

Noninvasive Skin Tightening Treatment

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(J Clin Aesthet Dermatol. 2015;8(6):14–18.)

Abstract

Noninvasive skin tightening has become one of the most common cosmetic aesthetic procedures being performed today. The use of radiofrequency devices for these procedures has been at the forefront of this trend for the past several years. Newer and more sophisticated radiofrequency devices are being brought to the market and presented here are the Venus Freeze and Venus Legacy.

Introduction

The demand for noninvasive skin/aesthetic treatments has grown significantly over the past several years. According to the ASAPS surveys released in 2014 and 2015, there has been a 12-percent increase in the demand for cosmetic procedures, with Americans spending more than \$12 billion and having 10 billion procedures in 2014.¹ Growth statistics in cosmetic procedures continue to rise, as seen in Figure 1. Even with the global economic challenges, in the

aesthetic space in 2009 to 2010, the market was unwavering in its demand for pain-free, low-risk, and little-down-time treatments that are consistent in their clinical outcomes. Patients demand these kinds of treatments and doctors are more than willing to deliver them, once they prove their safety and efficacy in clinical trial settings. Nonsurgical skin tightening treatments can be safely delegated to a nurse or medical professional under the guidance of the medical director in states that allow this, and, as a result, this has given doctors the ability to expand their practice.

The Technology

In 2011, Venus Concept (Tel Aviv, Israel; Toronto, Canada) introduced the Venus Freeze (Figure 2A) to the North American market, which had been launched in international markets, such as Europe and Asia, as early as 2007.

This skin tightening device, powered by MP² technology, which stands for Multi Polar Magnetic

Pulses, is unique in its delivery of radiofrequency (RF) energy for skin tightening with the addition of synergistically deployed pulsed electromagnetic fields, which is innovative in the aesthetic industry.

The device consists of two hand pieces; one with eight electrodes for large treatment areas and another with four electrodes for smaller treatment areas. Each synthesizer of the hand pieces, is built of 4 or 8 magnetized RF electrodes that emit both RF and magnetic pulse fields at the same time.

The RF pulses are transmitted in varying phases between any two synthesizers in an organized matrix that homogeneously raise the temperature over the entire treatment area and create highly efficient woven dense energy that deeply penetrates the skin layer simultaneously for maximum efficacy.

The pulsed electromagnetic field (PEMF) sends short pulses of electrical current through a coil placed over the skin that induces magnetic fields through the skin and forms Foucault (Eddy) electrical currents, which change the electrical potential of charged receptors on the membrane of dermal cells and stimulate molecular and cellular reactions.

The MP² synthesizers supply high-frequency alternating electrical currents at 1MHz, 150W penetrating the skin to generate heat production in the dermis and hypodermis. The PEMF supplies a low frequency of 15Hz, a pulsed magnetic field flux of 15G (=1.5mTesla), and a pulse duration of 5msec.

The skin tightening device's MP² technology has shown effectiveness for noninvasive treatments, including tightening of lax skin, smoothing of the appearance of

cellulite, reduction of localized fat deposits, and softening of fine lines and wrinkles.

A second-generation device, Venus Legacy, joined the device family in 2013 (Figure 2B). The Venus Legacy increased the size of the applicator, added variable level suction, and included real-time thermal feedback. Larger spot sized applicators lead to deeper energy penetration as the RF energy flows between each pair of electrodes with a fixed distance and theorized depth of penetration increasing as the electrodes are placed further apart.

The mild negative pressure from the Venus Legacy uses the studied “gate control” theory suggesting that pain can be reduced by simultaneous activation of nerve fibers that conduct non-noxious stimuli. Visual integrated temperature feedback ensures safe treatments by keeping the tissue heated in the desired thermal range.

