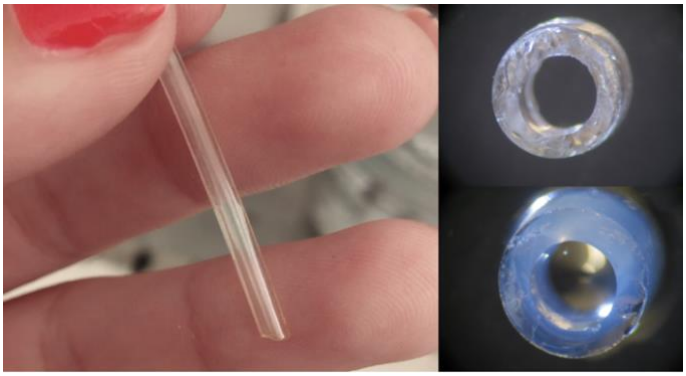
Technology Offer

NervGen: Nerve Guide Conduit for Peripheral Nerve Regeneration

KEYWORDS: Optical Peripheral Nerve Regeneration; Regenerative Medicine; Polymer; Dextran; Nerve Guide.



The injury of the peripheral nerves are a quite common, especially in the young male population due to accidental traumatic events. The degree of injury may vary, being the most severe cases associated with permanent disability. Since the last century, new strategies to improve peripheral nerve regeneration after injury have been studied. The first technique proposed and still nowadays showing the best results is the use of nerve autograph. Nevertheless, this technique is associated to some disadvantages, which include the need of two surgeries and site morbidity. In this sense, nerve guide conduits, which consist in hollow tubes that are sutured to both nerve ends have been proposed as alternative. These conduits should guide the newly formed axons to the opposite nerve stump while providing a suitable environment for the enhancement of axon regeneration.

Among several materials tested for the preparation of these devices, polymers have presented the most promising results. University of Coimbra and University of Porto have developed a novel polymeric nerve guide tube based on biocompatible and biodegradable polymers for regenerative medicine, namely peripheral nerve regeneration. This guide tube promotes the regeneration of the nerve, while it is reabsorbed (with adjustable rate) by the organism without inducing adverse reactions that could lead to its rejection and subsequent removal with recourse to a second surgery. This tube results from the combination of two biocompatible and biodegradable polymeric materials (dextran e poly(g)-caprolactone) for peripheral nerve regeneration that are approved by the Food and Drug Administration (FDA).

ADVANTAGES	APPLICATIONS
• Photopolymerizable characteristic. • Tailored rate of degradation. • Biocompatibility. • Non-acidic degradation material. • Transparency of the tube facilitates suturing. • Adequate biomechanical properties. • Suture resistant structure. • Simple and low cost production technology. • Properties and size of tubes adaptable to the needs.	• Peripheral Nerve Regeneration. • Polymeric tube. • Biomedical application (e.g: dental membrane for drug release).

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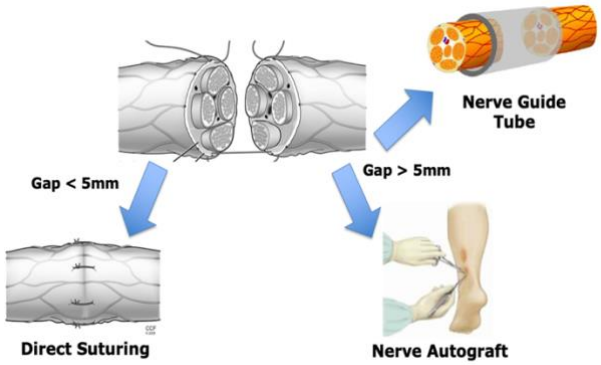
The dextran based nerve guide conduits have a slower degradation ratio in vitro, in comparison with commercially available collagen-based products. Being a biocompatible sugar its degradation products are neutral and do not cause extension of the immune response as proved by the data collected. The final product is completely amorphous, which confers total transparency to the final conduit. In addition, the conduit presents suitable mechanical properties and elasticity facilitating its manipulation and implantation. The conduit is resistant to suturing forming since no cracks or signs of fragmentation are observed.



The technology for tube fabrication is very simple, cost-effective and relatively fast, with a UV crosslinking mean time of 20 minutes. Moreover, the thermal/mechanical properties can be tailored made by using different formulations:

- **Thermal Properties:** TGA, DSC and DMTA analysis of the materials;
- **Surface Morphology:** Scanning Electron Microscopy of the surface of the prepared nerve guide conduits;
- **Mechanical tests:** Tensile tests of the prepared nerve guide conduits (hydrated);
- **Suture tests:** Preliminary suture tests in nerve guide conduits;
- **Swelling Capacity:** On both membranes and nerve guide conduits in PBS (pH=7.4);
- **In vitro hydrolytic degradation:** On both membranes and nerve guide conduits;
- **In vitro:** Cytotoxicity evaluation of membranes using human dental pulp stem cells (hDPSCs);
- **In vivo:** Biocompatibility evaluation by ISO 10-998-6 SCORE - implantation of membranes in the subcutaneous tissue of rats;
- **In vivo:** Implantation of nerve guide conduits in the rat sciatic nerve after neurotmesis injury to injury to evaluate the regeneration of the nerve.

VIDEO (QR Code or YouTube):

STAGE OF DEVELOPMENT: TRL 3

IPR LEGAL STATUS: Patent Pending USA, Japan, Brazil and Europe, claiming n.° PCT/IB2019/054735

OWNERSHIP: The rights to the technology are held by the University of Coimbra and University of Porto.

COLLABORATION SOUGHT: The University of Coimbra is seeking commercial partners interested in further developing the technology under a collaboration and license agreement or acquiring the existing rights.

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Cofinanciado por: