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RESEARCH ARTICLE

EFFECTS OF TECAR THERAPY ASSOCIATED WITH MANUAL THERAPY ON GLUTEAL SKIN FLACCIDITY

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Abstract

Background: A new technology called Tecar therapy, widely used in the orthopaedic area, has been studied in aesthetics in order to treat skin flaccidity. The equipment allows the association of radiofrequency with manual therapy. This study is an experimental research that aims to analyse the effects of the Tecar therapy associated with manual therapy on skin flaccidity of the gluteal region.

Methods: Volunteers were individuals aged between 21 and 54, who presented skin flaccidity in the gluteal region. The sessions/applications occurred once a week, totalling four applications with the TR THERAPY ELITE-6000 BTL™ device pre-set under the following parameters: 500 KHz frequency, 100% duty cycle and 80% power, capacitive mode, in an area corresponding to twelve quarters measuring 7 cm² each, during 60 minutes.

Results: The evaluations were carried out in all the sessions and included metric verification, photographic recording with subsequent photo submission to the AutoCAD software, and photogrammetric analysis. At the end of treatment, the volunteers answered an adapted questionnaire of satisfaction and a global aesthetic improvement scale form (GAIS). The results regarding AutoCAD, metric measurement, and photogrammetry did not present significant statistical differences.

Conclusion: Although the statistical results were not satisfactory despite its limitations regarding sample size, and possibly due to the subjective analysis of the resources used as the evaluation methods. Still, the volunteers reported improvement in the texture and firmness of the skin in the treated region, indicating their satisfaction with the performed treatment.

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Introduction:-

The skin is a complex biological structure, due to its multifactorial nature. Regarding its mechanical properties, the human skin has a viscoelastic behaviour, that is, it presents elastic and plastic characteristics (Dematini et al., 2015). Changes in the mechanical properties of the skin during adulthood include elasticity loss and increased time for skin to return to its original state after a clamping and, over the years, it entails a significant decrease in skin thickness (Cunha et al., 2016).

Flaccidity is considered an unsightly condition of the skin that results from tissue atrophy, resulting in loose appearance, affecting skin and muscles. From 25 (twenty-five) years of age, anelastic and collagen fibres decrease occurs and the process of their collapse begins (Silva et al., 2014). In addition to chronological aging, several factors contribute to the sagging appearance or worsening of the skin conditions, such as restrictive diets, weight loss, liposuction, and post-pregnancy, favouring skin elasticity loss even in young patients (Cunha et al., 2016).

In the last years, the concern with body aesthetics has gained much importance in society, as beauty reflects on self-esteem and quality of life. Nowadays, there are several invasive and non-invasive treatments for aesthetic dysfunctions (Araújo et al., 2015). Action in the treatment of flaccidity ranges from prevention and aesthetic care to the use of resources such as electrotherapy, LEDs, laser phototherapy, and radiofrequency, which have been highlights in the treatment of skin flaccidity (Silva et al., 2014).

Radiofrequency is a type of high-frequency current that generates heat by conversion, penetrating the deep tissue layers and promoting oxygenation, nutrition, and vasodilation. It acts to denature collagen fibres, resulting in their shortening, leading to contraction of redundant connective tissue. When passing through the tissues, the current generates a slight friction or resistance, promoting tissue temperature increase (Tagliollato, 2015).

The treatment consists of exposing the tissue to an electromagnetic wave between 30 KHz and 300 MHz, the most commonly used frequency being between 0.5 and 1.5 MHz. Its energy is applied through two electrodes, an active electrode that causes large current density, causing localized thermal effect on tissues, promoting collagen stimulation, fibrous septa retraction, muscle relaxation, and analgesia. The passive electrode consists of a large contact conductive plate that closes the current circuit, causing the energy to return to the patient (Carvalho et al., 2011).

