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Shock wave therapy associated with radio frequency in the treatment of abdominal skin flaccidity

Abstract

The skin suffers alterations resulting from chronological aging, photo-aging and substantial changes in body dimensions; thus, aesthetic disorders, such as flaccidity, appear. Currently, there are many treatment strategies with this purpose, and radiofrequency is the modality which presents the best results. However, new therapeutic modes are appearing, and among them is acoustic wave's therapy (ESWT).

Objective: to evaluate the effects of the association of ESWT and radiofrequency in the treatment of abdominal skin flaccidity.

Method: Two reports of women with abdominal skin flaccidity, received the treatment of shock waves associated with radiofrequency. As an evaluation method, images of the morphological alterations of the skin, the Antera 3D (MiraveX) was used, and for the viscoelastic properties of the skin the Cutometer® (MPA 580, Courage) was used. Results: Both volunteers presented evident improvement in relief alterations, roughness and skin texture. Regarding skin viscoelasticity, both cases presented significant results between $p<0.01$ e $p<0.05$ for the variable analyzed with the Cutometer®. However, each variable behaved in a coherent form in terms of the mechanical properties of skin.

Conclusion: the results presented in this study demonstrated the efficacy of the association of ESWT and RF in the treatment of skin flaccidity of abdominal skin; such benefits were evaluated mainly through the use of evaluation tools such as Antera 3D and Cutometer®, which were essential in the understanding of the results in a clear and concise manner.

Keywords: shock wave therapy, radiofrequency, skin flaccidity

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Abbreviations: ESWT, extracorporeal shock wave therapy; BMI, body mass index; RF, radiofrequency; IPL, intense pulsed light

Introduction

Skin flaccidity or laxity comes as a result of chronological aging, photo-aging or substantial changes in body dimensions experience after pregnancy or weight loss. The tissue suffers bio-molecular and structural alterations, causing damage to the collagen and elastin fibers.[1,2] In aesthetics there are a number of invasive and non-invasive treatment strategies, such as: surgery, chemical peelings, intense pulsed light (IPL), laser, and the most common and scientifically proved, radio frequency (RF), all of which have as objective combating, preventing and/or improving the aspect of skin.[2]

Monopolar, bipolar or unipolar RF generates heat in contact with the skin, by means of the passage of the electric field in high frequency, which causes polarization and oscillation of the water molecules. Friction between the molecules transforms electromagnetic energy in heat and thermically induces the contraction and remodeling of the existing collagen, as well as neocollagenesis and neoelastogenesis at a dermal level, without the need of a recovery period and without adverse effects.[2,3]

Nowadays, self-esteem, well-being and quality of life are directly related to beauty, and consequently, the search for new aesthetic treatments has grown exponentially. Aesthetic medicine enjoys the benefits of the technological advances of new electromedical devices which aim to develop new therapeutic modes. Among the new technologies is extracorporeal shock wave therapy (ESWT), indicated for the treatment of unaesthetic disorders, such as cellulite and localized fat. The therapy is also indicated for the treatment of skin flaccidity since scientific evidence demonstrates its benefits in this area.[4–6]

According to Modena et al.[4] ESWT promotes the stimulus of local microcirculation, increase of cell permeability, which leads to the reorganization of the extracellular matrix, with consequent collagen remodeling by the realignment of the dermal fibers, improving the aspect and texture of skin. Therefore, the proposed objective of this study was to present the effects of the association of ESWT and RF in the treatment of abdominal skin flaccidity in two cases with different etiologies.

Material and methods

Case I: RS, a 36-year-old woman, weighing 53.1kg, 1.58m in height and body mass index (BMI) of 21.27k/m², with abdominal skin flaccidity degree 3, caused by two pregnancies.

Case II: KV, 51-year-old woman, weighing 56.6kg, 1.67m in height and BMI of 20.29kg/m², with abdominal skin flaccidity degree 2 caused by chronological aging, however without any pregnancies.

