled to the skin with a neutral gel.

Figure 3. *Equipment*

Fonte: IBRAMED, 2014

The biocompatibility of materials in contact with the patient , according to ISO 10993-1 , IBRAMED (2014), declares that the ultrasound transducer and the coupling gel , which are supplied with the equipment , do not cause allergic reactions. They should only be placed in contact with the intact surface of the skin, respecting a time limit for the duration of this contact of 24 hours. There is no risk of harmful effects to the cells, nor allergic reactions or sensitivity.

Figure 4: *Equipment and Accessories used in Lipocavitation*

Fonte: *IBRAMED, 2014*

Effects and Results of Treatment

It is an extremely effective procedure in the dissolution of localized adiposities. It has great advantages for being a non-invasive technique, being performed through a low frequency ultrasound. According to the Ibramed (20 14) by using a frequency specific vibration and certain power, molecules of a structure - specific are brought into resonance, generating microbubbles collapse and implode, causing breakage of structures specific. In the case of adipocytes, the resonance frequency ranges from 27 to 42 kHz.

As shown in Figure 5, we can see the satisfactory results of the procedure used. The treated patients lose an average of 1.6 kg, with an average of 2.85 cm of reduction in the measurement of waist circumference. No patient treated and evaluated in this study showed systemic signs or symptoms as a result of the treatment (FILLIPPO, 2012).

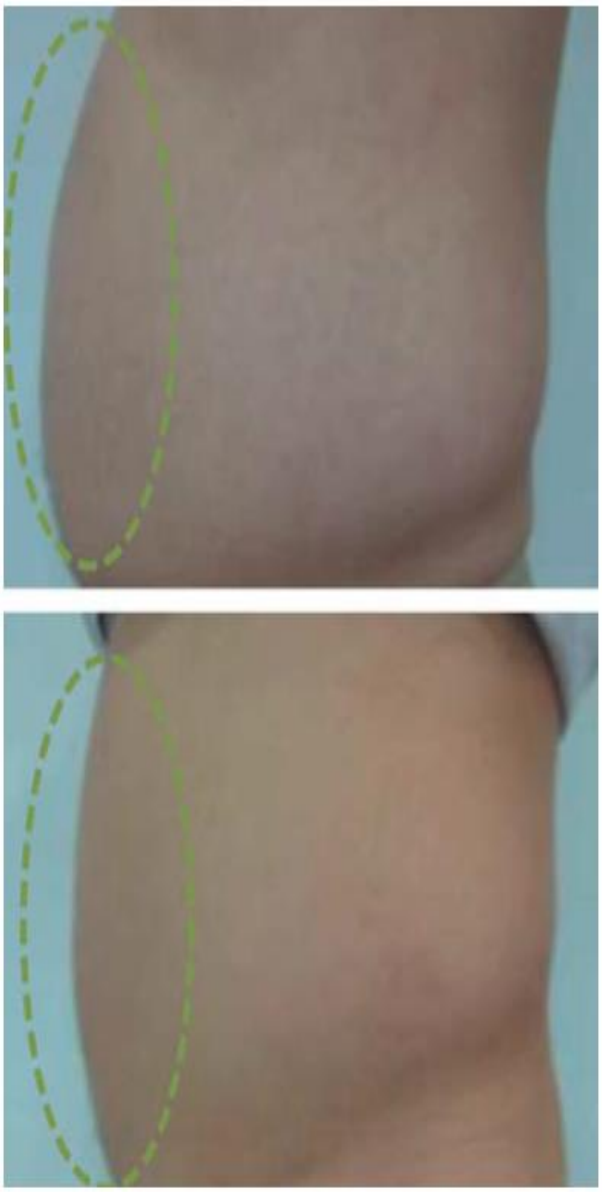

Figure 5. *Clinical Case before and after treatment*

Fonte: *Fillippo (2012)*

Lipid discharge is not accompanied by any morphological signs of adipocyte death and rupture or interstitial inflammation. In addition, the effects induced by the lipocavitation technique are restricted to adipocytes, while microvascular blood cells, endothelial cells, pericytes and mast cells, have normal characteristics. These findings suggest that lipocavitation does not create adverse local conditions that can favor tissue damage and inflammatory reaction (BANI et al., 2013).

