

DEVELOPMENT OF AN INTERFACE MODEL FOR THE GENERATION AND ENGINEERING OF TISSUE INTERFACES IN VITRO.

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INTRODUCTION: The interface between any newly engineered tissue and pre-existing tissue is absolutely key to tissue engineering, yet this process has so far largely ignored with only a few published reports of the mechanical strength of newly integrated surfaces between connective tissues with other engineered tissues or simply cell-free substrates. Although some correlation between cell migration and matrix deposition has been found, the cellular mechanism of tissue integration is still poorly understood. Work in our laboratory on a tendon - collagen gel interface model¹ has shown measurable adhesion strength increasing with cultivation time dependent on cell migration and surface injury (though not cell proliferation). This model has been evolved to generate a better-defined interface between two collagen lattices, one pre-contracted by resident fibroblasts and the other cell free.

METHODS: A new culture chamber has been designed and fabricated to allow a vertical casting of the cell free gel and then horizontal cultivation immediately after the interface is formed. This can be cultivated for prolonged period of time (> 2 weeks) and can be fitted onto a computer-driven mechanical testing system to perform indentation studies or apply predefined tensile loading.

RESULTS: In this new geometry, stress and strain can be precisely measured, allowing for further modelling of the mechanics of the system by finite element modelling. Baseline (time zero) adhesion force measurements showed good uniformity and reproducibility. Preliminary data also showed that the adhesion force after one week of cultivation was considerably higher.

DISCUSSION & CONCLUSIONS: The current experimental design permits solid interface formation in a controlled manner with a well-defined geometry and the possibility to measure mechanical linkage and/or apply various regimes of mechanical loading. The long-term findings of this research will be beneficial to the development of a new generation of tissue bioreactors.

REFERENCES: ¹ C. Cacou, M. Eastwood, D.A. McGrouther, R.A. Brown (1996) *Cell. Eng.*, **1**, 109-114.

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