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Cellulite Treatment With Electrotherapeutic Combinations: Cryolipolysis, Microcurrents, LED And Ultrasound N

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Abstract:
Cellulite is a multifactorial condition present in 80% to 90% of post-pubertal women and is one of the most intolerable aesthetic imperfections. It is a morphological alteration of the integumentary tissue, directly interfering with self-esteem. There are several theories about the pathophysiology of cellulite, and several different therapeutic regimens have been developed, from topical treatments to mechanical or electrotherapy-based devices. In this brief review, we summarize the scientific scenario to determine the clinical evidence regarding the safety and efficacy of cellulite treatment options. Clinical protocols and the author's experience using a combination of external procedures are also discussed. Therapies such as ultrasound and shock waves have shown improvements in cellulite and a good safety profile, but the combination therapy red LED, microcurrent, plate cryolipolysis and 40 kHz ultrasound have demonstrated the most beneficial results in cellulite reduction. Although there is a lack of scientific evidence for treatments that improve cellulite, future emerging options and their combination may pave the way to eradicating this aesthetic concern,
Objective*: The objective of this work was to review the literature on cellulite and the main electrotherapeutic resources used, to demonstrate the effectiveness of the technique that associates red LED before the cryolipolysis technique in a mobile handle and association with microcurrents and finishing with low frequency ultrasound in the licus system in the treatment of cellulite, reducing edema, inflammation and decreasing adipose tissue in addition to toning the dermis with the presentation of clinical cases.*
Materials and Methods*: In this study, we performed a comprehensive review of all scientific articles available and indexed in PubMed and Web of Science in the last 20 years about this technology and its effects on cellulite. We discussed the scientific evidence available in clinical studies and analyzed the effects and possible mechanisms of action of LED, cryolipolysis, microcurrents and the use of 40 kHz ultrasound in cellulite. The treatments were performed with LED at 4 joulles per cm2, cryolipolysis technique with mobile plate and associated microcurrents, with intervals for reperfusion. We used 4 series of 5 minutes of freezing and in the intervals 3 minutes for return of circulation, that is, reperfusion without injury, and finished with 40 kHz ultrasound at 0.3 watts/cm2 for 2 minutes per cm2. We demonstrated the result after 4 sessions.*
Conclusion: *In the author's opinion, a combined approach where combined approaches are used strategically and in a staggered manner to produce synergistic results has the best clinical outcome. For example, the use of red LEDs prior to the combination of microcurrents simultaneously with cryolipolysis and finishing with 40 kHz ultrasound in a weekly LICUS system can result in improvements in severe cellulite in approximately 2 months. More large-scale studies, particularly regarding combined approaches, need to be conducted to evaluate the long-term results of cellulite therapies in terms of safety, efficacy, and patient satisfaction. improve the appearance of cellulite, sometimes to a satisfactory degree, but never eradicate cellulite, as this involves extensive remodeling of the tissue. potential to be effective in lysing subdermal collagen, such as that seen in the dermal septa (the underlying cause of cellulite). References Despite multiple therapeutic approaches attempting to treat cellulite, no procedure has proven to be successful in the long term, requiring weekly or biweekly maintenance of treatment*

Keywords: *cryoliolysis, adipose tissue, cellulite; ultrasound, microcurrents, aesthetics.*

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I. Introduction

Concern about physical appearance and the relentless pursuit of body image satisfaction have emerged as significant areas of interest in contemporary society. This is largely due to the beauty standards propagated by the media. However, several skin disorders, including gynoid lipodystrophy, commonly called cellulite, can lead to body dissatisfaction. It directly interferes with self-esteem, with important psychological and aesthetic consequences. According to the literature, cellulite appears to affect 80 to 98% of young and adult women