Radiofrequency

RF energy is not new in aesthetic medicine; in fact, it has been a staple in skin tightening since 2001. The effects of dermal heating are well-recognized and include immediate effects on collagen structure with stimulation of dermal fibroblasts inducing a synthesis of new collagen fibers (known as neocollagenesis) and elastic fibers (known as neoelastogenesis).²

Stimulation of the dermal extracellular matrix induces an immediate shrinkage of collagen fibers. Thermal stimulation of the fat cells induces an immediate increase in the rate of lipase breakdown of triglycerides to glycerol and free fatty acids.³ Since the early days of RF, there have been improvements in the method, or platform, which is used to deliver the RF to the tissue

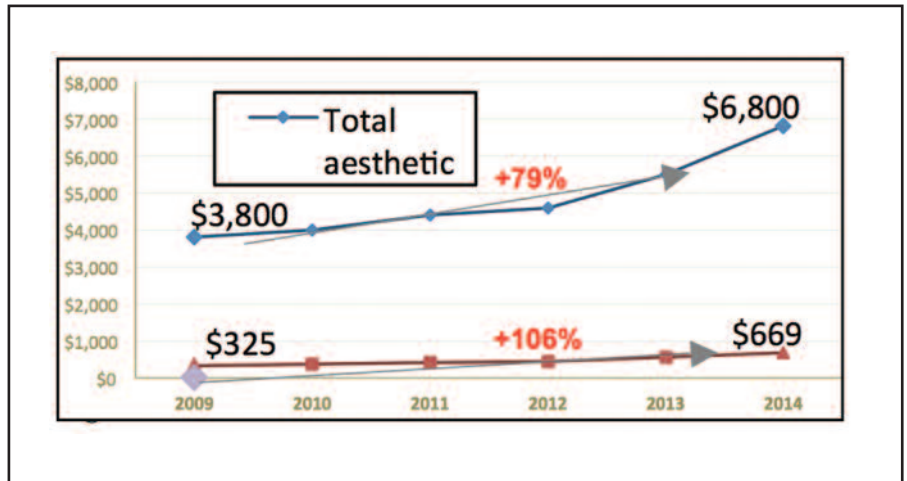


Figure 1. The demand for noninvasive skin/aesthetic treatments has grown significantly over the past several years.



Figure 2A. The Venus Freeze noninvasive skin tightening device



Figure 2B. The Venus Legacy noninvasive skin tightening device

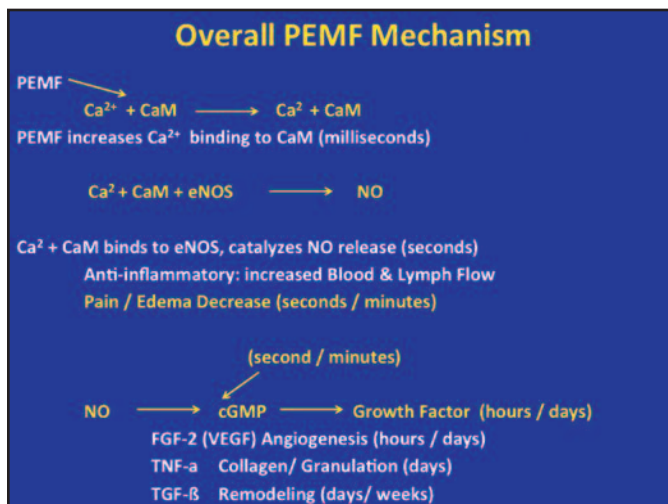


Figure 3. Overall pulsed electromagnetic field mechanism
Source: Strauch B, Herman C, Dabb R, et al. Evidence-based use of pulsed electromagnetic field therapy in clinical plastic surgery. *Aesthet Surg J.* 2009;29:135–143.

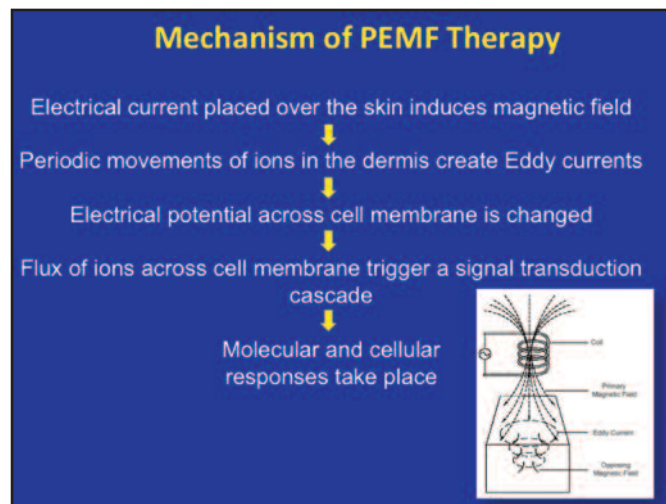


Figure 4. Mechanism of pulsed electromagnetic field therapy.
Source: Strauch B, Herman C, Dabb R, et al. Evidence-based use of pulsed electromagnetic field therapy in clinical plastic surgery. *Aesthet Surg J.* 2009;29:135–143.

