

EVALUATION OF THE CHEMICAL AND BIOMECHANICAL VISCOELASTIC PROPERTIES OF DECELLULARISED TRACHEAL SCAFFOLDS

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Tracheal tissue engineering using decellularised extracellular matrix (ECM) scaffolds was one of the first fields to be clinically introduced to patients with phase I/II clinical trials underway in the UK. A key requirement in functional tissue engineering is to characterise the biomechanical properties of tissueengineered constructs relative to native tissues. This will provide baseline assessment of the initial functional state of the decellularised tissue. In the present study we explored the effect of decellularisation on the biochemical and mechanical viscoelastic properties of porcine tracheal cartilage. Viscoelasticity describes the biphasic nature of cartilage attributed to its solid like composition of elastin and collagen fibrils and water trapped by glycosaminoglycans. This unique property helps prevent failure of cartilage under repetitive loading. Porcine tracheae were decellularised by vacuum assisted chemical enzymatic approach. Cellularity and key ECM components of the scaffolds were evaluated. And total DNA, glycosaminoglycan and collagen content were quantified. Dynamic mechanical analysis (DMA) frequency sweep test was used to assess the viscoelastic properties of tracheal cartilage. The results showed that decellularisation process removed most of the cellular contents with a significant reduction in total DNA content. There was no significant difference in the level of collagen and glycosaminoglycan content and the scaffolds retained most of the key extracellular matrix components. No significant difference observed in the viscoelastic storage modulus, loss modulus, complex modulus and tan delta. In conclusion, these results suggest that vacuum assisted chemical enzymatic decellularisation appeared to retain the critical structural and mechanical viscoelastic properties of tracheal scaffolds.