J Tissue Sci Eng 2018, Volume 9
DOI: 10.4172/2157-7552-C2-049

Growing of cardiac cells using alginate-chitosan scaffolds by using an electrical bioreactor

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Heart diseases are the main cause of mortality around the world. Is it's important to develop new strategies to fabricate healthy cardiac tissue that can be used to repair dead heart tissue? We design a novel bioreactor for the development of functional cardiac tissue using electrical stimulation to enhance cellular growing. The aim of the present work was to compare the development of cardiac tissue structures in static, perfusion, and perfusion with electrical stimulation conditions using our sponges and bioreactor. The bioreactor consists of a chamber with two carbon electrodes. Neonatal rat ventricular myocytes (1.5 X 106 cells) were seeded onto alginate-chitosan sponges. Constructs were precultured without electrical stimulation for three days with culture medium in a 37ºC and 5% CO2 humidified incubator. Constructs static cultured in 24-plates for seven days were controls. Second group of constructs were transferred to the bioreactor with medium flow at 1.5 mL/min for four more days; and the third group of constructs were transferred to the bioreactor with medium flow at 1.5 mL/min, and electrical stimulation for four more days. At day seven, all constructs were processed using the standard histological technique. Quantitative analysis was performed. The cell area of static constructs was 20 μm2; whereas perfused constructs had 40 μm2; and perfused+electrical stimulated constructs had 146 μm2. The total cellular area increases six times in perfused+electrical stimulated constructs compared with only perfusion constructs. Our proposed system enhances cardiomyocyte growing and should be used for further studies.

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