Procedures

Ten session of ESWT were performed, using the equipment Thork® Shock Wave, brand Ibramed® (Indústria Brasileira de Equipamentos Médicos EIRELI.), twice a week, in the abdominal area with approximately 300cm² of area, protocol of 6000 shots, frequency

of 15Hz, energy from 100mJ, plastic tip and as a conductive medium the lotion Loção Neutra Thork® (Thork Neutral Lotion) brand Essencial Cosméticos®. Associated with the ESWT treatment, eight session of bipolar RF of 27.12MHz, using the equipment Hooke® brand Ibramed® (Indústria Brasileira de Equipamentos Médicos EIRELI.), with initial power varying between 60-80W for 1minute of application to reach the therapeutic temperature between 40 and 42ºC and final power of 10-30W for 9minutes to maintain temperature for a total of ten minutes of application in the abdomen. Before the start and after the end of radiofrequency, one minute of application with the cooling device (to cool the tissue) was performed, coupled with the Hooke® equipment, to preserve and protect the epidermis. The treatment was carried out by a specialized who did not take part in the evaluations of the volunteers.

Data analysis

Data analysis was performed by two specialized physiotherapists; baseline, intermediary evaluation (after six treatment ESWT session and two RF sessions), post-treatment evaluation (ten ESWT sessions and four RF sessions) and evaluation with follow up (3months after the end of the ESWT treatment and eight RF sessions). Considering that the objective of the study was to evaluate the effects of ESWT associated with RF, the standardization of the evaluations chosen was to follow the protocol of the ESWT treatment.

An evaluation of skin viscoelasticity was performed by means of markings on the skin in the abdominal region, using the Cutometer® MPA 580 (Courage-Khazaka, Alemanha) equipment.[7] For the analysis of the morphological alterations, such as depressions, elevations, wrinkles and texture of the skin, a photographic device Antera 3D® (Miravex) was used, limiting the evaluation area around the umbilical scar and for the analysis of the images a medium filter was used. For the evaluations, the volunteers were lying down in a climatized environment.[8]

Statistical analysis

The skin changes were compared after six sessions, ten sessions and three months after the last session of treatment. A Lilliefors's normality test was applied. The normal distribution of the sample was verified and a parametric test was applied. One-way variance test (ANOVA) and Tukey post hoc multiple comparison test were used to compare all data ($P<0.05$) with BioStat5.0 software (Mamirauá Institute for Sustainable Development - MISD, Brazil).

Results

In the present study, after the treatment the participant of Case I showed an improvement of up to 50% morphological alterations of the skin, such as in relief, roughness and texture of the skin. In Case II, there was an improvement of about 20% in relation to the aspects of roughness, texture, depressions and elevation of the skin. Both benefits can be seen in the images and analysis of AnteraPro® software (Figure1), after 6sessions, 10sessions and at the 3-month follow-up of the end of treatment (Figure 2).

As observed in Table 1 of the Cutometer® evaluation, both cases presented significant results between $p<0.01$ and $p<0.05$ for the variables analyzed, however, each variable behaves in a coherent manner regarding the mechanical properties of the skin. Case I, represented in Table 1, shows an improvement in skin firmness, for variable R0 obtained a value of $p<0.01$ between baseline, 6 sessions and 10 sessions and follow up; The values of R managed to remain far from the value of 1.

Variables R6 and R7 presented $p<0.05$ and $p<0.01$ respectively, in relation to baseline and the 10 treatment sessions, making evident that there was improvement in viscoelasticity when the value of R6 was lower than 1 and the improvement in skin elasticity when the value of R7 was nearer to 1. In Case II, regarding R0, an improvement in skin firmness, $p<0.01$, was observed in relation to baseline until follow up of 3months after the end of the treatment, that is, the improvement in skin firmness was maintained even after the end of the treatment. Variables R2, R6 and R7 obtained results of $p<0.01$ in relation to the interval from 6 to 10sessions and 10sessions for the follow up of 3 months after the end of the treatment; that is, there was growing improvement in gross elasticity, viscoelasticity and skin elasticity after the end of the treatment, as seen in Table 1.

