Therapeutic potential of electromagnetic fields for tissue engineering and wound healing

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Abstract

Ability of electromagnetic fields (EMF) to stimulate cell proliferation and differentiation has attracted the attention of many laboratories specialized in regenerative medicine over the past number of decades. Recent studies have shed light on bio-effects induced by the EMF and how they might be harnessed to help control tissue regeneration and wound healing. Number of recent reports suggests that EMF has a positive impact at different stages of healing. Processes impacted by EMF include, but are not limited to, cell migration and proliferation, expression of growth factors, nitric oxide signalling, cytokine modulation, and more. These effects have been detected even during application of low frequencies (range: 30-300 kHz) and extremely low frequencies (range: 3-30 Hz). In this regard, special emphasis of this review is the applications of extremely low-frequency EMFs due to their bio-safety and therapeutic efficacy. The article also discusses combinatorial effect of EMF and mesenchymal stem cells for treatment of neurodegenerative diseases and bone tissue engineering. In addition, we discuss future perspectives of application of EMF for tissue engineering and use of metal nanoparticles activated by EMF for drug delivery and wound dressing.

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