3D in vitro advanced models based on bioprintable engineered hydrogels

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Abstract:
Over the past decades the develop of tissue engineering and regenerative medicine have resulted to innovative approaches in the biotechnology field applied to drug delivery, regeneration and replacement of tissues and engineering of complex 3D organ constructs.
Conventional 2-dimensional (2D) culture models cannot fully replicate the structure and functions of native tissues and organs, conversely cells are able to behave more natively when they grow in 3-dimesional (3D) microenvironments. To better mimicking the cells microenvironmental behaviours, it is necessary to develop 3-dimensional (3D) models that can accurately recapitulate the complexity of extracellular matrix (ECM). In addition, animal models cannot translate into the clinical disease in patients and the develop of *in vitro* 3D models could be a valid substitute (e.g. cancer, inflammatory disease…). Hydrogels due to their hydrophilicity and capacity to mimicking the extracellular matrix (ECM) have been employed as scaffolds to support the 3D cell growth in order to develop representative *in vitro* studies. Hydrogel has been formulated to own the right stiffness and viscosity allowing the bioprinting process to carry forward an advanced research method.
With this aim, a hybrid hydrogel has been designed and developed to be suitable for 3D bioprinting. Natural biopolymers have been properly functionalized and crosslinked in order to obtain a complex network able to mimic ECM features and support cellular grow. ECM components have been swapped whit chitosan for the polysaccharidic part, while gelatin and elastin were employed for the proteinaceous part. The crosslinking process occurs in physiological condition and without UV or catalysts in order to not compromise cell viability. The obtained hybrid hydrogel has been characterized and preliminary employed in 3D bioprinting techniques.