A well-known type of radiofrequency used in Europe is the Tecartherapy, which is already known in the area of orthopaedic rehabilitation, and has a slightly more current use in aesthetics. It is a type of radio frequency with electromagnetic radiation that generates deep high frequency heat between 0.3 and 1.5 MHz, but these values may vary among manufacturers (Meyer, 2018). According to Ribeiro et al. (2018), the Tecar therapy works through two modes of charge transfer: the capacitive and the resistive modes. The capacitive mode is used in tissues with higher electrolyte content, such as skin and muscles, and the resistive mode in more resistant structures such as tendons, bones, and joints.

The Tecartherapy can be an important tool for the treatment of fibrous tissues, scars, cellulite with fibrous adhesions, the lifting effect in various regions of the body such as glutes, abdomen, and other areas of flaccidity. Furthermore, it allows the association with the technique of manual therapies (Meyer, 2018). According to Silva et al. (2013), the connective tissue, when in contact with the manual techniques, suffer stimuli resulting in morphological adaptations capable of promoting tissue plasticity.

The use of the Tecartherapy associated with manual therapy in orthopaedic dysfunctions has been well studied. The Tecartherapy in combination with the soft tissue technique has its therapeutic effect enhanced by blood perfusion improvement, nutrient supplying, and oxygen delivery to the treated tissue (Ekelem et al., 2019). However, with respect to the use of the Tecartherapy associated with manual therapy in aesthetics is not mentioned in enough studies to prove its efficacy. Therefore, this research aims to analyse the effects of the Tecartherapy in association with a manual therapy to treat gluteal flaccidity.

Patients And Methods:-

The study was characterized as an experimental research that aims to analyse the effects of the Tecar Therapy when associated with manual therapy on skin flaccidity.

The sample selection was made by non-probabilistic convenience and started after the approval of the CAAE (Ethics Committee of the 4.062.746) with protocol number: 29253720.8.0000.5537. The sample consisted of 15 (fifteen) volunteers. To be considered for the study, the volunteers who were all female, aged 21 (twenty-one) to 54 (fifty-four), needed to present gluteal skin flaccidity condition, as well as comprehension capacity, and preserved local sensitivity.

Exclusion criteria applied to all individuals included cutaneous lesions, pregnancy, or no availability to attend sessions. At the end of the selection, according to the exclusion criteria, the sample ended up with seven (7) volunteers.

The instruments used to collect survey data were a mobile phone camera (IPHONE, APPLE INC., USA), a directed radiofrequency device (TR THERAPY ELITE 6000, BTL™, Bulgaria) registered before ANVISA under number #80991690005, the Global Aesthetic Improvement Scale form (GAIS) by Narinset al. (2003), a commercial computer-aided design and drafting software application (AUTOCAD 2015, AUTODESK™, USA), photogrammetry, and a satisfaction questionnaire adapted from Segot-Chicquet al. (2007). Based on this questionnaire, an adapted version was prepared for the skin appearance comparative evaluation before and after the use of Tecartherapy associated with manual therapy, which analysed the presence of reactions after application (Rhoda et al., 2003).

After sample selection, the individuals were oriented regarding research objectives, treatment benefits, and the procedures performed in this study. They signed the free and informed consent form (TCLE) and then were submitted to the metric measurement, followed by early photographic recording and Tecartherapy application in association with manual therapy. More photos were taken shortly after the session, then sent for software (AutoCAD) and photogrammetric analysis. The volunteers were evaluated and reassessed during all sessions, and only in the last session the adapted satisfaction questionnaire and the global aesthetic improvement scale form (GAIS) were used.

The photographic record was performed in orthostatism, with posterior/lateral views (right and left) and the volunteer was asked to perform a 90° shoulder flexion for photo taking. The same camera was used for all photos. With the aid of a tripod, the camera was positioned 90 cm of height from the floor, a distance of 50 cm of the volunteers and 80 cm from the wall and photos of the left and right gluteus were taken during and after radiofrequency treatment.

