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OPTIMAL GRAVITY CONDITIONS FOR BONE TISSUE HEALING USING MAGNETIC
NANOPARTICLES AND SCAFFOLDS

Abstract

Purpose: Novel methods using magnetic nanoparticles and porous scaffolds (MNPS) with magnetic fields and stem cells increases the osteogenic differentiation, angiogenesis and bone regeneration by 2–3 folds over those of the controls. The results of such treatment supposedly depend on the gravity conditions, particularly on the direction of the applied magnetic field and the direction of gravitational field. **Methodology:** To enhance bone tissue engineering efficacy, which has been defined as a multidisciplinary field that integrates principles of engineering and life sciences, the role of gravity is not yet fully explored. Under earth gravity conditions the question to answer is- should the applied magnetic field be oriented parallel to the gravity or perpendicular to it. The orientation of both fields define the ultimate blood circulation around the healing bone tissue. We propose to conduct several bone healing surgeries under different gravity conditions, ranging from non-gravity to normal gravity. An optimal gravity condition will be determined for getting the fastest and safest bone healing with best mechanical properties close to the human bone. **Results:** The mechanisms of MNPS with magnetic fields to enhance bone regeneration were identified as involving the activation of the blood and nutrition supply into the healing area. Mechanical properties of the regenerated and healed bone, its retention capacity of the biological fluids strongly depend on the final composition of magnetic fillers and scaffolds, and on the directions of the applied field and gravity. **Conclusions:** The proposed bone regeneration treatment with MNPS under varying gravity and applied magnetic fields will lead to a crucial knowledge on how to deal with such complications on the extended human space trips. **Areas of Discussion:** Bone and tissue regeneration and healing on Extended Human Spaceflight Missions.