Effects of matrix stabilization when using glutaraldehyde on the material properties of porcine meniscus


Abstract: Meniscus transplantation frequently is one of the only options available for treating symptomatic younger patients with tibiofemoral pain and early arthrosis after a prior meniscectomy. However, clinical results indicate that current meniscal allografts may undergo degenerative changes due to enzymatic degradation during the remodeling phase. The objective of this study was to evaluate the effects of glutaraldehyde-induced matrix stabilization on the material properties of porcine meniscus prior to surgical implantation. Protocols for fabricating heart-valve replacements were examined, followed by an exploration of the effects of reducing glutaraldehyde concentration and exposure time. Cylindrical meniscus specimens were tested in uniaxial confined compression under a 0.196 MPa compressive stress, and aggregate modulus (H(A)), permeability (k), and compressive strains at equilibrium (epsilon(eq)) were calculated from the creep response. Compared to controls, the mean values for H(A) and k increased, on average, by 213 and 709%, respectively, and epsilon(eq) decreased by 57% for all "heart-valve" treatments. Reducing tissue exposure time to glutaraldehyde had little effect, but decreasing glutaraldehyde concentration to 0.02% resulted in tissues with material properties no different from the untreated controls. We conclude that minimal concentrations of glutaraldehyde (less than 0.2%) should be used in future studies to preserve normal meniscus properties.