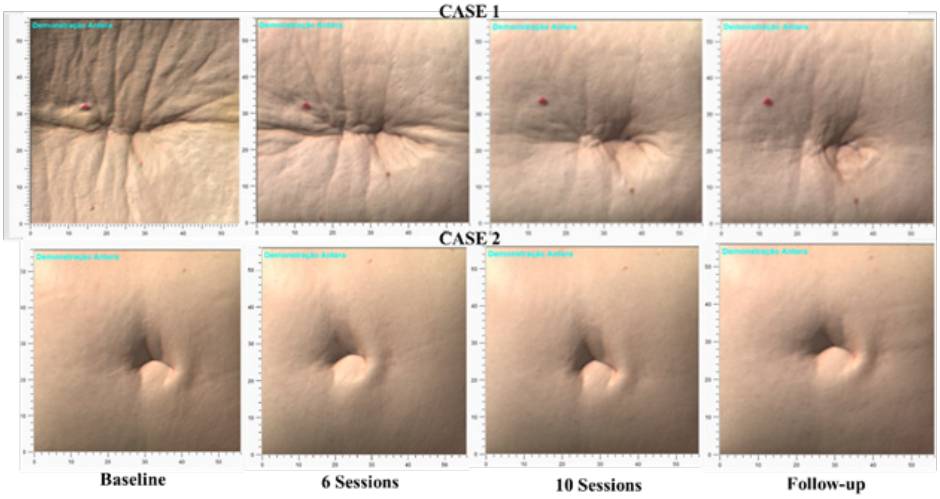

Figure 1 Cases 1 and 2, representation of the improvement of the sagging of the abdominal skin throughout the evaluations with AnteraPro®

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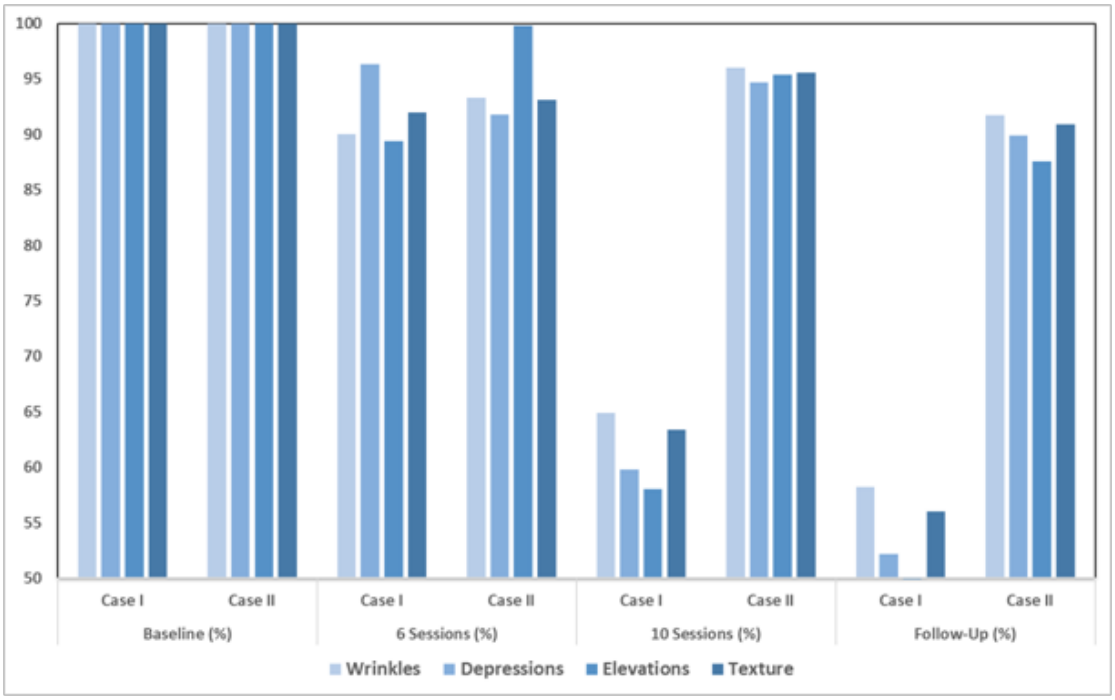

Figure 2 Data collected by the AnteraPro® software, showing evidence of the improvement of the skin after each evaluation for cases I and 2

