



Determination of Relationship of Fibrinogen and Thrombin Concentration to Fibrin Scaffold Properties Through the Use of Dextran Nanoparticles

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A chronic wound forms when any step of the wound healing process completes improperly. A potential treatment for this condition involves implantation of a fibrin scaffold seeded with fibroblasts into the wound site. In order for an implant to be successful, the pore size of the scaffold must be large enough to accommodate cellular nutrient exchange and proliferation, while not so large that the scaffold mechanical integrity is compromised. The purpose of this study was to determine the effects of different concentrations of fibrinogen and thrombin on scaffold porosity, diffusion capabilities, mechanical properties, and ultrastructure, using dextran nanoparticles as both scaffold probes and models of intracellular particles. Scaffolds of varying fibrinogen and thrombin concentrations were formed in modified Millopore™ Centricon® containers, and then evaluated for flow characteristics with serum-free DMEM with or without fluorescent dextran nanoparticles of varying sizes. Next, scaffolds were evaluated for the diffusive properties of dextran nanoparticles of varying sizes. Finally, scaffolds were tested for mechanical stiffness with an Instron machine, and ultrastructure with scanning electron microscopy. Results demonstrated an inverse relationship between pore size and both fibrinogen and thrombin concentration, indicating that an increase in either fibrinogen or thrombin concentration results in a decrease in pore size and permeability. These results suggest that higher concentrations of fibrinogen and thrombin inhibit nutrient uptake of seeded cells, confirming previous studies, which demonstrated a decrease in cell viability with an increase in fibrinogen concentration. Future studies involve evaluating dextran uptake of seeded cells in scaffolds.