Multilayer micromolding of degradable polymer tissue engineering scaffolds

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Abstract

Precise surface geometrical morphologies have been shown to improve cellular proliferation, adhesion, and functionality. It has been found that cells respond strongly to feature dimensions a fraction of their size. In this paper, soft lithography techniques were applied to microfabricate polydimethylsiloxane molds with precisely controlled micro-scale patterns. Three-dimensional polycaprolactone (PCL) scaffolds were fabricated using a multilayer micromolding (MMM) method. Proper heating and stamping parameters were developed for micromolding PCL. This process allowed control of the size, shape, and spacing of support structures within the scaffold. The micromolding of multiple layers with independent features allowed for alignment between layers. The high porosity, abundant interconnections, and sharp features were inherent advantages of the scaffolds. Human osteosarcoma cells were seeded in the 3-D scaffolds for cell growth testing. Fluorescent microscopy and scanning electron micrographs showed that cells responded well to the 3-D scaffolds and the scaffolds regulated cell morphology and adhesion.

Keywords

Polycaprolactone; Scaffold; Tissue engineering; Microfabrication; Soft lithography; Multilayer micromolding

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