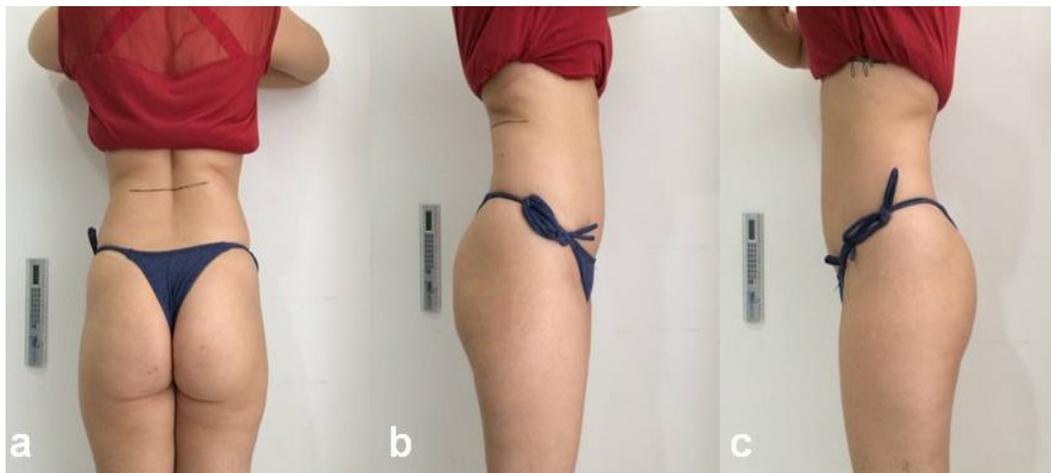


Figure 1:- Photographic records with posterior, lateral right, and left views.

The application was performed in the ventral, right, and left lateral decubitus, and the neutral electrode was positioned on the abdominal and hip region, respectively. The conductive cream supplied by the manufacturer, suitable for use with such radiofrequency device, was applied, and with the capacitive applicator between the index and the middle fingers, a sliding movement was performed from the gluteal fold upwards.



Figure 2:- Positioning of equipment.

The skin temperature was monitored through volunteer reporting and measured with a digital thermometer (BENETECH). The set parameters were the following: capacitive mode, 500 KHz frequency, 100% duty cycle and 80% power. At the desired temperature, the application in the region was maintained for 4 (four) min in an area corresponding 7 cm², resulting 12 quadrants, totalling an average application time of 60 min. The treatment consisted of one session per week, totalling four sessions.



Figure 3:- Quadrant drawing on area for radiofrequency application.

At the end of each session, the photos were sent to an examiner who analysed the gluteal fold measurements using the AutoCAD software. The analysis was carried out as follows: a ruler was positioned laterally to the hip of the volunteer as reference, then the measuring software was used, measuring the gluteal fold on the right and left sides. The marking performed in the posterior waist region of the volunteer was also used as parameter.

If the distance from the gluteal fold to the line marked at the volunteer's back (shown in the arrow below) decreases, it implies a reduction in the measure of the gluteal fold, otherwise, an increase in the measure of the gluteal fold is obtained. A transverse line was drawn 5 cm above the umbilical scar and marked with the aid of a FIBER™ tape measure, by wrapping it around the waist of the volunteer and marking a second point. From this second point, a line was drawn for the measuring of the gluteal fold from the left and right side.



Figure 4:- Software analysis of the gluteal fold.

The photos obtained in the evaluations were sent in Word format to the evaluators. This evaluation is called photogrammetry and according to Mendonça et al.(2009), the objective is to analyse possible signs of clinical improvement, and to verify the effects of manual therapy associated with manual therapy on skin flaccidity through photo comparison. Forty (40) photogrammetric questionnaires were sent to professionals from the dermatofunctional area, out of which 20 (twenty) questionnaires were answered.

The data collected during the evaluations were recorded in an Excel spreadsheet and then submitted to the descriptive statistical analysis of the Service Statistical Package for Social Science software (SPSS), version 17.0 for Windows. The descriptive statistics were presented in the form of tables. Data were checked for normality with the Kolmogorov-Smirnov test. The paired t-test was applied to compare the values between the initial and final evaluations. The level of significance of the obtained results was 95% with $p < 0.05$.