(Martins; Ruiz-Silva, 2022). Cellulite is a perceived change in the topography of the skin, predominantly found in areas abundant in adipose tissue, such as the hips, buttocks, thighs, and abdomen. Contrary to popular belief, the etiology and pathophysiology of cellulite remain far from consensus or well-established understanding. Despite the wide range of scientific articles (Martins; Ruiz-Silva, 2022). Despite exploring various types of treatment, our knowledge about the actual causes and pathophysiology of cellulite remains limited, and this lack of understanding about the actual etiology of cellulite directly influences the selection of appropriate treatments that can address both the aesthetic and inflammatory aspects of the condition. Several treatment methods, including electrophysical agents such as electrical currents, radiofrequency, ultrasound, and photobiomodulation, have been tested. However, the questionable methodological quality of many studies complicates the determination of effective treatments for cellulite. Despite the expansion of the aesthetic industry and the concerted efforts to align treatments with scientific advances, Longano et al. (2024) highlighted a concern in their systematic review. They noted a lack of consistent methodology to quantify non-invasive fat reduction across all studies analyzed. The pathology is characterized by alterations in adipose tissue and microcirculation that result from blood and lymphatic disturbances causing fibrosis of the connective tissue. The term Cellulite was mischaracterized between 1980 and 2000 by Ulrich and Ciporkin. According to Ulrich, the Latin word cellulite is used erroneously since this word simply means inflammation of cells, but cellulite will always be inflammatory in all its degrees (Martins; Ruiz-Silva, 2022)

The theory of chronic inflammation, ovarian hormones are important for the integrity of collagen and for the distribution and storage of adiposity (Au, 2016)

Draelos, 2005, a chronic inflammatory response after the menstrual cycle leads to the deterioration of the dermal collagen mesh. Changes in the endometrium are caused by metalloproteases, including collagenases and gelatinases, to produce bleeding.

Collagenases destroy collagen and Gelatinase B and are associated with the influx of inflammatory leukocytes. In addition to regulating the reproductive and metabolic functions of the body throughout the life of individuals, hormones (Bereshchenko, 2018)

While androgens are primarily anti-inflammatory, estrogens can act as pro- and anti-inflammatory, depending on several factors, such as the type of immune response and variability in the expression of different isoforms of the estrogen receptor (ER). The levels of pro-inflammatory markers interleukin-6 (IL-6), IL-1 and TNF-a increase significantly in menopausal and post-hysterectomy women, and prostaglandin E2 synthesis decreases (Bereshchenko, 2018).

Emanuele, 2010, described the polymorphisms of the angiotensin-converting enzyme and its association with the presence of cellulite. The author found that patients with the D allele of the enzyme increase the risk of developing cellulite due to increased production of angiotensin II in subcutaneous adipose tissue. (EMANUELE, 2013)

The classification of this condition, which continues to be widely used today, depends mainly on its mattress phenomenon, colloquially known as orange peel or cottage cheese appearance. This is characterized by dimpling of the skin. In grade 1, there are no signs of the orange peel appearance when the person is standing or lying down. The orange peel appearance only becomes apparent after a pinch test. In grade 2, the orange peel appearance appears spontaneously only when the woman is standing, but not when lying down. In grade 3, the orange peel phenomenon is evident even when the woman is in a resting position (la Casa; 2013; Martins; Ruiz-Silva; 2022).

Over the past 20 years, several studies have been published that have evaluated the appearance of cellulite after treatment with one or more electrophysical agents. While many authors consider cellulite merely an aesthetic disorder, related to gender, due to the orientation of the fibrous septa, we propose a different perspective. Given that the pathophysiology of cellulite is not well established.

The author and collaborators in 2022 published a study aimed at investigating the hypothesis that the more heterogeneous the tissue pattern analyzed by infrared thermography, the more severe the degree of cellulite. Forty female participants were selected and 60 thighs were analyzed by clinical anamnesis and infrared thermography. Classical visual analysis was correlated with tissue heterogeneity measured by thermography. In the study, we present a simple method based on infrared thermography that can be adopted in any aesthetics office with a correlation of 0.92 with the classic visual assessment, but, in addition, it can be very useful for the clinician to decide which treatment will be adopted, that is, an aggressive and inflammatory approach such as radiofrequency or shock wave therapy or an anti-inflammatory approach such as photobiomodulation, depending on the inflammatory state of cellulite (Martins; Ruiz-Silva, 2022)

Cellulite is different from generalized obesity because with obesity, adipocytes undergo hypertrophy and hyperplasia; Cellulite is characterized by large, metabolically stable adipocytes that are limited to lower areas of the body (e.g., pelvis, thighs, and abdomen. (Martins; Ruiz-Silva, 2022)

The phenotype of this condition is distinct, with the skin topography changing to a surface that resembles an orange peel. This is due to the herniation of subcutaneous fat lobules through the dermohypodermal junction,

where fibrosis of the collagen septa leads to their shortening and ultimately retraction, which causes the depressions that characterize cellulite. Although several factors are known to contribute to the development of cellulite (gender, genetics, lifestyle; (Nkengne, 2013) the exact pathophysiology is not understood. The most prevalent models that have been proposed range from vascular/inflammatory to hormonal and/or structural causes.

