

**Fiber-based fluorescence lifetime imaging of recellularization processes on vascular tissue constructs.**

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**Public Summary:**

New techniques able to follow the development of engineered tissues over time are needed for a more efficient control of the process. Here, a label-free fluorescence lifetime imaging (FLIm) approach implemented with fiber-optics is used for nondestructive evaluation of vascular biomaterials. The recellularization processes of antigen removed bovine pericardium scaffolds with endothelial cells and mesenchymal stem cells were evaluated on the two sides of the tissue, 2 distinct extracellular matrix niches, over the course of a 7 day culture period. Results indicated that fluorescence lifetime successfully reports cell presence. The recellularization process was different for each side of the tissue for both cell types, and endothelial cells expanded faster than mesenchymal stem cells on antigen-removed bovine pericardium. Fiber-based FLIm has the potential to become a nondestructive tool for the assessment of tissue maturation by allowing in situ imaging of intraluminal vascular biomaterials.

**Scientific Abstract:**

New techniques able to monitor the maturation of tissue engineered constructs over time are needed for a more efficient control of developmental parameters. Here, a label-free fluorescence lifetime imaging (FLIm) approach implemented through a single fiber-optic interface is reported for nondestructive in situ assessment of vascular biomaterials. Recellularization processes of antigen removed bovine pericardium scaffolds with endothelial cells and mesenchymal stem cells were evaluated on the serous and the fibrous sides of the scaffolds, 2 distinct extracellular matrix niches, over the course of a 7 day culture period. Results indicated that fluorescence lifetime successfully report cell presence resolved from extracellular matrix fluorescence. The recellularization process was more rapid on the serous side than on the fibrous side for both cell types, and endothelial cells expanded faster than mesenchymal stem cells on antigen-removed bovine pericardium. Fiber-based FLIm has the potential to become a nondestructive tool for the assessment of tissue maturation by allowing in situ imaging of intraluminal vascular biomaterials.

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