ABSTRACT SUBMISSION

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Polyvinyl alcohol cryopolymer 3D Printing: new route toward personalized vascular substitutes

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ABSTRACT

Since its early use in the late 90's, additive manufacturing, and particularly 3D printing, has been considered as a potentially breakthrough technique in biomedical engineering, mainly through its capacity to allow patient-specific implant production [1]. Then, vascular engineering application has rapidly took advantage of the technique, stimulated by the obvious lack of native vessel donors and the corresponding need for synthetic artificial grafts. However, creating a patient specific synthetic vascular graft composed of acceptable biomaterials and having regeneration capabilities still remains a major challenge [2]. Among all available implantable biomaterials, polyvinyl alcohol (PVA) has shown its great potential, both in term of mechanical properties and regeneration capabilities [3, 4],

In the present study, we developed an indirect 3D printing process for PVA hydrogels in order to create vascular substitutes. The proposed strategy is to use 3D printed fugitive PVA as a mold for the production of patient-specific, implantable PVA cryopolymer. The obtained hydrogel were characterized through mechanical properties (E=0,065MPa) measurement (uniaxial static traction procedures), rheological measurements (visco-hyperelastic behavior), compression cycles, and suture retention (59 gmf). The material's microstructures were elucidated through scanning electron microscopy and differential scanning calorimetry (microporous structure). Finally, the hydrogel biocompatibility was investigated in the presence of multiple cell lines (human fibroblasts and Human Umbilical Vein Endothelial Cells).

The results of this extensive study will be presented and will demonstrate that the proposed 3D fabrication process leads to PVA-based patient-specific implants with biocompatibility and customizable mechanical properties opening the path to the production of innovative synthetic vascular grafts.

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