Results:-

Initially, the group consisted of 15 (fifteen) female volunteers, with a mean age of 37 (thirty-seven) years. Due to incompatibility of time availability for the sessions as one of the exclusion criteria, the study was completed with 7 (seven) volunteers. The number of volunteers in the study (7), as well as the minimum (22.0), mean (37.0) and maximum (54.0) ages within the group, presenting a standard deviation of ± 14.04 .

Table 1:- Number of volunteers and age.

Number of volunteers	Minimum age (years)	Maximum age (years)	Average age (years)	Standard Deviation
7	22.0	54.0	37.0	14.04

According to the paired t-test analysis, the measurements of the left and right gluteal fold (44.60 and 45.13 cm) submitted to the intervention protocol did not present statistical differences, neither immediately after (45.35 and 46.07 cm) nor at the end of the 4 sessions (47.23 and 47.84 cm), considering that they presented a standard deviation > 0.05 .

Table 2:- Mean values of the left and right gluteal fold measurements before and after the application of Tecartherapy (service 1 and 4).

Mean of measures	LGF1* (cm)	RGF1* (cm)	LGF4* (cm)	RGF4* (cm)
Before application	44.60	45.13	46.60	47.17
After application	45.35	46.07	47.23	47.84

*LGF1- Left gluteal fold in the 1st session, LGF4- Left gluteal fold in the 4th session, RGF1- Right gluteal fold in the 1st session, RGF4- Right gluteal fold in the 4th session.

Another method of evaluation used in the study was the metric measurement which, associated with the paired t-test, did not obtain satisfactory statistical results either, presenting a standard deviation >0.05 . There, the left and right gluteal fold measurements (34.71 and 35.71 cm) submitted to the intervention protocol did not present statistical differences both immediately after (35.28 and 35.75 cm) and at the end of the 4 sessions (35.42 and 36.0 cm).

Regarding the adapted overall aesthetic improvement scale form, the subjects were asked about their impression regarding the appearance of the treated area, that 57% of the volunteers considered the treated region presented better appearance, 28.6% considered the treated area much better, and 14.3% considered the treated region far better, so there was no report of no improvement as noticed by the volunteers.

Table 3:- Volunteers response according to the aesthetic improvement scale.

Global Aesthetic Improvement Scale	Absolute frequency	Relative frequency (%)
Better	4	57.1
Much better	2	28.5
Far better	1	14.3
TOTAL	7	100.0

On the photogrammetric analysis of the posterior profile improvement, it was possible to observe that 54.1% of the evaluators noticed improvement of the treated region, and 45% did not report improvements.

As of the right lateral profile photogrammetric analysis, 66.3% of the evaluators pointed improvement of the treated area, corresponding to the absolute frequency of 65; and 33.7% reported no improvement of the treated region, corresponding to an absolute frequency of 33.

In the left lateral profile photogrammetric analysis, 55.1% of the evaluators visualized improvement in the region, which corresponds to the absolute frequency of 54; and 44.9% did not observe improvement, which corresponds to the absolute frequency of 44.

The Tecartherapy is a new technology in the aesthetic market, so the volunteers were questioned about the effects and reactions that occurred after the application of this type of radiofrequency. Regarding the presence of localized skin hyperaemia, 42.9% of the sample noticed localized hyperaemia, 28.6% of the sample observed hyperaemia in all sessions, and 28.6% of the sample did not report hyperaemia.

Regarding the hyperaemia observed by the volunteers during the applications of the Tecartherapy radiofrequency, 28.6% (absolute frequency of 2) reported not having observed hyperaemia; while 42.9% (absolute frequency of 3) reported hyperaemia.

Regarding the duration of hyperaemia in volunteers, 42.9% of the sample said that local hyperaemia disappeared shortly after application, 57.1% said that the localized hyperaemia lingered for about 1 hour.

As for slight shock sensations during the applications, 85.7% of the volunteers reported not feeling them, and 14.3% reported feeling light shocks.

