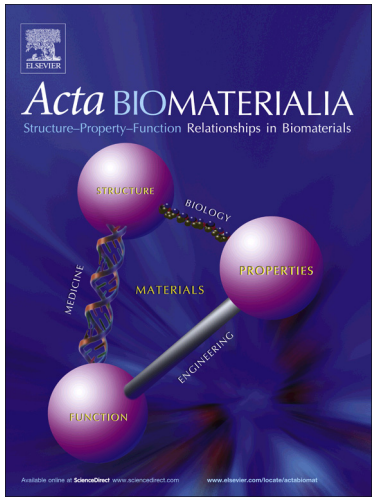

Full length article

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Additive Manufactured Biodegradable Poly(glycerol sebacate methacrylate) Nerve Guidance Conduits

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Abstract

Entubulating devices to repair peripheral nerve injuries are limited in their effectiveness particularly for critical gap injuries. Current clinically used nerve guidance conduits are often simple tubes, far stiffer than that of the native tissue. This study assesses the use of poly(glycerol sebacate methacrylate) (PGSm), a photocurable formulation of the soft biodegradable material, PGS, for peripheral nerve repair. The material was synthesized, the degradation rate and mechanical properties of material were assessed and nerve guidance conduits were structured via stereolithography. *In vitro* cell studies confirmed PGSm as a supporting substrate for both neuronal and glial cell growth. *Ex vivo* studies highlight the ability of the cells from a dissociated dorsal root ganglion to grow out and align along the internal topographical grooves of printed nerve guide conduits. *In vivo* results in a mouse common fibular nerve injury model show regeneration of axons through the PGSm conduit into the distal stump after 21 days. After conduit repair levels of spinal cord glial activation (an indicator for neuropathic pain development) were equivalent to those seen following graft repair. In conclusion, results indicate that PGSm can be structured via additive manufacturing into functional NGCs. This study opens the route of personalized conduit manufacture for nerve injury repair.

Keywords: Nerve guidance conduits, additive manufacturing, biodegradable elastomer