

The Development Of A Novel Human Corneal Substitute Using Decellularized Corneas

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There is currently no reliable or standardized protocol for decellularization of human corneas. The discrete integration between corneal architecture and functional integration is vital to maintaining the native (keratocyte) cell phenotype *in vivo* and this inevitably affects cell type *in vitro*. Decellularization protocols need to sufficiently eliminate cellular material with minimal disruption to tissue architecture. Additionally a technique needs to be established for successful cell infiltration. The aim is to utilize corneal eye-bank tissue deemed unsuitable for transplantation *via* optimized human specific decellularization techniques and recellularization using novel, enriched, corneal stem cell populations which may be utilized in two key areas: (i) A more relevant human corneal substitute for drug and irritant testing in order to replace animal work and (ii) the creation of an effective engineered corneal construct for corneal transplantation. Removal of detectable cellular and immune reactive material will be evidenced by immunofluorescence and CFSE based mixed lymphocyte assays. Preservation of biomechanical, dynamic biomechanical analysis, optical properties and retention of corneal architecture will be assessed.

The vision is that this research will yield reproducible, reliable constructs, available on demand. From an international public health standpoint, and from the perspective of patient quality of life, there is an undeniable need to develop a reliable artificial and healthy biomimetic cornea. We endeavor to provide the underpinning research to demonstrate that a bioengineered cornea repopulated with normal stromal and epithelial cells is both possible and clinically viable.