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RCMOS - Multidisciplinary Scientific Journal of Knowledge.
ISSN: 2675-9128. Sao Paulo-SP.

Year V, v.1, n.1, Jan/July 2025. | submission: 23/05/2025 | accepted: 25/05/2025 | publication:27/05/2025

Rejuvenation treatment using thulium laser, radiofrequency and microfocused ultrasound

Rejuvenation treatment by thulium laser, radiofrequency and microfocused ultrasound techniques

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SUMMARY

Natural skin aging is inevitable, and there are some factors that accelerate this process, such as extrinsic and intrinsic factors. The search for non-invasive procedures is growing, as they offer rapid results and do not require recovery time. This article aims to show the mechanisms of action, parameters and rejuvenation effects of microfocused ultrasound, radiofrequency and thulium laser equipment in the treatment of skin aging. It is an exploratory study that involves a bibliographic review based on specialized literature obtained through research in databases, magazines and periodicals. The equipment presented is effective in the treatment of aging, however, the main objective of the equipment must be evaluated in order to obtain the most satisfactory result.

Keywords: “Aging”, “Microfocused Ultrasound”, “Radiofrequency”, “Thulium laser”

ABSTRACT

The natural aging of the skin is inevitable, and there are some factors that accelerate this process, such as extrinsic and intrinsic factors. The search for non-invasive procedures grows, as they offer quick results and no need for downtime. This article aims to show the mechanisms of action, parameters, and action in rejuvenation of microfocused ultrasound, radiofrequency and thulium laser devices in the treatment of skin aging. It is an exploratory study that involves a bibliographic review based on specialized literature obtained through research in databases, magazines and periodicals.
The presented devices are effective in aging treatment, however the main objective must be evaluated in order to obtain more satisfactory results.

Keywords: “Skin aging”, “Micro Focused Ultrasound”, “Radiofrequency”, “Thulium

Introduction

The search for skin rejuvenation methods has been a recurring theme throughout history, being observed since ancient civilizations, such as the Egyptian, Greek and Roman. In these societies, the ideals of beauty and youth already influenced habits and practices, many of them with the aim of minimize the apparent signs of aging. As the centuries progressed, this concern with

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the preservation of youth has been intensified by scientific and technological development, which enabled the emergence of modern and less invasive procedures to address the effects of age.

Skin aging is a natural and inevitable process, determined by both factors internal — such as genetic inheritance and chronological aging — and external elements, such as sun exposure, environmental pollution, smoking, unbalanced diet and lifestyle inadequate. These aspects compromise the integrity and functioning of the skin, resulting in appearance of wrinkles, sagging, blemishes and loss of elasticity. In this scenario, the area of the aesthetics and cosmetics has invested in the development of technologies that enable more effective interventions with a lower degree of invasiveness, aiming to delay or even reverse the signs of aging.

Among the most current techniques aimed at skin rejuvenation, laser stands out thulium, radiofrequency and microfocused ultrasound. These methods have been gaining popularity because they offer effective results with a high level of safety. Each of these approaches works in different layers of the skin, stimulating the synthesis of collagen and elastin — substances essential for maintaining firmness and elasticity. The thulium laser is especially effective in uniformity of skin texture and attenuation of blemishes, while radiofrequency and microfocused ultrasound contributes to toning and lifting effect, without the need for invasive procedures such as surgical interventions.

Based on a bibliographic review, this study aims to analyze the factors that guide the choice of treatments for facial rejuvenation. As a result, we seek to present a Overview of the effectiveness and applicability of these technologies in the context of skin aging and current aesthetics.

1. THEORETICAL FRAMEWORK

SKIN PHYSIOLOGY

The skin, the largest organ in the human body, plays fundamental roles in protecting, temperature regulation and sensory perception. Its complex structure, composed of several layers, allows it to be both a physical barrier against external agents and a sensory organ crucial for interaction with the environment. According to Madison (2003), "the skin is not just a protective layer, but also a dynamic system, constantly adapting to the needs of the organism and environmental conditions." The skin can offer different functions such as protection, ultraviolet light absorption, waterproof barrier, thermal control, liquid absorption and secretion and aesthetic and sensory functions.

As aesthetic and sensory functions, we consider appearance, touch, softness, exhalation of odors, color and skin sensitivity, responsible for the individual's physical and social attraction

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(Harris, 2016) In this way, the skin can be understood as a mediating border between the organism and the external environment.

The skin is segmented into three main regions: the epidermis, the dermis and the hypodermis, a layer deeper characterized by the predominance of adipocytes. (Pereira et al., 2017)

The epidermis is the outermost layer, formed by epithelial tissue. It contains melanocytes, keratinocytes, and Langerhans and Merkel cells. It is avascular and is nourished by the permeation of nutrients from the dermis by capillarity. Its renewal occurs approximately between 40 and 56 days. Its thickness can vary depending on the region of the body, being thicker in areas subjected to intense friction, such as the palms of the hands and soles of the feet, and thinner in areas such as the face. (Rouselle, et al., 2023)

According to Harris (2016), the epidermis is made up of five layers: stratum corneum, stratum lucid, stratum granulosum, stratum spinosum and stratum germinativum.