Lipocavitation mechanism of action

For Borges (2006), cavitation oc orre across application ultras sound because the individual pulses released by the ultra-generator s s om make the cells and molecules located on the road to oscillate beam cyclically and directly proportional to the intensity of exiting the ultrasound generating unit, the bubbles oscillate from side to side within the pressure waves of the ultrasound, increasing and decreasing in volume.

The ultrasonic energy emitted goes to the subcutaneous fat, and produces small bubbles inside the fat cells. These bubbles progressively increase in number causing agitation inside the cell leading to its rupture.

In the treatment for localized fat, the choice of the type of cavitation will depend on the thickness of the patient's adipose tissue, and a high or low frequency electric current generator can be used, by stable and unstable cavitation, which will create transient membrane openings adipocyte cell. When the adipocyte membrane becomes weakened or ruptures, triglycerides are released into the intercellular space, where free fatty acids can be oxidized in tissues that require energy, or transported to the liver. The result is a reduction in adipose tissue (FELLER et al., 2018).

Application of Lipocavitation

Since the introduction of ultrasound as a therapeutic resource more than 50 years ago, its biological actions have been investigated. Therapeutic ultrasound is a modality of longitudinal sound energy that, when

transmitted to biological tissues, is capable of producing cellular changes due to mechanical and thermal effects. Therapeutic ultrasound comprises a frequency range that ranges from 20 kHz to 5 MHz and its current applicability varies according to the frequency, power and shape of the transducer. The transducer can be flat (not focused) or curved (focused) as shown in figure 6.

