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Healing Chronic Wounds From Electric Stimulation

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Abstract: *Electrical stimulation (ES) has gained considerable attention as a therapeutic modality for enhancing the repair of chronic wounds. By reproducing the body's endogenous electric fields, ES modulates several biological processes, including directed cell migration, angiogenesis, collagen remodeling, antibacterial activity, and the proliferation of keratinocytes and fibroblasts. Different stimulation formats such as direct current (DC), alternating current (AC), and pulsed current (PC) have demonstrated measurable improvements in tissue regeneration by regulating ion transport and activating intracellular signaling pathways. Recent advances in self-powered electroactive systems, including enzymatic biofuel cells, piezoelectric and triboelectric nanogenerators, conductive polymers, and electroconductive hydrogels, offer sustained local stimulation without the need for external energy sources. This review synthesizes current knowledge on the mechanisms, device platforms, and therapeutic potential of ES for chronic wound management and highlights its emerging role in restoring bioelectric cues essential for effective healing.*

Keywords: Wound healing, Chronic wounds, Electrical stimulation, Electric field

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