

Fibroblasts and Endothelial cells adhesion to polyurethane aortic valve scaffolds under Low- and High-flow conditions

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Background: The purpose of this study was to evaluate the cell adhesion of human vascular cells seeded on newly designed polyurethane aortic valve scaffolds (PAVS) under low- and high-flow conditions. **Material and methods:** Human vascular smooth muscle (SMCs), fibroblasts (FBs) and endothelial (ECs) cells were isolated from saphenous vein segments and expanded in culture. PAVS (n= 6) were produced at the iTV-Denkendorf by the spraying technique and divided into two groups. Group A were primarily seeded with human FBs, followed by a colonization with ECs. Group B were primarily seeded with a mixture of SMCs-FBs and secondarily seeded with FBs, followed by a colonization with ECs. Group A were then exposed for 24 hours ($V= 0.8$ L/min, $P= 40$ mmHg) and Group B for 48 hours ($V_1= 0.2$ L/min, $P_1= 25$ mmHg, $V_2= 0.8$ L/min, $P_2= 40$ mmHg) to different flow conditions and evaluated by scanning electron microscopy (SEM) and immunohistochemical staining (IHC). **Results:** SEM results showed a confluent cell layer on all PAVSs before and after 24h low-flow conditions. IHC staining with CD31 (EC-Antibody) and TE-7 (FB-Antibody) revealed a positive reaction of both cell layers before and after 24h low-flow conditions, whereas no or little CD31-positive reaction could be observed after 24h (A) and 48h (B) perfusion. ECs were not able to resist to high shear stress and detached from the PAVS. **Conclusion:** Already after 24h high-flow conditions, ECs detach from tissue-engineered cardiovascular prostheses pre-seeded with human FBs. FBs react to shear stress and maintain their confluence that may improve in-vivo biocompatibility.

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