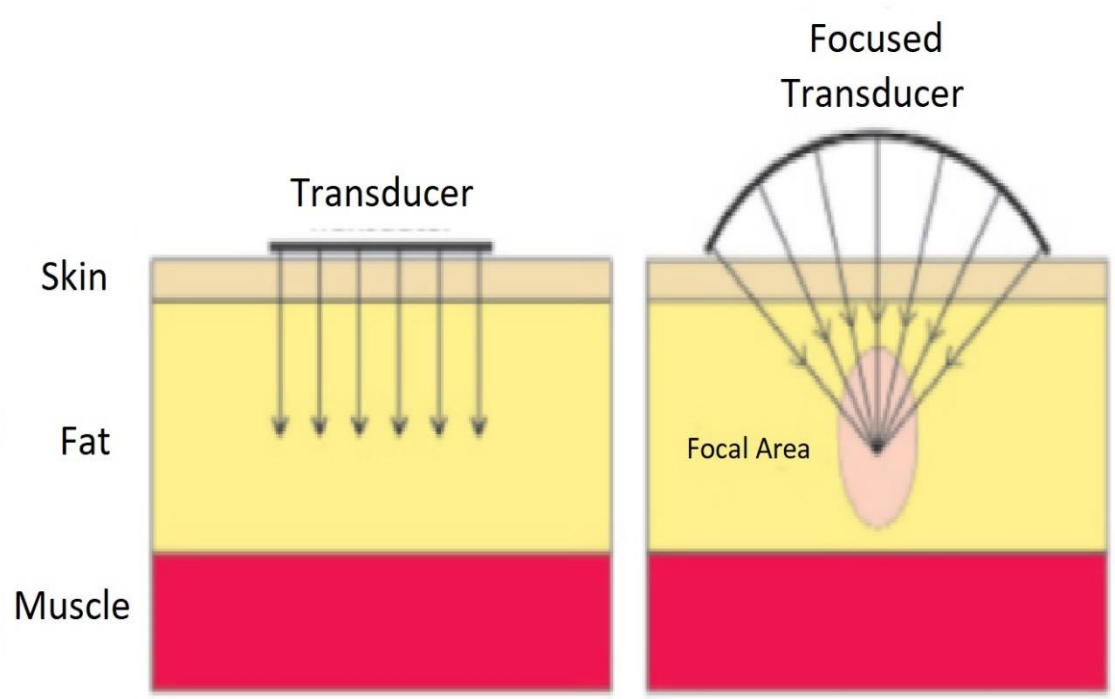

Figure 6. *Representative image of long-range transducer and focused transducer*

Lipocavitation associated with other techniques

The Cryolipolysis is a non-surgical technique for the reduction of localized fat, which means that there is a reduction in activity of Na-K-ATPase and increased mitochondrial free radical promoting reducing localized fat. The existing practice of combined therapies grows every day, and with this technique CRIO 2A emerged, which consists of the application of contrast cryolipolysis, associated with post-treatment with lipocavitation and radiofrequency, and proved to be very effective for the loss of abdominal adiposity. Because, in addition to including double reperfusion, with coupling and uncoupling of cryolipolysis to increase the number of apoptotic adipocytes and, therefore, greater loss of localized adiposity (MACHADO et al., 2017).

According to Bani (2014), c ombinado with electric current fields, low intensity the ultrasound is designed to increase the permeability of adipocytes with subsequent release of triglycerides in the lymphatic system. Additional lymphatic drainage therapy through vacuum massage increases the local blood circulation in the treated area, improving the transport of lipids in the lymphatic system.

Indications for Lipocavitation

Lipocavitation provides high intensity focused ultrasound energy and should be used with coupling gel. It is commonly indicated for aesthetic treatments for non-invasive body contour modeling (IBRAMED, 2014).

Among the indications we include: T reatment of localized fat; r eduction of measures; p re - operative; m odelagem Will not the invasive body contouring; p LICA efore above 12 years of age; only for patients over 35 kg.

Results

Data analysis

According to the data obtained in the database, localized adipose, non-invasive treatment techniques, especially lipocavitation, will be studied. Such factors will be analyzed and tabulated to compose a table.

For data collection, the databases were searched, as shown in chart 1, PUBMED and MEDLINE (Medical Literature Analysis and Retrieval System Online) and SCIELO (Scientific Electronic Library Online).

Database	Amount	Selected
Medline	21	08
Scielo	18	10
Lilacs	12	02
Pubmed	22	08
Total	**73**	**28**

Chart 1 - *Articles researched according to the inclusion criteria*

73 articles were found, after applying the exclusion criteria filters, such as being available in full, periodic from 2000 to 2020, languages being Portuguese, English and Spanish, were 55. Of these, 28 were selected, of which 8 were Medline, 10 Scielo 2 Lilacs and 08 Pubmed.

Completing the selection of published articles, in the same search, 8 books, 8 electronic publications and 2 manuals were found and selected. Thus, 46 documents were considered relevant to address the theme, and were selected for use in the present work. The articles chosen for the present study sought to understand non-invasive techniques for the treatment of localized adipose, such as lipocavitation and the performance of the Biomedical in Aesthetic Health.

Discussion

Sazaki et al., (2014), and although liposuction remains the most effective procedure for contouring the face and body, patients continue to seek non-invasive methods of reducing fat with lower morbidity rates and less time recovery. The proc current nonsurgical edimentos employ mechanical vacuum massage, laser, radiofrequency, ultrasound or infrared light low energy level and are not intended to remove large volumes of fat. While these tools produce individual benefits, their long-term value remains in question because they provide less dramatic and predictable results and require multiple treatments.

This study was conducted to investigate the effect of low-frequency ultrasonic lipocavitation on the normal lipid profile in healthy individuals with fat deposits located in the abdomen. Design: a repeated measure group. Subject, material and method: forty-eight healthy volunteer women participated in the study, age (25-45) years and BMI (25-35) Kg / m 2 (AHMED et al., 2018).