Table 1 Data of the variable by Cutometer® respectively to cases 1 and 2

Case I

Cutometer Variables	R0	R1	R2	R3	R4	R5	R6	R7	R8	R9
Baseline	0.86 ± 0.06	0.29 ± 0.10	0.66 ± 0.11	0.93 ± 0.06	0.37 ± 0.10	0.38 ± 0.08	0.37 ± 0.14	0.28 ± 0.08	0.56 ± 0.09	0.07 ± 0.01
6 Sessions	0.52 ± 0.02 **	0.11 ± 0.04 *	0.79 ± 0.07	0.55 ± 0.02 **	0.15 ± 0.04 **	0.51 ± 0.18	0.31 ± 0.02	0.39 ± 0.14	0.41 ± 0.03 **	0.03 ± 0.00 **
10 Sessions	0.61 ± 0.03 **↓	0.13 ± 0.07	0.79 ± 0.11	0.60 ± 0.04 *↓	0.16 ± 0.08 *↓	0.71 ± 0.14 *	0.19 ± 0.03 *	0.60 ± 0.11 **	0.48 ± 0.04 ↓	0.00 ± 0.00 **↓
Follow-up 3 months	0.86 ± 0.08 □	0.24 ± 0.10	0.73 ± 0.10	0.93 ± 0.08 □	0.33 ± 0.08 □	0.41 ± 0.13 □	0.27 ± 0.00	0.32 ± 0.10 □	0.62 ± 0.04 □	0.06 ± 0.00 □
Subtitles	**< 0.01	*< 0.05	↓6 Sessions for 10 sessions < 0.01			□10 Sessions for 3 months <0.01				

Case II

Cutometer Variables	R0	R1	R2	R3	R4	R5	R6	R7	R8	R9
Baseline	0.42 ± 0.02	0.05 ± 0.02	0.88 ± 0.05	0.45 ± 0.03	0.07 ± 0.01	0.62 ± 0.08	0.48 ± 0.04	0.42 ± 0.04	0.38 ± 0.04	0.03 ± 0.01
6 Sessions	0.51 ± 0.02 **	0.09 ± 0.02	0.83 ± 0.03	0.54 ± 0.02 **	0.13 ± 0.01	0.58 ± 0.05	0.46 ± 0.07	0.39 ± 0.03	0.42 ± 0.03	0.03 ± 0.00 **
10 Sessions	0.59 ± 0.02 **↓	0.11 ± 0.29 ↓	1.00 ± 0.07 ↓	0.63 ± 0.03 *↓	0.00 ± 0.01 ↓	0.66 ± 0.07 ↓	0.42 ± 0.05 ↓	0.47 ± 0.06 ↓	0.59 ± 0.02	0.04 ± 0.01 **
Follow-up 3 months	0.59 ± 0.03 **□	0.09 ± 0.06 □	0.86 ± 0.10 □	0.63 ± 0.03 *□	0.14 ± 0.03 □	0.58 ± 0.03	0.38 ± 0.06	0.42 ± 0.01	0.51 ± 0.04	0.03 ± 0.00
Subtitles	**< 0.01	*< 0.05	↓6 Sessions for 10 sessions < 0.01			□10 Sessions for 3 months <0.01				

Discussion

The present study proposed the association of Radiofrequency, a well-known therapy in the scientific field for its positive results in the treatment of flaccidity and rejuvenation, with ESWT therapy, which a number of studies have demonstrated as beneficial in the improvement of the aspect of skin, favoring the stimulus of neoelastogenesis and neocollagenesis. Several factors favor skin flaccidity, in Case I, the abdominal skin flaccidity was caused by the increase in tension and skin stretching as a result of pregnancies, with subsequent rupture of collagen and elastin fibers, resulting in stretch marks, increase of roughness, alterations in the relief and skin texture.[8,9]

Already in the Case II, the abdominal skin flaccidity which is caused by chronological aging, a natural phenomenon, physiologically progressive and irreversible, and added by the damage caused by ultraviolet radiation (UV) generates skin aging.[10] In both cases, there was improvement in the appearance of the skin and one of the methods used to evaluate such finding was the Antera 3D® camera and AnteraPro® software.[11] According to Linming et al.[12] there are traditional methods of measuring the texture and roughness wrinkles in the skin used in Cosmetic Dermatology such as optical profilometry, biometry and in some cases even confocal microscopy; however, these tools are less accessible and of high complexity.

