Abstract

The long term goal of this project is to tissue-engineer a corneal replacement, therefore an understanding of the optical and mechanical properties of the replacement tissue are essential. The short term summer goals were to study our tissue constructs over time in culture with optical coherence microscopy (OCM), histology, light transmission, and mechanical analysis as methods of examination. Glutaraldehyde (GTA) crosslinked chondroitin sulfate (CS) collagen sponges were used as scaffolds for corneal fibroblast growth and were compared to uncrosslinked sponges. In addition, sponges were cultured with and without ascorbic acid to observe if changes in collagen production were present and what impact they had on the transparency of the tissue. Free floating sponges were compared to sponges radially constrained in specially designed ring clamps. The ring clamps and associated OCM chambers were designed, constructed, and tested to present the same location in each sponge sample for imaging in the OCM each time it is imaged over the course of the study. The uncrosslinked sponges were weaker than the GTA sponges, while showing no significant difference in light transmission. The clamped sponges, as a group, showed an increase in light transmission over time. The unclamped sponges contracted thus becoming denser and therefore more highly scattering. The addition of ascorbic acid to the culture media did not result in any significant structural or mechanical differences, although the tissue constructs as a whole did have higher ultimate tensile strength values at later days in culture.