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Advanced scaffolds for adipose tissue reconstruction

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INTRODUCTION: The loss of subcutaneous adipose tissue due to the removal of tumours, congenital malformations, deep burns or trauma can have a severe disfiguring impact on the normal body contour. This can leave patients distressed both physically and emotionally. Current clinical treatment methods applied to replace lost adipose tissue often fail to restore the natural body contour. We present a gelatin scaffold combined with an extracellular matrix environment, which supports adipogenesis.

METHODS: Gelatin scaffolds were created using particulate leaching of alginate beads as templates for the macroporous structure[1]. The microporous structure within the gelatin walls was altered through the application of -80˚C temperatures and freeze drying. The viability and distribution of human adipose-derived stem cells (ADSCs) within the scaffolds was assessed. Collagen I and laminin were combined to create an extracellular matrix environment within the scaffold. After culture, adipogenesis was investigated by assessing gene expression.

RESULTS: The scaffolds supported ADSC viability and cell distribution within the porous scaffold was different between frozen and freeze dried scaffolds. Thus, the freezing techniques can be used to control the scaffold architecture and therefore cell distribution.

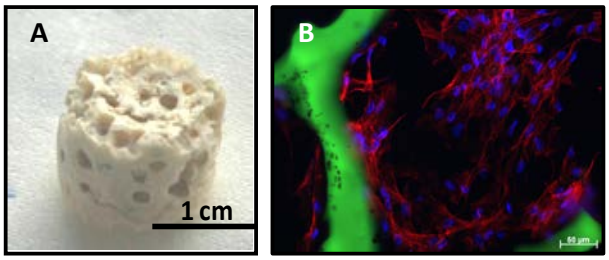

Fig. 1: Microporous macroporous (MM) scaffold supports cell infiltration and proliferation. (A) Freeze dried MM scaffold. (B) The macroporous structure supports cell infiltration and proliferation. Scale bars as indicated. Red = actin, blue = DAPI, Green = scaffold.

ADSCs delivered in the scaffold with a collagen I/laminin hydrogel showed increased adipogenic gene expression after culture for 10 days.

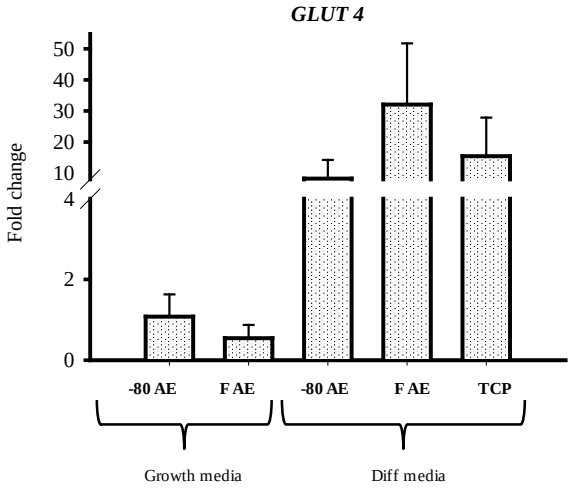

Fig. 2: Composite scaffolds support adipogenic gene expression. GLUT 4 is expressed by ADSCs cultured in the scaffolds and further upregulated in adipogenic differentiation (Diff) media. -80 AE = -80˚C frozen, FAE = freeze dried. Fold change was calculated against ADSCs in growth medium on TCP. Error bars = SD. n = 3.

DISCUSSION & CONCLUSIONS: The integration of a natural adipose environment (AE) within the scaffold resulted in a composite scaffold with features that can support adipose tissue reconstruction.

REFERENCES: [1]MK Phull, T Eydmann, J Roxburgh, et al. (2013) J Mater Sci Mater Med **24**(2):461-7.

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