Peptide-Modified Hydrogels for Tissue Engineering

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ABSTRACT

Successes in tissue engineering often depend on the use of biomaterials that mimick the cell binding interactions of the extracellular matrix. Alginates, naturally derived polysaccharide copolymers, have been widely utilized as tissue engineering materials; however, they lack of cell binding ability and the degradation is poorly controlled. In this study, we first studied the ability of cell interactive alginates, formed by coupling specific peptide sequence (e.g. RGD) to the polymer chain to bind cellular receptors, and control cell functions. RGD-modified alginate gels regulated myoblast phenotype in dimensional cell culture as myoblast proliferation and differentiation were dependent on the peptide presence and density. Mechanical measurement of cells encapsulated in RGD-modified alginate allowed us to calculate the number of receptor-ligand interactions in this system. The degradability of this cell-interactive polymer system was next controlled by combining partial oxidation of polymer chain, and formation of gels from a bimodal polymer molecular weight distribution. Preliminarily, myoblasts encapsulated in hydrolytically-labile gels fused to form myotubes, as indicated by F-actin staining, while those in non-degradable gels maintained a round morphology with no evidence of muscle fiber formation. These results indicate an appropriate combination of biological (e.g. cell-binding ability) and physical (e.g. degradation) properties are required of tissue engineering materials to control the formation of new tissues.

Keywords: alginate, RGD peptide, crosslinking, degradation, C2C12 myoblasts

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Materials Processing for Properties and Performance (MP[3]) Vol. 3
Edited by K.A. Khor, R. V. Ramanujan, C. P. Ooi and J. H. Zhao
Institute of Materials East Asia, 2004