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Variability in ovine tissue engineered heart valves

D. van Geemen, A. Mol, F.P.T. Baaijens , C.V.C. Bouten

Introduction
Today’s heart valve replacements often enhance survival and quality of life, but have several limitations [1]. Most important, these valves do not consist of living tissue and consequently do not grow. Tissue engineering (TE, Fig 1) focuses on developing living autologous heart valve replacements that have the ability to grow, repair and remodel.

Study approach and first results
Cellular properties: Differences in cell proliferation and phenotype will be studied as possible indicators of tissue variability. To study cell proliferation, cell expansion rates will be depicted in a growth curve for each sheep (Fig 3a). Immuno-fluorescence staining will be used for insight into the contractile and matrix forming characteristics of the cells (Fig 3b,c).

Tissue properties: ECM composition (collagen, glycosaminoglycans) and cell proliferation (DNA) will be quantified with biochemical assays, whereas tissue morphology will be analyzed by histology. Mechanical properties of the valve tissues will be analyzed by tensile testing. Finally, valve functionality will be studied by interpreting the echocardiogram, which is performed directly after implantation.

Discussion
Preliminary results indicate that the cell growth is similar in all sheep (Fig 3a). Therefore, cell growth is probably not the underlying cause in the variability between the ovine tissue engineered heart valves.

The immunofluorescence stainings indicate that a subset of cells is positive for smooth muscle α-actin (contractile marker, Fig 3b) and all cells are positive for heat shock protein 47 (matrix forming marker, Fig 3c). In future studies, these results will be quantified and correlated to functional performance.

References