

High resolution ultrasound methods in tissue engineering

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The fast development of interdisciplinary areas - tissue engineering and regenerative medicine, requires continuous improvement of research approaches and imaging techniques. This report will present the possibilities and perspectives of ultrasound methods for the evaluation of matrixes and tissue engineered constructs (TECs) for regenerative medicine needs. The information obtained by ultrasound includes both the evaluation of TEC morphology (geometry and internal structure of the fabricated matrix, integration into the living organism, settlement with cellular components, formation of extracellular matrix, vascularization and, finally, complete replacement by the organism's own tissues) and elastic properties (measurement of sound velocity, attenuation and spectrum). It should be noted that over the last twenty years a lot of research in this direction has been carried out, but if we delve into the issue in a little more detail, it becomes clear that a more general problem has not been solved: the development of a consistent comprehensive approach to the study of tissue-engineered structures. This situation was due to the fact that acoustic microscopy was used in each individual study to address a specific question on a specific type of matrix, cell, or tissue-engineered construct. Preliminary studies carried out in our laboratory on different types of matrixes before and after implantation in the organism, combined with the undoubted advantages of safety and non-invasiveness, allow us to consider acoustic microscopy as a universal method applicable from the manufacturing stage up to clinical trials, providing clear feedback, will help to develop a general integrated approach.

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