All of them adhered to a healthy balanced diet to maintain body weight and received 12 sessions of abdominal ultrasonic lipocavitation over 6 weeks with a frequency of 2 weekly sessions and duration of 25 min sessions with ultrasonic frequency of 32 to 36 KHz, output power 10 to 70 Watt / cm2. Lipid profile, BMI, WC, WC, WHR, MM and TF were measured before treatment, after 4 weeks of treatment and repeated at the end of treatment after 6 weeks (AHMED et al., 2018).

The results showed a significant decrease in the mass values of TC, TGs , LDL, WC, AC, WHR, BFM and TF. Also significant increase in HDL favoring "post 4 weeks of treatment" and "post 6 weeks of treatment" compared to pre-treatment and favoring post-6 weeks compared to post-4 weeks of treatment. Conclusion: Low Frequency Ultrasound The lipocavitação was effective to improve the lipid profile and reduce localized fat deposits abdominal , there was an average reduction of 3.14 ± 1,58cm and lost an average of 1 , 93 ± 1 , after 35Kg sessions (Figure 7) (AHMED et al., 2018).

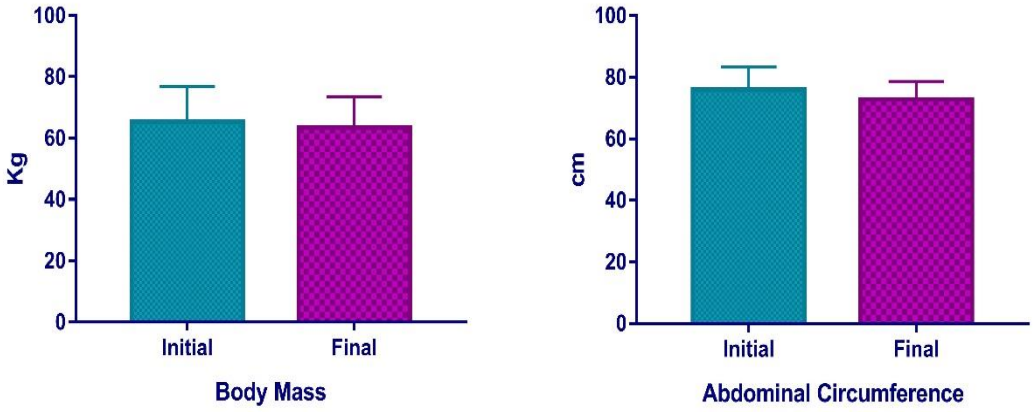

Figure 7: *Initial and final measurements of patients' weight and waist circumference.*

A total of 90 healthy women aged 18 to 40 years were randomized and divided into two groups. The volunteers were submitted to anamnesis, perimetry, bioimpedance, ultrasound examination and blood tests (complete lipidogram, creatinine and vitamin D) assessment before and after the end of the 10-session ultrasound protocol (3 MHz, 2 W / cm2 and 30w). The comparisons between the groups and the pre-post evaluation were performed by an analysis of variance of repeated measures of two ways. Values of p <0.05 indicated statistical significance.

The results demonstrated a significant reduction in the two groups, for perimetry (p <0.001) and measures of the thickness of adipose tissue (p <0.001). The exams showed significant changes only in the complete lipidogram, but without significance (p> 0.05). In the comparison of the groups, no statistically significant difference was identified in any of the analyzed parameters.

High-power ultrasonic therapy is effective in reducing localized adiposity, regardless of whether it is applied with neutral gel or 5 % caffeine gel. (SILVA et al., 2019).

Right and colleagues (2019) conducted a clinical trial with 7 v healthy oluntárias , aged approximately between - 41 ± 5 years in 06 sessions of one time per week , using the frequency 1,8MHz to 31KHz , and Intensity 2 2W , with t ime each shot of 2 seconds in the region of the bdome and/or flanks for 05 minutes local manual massage . D was analyzed anthropometric ed as body weight, adipometria and perimeter ; exams such as an ultrasound scan with real-time scanning ; f otografias personalized digital parts of the front, rear, right side and left ; eq UESTIONNAIRE tolerance and satisfaction with nalysis statistical (test t Student p <0.05) . As a result, he pointed out that the reduction in thickness measurements in mm of the abdominal fat layer were statistically significant, with the expected average values.