The peripheral layer of the epidermis is the stratum corneum, formed by dead cells and rich in keratin. These highly flattened, scale-like cells function as a barrier physics against pathogens and chemical agents. (Madison, 2003)

Below the stratum corneum is the stratum lucidum, characterized by transparent cells, flattened and anucleated, whose transparency is attributed to the abundance of keratin present. (Kligman, 1976) The stratum granulosum contains cells that present keratohyalin granules, responsible for forming an additional barrier against water loss. The stratum spinosum, in turn, gives the skin resistance and is named after the appearance of its cells, which have extensions that resemble thorns. (Madison, 2003)

The basal layer, or stratum germinativum, is the deepest layer of the epidermis and is formed by stem cells that generate new cells, which differentiate to form the upper layers. (Blanpain et al., 2006)

The dermis, located below the epidermis, is composed of connective tissue and contains cells such as fibroblasts, histiocytes and mast cells, as well as nerves, blood and lymph vessels, follicles hairy and sweat glands. (Jiang et al., 2021) It is divided into two layers: the papillary layer and the reticular layer. The union between the epidermis and the dermis is mediated by the basement membrane, which provides structural support to the epidermis. (Blanpain et al., 2006) The dermis is also highly vascularized, which ensures the nutrition of the epidermis.

The hypodermis, finally, is formed mainly by adipose tissue, performing functions such as storing energy reserves, regulating temperature, protection and support. (Bolognia et al., 2012)

GENERAL CHARACTERISTICS OF SKIN AGING

Natural skin aging is inevitable, and there are some factors that accelerate this process. process, being classified as extrinsic and intrinsic. Extrinsic aging derives from

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external factors such as stress, pollution, smoking, alcoholism, eating habits, use of some cosmetics and medicines in the wrong way and free radicals, while the intrinsic is related to the genetics and age. (Sánchez, 2013)

In the epidermis, the melanocytes weaken, causing white spots on the skin, due to the absence of melanin. Keratinocytes decrease due to the flattening of the papillae dermal, and this causes dry skin and prevents the transfer of nutrients between the layers of the skin. epidermis and dermis, causing adhesion between the layers and consequently making the skin more flaccid and will cause wrinkles to heat up. (Machado, 2014)

Due to the reduction in fibroblast activity, the thickness of the skin decreases, causing reduction of collagen and elastin, making the skin less firm, less elastic and reducing vascularization, preventing the exchange of nutrients between capillaries and cells. (Velasco, 2023)

Mast cells (defense cells of the dermis) decrease, causing the reactions of skin hypersensitivity are difficult to manifest. (Souza, 2019)

The skin appendages, sebaceous glands decrease in size. The sweat glands also change with age, causing loss of control. Hair follicles undergo a hair discoloration due to melanin production. (Santos, 2018)

The main characteristics of aging include:

Wrinkles and Fine Lines: The appearance of wrinkles is one of the most visible manifestations of aging, resulting from decreased production of collagen and elastin, which are essential for skin firmness and elasticity. (Pillay et al., 2021; Kumar et al., 2021)

Texture Changes: Aging skin tends to have a rougher texture, with loss of smoothness due to decreased cell turnover and dryness. (Daniel et al., 2019; Villanueva et al., 2019)

Changes in Pigmentation: Aging is associated with changes in skin color. skin, including age spots and hyperpigmentation, resulting from cumulative exposure to radiation UV and genetic factors. (García-Botella et al., 2021; Richards et al., 2020)

Sagging: Loss of elasticity and firmness in the skin leads to sagging, especially in areas such as the face and neck. This occurs due to the degradation of collagen and elastin fibers. (Weigand et al., 2020)

Skin aging can be categorized into different stages:

Early Aging (20-30 years): At this stage, small lines may begin to appear. appear, especially around the eyes and mouth. Collagen and elastin production is still high, but it gradually begins to decline. (Zou et al., 2017)

Moderate Aging (30-40 years): Wrinkles begin to become more visible and the skin loses some of its elasticity. Dehydration and the appearance of enlarged pores can be more noticeable. (Kumar et al., 2021; Pillay et al., 2021)

Advanced Aging (40-60 years): At this stage, wrinkles deepen, and sagging

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of the skin is more evident. Hyperpigmentation and age spots become common, reflecting years of sun exposure. (Daniel et al., 2019; Richards et al., 2020)

Late aging (over 60 years): The skin shows significant signs of aging, such as deep wrinkles, loss of volume and rough texture. Sagging becomes more pronounced, and healing ability of the skin decreases considerably. (Villanueva et al., 2019; Weigand et al., 2020)

TISSUE REPAIR

The mechanism of action of many aesthetic treatments based on micro lesions or controlled inflammation aims to stimulate the immune system response, promoting the production of collagen and elastin, which contribute to the regeneration and improvement of the skin's appearance.

The healing process is complex and divided into well-defined phases. The initial stage, known as the inflammatory phase, begins immediately after the injury. At this stage, dilation of blood vessels and recruitment of neutrophils, which play an essential role in the elimination of pathogens through the release of reactive oxygen species. The inflammatory response reaches its peak between the third and fourth day, with neutrophils being later replaced by macrophages. The latter are essential in the release of cytokines, growth factors and in stimulating the formation of new blood vessels, proliferation of fibroblasts and synthesis of the extracellular matrix. (Oliveira et al., 2012)

From the fourth day onwards, the proliferative phase begins, characterized by epithelialization, angiogenesis, granulation tissue formation and collagen deposition. Epithelial regeneration occurs early and, if the basement membrane is intact, the epithelial cells migrate superficially, reconstituting the epidermis in up to three days. In situations where the basement membrane is compromised, the cells at the edges of the wound proliferate to reestablish the skin barrier. The angiogenesis involves the migration of endothelial cells and formation of new blood capillaries, essential for adequate oxygenation and tissue nutrition. (Campos et al., 2007)

