

The Effect of Micro/Nano Structure of Poly (ϵ -caprolactone) (PCL) Film Using a Two-Step Process (Casting/Plasma) on Cellular Responses

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Abstract : One of the important factors in tissue engineering is to design optimal biomedical scaffolds, which can be governed by topographical surface characteristics, such as size, shape, and direction. Of these properties, we focused on the effects of nano- to micro-sized hierarchical surface. To fabricate the hierarchical surface structure on poly(ϵ -caprolactone) (PCL) film, we employed a micro-casting technique by pressing the mold and nano-etching technique using a modified plasma process. The micro-sized topography of PCL film was controlled by sizes of the micro structures on lotus leaf. Also, the nano-sized topography and hydrophilicity of PCL film were controlled by a modified plasma process. After the plasma treatment, the hydrophobic property of the PCL film was significantly changed into hydrophilic property, and the nano-sized structure was well developed. The surface properties of the modified PCL film were investigated in terms of initial cell morphology, attachment, and proliferation using osteoblast-like-cells (MG63). In particular, initial cell attachment, proliferation and osteogenic differentiation in the hierarchical structure were enhanced dramatically compared to those of the smooth surface. We believe that these results are because of a synergistic effect between the hierarchical structure and the reactive functional groups due to the plasma process. Based on the results presented here, we propose a new biomimetic surface model that maybe useful for effectively regenerating hard tissues.

Keywords : hierarchical surface, lotus leaf, nano-etching, plasma treatment

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