Conclusion

The search for aesthetic procedures that reduce measures is increasingly growing, especially where currently the search for the perfect body is stimulated by the media in an incisive way in society. This triggered a frantic search for procedures aesthetic less invasive became very frequent,

and the dysfunctions that more increase this index, both men and for women is the fat located or lipodystrophy.

The lipocavitation technique, used in aesthetics to reduce adipocytes, allows the destruction of localized fat, facilitating its elimination and contributing to the reduction of localized measures. The thermal effect increases the vascularization of the tissue and improves oxygenation in the region. The chemical effect, on the other hand, causes the production of collagen and elastic fibers, improving the firmness of the skin.

Most studies used in this research showed that T All patients noted a significant reduction in waist circumference compared to their pretreatment values when measured after 1-month of final treatment. Combined with the weight reduction that was observed, the treatments were found to be effective by both study physicians as well as by patients.

Lipocavitation pointed out several potential advantages when compared to non-surgical body contouring technologies currently available. It is considered as an easy and simple treatment, painless, however a little time consuming, lasting approximately 45 to 50 minutes each, with a series of 10 treatments to present good results and significant perception.

It was noted that the lipocavitation technique should be performed by a professional who has adequate knowledge of the technique and is capable of performing this invasive aesthetic procedure, such as the biomedical esthete, where the search for customer satisfaction is achieved safely and effectively.

This work contributed to the deepening of knowledge about this aesthetic procedure for the reduction of localized fat, demonstrating that there are several therapeutic resources used for the reduction of localized adiposity, but it is necessary to carry out a thorough evaluation in each person.

It further reinforced the current idea that non-invasive ultrasound lipocavitation is a promising and safe technology for localized fat reduction and provides experimental evidence for its specific mechanism of action in adipocytes.

With current technological advances, a variety of techniques can be used, or even combined, allowing innovation to professionals, bringing improvement and well-being to each individual.Lipocavitation is a non-invasive and well-tolerated treatment, and appears to be effective in reducing abdominal fat.

Future studies and larger proportion in the patient sample, s er will need to further elucidate the degree and duration of treatment, the results and to assist in understanding clearer the pathophysiology of treatment.

