A chemical surface modification of chitosan by glycoconjugates to enhance the cell-biomaterial interaction

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Abstract

The use of wheat germ agglutinin (WGA), a lectin molecule, to modify chitosan and enhance the cell-biomaterial interaction was examined. The percentage of living fibroblast cells on the surfaces of tissue culture polystyrene (TCPS) control, WGA-modified chitosan, and unmodified chitosan films increased to 99%, 99%, and 85%, respectively, after seeding for 48 h. DNA staining revealed that a portion of fibroblasts cultivated on chitosan films( )were undergoing apoptosis. In contrast, fibroblasts growing on WGA-modified chitosan film surfaces did not show any indication of apoptosis. The number of fibroblast cells was the highest on the WGA-modified chitosan surfaces, followed by the TCPS and unmodified chitosan surfaces. This WGA-mediated enhancement on the fibroblast cell-biomaterial interaction was cell type dependent. Other types of cells may need different lectin molecules for enhanced interaction with biomaterials. Further, the evaluation of the heat shock protein (HSP) mRNA expression indicated that HSP 90 expression was increased in the fibroblast cells cultivated on chitosan films and decreased to basal levels on the WGA-modified chitosan films. Taken together, our data suggest that the use of WGA and other lectin molecules to enhance the cell-biomaterial interaction via oligosaccharide-mediated cell adhesion is a promising way to improve cell adhesion and proliferation, the two key issues in tissue engineering.