

## Nerve guides; Thermal analysis as a key to successful product design

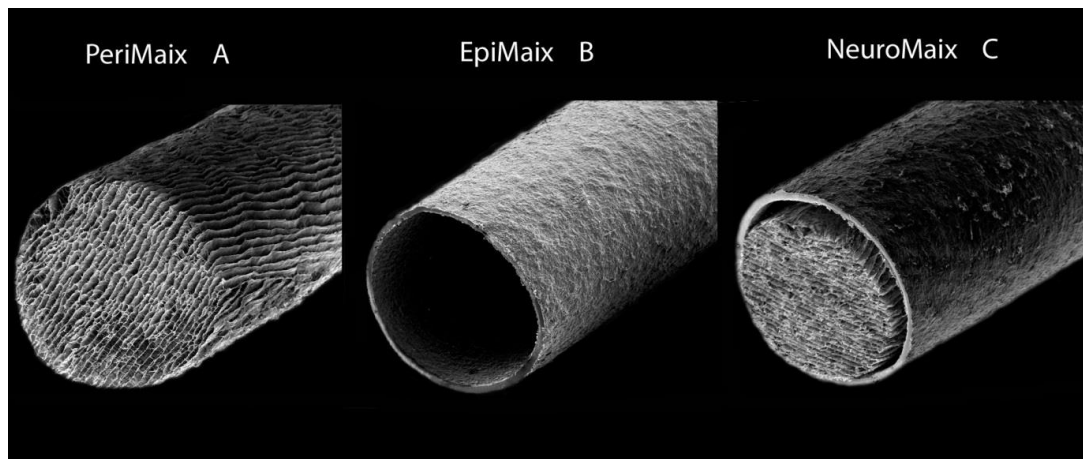
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Neuronal communication along sensory and motor fibers in the peripheral nervous system (PNS) enables the cross-talk between the central nervous system and peripheral organs. Depending on the severity, peripheral nerve injury (PNI), occurring in approximately 2.8% of trauma patients, can lead to life-long loss and/or disturbances in functions mediated by the injured nerve. Moreover, development of neuropathic pain is frequently observed following PNI. When PNI leads to a gap larger than 1–2 cm, nerve regeneration is severely hampered. In such cases, PNI require bridging strategies for repair. Autologous nerve transplantation (ANT) is still the gold standard for such interventions. In recent years, bioengineered nerve guides have been developed as alternatives for ANT and are becoming a promising strategy for the repair of peripheral nerve defects.

Since the foundation in 2001, Matricel GmbH has been working on the development of a collagen-based micro-structured nerve guide (Neuromaix) for the repair of PNI. Neuromaix is composed of a dense tube structure (EpiMaix) and a cylindrical, highly oriented, sponge structure (PeriMaix). PeriMaix is a cylindrical porous collagen sponge composed of parallel oriented layers with a longitudinal orientation from one end of the scaffold to the other. EpiMaix has a tubular shape and protects the inner structure PeriMaix from the surrounding tissue and cells. The development activities focused on the in-vitro cytocompatibility of the nerve guide [1], followed by studies demonstrating the in-vivo regenerative capacity of the nerve guide in an animal model [2]. Currently the nerve guide is being tested clinically [3].

The use of differential scanning calorimetry (DSC) characterization of the different nerve guide prototypes during the development of Neuromaix proved to be a key to successful product design and will be highlighted during the presentation.



- [1] Möllers S, et al. Cytocompatibility of a novel, longitudinally microstructured collagen scaffold intended for nerve tissue repair. *Tissue Eng Part A*. 15(3) (2009) 461-72.
- [2] Bozkurt A, et al. The role of microstructured and interconnected pore channels in a collagen-based nerve guide on axonal regeneration in peripheral nerves. *Biomaterials* 33 (2012) 1363-1375.
- [3] Bozkurt A, et al. The proximal medial sural nerve biopsy model: a standardised and reproducible baseline clinical model for the translational evaluation of bioengineered nerve guides. *Biomed Res Int*. (2014) Epub 2014 Jun 02.