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Title: Merging 3D printing with electrospun biodegradable small-caliber vascular grafts immobilized with VEGF

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Abstract

The major challenge of commercially available vascular substitutes comes from their limitations in terms of hydrophobic surface, which is hostile to cell growth. To date, tissue-engineered and synthetic grafts have not translated well to clinical trials when looking at small diameters. We conceptualized a cell-free structurally reinforced biodegradable vascular graft recapitulating the anisotropic feature of a native blood vessel. The nanofibrous scaffold is designed in such a way that it will gradually degrade systematically to yield a neo-vessel, facilitated by an immobilized bioactive molecule-vascular endothelial growth factor (VEGF). The nano-topographic cue of the device is capable of direct host cell infiltration. We evaluated the burst pressure, histology, hemocompatibility, compression test, and mechanical analysis of the new graft. The graft implanted into the carotid artery of a porcine model demonstrated a good patency rate as early as two week post-implantation. This graft reinforced design approach when employed in vascular tissue engineering might strongly influencing regenerative medicine.

Fabrication and in-vivo trial of structurally reinforced bio-degradable small-diameter vascular graft via combinatorial 3D printing an electrospinning method.

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