Development of a New Photopolymeric Material and Photolithographic Method for Cell Patterning

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Topography and chemical properties of the *in vivo* microenvironment affect most cell functions. For this reason, nano/micropatterned surfaces, constructed with different techniques, such as photolithography, soft lithography, nanoimprint lithography and electron beam lithography, are employed to create cell-culture substrates which mimic the highly organized *in vivo* microenvironment[1]. For example, it is known that vascular smooth muscle cells (VSMCs) adopt a contractile phenotype when they have elongated morphology, although they exhibit a synthetic phenotype when they have random organization and minimal alignment[2]. In this context, surfaces with alternating stripes of cell adhering and non-adhering areas have been employed to investigate how VSMCs' phenotype alters when cell morphology is changing.

Towards this direction, the aim of the present work was the development of a new cell-repellent photolithographic material for the selective adhesion and controlled growth of smooth muscle cells. Taking into account the well-documented cell-repellent properties of polyethylene glycol (PEG)[3], four copolymers of PEG and poly(2-tetrahydropyranyl methacrylate) (PTHPMA) were synthesized using different ratios of the two monomers. All materials were evaluated as photopolymers. It was found that the copolymer that provided the most well-defined and stable patterns was the one prepared using a 43/57 ratio of PEG to PTHPMA, and therefore was selected for cell-adhesion experiments. Smooth muscle cells were cultured on the selected surfaces for 1 and 3 days and an increase in cytoskeleton elongation, along with a decrease in nucleus surface area were determined; findings that indicate the preservation of cells contractile phenotype. These very promising results demonstrate the potential of the novel photolithographic and cell repellent material to find applications in the field of tissue engineering.

References:

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