New tricks for old materials: The Glycomer™ 631 case

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Abstract

Glycomer™ 631, a suture material (Biosyn™, Covidien) was used for the fabrication of a scaffold with aligned topography utilizing electrospinning technology. Human tenocytes cultured on the scaffold, remain viable, aligned and metabolically active after a 5-day period, providing indications that Glycomer™ 631 can find use as a tendon tissue engineering scaffold,

1. Introduction

Tendon tissue engineering is becoming increasingly important, as current surgical treatment modalities based on tissue grafts and non-degradable polymers have numerous drawbacks, including (inter-species) disease transmission, foreign body response and scar tissue formation. Although electro-spun scaffolds based on biodegradable polymers have demonstrated promising results in both in vitro and in vivo setting, long-term implantation studies indicate suboptimal mechanical resilience [1,2]. Herein, we hypothesise that Glycomer™ 631, composed of 60% glycolide, 26% trimethylene carbonate and 14% dioxanone will maintain tenogenic phenotype in vitro and promote functional repair and regeneration in vivo.

2. Experimental Methods

Glycomer™ 631 was dissolved in hexafluoro-isopropanol (HFIP) at 100mg/ml concentration. Using a rotating collector (1400 RPM) anisotropic electro-spun fibres were produced. Human patellar tendon tenocytes were expanded up to passage 3 in DMEM media, supplemented with 10% foetal bovine serum and 1% penicillin / streptomycin. 50,000 cells / cm2 were subsequently cultured for up to 5 days. Fibre orientation was assessed with Scanning Electron Microscopy (SEM). The influence of electro-spun fibres on cell viability and metabolic activity was assessed using Live/Dead® and alamarBlue® assays respectively. Cell morphometric analysis was carried out using DAPI and rhodamine conjugated phalloidin and subsequent image analysis (ImageJ).

3. Results and discussion

Electrospinning of Glycomer™ 631, at 1400 RPM, yields a scaffold with aligned topography (fig 1). Tenocytes remain viable and maintain their metabolic activity on the electrospun Glycomer™ 631 scaffold, while they acquire an elongated morphology, parallel to the fiber orientation (fig 2&3).

Fig. 1. A high degree (>80 %) of alignment of Glycomer™ 631 was achieved electrospinning.

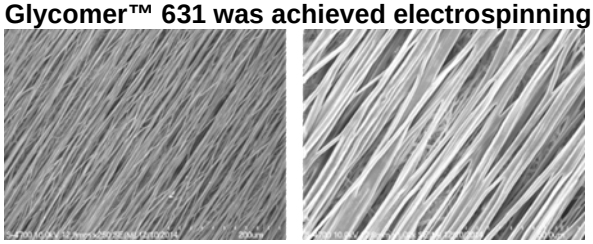


Fig. 2. Tenocytes remain viable & metabolically active up to 5 days in culture

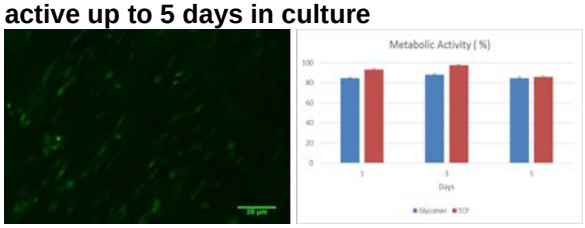
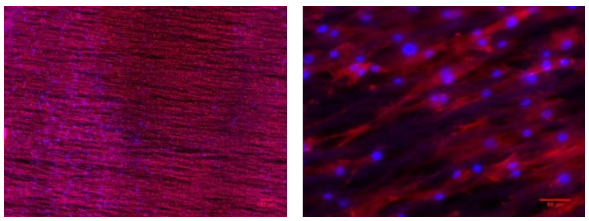


Fig. 3. High degree (>80 %) of alignment on human tenocytes on Glycomer™ 631 electrospun.



4. Conclusions

These preliminary *in vitro* data indicate that anisotropic electro-spun Glycomer™ 631 scaffolds provide a suitable microenvironment for tenocyte growth. Further mechanical analysis, protein and gene assays studies are under way.

5. References

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5. Acknowledgments

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