Antera 3D® and the software AnteraPro®, were designed to be practical and fast, the analysis of the skin surface is carried out based on multidirectional light obtained by LEDs of different wavelength, which makes these methods more advanced and efficient to evaluated the improvement of the morphologic alterations of the skin, such as roughness, texture, depressions and elevations of the skin, as seen in the present study in both cases after the association of the ESWT and

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RF therapies.[7,11,12] However, currently there is no scientific evidence of its use as an evaluation method for body skin flaccidity; but only for rejuvenation, facial spots, appearance of cellulite and efficacy of cosmetics and healing.[8,12,13]

Another evaluation tool used in the present study was the Cutometer® globally recognized as the standard device to Measure elasticity and other biomechanical parameters of the skin. During the measurement the result is converted in a skin suction curve and variable from R0 to R9 are generated; among these, some are scientifically more relevant and represent clearly the viscoelastic properties of the skin. They are R0, which indicates skin firmness, R2, which indicates gross elasticity, R6, indicating viscoelasticity and R7, indicating elasticity.[14]

The results made evident that both cases behaved and responded in different manners regarding the benefits of the therapies. In both cases, improvement was obtained in the variables of the Cutometer® during treatment, among them skin firmness, which only in Case II was maintained after the end of the treatment.[15]

Aging and pregnancy generate important alterations in skin properties; however, in pregnancy the structural deformations reach a plasticity limit, there is cleavage of the dermal connective tissue, rupture of the elastic fibers and separation of the collagen fibers.[9–11] The patient in Case I presented skin flaccidity degree 4, for which the indication is surgical, by abdominoplasty.

The dermal alterations caused by the effects of plasticity are very difficult to be reversed with the aesthetic treatment and that could explain the reason why the patient in Case I presented improvement in skin firmness during the treatment, but after the 3 months of its interruption the skin returned to the initial State, differently from Case II, in which the skin firmness was maintained 3 months after the end of the treatment.[9,10,16]

In the aging process, there is depletion in collagen and the structural alterations are progressive. The stimulus generated by the aesthetic treatments may excite the functions of the dermal fibroelastic cells to reactivate the synthesis of their products, such as collagen and elastic fibers, to maintain a continuous balance of the mechanical properties.[2,9,10] According to the findings of the present study, this can justify the maintenance of the improvement of skin firmness in the volunteer in Case II. For this and other reasons, RF is very frequently used in facial rejuvenation treatments. According to Beasley et al.[17] RF presents an immediate effect in the temporary change of helicoidal structure of the collagen, and the collagen fibrils present a larger diameter, there is also stimulation of fibroblasts and other substances which contribute to the dermal restructuring in a continuous manner.[17,18] Regarding ESWT, Kuhn et al.[19] demonstrated similar results to RF in a case study of a 60-year-old woman, who received four therapy sessions in the thigh region. The results demonstrated that there was increase in the thickness of the cellular matrix of the dermis, by means of the induction of formation of neocollagen and neoelastina, and with the subsequent histological improvement of the dermis and epidermis.[19]

The two therapies used in the present study presented scientific evidence which prove their safety and efficacy, which associated corroborate satisfactory physiological effects. However, the fact that the two patients presented different results, being subjected to the same treatment protocol, serves as a warning that there is not a pre-established treatment protocol for certain aesthetic conditions; observing that the causes and physiological aspects of these conditions vary. Therefore, professionals must always evaluate the treatment protocols on an individual basis and suggest to patients that maintenance session is performed, according to the therapeutic needs of each patient.

Conclusion

The results presented in this study show the efficacy of the association of RF and ESWT therapies in the treatment of abdominal skin flaccidity of different causes, and that the evaluation tools such as Antera 3D, software AnteraPro and Cutometer® were essential for the comprehension of the results in a clear and concise manner. However, further studies must be carried out with different protocols, individuals and methodologies to enhance the knowledge of the effects of both therapies in the biological tissue in other aesthetic conditions, respecting the causal factors and the individual response of each patient to the treatment.

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None.

Conflicts of interest

Authors Delinocente CPT, Araújo BT, Carvalho MT, and Campos G, declare that there is no conflict of interest. Authors Modena OAD, Silva NC, Grecco C, Moreira GR, Souza JR and Guidi MR declare there is Conflict of Interest, since they are researchers at Ibramed Company, the manufacturer of the device used in the present study; however, all of them declare that the research was not biased in any way.

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