References

1. AHMED Rania M; LABIB Awatef M. (2018) DRAZ Amira H. Effect of Ultrasonic Lipocavitation on Normal Lipid Profile in Healthy Subjects. v. 7; issue 4; p.:768-747. **Current Science International.**
2. ASAPS – International Society of Aesthetic Plastic Surgery. (2016) **The International Study on Aesthetic/Cosmetic Procedures Performed in 2016** – Procedures by Country. [Artigo Eletrônico].
3. BANI, D.; QUATTRINI A. L.; FRESCHI, G.; LO RUSSO, G. (2013) Histological and Ultrastructural Effects of Ultrasound-induced Cavitation on Human Skin Adipose Tissue. **Plast Reconstr Surg Glob Open**. v. 1, n. 6, p.: e41.
4. BRASIL. Ministério da Saúde. (2019) **Brasileiros atingem maior índice de obesidade nos últimos treze anos**. [Artigo Eletrônico].
5. BORGES, F. (2015) **Palestra Sorocaba Ultrassom e Ultracavitação para aluno**.
6. BORGES, F. S. Ultra-som. In: **Dermato-funcional**. (2006) Modalidades terapêuticas nas disfunções estéticas. São Paulo: Phorte.
7. BRASIL. Ministério da Saúde. (2019) **Brasileiros atingem maior índice de obesidade nos últimos treze anos**. [Artigo Eletrônico].
8. BRATZ, P. D. E.; MALLET, E. K. V. (2015) Toxina botulínica tipo A: abordagens em saúde. **Rev. Sau. Int**., v. 8, p.:15-16.
9. BUSETTO, L., DIXON, J., DE LUCA, M. et al. (2014) Bariatric Surgery in Class I Obesity. **OBES SURG** 24, 487–519.
10. CFB - Conselho Federal de Biomedicina. (2015) **História da Biomedicina**.
11. CFB - Conselho Federal de Biomedicina. (2011) **Resolução n° 197**, de 21 fevereiro de 2011. Diário Oficial da União n°37, 22 de fevereiro de Seção 1, p. 114.
12. CFB - Conselho Federal de Biomedicina. (2014) **Resolução n° 241**, de 29 de maio de 2014. Diário Oficial da União n°129, 9 de julho de – Seção 1, p. 45.
13. DAHLMAN, I.; RYDÉN M.; BRODIN D.; GRALLERT H.; STRAWBRIDGE R. J.; ARNER Peter. (2016) Numerous Genes in Loci Associated With Body Fat Distribution Are Linked to Adipose Function. **Diabetes**, v. 65, n.2, p.: 433-437.
14. Dambros, D. G. S. (2017) **O impacto da perda ponderal na qualidade de vida e comorbidades de pacientes obesos na ESF São João de Uruguaiana**. Universidade Federal de Ciências da Saúde de Porto Alegre, UNASUS/UFSCPA.
15. FELLER, A. G.; SILVA, E.; ZIMMERMANN, C. E. P. (2018) Utilização do ultrassom estético na gordura localizada. **Revista Saúde Integrada**, v. 11, n. 21
16. FILIPPO, A. A.; SALOMÃO, JÚNIOR A. (2012) Tratamento de gordura localizada e lipodistrofia ginóide com terapia combinada: radiofrequência multipolar, LED vermelho, endermologia pneumática e ultrassom cavitacional. **Surg Cosmet Dermatol**; v. 4, n. 3, p.:241-6.
17. FONSECA-ALANIZ, Miriam H. et al . (2006) O tecido adiposo como centro regulador do metabolismo. **Arq Bras Endocrinol Metab**, São Paulo , v. 50, n. 2, p. 216-229. Medline.
18. GIL, A. C. (2010) **Como elaborar projetos de pesquisa**. 5. ed. São Paulo: Atlas.
19. GUYTON, A. C.; HALL, J. E. (2011) **Tratado de Fisiologia Médica**. 12ª Edição. Rio de Janeiro: Ed. Elsevier. 1176p
20. HAAR, G. (2003) Princípios Eletrofícos e Térmicos. In Kitchen, S.; BAZIN, S. **Eletroterapia**, práticas baseadas em evidências. São Paulo: Manole, v. 14, n.11, pg: 221-228.http://fnti.com.br/biblioteca/wp-content/uploads/2015/11/sheila-kitchen-eletroterapia-pratica-baseada-em-evidencias.pdf
21. HARRIS, M. I. (2016) **Pele - do nascimento à maturidade**, Ed 1, São Paulo, Brasil: Editora Senac São Paulo.
22. HUNTER, Hamish J.A.; WELLER, Richard B., MANN, Margaret W. (2015) **Clinical Dermatology.** Fifth Edition. John Wiley & Sons, Ltd. Published 2015 by John Wiley & Sons, Ltd.
23. IBRAMED. SONOFOCUS - **Ultrassom focalizado de 1,8 MHz.** (2014) Indústria Brasileira de Equipamentos Médicos – EIRELI. ANVISA n° 10360319004. 2ª edição.
24. ISAPS – Sociedade Internacional de Cirurgia Plástica e Estética. (2018) **Hanover**: Internationa Society of Aesthetic Plastic Surgery.
25. JEWELL, M. L. ; SOLISH, N. J. ; DESILETS, C. S. (2011) Noninvasive body sculpting technologies with an emphasis on high-intensity focused ultrasound. **Aesthetic Plast Surg.,** v.35, n.5, p.901- 912. Medline.