Physical agents Energy delivery devices

Radiofrequency The devices RF devices deliver thermal energy to the dermal/subcutaneous skin plane via electrode(s). By raising the tissue temperature in the target area, collagen denaturation, remodeling, and neocollagenesis occur, apoptosis is stimulated, and lipolysis is also triggered. Depending on the electrode or generator configuration, RF devices come in several iterations, starting with the first generation (e.g., unipolar, monopolar, and bipolar) to the latest generation (e.g., devices with controlled cryotherapy). Some RF devices also integrate other energies into their technological design, such as infrared light, vacuum suction, and pulsed electromagnetic fields (Sadick, 2007; Sadick and Rothaus, 2016a, 2016b; Sadick 2005; 2014; 2019). In my opinion and based on clinical experience, the use of Radiofrequency is only justifiable in specific applications aiming at the fibrinogenic effect, which is the breaking of the triple helix of collagen (lysine, proline and glycine) in cases of fibrosis and adhesions that are commonly confused with cellulite. (Ruiz-Esparza, 2006).

The indiscriminate and incorrect use of radiofrequency generates more fibrosis and increased inflammation, generating more blood extravasation, more edema and more compression of compartments in the lower limbs.

Laser and light

Depending on their wavelength, laser and light devices emit energy into the dermis/subcutaneous plane; by heating the local tissue, they can stimulate collagen remodeling and increase microcirculation, which can improve or worsen the appearance of cellulite. The impact of these devices is not very substantial in terms of adiposity or even rupture of the fibrous septa that characterize cellulite, but they can improve the appearance of the skin and smooth the surface.

Most articles use a minimally invasive side-firing fiber of 1440 nm Nd:YAG laser for cellulite (DiBernardo et al., 2013, 2016). This is not effective.

In our clinical practice, we use red LEDs of 650 to 680 nm with effective results. The reduction in adipocyte content, anti-inflammatory effect, and decrease in edema are consequences of the photoexcitation process of cytochrome c oxidase in the mitochondrial respiratory chain. The results obtained in different studies demonstrate the effectiveness of LLLT in reducing body measurements (Jankowski et al. 2016). A randomized controlled study published by Caruso et al.-Davis in 2011 shows the effect of LLLT in reducing the circumference of the abdominal region (n=311). The data show a statistically significant effect, with an average of 0.4 to 0.5 centimeters of reduction in each treatment session, but noted that, although this treatment offered a statistically viable reduction in waist circumference, the mobilized fat should be metabolized through physical activity. (Caruso, 20110

Podichetty & Bourassa, 2010, demonstrated from a retrospective study of 311 patients, an average loss measured from a single treatment session of 0.55 centimeters

Acoustic wave therapy

Acoustic wave therapy (AWT) is another energy-based therapy, where pressure waves are transmitted to the subcutaneous tissue and promote activation of mast cell degranulation, improve local blood flow, allow lymphatic drainage and stimulate the production of new collagen. Two types of shock waves have scientific efficacy because they are ballistic, electromagnetic shock waves and pneumatic shock waves (Knobloch and Kraemer, 2013; 2015; Nassar et al., 2015).

Shock waves produce two basic effects: a direct (primary) generation of mechanical force, and another indirect (secondary) effect of mechanical force called cavitation. During the tensile phase, the tensile forces of the wave exceed the dynamic tensile strength of the water (or interstitial fluid), generating cavitation.

It produces a biological response at the tissue level, including the induction of neovascularization associated with increased expression of growth factors (eNOS, VEGF, PCNA and BMP, etc.).

Increased synthesis of endothelial nitric oxide (eNOS) and endothelial growth factors (VEGF), proliferating cell nuclear antigen (PCNA), reflected in the proliferation of endothelial cells, bone morphogenetic protein (BMP-2) among others, changing the concept of action based on a purely mechanical mechanism.

Siems and collaborators evaluated oxidative stress by the concentrations of malondialdehyde (MDA) and protein carbonyls in blood plasma, which decreased after the application of shock waves, proving their anti-sclerotic effect. Their concentrations are double in people with cellulite compared to normal controls.
Lipid peroxidation (LPO) is released, which is an important antisclerotic effect.

Expression of angiogenesis and lymphangiogenesis-stimulating factors such as VEGF (vascular endothelial growth factor) was not induced by SWT.

