

عنوان مقاله:

Enhanced re-endothelialization of rat acellular lungs by application of engineering principles

محل انتشار:

اولین کنگره بین المللی مهندسی بافت و پزشکی بازساختی ایران (سال: 1397)

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خلاصه مقاله:

Introduction Lung tissue engineering based on decellularized scaffolds is a new approach which can lead to complete treatment of end-stage patients with pulmonary diseases. However, to create a functional organ, complete recellularization of the decellularized scaffolds in terms of density and distribution has remained as one of the main challenges of the field. Objectives This study aimed to enhance the repopulation of rat decellularized lung vascular beds with endothelial cells by applying engineering principles including mass and momentum transfer in the recellularization process. Methods Human Umbilical Vein Endothelial Cells (HUVECs) were seeded in the decellularized scaffolds and underwent an 18-hour static culture continued by perfusion culture up to a week. A mathematical model of the oxygen transfer rate (OTR) in the culture medium was used to correlate cell respiration to the oxygen pressure differences in the lung-containing chamber headspace. Also, mass transfer coefficient (kLa) and shear stress were manipulated using shaking. Results H&E staining and MTT assays demonstrated that more cells were proliferated on the decellularized scaffolds using shaking than only-perfusion case due to the enhanced kLa and the cell stimulation by shear stress. Also, continuous monitoring of cell viability using the mathematical model for OTR demonstrated the overall status of the cells within the scaffolds during the culture. Conclusion In conclusion, using engineering principles such as mass and momentum transfer can hasten the advancement of the lung tissue engineering research toward a functional organ not only by providing monitoring tools but also by allowing for manipulating cell behavior through shear stress and efficient nutrient supply.

کلمات کلیدی:

Tissue engineering, Regenerative medicine, Engineering principles, Lung, Decellularization, Recellularization

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