In regard to the volunteers' perception of the fluid retention decrease after radiofrequency application, 71.4% of the sample reported decreased fluid retention and swelling, and 28.6% did not notice improvements in this aspect.

As for the perception of clothes fitting, 85.7% of the sample did not notice looser clothing and 14.3% perceived looser clothing from the second week.

The volunteers were questioned if any difference regarding skin firmness was noticed, 85.7% of the sample (absolute frequency of 6) considered the skin firmer when comparing current skin conditions with conditions perception two months before the application; and 14.3% (absolute frequency of 1) considered the skin much firmer when compared with its firmness two months before the application.

With regard to the perception of firmer glutes, 85.7% of the sample noticed firmer glutes from the fourth week, and 14.3% saw firmer glutes from the first week.

When questioned about skinmarks after the applications, and their duration, there was no report by the volunteers.

The data obtained through the adapted satisfaction questionnaire were analysed and it was observed that 100% of the sample were satisfied with the treatment.

As for the evaluation of the volunteers concerning the attribution of an overall perception of treatment results, 57.1% stated it was an excellent treatment, 28% said it was a very good treatment, 14.3% found it a good treatment. The alternatives “weak treatment” and “would not indicate this treatment to anyone”, were not indicated.

Table 4:- Tecar Therapy treatment evaluation by the volunteers.

Treatment evaluation	Absolute frequency	Relative frequency (%)
Excellent	4	57.1
Very good	2	28.6
Good	1	14.3
TOTAL	7	100.0

Discussion:-

A major advantage of Tecartherapy radiofrequency is the possibility of its association with a manual therapy. The ability to change the fascia structure through manual therapy may be responsible for its traction and lifting effect, since it promotes the biological effect of increasing collagen distensibility when associated with radiofrequency (Meyer, 2018; Silva et al., 2013).

Manual therapy has the basic principles of muscle relaxation, nutrition, and tissue oxygenation, as well as circulation improvement and lymph nodes' drainage flow. According to the pressure and speed applied with the technique, it is possible to promote capillary dilation by increasing the region's blood flow, tissue traction in the chosen direction and the re-education of this position through proprioceptive stimuli. All these effects added to the radiofrequency effects are important when the objective is to decrease gluteal regions sagging (Gondim and Almeida, 2018).

In the study conducted by Silva et al. (2013), with a sample of 40 (forty) volunteers, whose objective was to analyse the effects of manual therapy on facial skin flaccidity, it was concluded that manual therapy presented some satisfactory results, also being used as a dermatofunctional physiotherapy resource.

In the results found in this study that sought to demonstrate the association of radiofrequency in the form of Tecartherapy with manual therapy, it was noticed that the majority of the quantitative results were not as positive as the qualitative results regarding the description of the volunteers' results and their satisfaction, which may have been due to a large influence of the small number of the sample and also the methodological limitation of the study, which did not present a control group nor compared the use of Tecartherapy with and without associated manual therapy.

One of the tools used in this study was the AutoCAD software. According to Amorim (2005), the AutoCAD program has been widely used for research in physiotherapy, as it makes it possible to quantify ADM digital photography, providing visual feedback to the patient. Wong et al. (2012) reported that the reliability of the results may have been enhanced by the fact that the digital photographs analysis was performed with AutoCAD. However, in this study, the results of the gluteal fold analysis with AutoCAD did not obtain a significant statistical analysis response, probably due to the subjectivity of the analysis and low sample number ($n = 7$), thus interfering with the statistical results. However, in the results obtained through volunteers' response concerning the global aesthetic improvement scale, it was observed that after radiofrequency application, the volunteers noticed improvement in the texture of the treated region and there were no negative perception reports.

These results corroborate with a study carried out by Bohnert et al. (2017) in which the use of the Global Aesthetic Improvement Scale (GAIS) showed analyses reliability regarding the use of radiofrequency for skin texture improvement, demonstrating a statistically significant increase in the skin condition enhancement of subjects with initial reports of irregular skin texture.

