Tissue Engineering in Fractured Mandible Reconstruction

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Abstract. The paper presents an overview of human tissue engineering and modelling-simulating methods currently in use. Tissue engineering is a promising alternative for the reconstruction of altered or totally damaged biological tissue, applied to eliminate the complications associated to traditional transplants.

Keywords. tissue engineering, stem cells, biological tissue substitute

Tissue engineering represents a new scientific field dealing with the creation in vitro of biological tissue substitutes. Tissue substitutes can be implanted in order to replace defective regions of the human body. The method to obtain tissue structures involves adding certain types of specific cells (stem/differentiated cells) to a polymeric matrix, which has the form of the tissue that is about to be restored and creates the appropriate conditions for the tissue development [1]. There are two approaches in tissue engineering for the study and control of the cells and tissues: continuous and discrete. For the former, the distribution of cells in the tissue is described in terms of density, while for the latter the tissue is represented by a lattice of cells [2].

Starting with a critical analysis of the modelling-simulating methods and techniques used in tissue engineering nowadays (the Differential Adhesion Hypothesis for the continuous approach, respectively, the Monte Carlo method and Metropolis algorithm for the discrete approach [2]), the future work will result in specific tissue modelling-simulating methods and development of cell adhesion techniques to form new tissues for the mandible. The implementation under research will allow monitoring of the tissue development, and will support comparative analysis of the results. These results will be used to solve a specific tissue engineering problem based on stem cells, as a bone tissue implanted in patients with mandible fracture. The modelling-simulating methods will be implemented in MatLab environment, which provides a wide set of modelling and simulating facilities.


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