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CASE STUDY: Delivering Stem Cell Therapies for Nerve Repair

Manchester BIOGEL

The Challenge

Peripheral nerve injuries (PNI) are a common consequence of trauma to upper and lower limbs; they profoundly affect the patients' quality of life and are a cause of substantial socio-economic burden. Currently, these injuries are treated by transplanting nerves from another part of the patient's body to the injury site (autografting), but this approach causes donor site morbidity and loss of sensitivity; it still leads to unsatisfactory regeneration and suboptimal motor-sensory functional outcomes.

The Solution

Dr Adam Reid, Senior Clinical Lecturer at The University of Manchester and Consultant Plastic and Reconstructive Surgeon at University Hospital of South Manchester, and his group are designing fully bioengineered nerve grafts exploiting regenerative approaches.

The Science

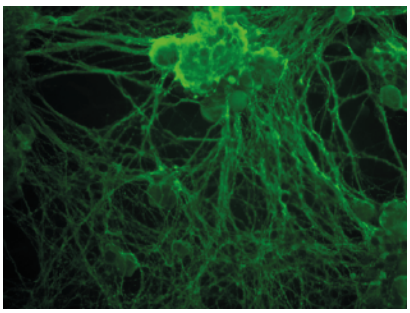
Regenerative approaches require growing the cells involved in nerve repair in vitro before implantation into the patient. Schwann cells (SCs) are the key cells involved in nerve regeneration, but acquiring enough SCs requires the harvesting of healthy patient nerves.

An alternative approach is to harvest and expand human derived-adipose stem cells (hdASC) readily available from fat tissues, and chemically differentiate them in vitro towards the Schwann-like phenotype. To do this, novel, translatable biomaterials are required. In this study synthetic PeptiGels® and animal-derived collagen I are compared to determine if such hydrogel scaffolds are able improve the outcome of hdASCs in this process.

READ MORE
Ferroni et al. Advanced. Healthcare Materials 2019, 1900410

We have demonstrated that PeptiGels® can be used as scaffolds for the culture and differentiation of hdASCs in vitro towards a Schwann cell-like phenotype. We are continuing to explore the potential of PeptiGels® to generate fully-synthetic bioengineered nerve grafts for the treatment of PNIs.

Dr Adam Reid
Senior Clinical Lecturer in Plastic and Reconstructive Surgery, The University of Manchester



The Results

PeptiGels®, Alpha1 and Alpha2, successfully allowed culture of hdASCs with good viability and proliferation over four days. Gene expression analysis of key differentiation markers demonstrated that PeptiGels® supported the differentiation of hdACSs toward a Schwann-like phenotype which was retained upon removal of the chemical simulation. PeptiGel® Alpha2 was successfully used for the long-term culture (20 days) of hdASCs showing higher stability compared to collagen I. Furthermore, both Peptigels® Alpha1 and Alpha2 demonstrated their utility for the culture of rat dorsal root ganglia (DRG) neurons showing good cell attachment and functional neurite sprouting, even in the absence of a laminin coating.

The Future

PeptiGel® Alpha2 has proven capable in delivering cells for the regeneration peripheral nerves. The next step is for PeptiGel Alpha2 to be used to bioengineer nerve grafts in small animal trials.