

Sanuwave Health Sponsored Learning: Innovative Energy Transfer Medical System: PACE® – Focused Shockwave Technology: Facilitates Revascularization and Capillary Perfusion in Chronic Wounds



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The Power of Shockwaves

Shockwaves are audible and very strong pressure impulses in any elastic medium (e.g., air, water, solid). They can be created by supersonic aircraft, lightning, explosions, earthquakes or other extreme phenomena that generate sudden and significant changes in pressure. Shockwaves can be precisely controlled and directed inside the human body to produce a specifically tuned "wall of pressure" that has healing power.

Focused shockwaves have several important features:

- Extremely rapid rise time
- Compressive pressure causes mechanical tissue stimulation
- Negative pressure generates cavitation that stimulates cells
- Duration of a pressure pulse is 5–8 nanoseconds

- Each shockwave pulse has a cumulative effect on the energy deposited in the wound region
- Dosage (number of shocks, input energy setting and frequency [number of shockwaves per second]) dictates treatment outcome

Cellular Expression from dermaPACE® Treatment

Pulsed Acoustic Cellular Expression (PACE®) is a proprietary form of extracorporeal shockwave technology (ESWT) that uses high-energy acoustic pressure waves created through an electrohydraulic energy (Figure 1). When shockwaves from dermaPACE® treatment pass through a tissue and associated cells, it immediately produces a response (Table 1).

During shocks, shear and tensile stresses are generated on the tissue. Tissue strain produces improved microcirculation and oxygen supply, angiogenesis, long term anti-inflammation

Table 1. Key Effects of dermaPACE® Treatment

Perfusion	PACE® treatment leads to an increase in perfusion. As the PACE® shockwaves penetrate the micro-circulatory system, there is an immediate change in local blood flow in the treated area.
Biofilm	Shockwave treatment can break physical biofilm barriers and allow antibiotics to access to the entrenched bacteria.
Inflammatory response	Increased leukocyte activation assists in the inflammatory phase of wound healing by triggering the release of pro-angiogenic factors. After shockwave treatment, wounds move quickly through the inflammatory phase to the proliferation phase of healing.
Angiogenesis	Pro-angiogenic factors released in response to PACE® treatment lead to new vessel formation and the creation of new capillary networks in the treated area.
Epithelialization	The dermaPACE® system has an effect in the stabilization, size reduction and complete re-epithelialization of wounds, specifically diabetic foot ulcers.

*PACE® also has an antibacterial effect.

and expression of growth factors. The negative pressure that results from shocks form cavitation bubbles, and when the bubbles collapse near a solid boundary and form microjets, it produces cellular level action. Reactive oxygen species (ROS) are formed in the cells' interstitial fluid, activating signaling proteins and cytokines. The resulting growth factors generate cell proliferation and differentiation.

Indications for use include ischemic injuries, venous ulcers, diabetic ulcers, pressure injuries, arterial and mixed etiology ulcers, full- or partial-thickness burns, post-traumatic acute wounds, post-operative wound healing defects on suture lines, septic/infected wounds and locally infected wounds.

The dermaPACE® device can be used as a standalone treatment or it can be used with standard of care dressings or other advanced therapies such as negative pressure wound therapy. It complements other therapies to optimize the granulation tissue in and around the wound bed, overcoming a long-lasting inflammatory stage and leading to more effective wound healing and less ulcer recurrence. The dermaPACE® machine is easy to use and can be set up in about two minutes. Active treatment time is about 4–7 minutes, depending on the size of the wound area. Analytical reports show no statistically significant adverse effects.

**Figure 1.** dermaPACE® machine

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