26. JUNQUEIRA, L. C. U.; CARNEIRO, J. (2013) **Histologia básica** I. 12. Ed. Rio de Janeiro: Guanabara Koogan. 558p.
27. LACRIMANTE, M. L. (2008) **Curso Didático de Estética**: volume I. São Caetano do Sul, SP: Ed. Yends.
28. MACHADO, V.; ORTEGA, A. C.; JURADO, S. R. CRIO 2: (2017) Um novo método para a remodelação corporal. II Jornada Acadêmica de Medicina. UFMS/CPTL. UFMS - Campus de Três Lagoas. Scielo.
29. MANSTEIN, H. L.; WATANABE, K.; FARINELLI, W.; ZURAKOWSKI, D.; ROX, R. A. (2008) **Selective Cryolysis:** A Novel Method of Non-Invasive Fat Removal Dieter. Lasers in Surgery and Medicine v. 40, p.:595–604.
30. MANUAL DO BIOMÉDICO. (2020) **Edição digital. 2017.** Scielo.
31. MENDONCA, A. G.; RODRIGUES, R. D.; CORRADI, D. P.; CRUZ, L. B.; MEYER, P. F.; ANTUNES, M. J et al. (2008) Protocolo de avaliação fisioterapêutica em adiposidade localizada. **Fisioter Bras;** (suppl):p.26-31. Scielo.
32. MONTANARI T. (2015) **Histologia: texto, atlas e roteiro de aulas práticas**. 3ª edição. Porto Alegre: Ed. da autora.
33. MORAES J. M.; CAREGNATO R. C.; SCHNEIDER D. S. (2014) Qualidade de vida antes e após a cirurgia bariátrica. **Acta Paul Enferm**. v. 27, n. 2, p.:157-64. Scielo.
34. MORENO, R. (2008) **A beleza impossível** - mulher, mídia e consumo. São Paulo (SP):Ágora.
35. POSSAMAI, C. G. (2013) **Radiofrequência em mulheres sobre o contorno do ângulo cérvico facial.** Tese de Fisioterapia da Universidade do Extremo Sul Catarinense, UNESC.
36. PRADO, W. L.; LOFRANO, M. C.; OYAMA, L. M.; DÂMASO, A. R. (2009) Obesidade e Adipocinas Inflamatórias: Implicações Práticas para a Prescrição de Exercício. **Rev Bras Med Esporte,** v. 15, n. 5.
37. PUGA, A. C. (2016) Instituto de Biomedicina. **Técnicas não invasivas**. [E-book].
38. REZENDE I. F. B.; TOLEDO, D. V. C.; SILVA, L. R. (2015) Distribuição de gordura corporal da região superior do corpo e dos fatores sociais de risco cardiovascular em estudantes do curso de nutrição em Salvador/BA. **Rev. Ciênc. Méd. Biol.,** Salvador, v. 14, n. 3, p. 355-359, set./dez. Scielo.
39. SBBME – **Sociedade Brasileira de Biomedicina e Estética**. (2017)
40. SILVA SIQUEIRA, K., MAIA, J.M. (2019) High-power therapeutic ultrasound for treatment of abdominal localized adiposity—double-blind randomized clinical trial. **Lasers Med Sci** .
41. SOUZA, M. P. (2017) **Biomedicina: da sua criação a sua versatilidade como profissão**. [Artigo Eletrônico].
42. SASAKI G. H., ABELEV, N.; TEVEZ-ORTIZ A. (2014) Noninvasive Selective Cryolipolysis and Reperfusion Recovery for Localized Natural Fat Reduction and Contouring, **Aesthetic Surgery Journal**, v. 34, Issue 3, p.:420–431.
43. SUNG S. C.; HUH, J. Y.; HWANG, J. In KIM, J. B. (2016) **Adipose Tissue Remodeling:** Its Role in Energy Metabolism and Metabolic Disorders. Front. Endocrinol., 13. Pubmed.
44. TOSCAN, N. F.; ZANOL, F. M. (2017) Avaliação comparativa da técnica de lipocavitação focalizada no tratamento de lipodistrofia localizada / Comparative evaluation of ultra-cavitation technique in the treatment of localized lipodystrophy. **Fisioterapia Brasil** v. 18,n.3,p.:329-338.

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