Following the proliferative phase, the formation of granulation tissue begins, highlighting if the action of fibroblasts and endothelial cells. Fibroblasts move from nearby areas to the injury and are stimulated by platelet-derived growth factor (PDGF). Then, the transforming growth factor beta (TGF-ÿ) stimulates the production of type I collagen, essential for the structuring of the new tissue. (Balbino et al., 2005)

The last phase, known as remodeling or maturation, lasts an average of 28 days. During this period, type III collagen is degraded and replaced by more resistant type I collagen. and organized according to the tissue tension lines. However, the structuring of collagen in the tissue healed skin does not reach the same standard as intact skin. (Campos et al., 2007)

Several factors can negatively interfere in this process, such as age, conditions

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genetics, smoking, diabetes, ischemia, infection, inadequate surgical technique, tissue pressure excessive, vitamin deficiency, use of corticosteroids and malnutrition. (Oliveira et al., 2012)

HOW AGING AFFECTS HEALING

Healing takes longer in older people, since the synthesis of fibroblasts decrease with aging. Growth factors released by macrophages, which stimulate the expression of several extracellular matrix genes, their levels are reduced in the process of aging. There is a complication in obtaining results in aesthetic treatments that use the principle of thermal injury or controlled inflammation, considering that the immune system may be compromised in old age. (Cunha, et al., 2015)

According to Levine (2020), little is known about the biological mechanisms that impact healing. The complexity of factors that can affect this process makes it difficult to identify and accuracy in diagnostics.

RADIO FREQUENCY

Radiofrequency (RF) is a technology widely adopted in the field of aesthetics since the 2000s, being recognized for its non-invasive characteristic and for offering a variety of applications, such as the treatment of sagging skin, cellulite, facial rejuvenation, scars and modeling body. Its operation is based on the transformation of electrical energy into heat, which penetrates deep into the skin. This heating promotes the retraction of existing collagen fibers and stimulates neocollanogenesis. (Fischer et al., 2016)

One of the main advantages of this resource is obtaining good aesthetic results. provide satisfactory aesthetic results without resorting to surgical procedures or requiring long recovery periods, which makes RF an attractive alternative for those looking for interventions with lower risk and discomfort (Souza et al., 2018). There are several types of equipment that uses radiofrequency, the most common being monopolar devices, bipolar and multipolar, each with specific indications for different skin types and objectives. (Oliveira et al., 2017)

The technique has also proven effective in reducing wrinkles around the eyes and sagging of the eyelids, showing good results in clinical studies. (Tanaka et al., 2014) In addition In addition, radiofrequency helps improve blood circulation, tissue oxygenation and collagen stimulation, resulting in an immediate firming effect on the skin. (Fritz et al., 2004)

As far as safety is concerned, most modern devices have thermal control. automated, which significantly reduces the risk of burns and adverse effects. Research Recent studies also indicate that the combined use of radiofrequency with other technologies, such as ultrasound and laser, enhances the effects of treatments, allowing more effective approaches

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individualized and effective. (Silva et al., 2020)

The most recent scientific production highlights that RF can be applied to different phototypes skin, including sensitive skin and delicate areas such as the neck and periocular region. In However, the correct individualization of application parameters is essential to ensure good results and avoid possible complications. (Melo et al., 2021)

MECHANISM OF ACTION

Radiofrequency encompasses electromagnetic radiation with frequencies from 3 to 300 GHz. Its The main effects on tissues are of a thermal nature, aiming to heat specific layers of the skin to induce collagen degeneration. (Elsaie, 2009) This non-ablative method consists of passage of current through the dermis to generate small thermal injuries, thus stimulating the collagen production and softening scars. (Araújo et al., 2015)

Monitoring tissue temperature is essential during radiofrequency application to ensure its effectiveness and safety. (Agne, 2009) The tissue repair process promoted by RF involves the activation of fibroblasts, resulting in the synthesis of new collagen and elastin fibers. (Sadick et al., 2014) This neocollagenesis is essential for dermal thickening and reduction of irregularities in the skin. (Gold and Adelglass, 2014)

PARAMETERS

According to Borges (2010), the lifting effect occurs after the application of radiofrequency to the places where there is a reduction in tissue elasticity. The results analyzed with the application of technique, lead to an increase in temperature, reduction in distensibility and an increase in density of the collagen, leading to the process called radiofrequency lifting.

The parameters range from 0.3 MHz to 3 MHz, with the most common use being 1 MHz to 3 MHz for facial procedures. The ideal temperature for stimulating collagen in the deep dermis varies from 40° to 45° promoting the desired rejuvenation result. Each radiofrequency session facial varies from 20 to 40 minutes depending on the area treated. (Souza et al., 2018)

ACTION IN REJUVENATION

As mentioned by Ullmann (2008) and Giraldo (2007), radiofrequency is applied in functional dermatology to combat sagging skin that affects the face, neck and hands, one of the main effects of aging. This method acts on the deepest layers of the skin, shaping collagen fibers and reducing facial wrinkles. This set of actions results in revitalizing the skin, promoting greater elasticity and firmness to tissues that contain collagen, in addition to stimulating the formation of new fibers of superior quality, improving sagging both in the

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body and face.

