IN VITRO SYNOVIAL FIBROCHONDROGENESIS
FOR MENISCAL TISSUE ENGINEERING

Jennifer J. Warnock

Dr. Derek B. Fox, Dissertation Supervisor

ABSTRACT

A series of *in vitro* studies were performed to evaluate the fibrochondrogenic potential of synovial membrane cells, for the long term goal of inducing meniscal fibrocartilage healing and regeneration. The first study determined that synoviocytes seeded on PGA scaffolds and cultured in a rotating bioreactor resulted in the most optimal cell and matrix characteristics, however, scaffolds dissolved prematurely. PGA scaffolds were then coated with 2% and 4% PLLA, however, the PLLA coating resulted in severely clumped cellular distribution, and did not prevent rapid dissolution of the PGA scaffolds. To induce a synovial fibrocartilage phenotypic shift, synovial membrane cells were then cultured on a copolymer of 10% poly-L-lactic acid and 90% poly-glycolic acid and exposed to various growth factor treatments. The combination of FGF followed by sustained IGF and TGF-β resulted in the highest expression of aggrecan, a constituent of the axial avascular meniscus. The next study increased bioreactor cell seeding density to 9.5 million cells/mL, which resulted in grossly visible fibrocartilage- like tissue, however, cell mortality was high. To determine if autologous osteoarthritic synovium could be a cell source for meniscal fibrocartilage tissue engineering, normal and osteoarthritic synovial membrane cells were cultured in monolayer with growth factors. It was found that osteoarthritic synoviocytes can undergo fibrocartilage phenotypic shifts, however their production of collagenous ECM was less than normal synoviocytes. Autogenous osteoarthritic synovium may be a viable cell source for meniscal tissue engineering, however, osteoarthritic synoviocytes may require longer culture times or other special treatments compared to normal synoviocytes.