Ultrasound with the LICUS technique – Continuous Low Intensity Ultrasound

Using ultrasound does not matter the frequency, the important thing is to use an intensity of 0.3 watts/cm2 in continuous mode. The human body is overly sensitive to mechanical impetus and minimal vibrations of ultrasound in LICUS. It has a neuromodulatory effect, central and peripheral, and plays a significant role in activity, suppression and proliferation, at low intensities proliferation (Uddin, 2021),

Increases NO (nitric oxide), activates molecular and cellular pathways that lead to cell differentiation and activate transcription factors, increases macrophage migration and increases Ca gradient in the membrane, activates fibroblasts and healing, at low intensities (Lucas, 2020; Draper, 2020)

The property of cavitation and microtransmission always in continuous cycles of compression and reflation of microbubbles within inert fluids, leading to localized stress and loosening of the matrix and cell membrane (Uddin, 2021)

In the 2021 systematic review we have demonstrated increased cellular nutrition and oxygenation, anti-inflammatory, angiogenesis, increased NO with 0.25 w/ cm2, Sonophoresis 0.3 w/cm2, Healing 0.3 w/cm2, capillarization and myofiber formation, Pain reduction 0.4 w/cm2 (Uddin, 2021)

Increase in mitogenic factor C ERK/MARK (Lucas, 2020)

. Cryolipolysis using the moving handle

Moving handle techniques associated with beta-adrenergic stimuli promote the biogenesis of mitochondrial cristae (Martins; Ruiz-Silva, 2021; Ruiz-Silva, 2023; (Ruiz-Silva; Moleiro; Rodrigues; 2024; Ruiz-Silva; Moleiro et al. 2024). Cold stress or beta-adrenergic stimulation activate PERK, which phosphorylates N-acetylglucosamine transferase (OGT). OGT phosphorylates TOM70 at Ser94, increasing the import of the MIC19 protein into mitochondria, promoting cristae formation and respiration. This activates the transformation of white adipose tissue (with many lipids and few mitochondria) into beige adipose tissue (with few lipids and many mitochondria) (Ruiz-Silva; Moleiro; Rodrigues et.al, 2024)

Through cryolipolysis, the multiplication of healthy mitochondria is activated without a predominance of survival factors with anti-apoptosis proteins, through the mobile cryolipolysis handle, generating the activation of the MICOS ridge organization system, through the translocation of MIC19 and outer membrane translocation receptors 70. Beta-adrenergic stimuli also promote the biogenesis of ridges. The great secret to treating cellulite is to change this mitochondrial characteristic through fission (Yau, 2020; Martins; Ruiz-Silva, 2021; Ruiz-Silva, 2023; 2023; 2024). The association of cold with the stimulation of the sympathetic nervous system through electrotherapy promotes activation of the PERK and Micos systems. The action of freezing and simulating physical activity through micro-current (release of hormones similar to physical activity) after lipolytic stimuli (electrolipolysis) finds an environment with many lipid droplets that influence the organization of the cristae; Mitochondria perform β-oxidation of fatty acids, however, when stimulated by cold, drastic changes in morphology occur due to activation of PERK; (Gallardo-Montejano, 2021)

Cristal density increased dramatically after cold exposure, forcing the overexpression of perilipin 5 (PLIN(5). This increase in ridge density may be driven by PERK-dependent ER stress (Latorre-Muro et al., 2021). Microcurrents or TCM, Cellular Microtherapy consists of the application of low-intensity (μA) and low-frequency currents similar to the endogenous electric fields generated during tissue repair systems (Ruiz-Silva, 2006; 2016; 2024; Xu, 2021; lee, 2024).

The density of the ridges increased dramatically after cold exposure, forcing the overexpression of perilipin 5 (PLIN(5). This increase in ridge density can be driven by PERK-dependent ER stress (Latorre-Muro et al., 2021). Microcurrents or TCM, Cellular Microtherapy consists of the application of low intensity (μA) and low frequency currents similar to the endogenous electric fields generated during tissue repair systems (Ruiz-Silva, 2006; 2016; Xu, 2021; Lee, 2024).