Radiofrequency equipment enables the contraction of collagen fibers without the need for need to cut them. This technology uses radiofrequency energy to raise the tissue temperature, promoting non-surgical retraction and tissue shortening without compromise the integrity of the epidermis. This process occurs within thermal limits and induces a microinflammation that stimulates collagen production. (Souza, et al., 2018)

Additionally, radiofrequency uses heating to reduce localized fat, being effective in treating sagging skin in different areas of the body, such as the chin, abdomen, thighs and arms. It also helps reduce wrinkles, improve cellulite and define the contour body. (Agne, 2013; Veijabhinanta et al., 2013)

The technique also promotes induced vasodilation, increasing blood circulation and lymphatic system. This improves the supply of nutrients and oxygenation of tissues, stimulates cellular respiration and helps eliminate toxic substances, including free radicals, which are mainly responsible for skin aging. As a result, radiofrequency promotes skin regeneration, providing a firmer and healthier appearance to aging skin. (Agne, 2013)

MICROFOCUSED ULTRASOUND

Microfocused Ultrasound (MFU) allows precise heating of the middle and deep layers of the subcutaneous tissue, without breaking the papillary dermis and epidermis. UMF is ideally used for treat sagging and oily skin. (Luccia, et al., 2023)

MECHANISM OF ACTION

Microfocused Ultrasound stimulates neocollagenesis through thermal injuries caused to from the middle of the reticular dermis to the muscular aponeurotic system - three-dimensional structure of collagen fibers, elastic fibers and fat cells - which is a great target for treating sagging through non-invasive techniques. (Menezes et al., 2014)

With an ideal temperature for collagen denaturation, Microfocused Ultrasound heats the deep dermal tissues and fibromuscular layers, including the SMAS. (Khan et al., 2021)

> The superficial muscular aponeurotic system is in contact with the fat subcutaneous and involves the muscles of facial expression, it is composed of collagen and elastic fibers, just like the dermis, but it has the advantage of providing support and maintaining long-term skin support. (Daiane, 2016)

With heating, the denatured collagen fibers contract, activating the system

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immune system and strengthening of the skin. This process of neocollagenesis helps to tone the skin skin, masking aging.

Fast bursts combined with more focused frequency delivery allow ischemic necrosis occurs more deeply, leaving the epidermis and more superficial layers of uninjured tissue. (Gliklich, et. al, 2007)

PARAMETERS

Microfocused Ultrasound has energy parameters of 0.4 - 1.2 J/mm2, frequency of 4 - 10 MHz and reaches depths of 1.5 - 4.5mm. It can heat tissue to temperatures above 60°C, creating small thermal coagulation points (<1 mm^3) at a depth of up to 5 mm in the middle and deep reticular layers of the dermis, in addition to the subdermis, without affecting the epidermal layers and papillary dermal of the skin. (Fabi, 2015)

The penetration depth is adjusted to reach different layers of the skin, such as the dermis, the hypodermis or even the muscular fascia. For facial rejuvenation, the deepest common are 1.5 mm for the epidermis, 3 mm for the superficial dermis and 4.5 mm for the muscular fascia. These configurations allow microfocused ultrasound to act on the specific layers where the sagging and skin aging are more pronounced, stimulating cell regeneration of efficiently. (Wu et al., 2016)

The depth reached by the device is determined by the frequency of the waves. In Microfocused Ultrasound, the frequency used is lower compared to Macrofocused Ultrasound, which allows thermal injury to occur in deeper layers of the skin. Energy delivery is more concentrated, which becomes more effective in treating sagging. (Luccia, et al., 2023)

The duration of the effects varies from patient to patient, but in general, the results can be seen from 6 to 12 weeks after treatment, with continued improvements over 3 to 6 months, as collagen and elastin are renewed in the deeper layers of the skin (Norton; Tanzi, 2018).

ACTION IN REJUVENATION

Microfocused ultrasound has demonstrated significant effects on skin rejuvenation. skin, for its effectiveness in promoting renewal and increasing collagen in the inner layers of the dermis. This non-invasive technique uses ultrasound waves focused on precise points of the skin, providing controlled heating that penetrates to the muscle fascia. This process induces

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a thermal reaction that activates fibroblasts, cells responsible for collagen production, which causes an increase in skin firmness and elasticity. (Choi et al., 2015)

According to Geronemus et al. (2015), microfocused ultrasound has visible effects on facial rejuvenation, such as reducing sagging and improving the definition of the facial contour. The technique has also been associated with the reduction of wrinkles and expression lines, especially in the areas around around the eyes and in the jaw region, which are the most affected by aging. The mechanism of action involves not only the stimulation of collagen production, but also the reorganization of existing collagen fibers, providing a more uniform texture and toned to the skin. (Norton and Tanzi, 2018)

Furthermore, UMF has the advantage of not requiring recovery time, since the skin does not suffers superficial damage, and the results begin to be visible after a few weeks, with improvements continuous over three to six months. This efficiency in producing lasting and natural effects makes microfocused ultrasound is an attractive alternative for those seeking rejuvenation without resorting to to invasive procedures. (Wu et al., 2016)

THULIUM LASER

The Thulium Laser is a fractional Thulium laser system with a wavelength of 1927nm, designed for aesthetic and dermatological treatments, such as skin rejuvenation, resurfacing and hyperpigmentation treatment. (Boehm, et al., 2019)

The Thulium Laser combines different wavelengths and modes to provide a versatile and effective approach to a range of procedures. Its ability to treat different skin types and conditions makes it a valuable tool in dermatology clinics and aesthetics. (Gold, et al., 2017)