Regarding photogrammetry, a tool which has been previously used in radiofrequency studies concerning tissue sagging analysis, it is assumed that the changes caused by radiofrequency have not been completely observed, since photographic analysis alone hinders the assessment accuracy and interpretation (Silva et al., 2017). In this study, the photogrammetric results of the photos seen in the right lateral profile angle were more satisfactory (66.3%), probably because from a lateral perspective, flaccidity of the gluteal region may be better visualized, thus justifying the best results described by the evaluators, which is in line with the findings by Bravo et al. (2013), which showed improvement in gluteal region flaccidity, demonstrated through photographic records of lateral profile before and after 30 days of radiofrequency treatment.

Regarding the sensations reported by the volunteers, hyperaemia was present in the answers described in the questionnaires, but these are part of the routine of any application of radiofrequency applied to skin sagging treatments. The increase in temperature in the Tecar therapy treatment is caused by the movement of electrolytes along the tissue, which propagates to skin surface. This thermogenesis causes a biostimulating action and produces a vasodilation with increased blood and lymphatic circulation through the stimulation of nerve endings and chemical mediators. The cellular oxygenation is linked to vasodilation and consequent increase in blood flow, thus increasing the supply of oxygen through the bloodstream. Therefore, vasodilation and hyperaemia arise as a consequence of the thermal effect, in which vasodilation promotes an increase in local peripheral circulation, generating hyperaemia of the skin. The hyperaemia only occurs with long and high intensity applications (Fonseca et al., 2018)

Regarding the duration of hyperaemia, Bravo et al. (2013) reported that the only side effect found in volunteers in treatment with gynoid lipodystrophy using radiofrequency was a moderate to severe erythema, with a maximum duration of one to two hours. On the other hand, Bohnert et al. (2017) stated that during treatment, several volunteers presented mild erythema after application, which ceased within a few hours. Silva (2017), in his study on the efficacy of the radiofrequency associated with vitamin C in facial rejuvenation, observed that all participants presented controlled hyperaemia during radiofrequency application; however, the face redness disappeared hours after treatment. In this study, most volunteers reported that hyperaemia disappeared an hour after application (Bohnert et al., 2018; Bravo et al., 2013).

According to Bravo et al. (2013), RF works through two action mechanisms: producing dermal heating and vasodilation. This thermal injury activates an inflammatory cascade and stimulates the fibroblasts' collagen synthesis through neocollagenesis, promoting dermal thickening. The vasodilation leads to hyperaemia and lymphatic drainage of fatty tissue and the association of these mechanisms in the dermis and in the subcutaneous tissue favours the skin appearance improvement.

Carvalho et al. (2011) report that temperature, when increased above the physiological level, facilitates vasodilation with capillary opening, favouring tissue trophism, and reabsorption of excessive intracellular fluids, increasing circulation and promoting nutritional gain of oxygen, nutrients and trace elements to the tissue, which facilitates the drainage of toxins and free radicals. This explains the decrease in fluid retention and swelling, as 74.1% of the volunteers observed improvement in this aspect, as well as improved skin texture, in which 85.7% noticed firmer skin, and 14.3% found skin stronger.

This study of the radiofrequency combined with manual therapy in gluteal cutaneous flaccidity promoted satisfaction to all the volunteers, which coincides with the prospective study carried out by Bohnert et al. (2017), which analysed the effects of radiofrequency on facial skin texture. In their study, satisfaction questionnaires were applied one month after the application, and results demonstrated that 82% of the volunteers were satisfied with the treatment.

According to Fonseca (2018), the results in his study showed unanimity when two (2) physicians, three (3) physiotherapists, and three (3) beauticians were interviewed, highlighting the application of radiofrequency as an effective treatment for tissue flaccidity, corroborating with the findings of this research, despite its limitations regarding sample size and possibly due to the subjective analysis of the resources used as the evaluation methods.

Conclusion:-

Thus, it is understood that Tecartherapy is a radiofrequency modality that improves appearance of cutaneous aspects, minimizing the effects of tissue flaccidity.

Declaration of Conflicting Interests:

The Author(s) declare(s) that there is no conflict of interest.

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