Tissue Engineering of the Esophagus:
Scaffold Preparation, Characterization and Cytocompatibility

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Introduction
Esophageal atresia is a relatively common congenital disease (approximately 1 in 4,000) in
which the esophagus is interrupted. The current surgical methods need new tools to improve
neonatal outcome. In this study different constructs were developed, characterized and
evaluated for cytocompatibility.

Materials and Methods
Three different tubular scaffolds were developed: single layer, a dual layer (porous and
compressed collagen) and a collagen-PCL (polycaprolactone knitting) scaffold. The
constructs were characterized by means of scanning electron microscopy (SEM), histology
(H&E), immunofluorescent (IF) staining, TNBS assay (degree of crosslinking), ultimate tensile
strength and suture retention experiments. The tubular scaffolds were seeded with primary
smooth muscle cells on the outside and epithelial cells in the lumen of the scaffold, and cultured
for 3 weeks.

Results
The dual layer scaffold had a non porous lumen and the hybrid scaffold showed full
incorporation of the PCL knitting. Ultimate tensile strength and suture retention of the three
constructs varied greatly; namely 0.2±0.1 N/mm, 0.35±0.06N, 0.4±0.1 N/mm 0.52±0.09N; 1.4±0.4
N/mm, 3.73±1.13N, respectively. Adult porcine esophagus tissue was used as a reference: 1.5±0.4
N/mm. H&E and IF analysis revealed a homogeneous distribution of smooth muscle
cells on the outside and epithelial cells in the lumen of the constructs.

Discussion and Conclusions
We have successfully prepared three different collagen-based tubular constructs; a single layer,
a dual layer and a hybrid scaffold, which were cytocompatible. The tensile strength of both
hybrid construct and adult porcine esophagus tissue was comparable. Our date indicates that
this construct may be useful for esophageal atresia reconstruction. Overall, this study
introduces new insights for tubular tissue engineering and may lead to new approaches for
paediatric surgery.

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