MECHANISM OF ACTION

The Thulium laser mainly targets water in tissues, unlike other lasers. technologies that act on melanin or hemoglobin. This means that the laser energy is absorbed mainly by the water present in the skin, making the procedure safer, more selective and effective on the skin layers. The Thulium Laser, with a wavelength of 1927nm, also has strong affinity for water and stands out for its ability to act directly on the epidermis, especially in the basal layer, where melanin is located. When we come into contact with water, it increases the temperature of the region, causing the vaporization of tissues and leading to selective destruction

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of cells that have pigment. This technique is quite efficient in treating spots and differences in skin tone, as it can remove the melanin accumulated in the deepest layer superficial, without causing significant damage to the skin structure. After this controlled heating, the melanin is gradually eliminated, which helps to lighten and brighten the skin, generally with little peeling. Because it is a selective action and preserves the outer layer of the skin, this procedure usually has a shorter recovery time, in addition to offering safe and visible to those carrying out the treatment. (Lavieen, 2024)

BENEFITS

The main benefits of Lavieen treatment include:

Rapid Healing: Since it is a non-ablative laser, patients typically experience less pain and a reduced recovery period, which makes it an attractive option for those looking for fast results with minimal downtime. (Lavieen, 2024)

Treatment Customization: Laser parameters can be adjusted to meet the needs of specific needs of each patient, allowing a more personalized approach to the treatment of various dermatological conditions. (Jung et al., 2022)

Low Risk of Side Effects: Overall, Lavieen has a low risk of side effects. side effects, such as hyperpigmentation or irregular scarring, that can occur with other types of lasers. (Lavieen, 2024)

PARAMETERS

For aging treatment, the parameters used vary according to the phototype, being completely customizable to suit each individual. The pulse duration used is between 600 and 1100, while the power varies between 6W and 10W. The application is done in continuous mode of the equipment, having its *endpoint* when the skin presents erythema. (Rodrigues, 2024)

ACTION IN REJUVENATION

According to Friedman et al. (2021), the use of non-ablative laser acts on water as chromophore, generating a photothermal effect that forms conical areas of coagulation in the epidermis and upper dermis, preserving the stratum corneum. This preservation maintains the integrity of the skin, reducing superficial damage and accelerating recovery.

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Controlled heating destroys melanocytes in the basal layer of the epidermis in the microscopic treatment, promoting cell renewal. Between the second and third day there is a slight peeling, and between the third and seventh day, micro peeling, which results in a whitening effect and improves skin texture and tone. Thermal energy in the papillary dermis stimulates neocollagenesis, with the formation of new collagen fibers, which reduces pores and expression lines, improving the elasticity and promoting a rejuvenated appearance. (Santos, 2024)

2. MATERIAL AND METHOD

The methodology used was a bibliographic survey, through research of articles in databases such as PubMed, Google Scholar, Scientific Electronic Library Online (SciELO), books and periodicals that address the topics studied, published between 2004 and 2024. The search was carried out by the keywords: "Microfocused ultrasound", "Radiofrequency", "Thulium Laser", "Skin" and "Aging". Inclusion criteria are publications in Portuguese and English, articles clinical trials and bibliographic surveys focusing on the area of aesthetics and health. Aiming collection of data on the mechanism of action of the three aging treatment methods addressed in this project. After this, the results are discussed.

3. RESULTS AND DISCUSSION

To obtain these results, 77 scientific articles were selected that address the topics presented by this bibliographic review.

The Thulium Laser is a non-ablative laser, and its main objective is to improve the texture of the skin. skin, expression lines and photoaging. Unlike Ultrasound equipment Microfocused and Radiofrequency, whose main objective is to stimulate collagen, improving the sagging skin, and reduced fat.

Furthermore, the Thulium Laser is suitable for all skin types, following the parameters indicated. Its recovery time is reduced, allowing the patient to resume their daily activities almost immediately. Its cumulative effect is also a differential, since the results intensify with regular sessions.

Microfocused Ultrasound, as it acts on deeper layers of the skin, is especially indicated for non-surgical facelift. It is ideal for patients seeking a more significant reduction in sagging, with visible effects immediately after the first session and progressive results in the following months. However, because it is a higher investment, it is often reserved for

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specific areas with a greater degree of sagging.

Radiofrequency, in turn, is a great option for those looking for a more affordable and progressive. Although it requires more sessions to achieve results comparable to Microfocused Ultrasound is highly effective when performed regularly.

FINAL CONSIDERATIONS

Through this study, it is noted that non-invasive aesthetic procedures aimed at rejuvenation are establishing themselves as safe, efficient and increasingly accepted options in field of aesthetics. Technologies such as Microfocused Ultrasound, Radiofrequency and Laser Thulium, allow the stimulation of collagen and elastin production, resulting in improvement in firmness, texture and general appearance of the skin, in a subtle and natural way. (Fonseca, et al, 2018)

These techniques offer significant aesthetic advantages without disrupting the routine of patients, thanks to its low invasiveness and short recovery time. This set of elements directly contribute to the increased demand for these procedures by individuals who seek facial rejuvenation without resorting to surgical procedures. (Erkiert-Polguj et al., 2019)

However, it is crucial that such treatments are conducted by competent professionals, with appropriate guidance on pre- and post-procedure care, to ensure effectiveness of results and patient protection. (Luccia, et al., 2023)

Thus, it is concluded that non-invasive rejuvenation techniques are a strategy modern, accessible and personalized, which meets current aesthetic needs through procedures efficient, with less risk and greater comfort.

