GUIDED FUNCTIONAL RE-ENGINEERING OF THE MITRAL VALVE LEAFLETS

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Introduction
Mitral valve regurgitation represents the second major valvular disorder in the western world, whereas current strategies for mitral valve reconstruction are imperfect [1]. The aim of this study was to develop a TE substitute for mitral valve leaflet reconstruction using acellular porcine pericardium seeded with porcine mesenchymal stem cells (pMSC).

Methods
Porcine pericardial scaffolds were decellularised as described previously [2]. pMSC were cultured on the mesothelial surface of the scaffolds (3 cm diameter) under static conditions, using 3 different cell densities (2×10⁴, 1×10⁵ and 2×10⁵ cells/cm²). The seeded scaffolds were analysed by scanning electron microscopy (SEM), H & E staining and live/dead staining at 1, 3 and 7 days (Table 1). Following 3 days of static culture, samples seeded with 1×10⁵ cells/cm² were cultured dynamically (10% strain) for 1 day in a biaxial strain bioreactor (Fig. 1). Following dynamic conditioning, the samples were assessed for cell viability with live/dead staining and MTT assay, and for extracellular matrix (ECM) integrity with H&E (Fig. 2).

Results
The optimum seeding density for acellular pericardial samples was 10⁵ cells/cm². Samples seeded with this density and maintained statically for 3 days, prior to dynamic conditioning, showed the best cell penetration without a significant disruption in the ECM (Fig. 2). Seeded samples conditioned dynamically for 1 day showed similar levels of viable cells to seeded samples cultured statically for 1 day (Fig. 3 & 4). Cell alignment was also obvious in the dynamically conditioned samples.

Discussion
Acellular pericardium was shown to be an optimum material for cell repopulation. Reseeded scaffolds were viable after 1 day under 10% dynamic strain. This study provided the basis for optimising the mechano-stimulation of cell-seeded pericardial scaffolds in vitro in order to generate heart-valve like tissue.

References