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Dimensional Shapes, Similar in the Shape and Architecture to the cup-like Structure of a Normal Human Valve, Produced using PET Spatial Knitted Fabric

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Recently multiple examples of applications of knitted fabrics in HVTE were reported. One of the most frequently citrated strategy was developed in Mela's group. In that case, the fibrin constituting the leaflets of valves is enforced using a warp-knitted tubular mesh, made out of polyethylene terephthalate (PET). In all reports, the authors evaluated biocompatibility of the construct by encapsulating the cells in the fibrin gel constituting the leaflets and quantifying the secreted ECM proteins. Other authors reported that in vivo implantation with fibrin-based tissue-engineered heart valves revealed an absence of calcification, thrombus formation, aneurysm development or stenosis. After 90 days of implantation, it was also observed that a monolayer of endothelial cells was formed, which exhibits the promise of fibrin scaffolds for HVTE. This approach is potentially adaptable for the intelligent scaffold development, which will require replacing non-degradable yarns with bioresorbable yarns. This would be necessary since in the smart solutions; the synthetic yarns need to be finally absorbed and replaced by extra cellular matrix proteins, deposited by in situ recruited cells. PET is not a bioresorbable material, thus alternative strategies need to be proposed to enable growth of valve tissue within the patient. The solutions proposed by Mela and colleagues are promising and encourageable. Inspired by these reports, we fabricated valve leaflets using spatial PET knitted fabric. The construct obtained very closely matched the histological structure of leaflets with 3 layer architecture. This is already important accomplishment towards scaffold closely matching architecture of native valves. The future steps will involve replacing PET with polycaprolactone yarns to enhance construct biocompatibility.

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