CELL guidance systems

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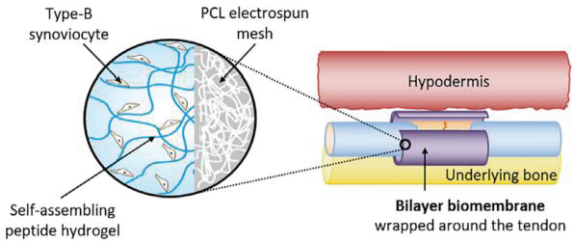
Engineering a Cell-Hydrogel-Fibre Composite to Mimic the Structure and Function of the Tendon Synovial Sheath

The Challenge

Poor recovery from flexor tendon injury can lead to pain and disability, which in turn significantly impacts an individual's global hand function, ability to work and confidence to contribute to society. Tendons repaired using sutures result in 28% of cases presenting with poor restoration of function due to disruption of the synovial membrane and formation of adhesions between the intrasynovial tendon and the surrounding tissue.

The Solution

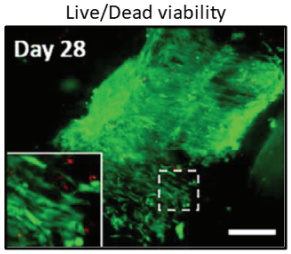
PeptiGel® Alpha 4 seeded with synoviocytes were utilised in conjuction with an electrospun nanofibrous poly (ε-caprolactone) mesh to develop a bilayer biomembrane with the potential to reduce post-operative adhesions, restore tendon gliding ability and support synovial sheath repair.



The Results

PeptiGel® Alpha 4 provided excellent lubricating properties against tendon and hypodermis tissues while the PCL mesh created a barrier to fibroblast infiltration (see publication for further details). After material characterisation, PeptiGel® Alpha 4 was tested to confirm biocompatibility with HIG-82 synoviocytes. A viable population of HIG-82 was observed after 28 days in culture with live/dead viability assay while AlamarBlue demonstrated significant population expansion across the 28 days.

Live/Dead viability



For this project we needed a biocompatible, stable hydrogel for the synoviocytes to create a pericellular matrix. PeptiGel® Alpha 4 proved to be an excellent choice and had the added benefit of providing lubricating properties to facilitate the creation of our bilayer model.

Dr Angela Imere
Postdoctoral Research Associate
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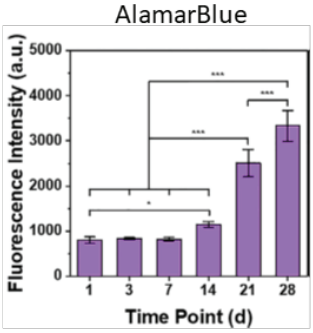
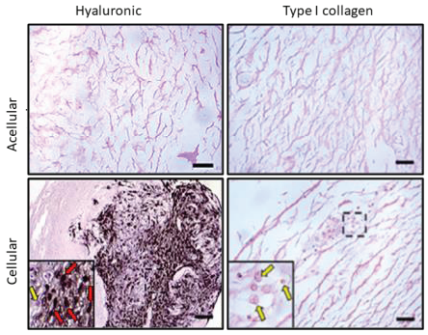
AlamarBlue



After 28 days in culture the synoviocytes within the PeptiGel® Alpha 4 secreted a hyaluronic acid-rich peri-cellular matrix which was negative for type I collagen, this matrix may improve long term tendon functionality.



The Future

This study showed that our fully-defined peptide hydrogels can support synovial sheath repair by providing good lubrication properties, 3-dimensional (3D growth and maintenance of rabbit synoviocytes, evidenced with the production of specific matrix components, such as hyaluronic acid.

A. Imere et al.
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