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Effectiveness of Tissue Engineering in Obtaining the Extracellular Composite Vascularized Bone Matrix

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Abstract

Massive bone defects are considered to be one of the basic causes of functional disability. The gold standard, which nowadays is autologous grafting, is a perfect combination of mineralized extracellular matrix, bone marrow, and osteogenic cells. However, the available amount of such biological material is limited and the bone large defects remain a challenge. The lack of oxygen and nutrient transport actually remains the basic technical challenge in tissue engineering that limits the achievement of an effective bone allograft in the treatment of massive bone defects. The purpose of the paper is to present the results collected from the experimental study in obtaining the biocompatible extracellular composite vascularized bone matrix (vECCBM). We present a universal approach to a decellularization protocol based on the consecutive use of an isotonic solution, a chelating agent, anionic and ionic detergent as well as an enzyme solution. The effectiveness of decellularization was tested by histological examination (H&E and DAPI staining) and DNA quantification. The biocompatibility test was performed using the cultivation of the STEM cells from the bone marrow. Results: we were able to obtain a protocol for decellularization of the composite grafts, bone + vessel (soft and hard tissue) with the preservation of the vascular pedicle integrity and its connection with the bone compartment having in this way the possibility of applying anastomoses between the decellularized matrix and host.

Keywords: bone defects, extracellular composite bone matrix, bone allograft, tissue engineering

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