Corneal decellularisation: recycling tissue for transplantation [abstract]

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Corneal Decellularisation: Recycling tissue for transplantation
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PURPOSE: There is a clinical need for reliable, reproducible biomimetic corneas. Decellularised tissues are advantageous compared to synthetic/semi-synthetic tissues in that the native matrix ultrastructure and intrinsic cues including growth factors, cytokines and glycosaminoglycans (GAGs) may be retained. However, there is currently no reliable, standardised human corneal decellularisation method. Here, we provide a systematic study of commonly used decellularisation methods and assess their appropriateness for corneal applications.

METHODS: Eye-bank tissue unsuitable for transplantation was used to test decellularisation methods: Dispase removal of the epi- and endothelium; Mechanical agitation; Hypertonic NaCl; Ionic detergent (SDS); Non-ionic detergent (Triton-X100); all followed by nuclease treatment. Removal of cellular material, preservation of transparency, retention of corneal architecture and GAGs was assessed via histological, immunofluorescence and quantitative analysis. Potential cytotoxicity in vitro of the treated tissue was also assessed.

RESULTS: No decellularisation technique investigated successfully removed 100% of cellular components. The techniques which had the least residual DNA, SDS and Triton-X, were most structurally compromised with reduced GAG content. Dispase treated, NaCl and mechanically agitated corneas had better preservation of structure, transparency and GAGs, but had higher residual DNA.

CONCLUSIONS: The ability to reprocess and regenerate tissues deemed “unsuitable” for transplantation allows us to salvage valuable tissue. However, in order to progress, we may need to take a step back to establish a “decellularisation” criterion; which should balance effective removal of immune reactive material with maintenance of tissue functionality.