

Tissue Engineering for the Intervertebral Disc: Research with the Sand Rat Model

H.E. Gruber, PhD; E.N. Hanley, Jr., MD

The objective of this study was to use a small animal model with spontaneous disc degeneration to illustrate the feasibility of autologous disc cell implantation. The use of autologous disc cells in the potential treatment of disc degeneration offers attractive possibilities for novel therapies. Results are presented on use of the sand rat (*Psammomys obesus*), a small rodent which spontaneously develops disc degeneration during aging, in experimental studies in which cells were harvested from a lumbar intervertebral disc, expanded in monolayer tissue culture, labeled with agents which allow subsequent immunolocalization of these cells and re-implanted in a second disc site of the donor animal. Tissue culture, disc surgery, histology and immunocytochemistry techniques were employed. Cells were either engrafted in a bioresorbable carrier tested for cell compatibility or injected into the recipient disc. Results were assessed with radiographic examination of the implantation site and with histology and immunocytochemistry. Data from 15 animals were obtained with engraftment resident in the animal for up to 33 weeks. Immunocytologic identification of engrafted cells showed that they integrated into the disc and were surrounded by normal matrix at time points up to eight-seven month's post-engraftment. Engrafted cells exhibited either a spindle-shaped morphology in the annulus or a rounded chondrocyte-like morphology in the nucleus. Although technically challenging, our experience showed that autologous disc cell implantation can be successful and that the sand rat is a valuable model for autologous disc cell studies.