'Novel scaffolds for tissue engineering of human skeletal muscles'

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INTRODUCTION: Tissue engineering is a multidisciplinary approach aimed at producing new organs and tissues for implantation in order to circumvent the limitations imposed by current techniques such as surgical tissue transfer.

Structure begets function and highly ordered skeletal muscle (SkM) consists of elongated, multinucleate muscle cells (fibres) that are arranged in bundles surrounded by connective tissue sheaths. It is therefore of no surprise that tissue engineered SkM complexes are often designed around fibre containing scaffolds. This work is the natural continuation of strategies introduced at TCES 2002[1].

METHODS: Primary human jaw (masseter) muscle derived cells (hMDC) were obtained using our well-established protocols. 3D organoids were generated using a degradable artificial scaffold (soluble phosphate glass), Type I collagen, or a composite of glass fibres and Type I collagen. Using immunocytochemistry and microscopy, the organoids were tested to determine structure and expression of relevant proteins, and qPCR was used to determine transcription of functional genes.

RESULTS: By day 17, hMDC cultured on glass fibre scaffolds *in vitro* had attached, proliferated and differentiated to form organised prototypic muscle fibres attached to the glass fibres reminiscent of a "myotendinous" junction (Figure 1).

In comparison, hMDC cultured in 3D collagen scaffolds showed a random disorganised arrangement by day 17. A composite of both fibres and collagen did not enhance either situation; in fact the resulting cells population was highly disorganised and not associated with the glass fibres (Figure 2).

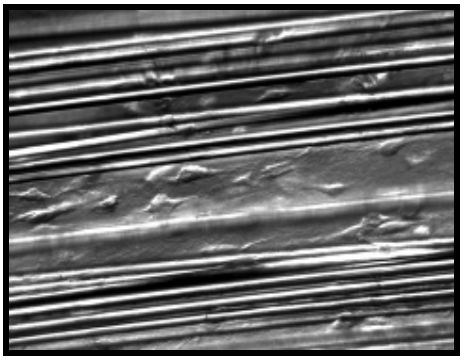

Fig. 2: Composite scaffolds with single cells within the collagen encasing the glass fibres – day 17, 20x modulation contrast

DISCUSSION & CONCLUSIONS:
Artificial phosphate-based glass fibres have been produced to form a biomimetic scaffold. The parallel nature of the fibres has encouraged hMDC to form organised muscle fibre-like structures along the length. The size of the fibre in figure 1 is comparable to fibre lengths found in the eye muscles. This is another step closer to engineering human skeletal muscle. Work is in progress to refine the system further.

REFERENCES: [1] Shah, R., Knowles, J.C., Hunt, N.P. and Lewis, M.P. (2002) European Cells and Materials **4[S2]**: 3.

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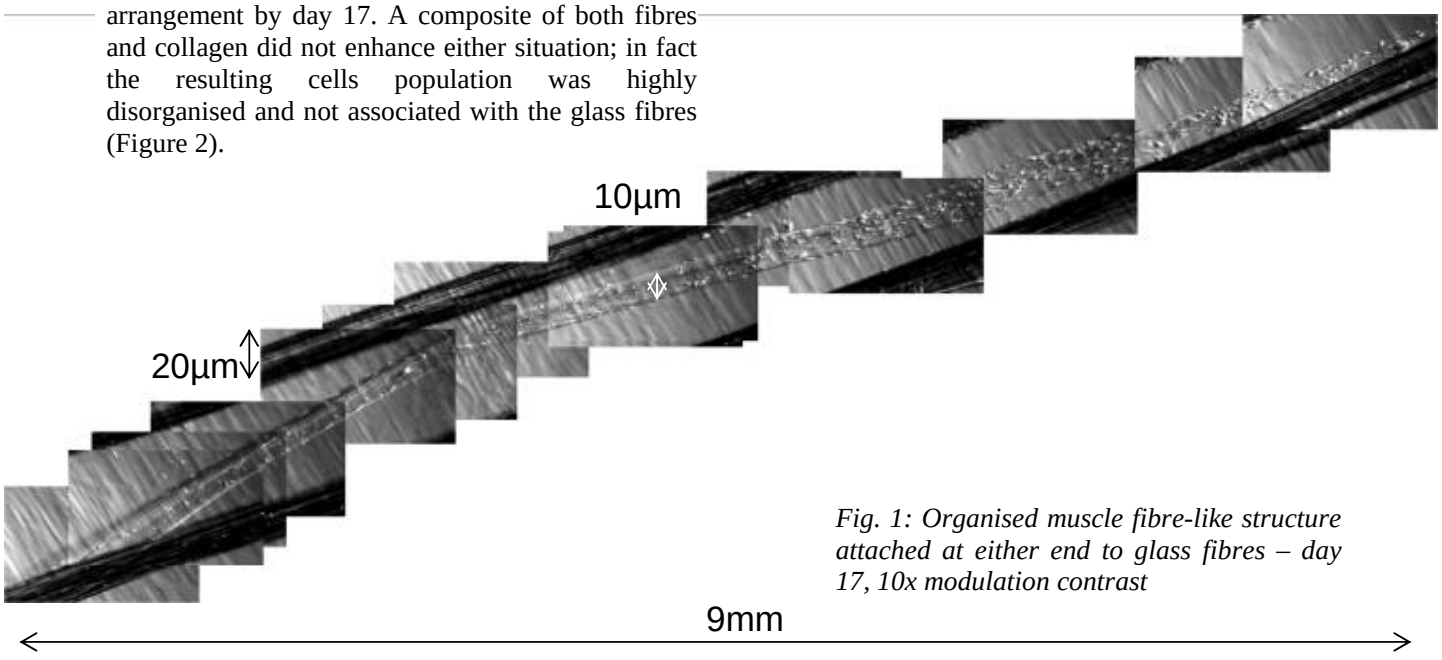

Fig. 1: Organised muscle fibre-like structure attached at either end to glass fibres – day 17, 10x modulation contrast