Enhancing Growth Human Endothelial Cells on Arg-Gly-Asp (RGD) Embedded Poly (ε- caprolactone) (PCL) Surface with Nanometer Scale of Surface Disturbance

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Abstract

To explore the application of PCL for the engineering of soft tissues, the PCL surface was first embedded in an amphiphilic moiety and then grafted with RGD peptide to enhance the growth rate of human endothelial cells (HUVEC) on the surface. To graft cell-adhesive peptide RGD on the PCL surface, the PCL surface was first etched by the selected solvent with only nanometer-scale of surface disturbance, and simultaneously embedded with DSPE-PEG [di-stearoyl-phosphatidyl-ethanolamine-methoxy-poly (ethylene glycol)] moiety. Then the PCL-PEG surface was photochemically grafted by GRGD to form PCL-PEG-RGD surface. PCL and the modified surfaces were characterized by surface morphology, surface disturbance, contact angles, ATR-FTIR functional group analysis, and the growth rate of HUVEC. The surface disturbances of PCL and the modified surfaces were examined by atomic force microscope (AFM) and presented by the topography and a roughness parameter, Ra. The Ra values were 16.4 ´ 3.0, 34.8 ´ 1.6, and 12.8 ´ 0.3 nm (n = 3) for PCL, PCL-PEG, and PCL-PEG-RGD surfaces, respectively. The topographies of the surfaces and Ra values indicated that the PCL modified technique developed by this study resulted in only nanometer scale of surface disturbance. In addition to reducing surface disturbances, reducing contact angle from 73.7° ´ 0.4 (n = 3) for the PCL surface to 56.9° ´ 4.0 (n = 3) for the PCL-PEG surface, and the ATR-FTIR transmission spectra at 1660 cm-1 for shoulder of amine I of PCL-PEG-RGD surface both confirmed the successful modification of PCL surfaces. HUVECs adhered well and grew on the PCL-PEG-RGD surface after 36 h incubation, whereas other surfaces did not support growth. Moreover, the viability for the relative growth rate of HUVECs on the PCL-PEG-RGD surface analyzed by MTT assay showed 8.5 times greater growth than that of the unmodified one. In conclusion, a PCL-PEG-RGD surface for enhancing the growth rate of HUVECs has been prepared by a new technique that caused only a

nanometer-scale of surface disturbance. This technique and the PCL-PEG-RGD surface could be further applied to engineer soft tissues.