567g Synthetic Scaffolds Mimicking Small Intestinal Submucosa

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Use of biodegradable scaffolds as an alternative to engineer new tissues has become an attractive candidate in various transplantation protocols. In particular, small intestinal submucosa (SIS), has shown significant success in bladder regeneration. However, it is a natural matrix and large-scale preparations are hindered by various physicochemical properties which affect the quality and reliability of the tissue regeneration in the clinical settings. We questioned whether a synthetic matrix mimicking the characteristics of the SIS can be developed. For this purpose, scaffolds were formed from chitosan, gelatin, and poly-lactic-co-glycolic acid (PLGA) in different configurations: 1) uniform matrix from emulsion of chitosan/gelatin and PLGA, ii) composite matrix containing a PLGA membrane sandwiched between porous gelatin/chitosan matrix (NaCl was used while forming PLGA membranes to anchor the porous region). Cellular activity of GFP-transfected canine bladder-smooth muscle cells were tested on these scaffolds. Uniaxial tensile properties, fatigue properties, permeability to urea, and the surface microarchitecture were analyzed similar to SIS [1]. These results showed that the first configuration showed less support for cell spreading and proliferation. However, the acidic degradation products of PLGA significantly influenced the degradation of lysozyme-dependent chitosan degradation in four weeks. The second configuration allowed better tailorability of various physicochemical properties such as tensile properties, permeability of the membrane by regulating the thickness of the PLGA membrane and the amount of NaCl. Further, support for cell spreading and proliferation was better than the first configuration. In summary, these results show a promising potential.

[1]. Raghavan D, Kropp BP, Lin H-K, Zhang Y, Cowan R, Madihally SV. Physical Characteristics Of Small Intestinal Submucosa Scaffolds Are Location-Dependent. J. Biomedical Materials Research-Part A. 73A(1):90-9, 2005.