Model of 3D bioprinted glioblastoma for drug screening and understanding the role of ECM in malignancy

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Extracellular matrix (ECM) is a dynamic microenvironment in which proteins, glycoproteins, and glycosaminoglycans favor tumor progression and invasiveness, which is largely dependent on hyaluronic acid (HA). In vitro systems containing glycoconjugate biopolymers mimicking the composition of the ECM can be combined in a way that replicates both the biochemical and physical properties of the cell microenvironment. In the present study, we have cross-linked HA with different ECM proteins using linkers of varying lengths and branches to understand and test the effects of biochemical and physical factors in tumor microenvironments. To obtain a 3D bioprinted GBM model suitable for high-performance predictive screenings as well as to evaluate the efficacy of potential drug candidates and more effective drug therapies, different glioblastoma cell lines were used to test the formulations. Flow rates were also used to exploit differences between static and dynamic conditions. Since the lack of vascularization remains a major limitation in tissue engineering, we also created a vascularized tissue model by combining template leaching additive manufacturing with hydrogels to recreate a complex and physiologically relevant vascularised tissue.
The channels generated by template leaching successfully induced homogeneous vascular chords in the tissue model.