REFERENCES

1. AGNE, JE *Aesthetic technologies: radiofrequency and localized fat reduction.* New York: Routledge, 2013.

2. ALMEIDA, RF; LIMA, AC; COSTA, PD Phases of healing: The response inflammatory and its impact on tissue regeneration. *Brazilian Journal of Plastic Surgery,* v. 35, n. 2, p. 211-218, 2020.

3. ALVES, Dalton Gonçalves Lima et al. *Structure and function of the skin.* Medicine Outpatient IV. Montes Claros-MG: Dejan Printing and Publishing, 2019.

4. APOLINÁRIO, Amanda Fernandes. *Microfocused ultrasound in the treatment of facial aging: an integrative review.* 2020.

5. ARACO, Antonio. Prospective Study on Clinical Efficacy and Safety of a Single Session of Microfocused Ultrasound With Visualization for Collagen Regeneration. *Aesthetic*

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Machine Translated by Google

Surgery Journal, vol. 40, n. 10, p. 1124–1132, 2020.

6. BALBINO, Carlos Aberto; PEREIRA, Leonardo Madeira; CURI, Rui. Mechanisms involved in healing: a review. *Brazilian Journal of Pharmaceutical Sciences,* São Paulo, v. 41, no. 1, p. 1-10, Jan./Mar. 2005.

7. BLANPAIN, Cédric; FUCHS, Elaine. Epidermal Stem Cells of the Skin. *Annual Review of Cell and Developmental Biology,* Palo Alto, vol. 22, p. 339-373, 2006.

8. BOEHM, SL; BITTNER, RR Fractional laser treatment of the skin: Indications and techniques. *Journal of Clinical and Aesthetic Dermatology,* vol. 12, no. 8, p. 15-22, 2019.

9. BOLOGNIA, JL; JORIZZO, JL; SCHAFFER, JV *Dermatology* (3rd ed.). Elsevier, 2012.

10. BORGES, F. Dermato-Functional Physiotherapy: Therapeutic Modalities in Aesthetic Dysfunctions. Phorte Publishing. São Paulo, v. 1, p. 33-127, 2010.

11. CAMPOS, Antonio Carlos Ligocki; BORGES-BRANCO, Alessandra; GROTH, Anne Karoline. Wound healing. *ABCD. Brazilian Archives of Digestive Surgery (São Paulo, Brazil). Paulo),* v. 20, n. 1, p. 51-58, 2007.

12. CHOI, SY; LEE, JH; PARK, SK Clinical efficacy of microfocused ultrasound in skin rejuvenation. *Journal of Cosmetic Dermatology,* vol. 14, no. 2, p. 144-150, 2015.

13. CUNHA, Marisa Gonzaga da; PARAVIC, Francisca Daza; MACHADO, Carlos A. Histological changes in collagen types after different treatment modalities for dermal remodeling: a literature review. *Surg Cosmet Dermatol,* São Paulo, v. 7, n. 4, p. 285-292, 2015.

14. CUSTÓDIO, Antônio Luis Neto et al. *SMAS and facial ligaments - Review anatomical.* Aesthetic Orofacial Science, 2021.

15. DA CÂMARA, Vivianne Lira. *Anatomy and physiology of the skin.* 2009.

16. DAIANE, Ketlin. *Use of microfocused ultrasound in the treatment of signs of age: a pilot study.* Digital Library of TCC-UniAmérica, p. 1-23, 2016.

17. DANIEL, H. et al. Skin aging and its relation to oxidative stress. *Journal of Clinical and Aesthetic Dermatology,* vol. 12, no. 8, p. 23-30, 2019.

18. ELSAIE, ML Cutaneous remodeling and photorejuvenation using radiofrequency devices. *Indian Journal of Dermatology,* vol. 54, no. 3, p. 201-205, 2009.

19. ERKIERT-POLGUJ, Anna. Et al. Assessment of elasticity after radiofrequency non-ablative rejuvenation. Journal of cosmetic dermatology, v. 18, n. 2, p. 511-516, 2019.

20. FABI, Sabrina Guillen et al. Noninvasive Skin Tightening: Focus on New Ultrasound Techniques. *Clinical, Cosmetic and Investigational Dermatology,* vol. 8, p. 47–52, 2015.

21. FABI, Sabrina Guillen et al. Practical Guidance for Optimizing Patient Comfort During Microfocused Ultrasound with Visualization and Improving Patient Satisfaction. *Aesthetic Surgery Journal,* vol. 40, n. 2, p. 208–216, 2020.

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Machine Translated by Google

22. FISCHER, TC; BRUGNERA, A. Applications of radiofrequency in treatments aesthetic. *Journal of Cosmetic and Laser Therapy,* vol. 18, no. 5, p. 220-226, 2016.

23. FONSECA, E.; ALVES, J.; HASSE, R. The use of radiofrequency in the treatment of facial rejuvenation. Aesthetics in Motion Magazine, 2018.

24. FRANCE, Jefersson da Silva; FRANCE, Jessica Nathalia Chagas. Ultrasound microfocused in facial rejuvenation: an integrative review. 2020.

25. FRIEDMAN, PM et al Non-ablative fractional laser system with doping of 1,550 nm erbium and 1,927 nm thulium: best practices and recommendations for scenarios treatment. Journal of Drugs in Dermatology, vol. 20, no. 1, p. 1-10, 2021.

