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SENSORY & NEUROPROSTHESES

Development of elastomeric nerve guidance channels featuring a higly smooth internal surface.
After a severe injury, or a resection, severed nerves can be secured within synthetic tubular structures so as to induce and guide regenerating axons. The regeneration process is strongly influenced by the physical properties of the nerve guidance channels (NGC); in particular surface microtexture play a pivotal role in the PNS regeneration. NGC with a smooth internal surface (IS) show regenerating nerve cable of higher quality respect to NGC displaying a rough or porous IS. Based on these observations our work was that of producing flexible NGC featuring a highly smooth IS. The material we used was ChronoFlex™ (PolyMedica, Inc., Woburn, MA, U.S.A.) a family of biostable thermoplastic polyurethane elastomers specifically synthesized to overcame the in vivo biodegradation phenomenon. NGC with a highly smooth IS were fabricated by a dipping, spray-heating technology, using as a channel mold a borosilicate glass capillary which displays a very smooth surface. NGC we produced possess the following features: extremely smooth IS; 140 μm thin, not collapsible, totally impermeable wall; elasticity, flexibility, easy suturability and high transparency. One month implantation experiments in transected rabbits and rats sciatic nerve shown NGC's to be biocompatible and capable of sustaining regenerated nerve cables with a thin epineurium and densely packed axons.

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