as well as better pain management techniques and a far better consistency in the heat distribution. Moving in an algorithm of more than one million times per second, the electrodes in the skin tightening hand pieces change polarity, causing a deep heating matrix to form over the treatment area. This heat matrix allows the user to deliver more energy to the area, achieving higher surface temperatures, allowing one to maintain higher internal temperatures,^{4,5} while still providing a minimal risk and minimal pain aesthetic solution for patients looking for treatment options on their face, neck, or body. As unique as the RF delivery method is, magnetic pulses are a novel addition to this innovative design.

Pulsed Electromagnetic Fields

PEMF has been used in medicine for bone growth, wound healing, neuropathies, and depression since before the 1950s. The first United

States Food and Drug Administration (FDA) approvals were in 1979 for bone growth.

PEMF has been clinically documented and proven to be beneficial for multiple ailing tissues ranging from bone to brain. The reason for these beneficial effects is because PEMF triggers a cascade of biological processes in exposed tissues without effecting nerve or muscle tissue. PEMF has been used extensively, effectively, and safely in the management of postsurgical pain and edema, the treatment of chronic wounds, and in facilitating vasodilatation and angiogenesis. Some studies suggest that PEMF may modulate the production of growth factors.⁶

PEMF can be configured to modulate calcium-binding kinetics to calcium/calmodulin, which then activates nitric oxide synthase, and the relevant cascade ensues dependent upon stage of tissue repair process (Figure 3).⁶ The

PEMF's effects depend upon nitric oxide cascades leading to a biochemical process leaving visible physiological effects. The PEMF therapy mechanism is described in Figure 4.

In the cosmetic medicine industry, PEMF is being used to significantly increase production of collagen fibers by dermal fibroblasts,^{7,8} not via thermal mechanisms,⁹ and stimulate angiogenesis,¹⁰ triggering a wound-healing response.^{6,11}

The blend of both of these effective and proven energies delivered simultaneously to the tissue enables the user to predict the aesthetic outcome of the treatments more accurately because both energies (RF and PEMF) have diverse mechanisms of action and specific biological responses on different structures in the body. The synchronized delivery of RF and PEMF increases neovascularity, proliferates fibroblasts, collagen



Figure 5. Face and neck. Before and after seven treatments with the Venus Freeze



Figure 6. Neck. Before and after six treatments with the Venus Freeze



Figure 7. Face and neck. Before and after 10 treatments with the Venus Freeze



Figure 8. Arms. Before and after four treatments with the Venus Freeze

neosynthesis, denaturation of existing collagen, and contracts the elastin fibers.

Treatment

During the procedure, the patient lies down on the treatment bed with the treated area exposed. A proprietary glycerine-based formula is applied thoroughly over the treatment area. The operator

selects from the main screen a hand piece, sets initial MP² energy level (varies from 0%–100%), places the hand piece on the treatment area, and moves over the treatment area in a pattern, elevating the skin temperature to the therapeutic temperature. Edema and erythema are expected effects that will disappear up to a few hours following the end of the

treatment. Treatment time varies according to the size of the treatment area.

Patients are compliant to the weekly series of treatments, performed over 6 to 10 weeks (depending on the area of the body that is being treated) as there is virtually no pain and the sensation is akin to a hot stone massage; therefore, no down time is needed.

Clinical Cases

While still in its infancy in the North American market, case studies performed in key centers demonstrate that the results achieved with the device allows doctors a newfound luxury in treating their aesthetic patients without the need for out-of-pocket disposables, which other devices in the class often require (F. V. Rueckl, personal communication, 2012). Figures 5 through 8 show before and after photos of patients who underwent noninvasive skin tightening with the Venus Freeze device.

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AESTHETIC UPDATE