

Transdermal photopolymerization of poly(ethylene oxide)-based injectable hydrogels for tissue-engineered cartilage

Elisseeff J, Anseth K, Sims D, McIntosh W, Randolph M, Yaremchuk M, Langer R

PLASTIC AND RECONSTRUCTIVE SURGERY

104 (4): 1014-1022 SEP 1999

Abstract:

Transdermal photopolymerization, a minimally invasive method for implantation, was used to subcutaneously place a mixture of polymer and isolated chondrocytes to regenerate cartilage tissue in vivo. Semi-interpenetrating networks of varying proportions of poly(ethylene oxide)dimethacrylate and poly(ethylene oxide) and primary, bovine articular chondrocytes were implanted in athymic mice. Four mice (12 implants) were harvested at 2, 4, and 7 weeks. Chondrocytes survived implantation and photopolymerization and formed neocartilage containing 1.5 to 2.9% wet weight collagen and 4 to 7% glycosaminoglycan. Thirty-five percent of the total collagen was type II collagen. Histologic analysis exhibited tissue structure resembling neocartilage, and safranin O staining demonstrated glycosaminoglycan distribution throughout the hydrogels. This study demonstrates the potential use of transdermal photopolymerization for minimally invasive subcutaneous implantation of hydrogels and chondrocytes for in vivo cartilage regeneration.