26. FRITZ, M.; COUNTERS, JT; ZELICKSON, BD Radiofrequency treatment for middle and lower face laxity. Arch Facial Plast Surg, vol. 6, no. 6, p. 370-373, 2004.

27. GARCÍA-BOTELLA, A. et al. Skin aging and photoprotection: The role of antioxidants in skin care. *Dermatology and Therapy,* vol. 11, no. 5, p. 555-568, 2021.

28. GERONEMUS, RG; LEE, W. The use of microfocused ultrasound for skin Tightening and lifting: A review of clinical results. *Journal of Drugs in Dermatology,* vol. 14, no. 5, p. 456-463, 2015.

29. GIRALDO, M. *Comparative study of the radiofrequency technique in dysfunctions facial aesthetics.* Interdisciplinary Journal of Study and Research in Health, v. 2, n. 2, p. 120-138, 2013.

30. GLIKLICH, Richard E. et al. Clinical Pilot Study of Intense Ultrasound Therapy to Deep Dermal Facial Skin and Subcutaneous Tissues. *Archives of Facial Plastic Surgery,* vol. 9, no. 2, p. 88-95, 2007.

31. GOLD, MH; ADELGLASS, J. Evaluation of safety and efficacy of the TriFractional RF technology for treatment of facial wrinkles. Journal of Cosmetic and Laser Therapy, vol. 16, no. 1, p. 2-7, 2014.

32. GOLD, MH; BIRON, JA; FITZPATRICK, RE The role of thulium lasers in dermatology. *Lasers in Surgery and Medicine,* vol. 49, no. 3, p. 170-179, 2017.

33. HARRIS, Maria Inês. *Skin: from birth to maturity.* Senac São Paulo, 2016.

34. JIANG, J.; WANG, Z.; ZHANG, L. Structure and function of the dermis in skin regeneration. *The Journal of Dermatology,* vol. 48, n. 6, p. 724-734, 2021.

35. JUNG, C.; LEE, S.; PARK, S.; et al. *The Efficacy and Safety of a Thulium Laser for Skin Rejuvenation in Patients with Skin Aging and Photodamage. Journal of Cosmetic and Laser Therapy,* vol. 24, no. 2, p. 1-8, 2022.

36. KHAN, U.; KHALID, N. A Systematic Review of the Clinical Efficacy of Micro-Focused Ultrasound Treatment for Skin Rejuvenation and Tightening. *Cureus,* vol. 13, no. 12, e20163, 2021.

37. KLIGMAN, AM The structure of the skin. In: *The Biology of the Skin,* p. 14-44. A.

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Machine Translated by Google

J. G. Jones & B. J. Williams (Eds.). Oxford University Press, 1976.

38. KUMAR, S. et al. Role of diet and nutrition in skin aging. *Cosmetics,* vol. 8, no. 3, p. 25, 2021.

39. LUCCIA, Franca; GOTARDO, Luciana. *The effectiveness of microfocused ultrasound in skin aging.* Scientific Journal of Aesthetics and Cosmetology, v. 3, n. 1, 2023. p. 106.

40. LAVIEEN. User Manual. Medsystems. São Paulo, Brazil. 2024. Available at: https://medsystems.com.br/wp-content/uploads/2024/10/LAVIEEN-Manual.pdf

41. MACHADO, AC et al. Study of age-related changes in the skin human. *Brazilian Journals of Dermatology,* v. 89, n. 5, p. 697-704, 2014.

42. MADISON, KC Barrier Function of the Skin: "La Raison d'Être" of the Epidermis. *Journal of Investigative Dermatology,* vol. 121, no. 2, p. 231-241, 2003.

43. MELO, DF; FONSECA, LA Customized radiofrequency protocols for facial rejuvenation and treatment of neck sagging. *Aesthetic Science Journal,* v. 16, n. 4, p. 99-106, 2021.

44. MENEZES, Denise Martins de; Lauscea Regina; NOGUEIRA, Marcia Vivianne; BARBOSA, Chrystianne Rabelo Lima; RIBEIRO, LUIS, JOSEPH;

45. MONTEZUMA, Gina Elayne Silva; SANTOS, Marcelo Januzzi. *Weight loss non-invasive facial microfocused ultrasound.* FT *Health Sciences Journal,* v. 28, n. 137, p. 31-08, Aug. 2024.

46. MURAO, Renata Mayumi. *Effects of Microfocused Ultrasound on Rejuvenation Facial.* 2021.

47. NÉRI, Júlia dos Santos Vianna et al. Application of microfocused ultrasound in facial rejuvenation: a literature review. *Fluminense Journal of Dentistry,* v. 1, n. 60, p. 137-146, 2023.

48. NORTON, S.; TANZI, E. Non-invasive treatment options for facial aging: A review of ultrasound and radiofrequency technologies. *Dermatologic Surgery,* vol. 44, no. 3, p. 365-373, 2018.

49. OLIVEIRA, CL; SANTOS, FM; BRAGA, LE Radiofrequency technologies for the treatment of sagging skin and cellulite. *Aesthetic Medicine Journal,* v. 14, n. 2, p. 78-85, 2017.

50. GARCIA, Mariana; Wound healing: phases and influencing factors. *Acta Veterinaria Brasilica,* Fortaleza, v. 6, n. 4, p. 267-271, 2012.

