
Scientific & Clinical Background of (MP)²® - A synergy between Multi polar RF and Pulsed Magnetic Field developed by Venus Concept. Prof. Yeouda Edoute M.D., Ph.D.

INTRODUCTION

Recently a novel device Venus Freeze[®] powered by (MP)² technology which stands for **M**ulti **P**olar **M**agnetic **P**ulsed was developed and introduced by Venus Concept. (MP)² is a combination of RF and pulsed magnetic fields.

The (MP)² synthesizers supply high-frequency alternating electrical currents at 1 MHz, 150 Watts penetrating the skin to generate heat in the dermis and hypodermis.

The Venus Freeze system consists of 2 hand held apparatuses OctiPolarTM with 8 (MP)² synthesizers for large treatment areas such as abdomen, thighs and buttocks and DiamondPolarTM with 4 (MP)² synthesizers for smaller treatment areas such as face, neck and arms.

Each synthesizer of the hand held apparatus is built of 4 or 8 magnetized RF electrode that emits both RF and pulse magnetic fields (PMF) at the same time. The RF is transmitted in varying phases between any 2 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 PMF 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 facial and body arcs enhancers (Optional apparatus offered with the Venus Freeze) are “operator independent” devices designed to add a magnetizing boost that enhance the PMF effectiveness w/o consuming operator time.

THE DERMIS

The dermis layer (0.5 – 3mm. thick) beneath the superficial layer of the skin (epidermis) is a connective tissue that support the specialized elements of the skin and is composed of cell's: fibroblasts and the extra cellular matrix (ECM). The fibroblasts synthesizes the components of the ECM which are composed of delicate collagen, reticular and elastic fibers interlacing in all directions and other proteins.

Collagen fibers (type I) are delicate fibrillar non branching fibers forming the framework of the dermis and gives tensile and compressive strength to the skin. Specific matrix collagen enzyme (MMP-1) is capable to initiate breakdown of collagen type I.

Once cleaved by enzyme, collagen unravels and is called Gelatin.

Reticular fibers: are thin branching non fibrillar fibers forming delicately woven strands composed of type III collagen. These branching fibers form a fine reticular framework of the dermis that acts as a supporting mesh in the skin.

Elastic fibers: are fibrillar non-branching, highly elastic fibers formed from insoluble protein (elastin) and others proteins found in ECM. Elastic fibers give elasticity to the skin. They can stretch up to 1.5 times their length and snap back to their original length when relaxed.

THE SUBCUTANEOUS

Subcutaneous adipose (fat tissue) beneath the dermis layer is loose connective tissue contains about 87% lipids. It is composed of clusters of fat cells ranging from small to large mature cells. Its main role is to store energy in the form of triglyceride (TG) and to break it up when necessary and it also cushions and insulates the body.

SCIENTIFIC & CLINICAL BACKGROUND THE EFFECTS OF RF

In recent years several new radiofrequency (RF) devices have been introduced for aesthetic non-invasive treatments¹. RF device supplies high-frequency alternating electrical currents penetrating the skin through electrodes.

The penetrated electrical energy to the skin causes collisions between charged molecules and ions with transformation of mechanical energy into heat leading to supra normal temperatures in the dermis and hypodermis.

The heat affects fibroblasts, extra cellular matrix (ECM) and fat cells. Zelickson et al^{2,3} documented that heating human abdominal skin with RF caused immediate collagen shrinkage. The collagen fibers became shorter and thicker. This leading to tissue contraction.

The mechanical effect of collagen heating can be “reversible” = partial denaturation or “irreversible” = complete denaturation. Moderate heating results in a local unfolding within the collagen, leading to shrinkage which appears to regain its native structure upon restoration of normal temperature⁴.

The unfolding of collagen fibers is due to the breaking of a small number of consecutive hydrogen bonds.

Severe heating results in a time dependent irreversible transformation of the native triple helical structure into a more random (coiled) structure. This transformation occurs primarily via breaking of longer sequence of hydrogen bonds that stabilize the triple helix⁴.

Stimulation of dermal fibroblasts by mild thermally mediated wounding, induces a synthesis of new collagen fibers^{5,6} (neocollagenesis) and elastic fibers (neoeLASTOgenesis) after several weeks⁵.

Stimulation of skin fat cells by supra normal temperature, induces an immediate increase rate of enzyme (lipase) mediated breakdown of TGs (Lipolysis) to glycerol and free fatty acids (FFAs) with decrease of fat cells volume⁷. However RF does not increase oxidation of FFAs and weigh loss.

SCIENTIFIC AND CLINICAL BACKGROUND FOR THE EFFECTS OF MAGNETIC PULSES IN VENUS FREEZE® DEVICE

Human cells and tissue metabolism are greatly controlled by magnetic fields and electrons. The pulsed magnetic field (PMF) is now recognized by the 21st century medicine, as an important and successful modality, approved by FDA, to treat a wide range of clinical disorders⁸. Using the PMF we can apply 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 cells. The stimulated receptors activate the cell biological systems to perform molecular and cellular reactions.

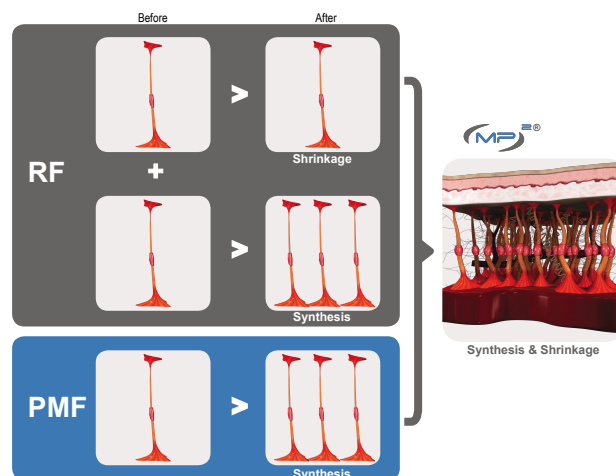
PMF & COLLAGEN SYNTHESIS:

It was demonstrated that fibroblasts exposed to various periods to a low pulsed PMF (1.3 mT, 60 Hz) significantly increase production of collagen. The major differentiated function of fibroblasts, possibly by reducing cyclic-AMP level⁹ but not via thermal mechanisms¹⁰, since the magnetic pulses apparatus caused an insufficient temperature rise (less than 0.1 degree C) to account for these results.

Shahin et al. demonstrated that applying magnetic pulses (2mT peak intensity 25 Hz for 2.5 h/day) during 8 days increased significantly the collagen production in rat skin¹¹.

PMF & ANGIOGENESIS:

Stimulation of dermal fibroblasts by magnetic pulses stimulate the production of vascular growth factors mainly FGF-2 and other growth factors which stimulate proliferation of endothelial cell and tubulization and induction of changes in different surrounding cells. The consequence is enhancement of angiogenesis = formation of new capillaries and small blood vessels¹².



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