

Characterizing the Role of Dextran in the Decellularization of Porcine Corneas

Lynch A. P.^{1,2}, Wilson S. L.³, Ahearne M.^{1,2,1}Trinity Centre for Bioengineering, Trinity Biomedical Sciences Institute, Trinity College Dublin, Dublin, IRELAND²Department of Mechanical and Manufacturing Engineering, School of Engineering, Trinity College Dublin, Dublin, IRELAND³Academic Ophthalmology, Division of Clinical Neuroscience, Queen's Medical Centre Campus, University of Nottingham, Nottingham, UNITED KINGDOM.

In recent years, corneal decellularization has emerged as a promising alternative to traditional tissue-engineered methods to create a corneal replacement for transplantation. One of the significant problems arising from the decellularization of porcine corneas is that of corneal swelling, limiting its potential use as a scaffold for corneal tissue engineering. Here, we propose the use of the complex polysaccharide dextran during decellularization to combat this undesirable effect. To achieve this, corneas were treated with detergents and nucleases under constant rotation followed by a washing step. A dextran solution was added to one group throughout the decellularization process and to a second group during the washing cycle. A final group consisted of corneas decellularized by several freeze/thaw cycles. The resultant scaffolds were extensively characterized by histological and biochemical analyses in addition to examining the ultrastructure of the cornea by transmission electron microscopy (TEM). Results revealed that a combination of detergents and nucleases effectively removed the majority of cellular material from the cornea. The addition of dextran prevented significant swelling when used throughout the protocol or during the washing process alone. A degree of transparency was restored to all groups by placing the scaffolds in glycerol, suggesting maintenance of the extracellular matrix. However, TEM analysis revealed that dextran must be present throughout the decellularization process to preserve the native ultrastructure of the cornea. This data suggests that dextran could be a useful addition for the decellularization of porcine corneas for corneal tissue engineering.