Microfluidic Spinning of Cell-Responsive Grooved Microfibers

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Abstract

Engineering living tissues that simulate their natural counterparts is a dynamic area of research. Among the various models of biological tissues being developed, fiber-shaped cellular architectures, which can be used as artificial blood vessels or muscle fibers, have drawn particular attention. However, the fabrication of continuous microfiber substrates for culturing cells is still limited to a restricted number of polymers (e.g., alginate) having easy processability but poor cell-material interaction properties. Moreover, the typical smooth surface of a synthetic fiber does not replicate the micro-and nanofeatures observed in vivo, which guide and regulate cell behavior. In this study, a method to fabricate photocrosslinkable cell-responsive methacrylamide-modified gelatin (GelMA) fibers with exquisite microstructured surfaces by using a microfluidic device is developed. These hydrogel fibers with microgrooved surfaces efficiently promote cell encapsulation and adhesion. GelMA fibers significantly promote the viability of cells encapsulated in/or grown on the fibers compared with similar grooved alginate fibers used as controls. Importantly, the grooves engraved on the GelMA fibers induce cell alignment. Furthermore, the GelMA fibers exhibit excellent processability and could be wound into various shapes. These microstructured GelMA fibers have great potential as templates for the creation of fiber-shaped tissues or tissue microstructures.

Keywords

KeyWords Plus: GELATIN METHACRYLATE HYDROGELS; REGENERATIVE MEDICINE; PDMS MICROBIOREACTOR; TISSUE CONSTRUCTS; MUSCLE CELLS; STEM-CELLS; ADHESION; SCAFFOLDS; HYBRID; LADEN

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