Microcurrents

In inflamed adipose tissue, the low concentration of endogenous electric current in the tissues reduces the oxygen supply, decreasing the arrival of growth factors, oxygen generating hypoxia and inhibiting collagen synthesis (Ruiz-Silva, 2006; 2016; Xu, 2021; Coy, 2022). Microcurrent compensates for the bioelectricity that is decreased in hypoxic and inflamed tissue (Ruiz-Silva, 2006; 2016; Xu, 2021; Coy, 2022) generating ATP and Mitogenesis. The presence of microcurrent generates a constant intensity current, increased electrical flow, dissociating the water molecule, hydrogen and hydroxyl ions are formed around both electrodes. The hydrogen that leads to the creation of ATP, it follows that, as a residual effect after the microcurrent stimulator is turned off, ATP production continues at the site this ATP formation can be explained through Mitchell's chemiosmotic theory (Cheng, 1985, Ruiz-Silva, 2016). Ruiz-Silva in two theses prescribes 0.1 to 0.5 Hz with an intensity of 150 uA, from 40 minutes to 1 hour of application, current with an intensity of 150 μA, with a biphasic, symmetrical,

balanced square waveform. (Ruiz-Silva, 2006; 2016; 2024), promote anti-inflammatory effects, oxygenate, increase collagen, toning the tissue and increase the number of mitochondria

Norepinephrine secretion increases, binding to the β3-adrenoreceptor (β3-AR), which in turn converts ATP into cAMP in adipocytes (Noites, 2017), therefore MCT induces lipolysis throughout the stimulation of the postganglionic sympathetic neuron (Vilarinho et al. 2022; Couto; Ruiz-Silva; 2010; Ruiz-Silva, 2024).

II. Material And Methods

Case Report

A total of 100 female patients, aged between 25 and 50 years, were treated. They were diagnosed with hydrolipodystrophy (cellulite), with inflammation detected by thermography, and aesthetic complaints of increased adipocyte volume and sagging in the lower limbs, with clinical indication for the red LED procedure and a technique combining cryolipolysis with a mobile handle and microcurrent, ending with 40 kHz ultrasound at 0.3 watts/cm2. All patients were duly informed with the Free and Informed Consent Form, in addition to having signed an authorization for the use of their images, completed for diagnostic, scientific and educational purposes. The equipment used in this study was a cryolipolysis plate from the brands

The clinical sequence of the technique followed the following protocol:
1. Cleaning the area to be treated with 2% aqueous chlorhexidine
2. Use of a red LED with 4 joules per cm2
3. Use of antifreeze gel from the CrioHD brand to protect the epidermis and dermis (CrioHD, São Paulo, Brazil)
4. Use of plates in a mobile handle in 4 cycles of 5 minutes in each area of 30 x 30 cm.
5. Use of microcurrents.
6. After removing the antifreeze gel, we used 40 kHz ultrasound in continuous mode with conductive gel, at an intensity of 0.3 watts per cm2, respecting the time calculation of 2 minutes per cm2

III. Result

Figures 1 to 5 show clinical cases treated with the protocol described above.

Figure 1. Patient K. B 27 years old. Source: Author 2 (2024).

Figure 2. Patient S.B. 32 years old. Source: author 2 (2024)

Figure 3 A and B and Patient K.K 28 years old. Source: Author 2 (2024).

Figura 4. Paciente T.K 44 anos. Fonte: Autor 2 (2024).

IV. Discussions

Most beauty standards are propagated by the media. However, several skin disorders, including gynoid lipodystrophy, commonly called cellulite, can lead to body dissatisfaction with important psychological and aesthetic consequences. According to the literature, cellulite appears to affect 80 to 98% of young and adult women (Martins; Ruiz-Silva, 2022). Cellulite is a perceived change in the topography of the skin, predominantly found in areas abundant in adipose tissue, such as the hips, buttocks, thighs and abdomen. Contrary to popular belief, the etiology and pathophysiology of cellulite remain far from consensus or well-established understanding. Despite the wide range of scientific articles (Martins; Ruiz-Silva, 2022). Despite exploring various types of treatment, our knowledge about the real causes and pathophysiology of cellulite remains limited. This lack of understanding about the real etiology of cellulite directly influences the selection of appropriate treatments that can address both the aesthetic and inflammatory aspects of the condition. Several treatment methods, including electrophysical agents such as electrical currents, radiofrequency, ultrasound, and photobiomodulation, have been tested. However, the questionable methodological quality of many studies complicates the determination of effective treatments for cellulite. The tissue presents inflammatory cells, fibrosis, and edema, with primary microvascular dysfunction in the lymphatic and blood capillaries. Excessive expansion of adipose tissue generates hypoxic stimulation and compression of sympathetic nerve endings, leading to pain and increased activation of adipocyte transcription factors (Ruiz-Silva; Moleiro; Rodrigues et.al, 2024). One of the main goals of treatment should involve mitogenesis, which is the increase in the number of mitochondria by activating the formation of mitochondrial cristae, global disinflammation of the affected limb, and inhibition of adipocyte transcription factors. Deficiency of the mitochondrial inner membrane complex system (MICOS) leads to a coarse inner membrane architecture; these alterations affect the function of MICOS and are responsible for a diverse spectrum of human diseases. The cure comes from mitochondrial fission and multiplication of cristae (Ruiz-Silva; Moleiro; Rodrigues; 2024).

