

Revolutionizing Cardiac Therapy: 3FEED - A Nanofunctionalized Scaffold for Post-Myocardial Infarction Tissue Protection and Regeneration

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Cardiac tissue engineering is an innovative and highly promising therapeutic strategy for addressing cardiovascular diseases, which remain the primary global cause of mortality. Advancing nanofunctionalized cardiac scaffolds offers a solution in promoting cardiac tissue repair, regeneration, and protection within the damaged heart, primarily resulting from ischemic damage. In this scenario, our patented 3D nanoFunctionalized and Engineered Electroconductive Patch (3FEED) emerged as a result of the European research project INCIPIT. This pioneering tissue-engineered acellular microstructured scaffold aims to promote post-myocardial infarction (MI) tissue regenerative processes. 3FEED is designed to attract stem/precursor cells, regulate left ventricular remodeling, and to facilitate cardiac cell electrical coupling. This study validates 3FEED's biocompatibility and assesses its effectiveness in restoring cardiac functionality after MI. Due to the limited myocardium tissue regeneration rate, recruiting cells capable to re-build cardiac affected area is necessary. The performed migration assays demonstrated that 3FEED has the capacity to attract mesenchymal stem cells and non-myocyte cardiac cells. Gene expression analysis revealed the cardioinductive effect of 3FEED on cardiac stem cells. Additionally, the in vivo studies confirmed the 3FEED capability to recruit stem cells within the damaged heart tissue and also emphasized its role in promoting new blood vessel formation. The present study demonstrates the efficacy of 3FEED as a viable approach for cardiac tissue regeneration. These encouraging findings foster in vivo investigations in large animal models, a crucial step to translate 3FEED to the first-in-human trials and CE mark certification of our medical device. Our disruptive tissue regeneration technology offers a potential solution for the existing limitations in cardiovascular disease treatment, improving patient outcomes and reducing healthcare costs.