51. ONI, Georgette et al. Evaluation of a Microfocused Ultrasound System for Improving Skin Laxity and Tightening in the Lower Face. *Aesthetic Surgery Journal,* vol. 34, no. 7, p. 1099–1110,

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Machine Translated by Google

2014.

52. PEREIRA, MM; ALMEIDA, RA; COSTA, AL The structure of human skin and its clinical implications. *Journal of Dermatology,* v. 92, n. 4, p. 293-301, 2017.

53. PERES, Flavia Nicea Camarinha; PERES, Luciane Nicea Camarinha. The benefits of the use of technology in facial rejuvenation treatment - microfocused ultrasound. *Journal of Multidisciplinary Dentistry,* vol. 13, no. 1, p. 134-141, 2023.

54. PILLAY, A. et al. The efficacy of various anti-aging treatments on the skin. *International Journal of Dermatology,* vol. 60, n. 4, p. 435-445, 2021.

55. RICHARDS, L. et al. The impact of UV exposure on skin aging: A review of current knowledge. *Dermatologic Clinics,* vol. 38, no. 4, p. 691-700, 2020.

56. ROCHA, JCT Laser therapy, tissue healing and angiogenesis. *Brazilian Journal in Health Promotion,* v. 17, n. 1, p. 44–48, 2012.

57. RODRIGUES, Gislaine. Lavieen – Become an expert. Innovant Courses. 2024.

58. ROUSSELLE, P.; LAIGLE, C.; ROUSSELET, G. *The basement membrane in epidermal polarity, stemness, and regeneration.* 2023.

59. SADICK, NS et al. Bipolar and multipolar radiofrequency. Dermatologic Surgery, v. 40, p. S174-S179, 2014.

60. SÁNCHEZ, A. et al. Intrinsic and extrinsic factors involved in it skin aging. *Dermo-Syfiliographic Acts,* v. 104, no. 1, p. 13-20, 2013

61. SANTOS, AB; SOUZA, RF; PEREIRA, JC Radiofrequency in the treatment of scars and stretch marks: a practical approach. *Journal of Clinical Dermatology,* v. 17, n. 2, p. 88-95, 2016.

62. SANTOS, Ana Luiza Ramos de Moura dos. *Changes in cutaneous appendages during aging.* 2018.

63. SANTOS, Giovanna Laura Mortarelli. Bibliographic review on the use of laser Lavieen® and the application of Polydeoxyribonucleotide (PDRN) in improving skin disorders. 2024. Course Completion Work (Degree in Biomedical Sciences) – UNESP Botucatu, Brazil, 2024.

64. SASAKI, Gordon H. et al. Clinical Efficacy and Safety of Focused-Image Ultrasonography: A 2-Year Experience. *Aesthetic Surgery Journal,* vol. 32, no. 5, p. 601–612, 2012.

65. SILVA, FR; MARTINS, GP Innovations in aesthetic treatment with radiofrequency: advances and new techniques. *Brazilian Journal of Aesthetic Technology,* v. 22, n. 3, p. 56-65, 2020.

66. SILVA, TP et al. Efficacy of fractional radiofrequency in facial rejuvenation:

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Machine Translated by Google

a clinical review. *Aesthetic Dermatology,* v. 10, n. 1, p. 33-40, 2019.

67. SOUZA, MR; SILVA, LA; FONSECA, RJ Facial and body treatments with the use of radiofrequency: a systematic review. *Brazilian Journal of Aesthetic Dermatology,* v. 15, n. 2, p. 19, n. 4, p. 112-120, 2018.

68. SOUZA, Suimey Alexia Silva; PINTO, Liliane Pereira; BACELAR, Isabela de Assis. *The use of radiofrequency in facial rejuvenation – literature review.* Saúde em Foco Magazine, v. 10, p. 569-574, 2018.

69. TANAKA, Y. et al. Treatment of skin laxity using multisource, phase-controlled radiofrequency in Asians: visualized 3-dimensional skin tightening results and increase in elastin density shown through histological investigation. Dermatol Surg, vol. 40, n. 7, p. 756-62, Jul 2014.

70. THE AESTHETIC GUIDE. Versatile fractional laser system benefits physicians and patients. Available at: *The Aesthetic Guide.* Accessed on: 16 Oct. 2024.

71. ULLMANN, A.; GIRALDO, M. *Radiofrequency in facial rejuvenation.* Journal of Health Sciences, v. 10, p. 123-130, 2008.

72. VEIJABHINANTA, P. et al. *Study on the effectiveness of radiofrequency in treatment of sagging skin and cellulite. Journal of Aesthetic Medicine,* v. 12, n. 2, p. 87-92, 2013.

73. VELASCO, Rogério Gonçalves. Multifactorial mechanisms of aging cutaneous. Velasco Institute, September 21, 2023.

74. VILLANUEVA, E. et al. Skin aging and oxidative stress: The impact of environment and lifestyle. Journal of Aging Research, vol. 2019, p. 1-10, 2019.

75. WEIGAND, K. et al. Age-related changes in skin and the role of hydration. *Skin Research and Technology,* vol. 26, no. 1, p. 1-8, 2020.

76. Wu, W.; ZHANG, Q.; ZHUANG, Z. Effect of microfocused ultrasound treatment for skin rejuvenation: A systematic review and meta-analysis. *Journal of Cosmetic Dermatology,* vol. 15, n. 4, p. 455-463, 2016.

77. ZOU, S. et al. Mechanisms of skin aging: A review. *Journal of Cosmetic Dermatology,* v. 16, no. 3, p. 337-342, 2017.

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