We must restore the electrical conductivity of locoregional sensory nerve fibers by regenerating the fibers of the sympathetic innervation endings. The lack of axonal nerve transmission generates compensation and blockage of the electrical bioconductivity of the SNS, activating hyperplasia. For this, we use microcurrents with a frequency of 0.1 Hz to 0.5 Hz and a constant intensity of 150 uA. We use square, bipolar, biphasic, symmetrical and balanced current.

We activate the multiplication of mitochondria without predominance of survival factors with anti-apoptosis proteins, through the mobile cryolipolysis cable, generating the activation of the MICOS ridge

organization system, through the translocation of MIC19 receptors and translocation of the outer membrane 70. Beta-adrenergic stimuli also promote ridge biogenesis. (Martins; Ruiz-Silva, 2021; Ruiz-Silva, 2023; 2023).

The association of cold with the stimulation of the sympathetic nervous system through electrotherapy promotes the activation of the PERK and MICU systems. The action of freezing and simulating physical activity through microcurrent (release of hormones similar to physical activity) after lipolytic stimuli (electrolipolysis) encounters an environment with many lipid droplets that influence the organization of the ridges; Mitochondria perform β-oxidation of fatty acids, but when stimulated by cold, drastic changes in morphology occur due to the activation of PERK; (Gallardo-Montejano, 2021).

The mobile cable promotes the selective reduction of adipose cells and is effective in the treatment of cellulite and lipedema through the remodeling of dermal collagen (cryodermatrin). When we combine red LEDs of 650 to 680 nm in our clinical practice, the results are effective. The reduction of adipocyte content, anti-inflammatory effect, and decrease in edema are consequences of the photoexcitation process of cytochrome c oxidase in the respiratory chain of mitochondria. The results obtained in different studies demonstrate the effectiveness of LLLT in reducing body measurements, (Jankowski et al. 2016)

The shock wave equipment and technique are recognized worldwide as one of the best treatments for cellulite and lipedema, but not all professionals have the financial resources to purchase the equipment, while ultrasound is a commonly used equipment in aesthetic clinics. The human body is excessively sensitive to the mechanical impulse and minimal vibrations of ultrasound in LICUS. It has a neuromodulatory effect, central and peripheral, and plays a significant role in the activity, suppression and proliferation, at low intensities proliferation (Uddin, 2021), increases NO (nitric oxide), activates molecular and cellular pathways that lead to cell differentiation and activate transcription factors, increases macrophage migration and increases Ca gradient in the membrane, activates fibroblasts and healing, at low intensities (Lucas, 2020; Draper, 2020) The property of cavitation and microtransmission always in continuous cycles of compression and reflation of microbubbles within fluids inert, leading to localized stress and loosening of the matrix and cell membrane (Uddin, 2021)

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Increased mitogenic factor C ERK/MARK (Lucas, 2020) which makes ultrasound an excellent finalizer for the treatment of cellulite

V. Conclusion

In the author's opinion, a combined approach where combined approaches are used strategically and in a staggered manner to produce synergistic results has the best clinical outcome. For example, the use of red LEDs prior to the combination of microcurrents simultaneously with cryolipolysis and finishing with 40 kHz ultrasound in a weekly LICUS system can result in improvements in severe cellulite in approximately 2 months.

More large-scale studies, particularly regarding combined approaches, need to be conducted to evaluate the long-term results of cellulite therapies in terms of safety, efficacy, and patient satisfaction. improve the appearance of cellulite, sometimes to a satisfactory degree, but never eradicate cellulite, as this involves extensive remodeling of the tissue. potential to be effective in lysing subdermal collagen, such as that seen in the dermal septa (the underlying cause of cellulite). References Despite multiple therapeutic approaches attempting to treat cellulite, no procedure has proven to be successful in the long term, requiring weekly or biweekly maintenance of treatment

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