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THE ROLE OF THE FLOW RATE ON CELL DIFFERENTIATION DURING SEEDING OF THE STEM CELLS WITHIN THE MATRIX

Zahra Eslami
Shahid Beheshti University of Medical Sciences, Iran

Cardiovascular disease (involving narrowed or blocked blood vessels which can lead to heart attack or stroke) is a widespread disease throughout the world and conventional surgical implantation procedures such as coronary artery or peripheral by-pass require autologous vessels or synthetic grafts with diameters lower than 5 mm. In this case, tissue-engineered vascular grafts are considered as an appropriate alternative which are typically fabricated by seeding the stem cells into a porous tubular scaffold. However, the method by which the stem cells are seeded within a 3D tubular scaffold can be a dramatically decisive parameter to achieve a fully functional vascular graft. Spatially-uniform cellular distribution throughout the thickness of the tubular tissue-engineered graft is particularly of great importance since it provides the required conditions for uniform regeneration of the tissue. Also, the stem cell viability is often challenging because the mechanical driving forces used for seeding step can cause shear-mediated membrane lysis or may result in triggering of apoptotic pathways. To address these problems, simultaneous application of centrifugal force and the pumping flow offers a promising seeding procedure. As a particular item, various flow rates during incorporation of the stem cells within tubular scaffolds play a key role on cell differentiation in terms of cell number, distribution, viability and phenotype. The change in the applied volume of the flow as well as the change in the corresponding frequency leads to alterations in shear stress on protoplasm of the stem cells, which in turn results in differentiation of these cells to myocytes. The mentioned changes in the volume and frequency of the flow are applied by changing the diameter of the lumen.

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