DEVELOPMENT OF ADAPTABLE 3D-BIOPRINTED SCAFFOLDS FOR TISSUE REGENERATION

S. Galvano[1], A.B. Di Stefano[2], E. Muscolino[1], M. Trapani[2], F. Toia[2,3], C. Dispenza[1]

[1]*Dipartimento di Ingegneria, Università degli Studi di Palermo, Viale delle Scienze 6, 90128 Palermo, Italy;*
[2]*BIOPLAST - Laboratory of BIOlogy and Regenerative Medicine - PLASTic Surgery, Dipartimento di Discipline Chirurgiche, Oncologiche e Stomatologiche, Università degli Studi di Palermo, via del Vespro 129, 90127, Palermo, Italy;*
[3]*Dipartimento di Discipline Chirurgiche, Oncologiche e Stomatologiche, Università degli Studi di Palermo, via del Vespro 129, 90127 Palermo, Italy*
[*] Corresponding author: simona.galvano@unipa.it

3D printing is an additive manufacturing technology that can transform 3D virtual models into physical 3D objects by layer-by-layer deposition of suitable materials able to rapidly undergo liquid to solid transformation after dispensing.[1] Hydrogels are one of the most interesting and challenging class of material systems that can be used as inks for 3D printing. Hydrogel-based 3D printing is being exploited in tissue engineering, regenerative medicine, cancer research, in-vitro disease modeling, high throughput drug screening, surgical preparation, advanced wound bandages and flexible wearable electronics.[2] We formulated hydrogel bioinks using k-Carrageen (kC) and poly(vinylalcohol) (PVA). The kC gives the systems the ability to undergo rapid sol-to-gel transitions upon cooling from 60 °C and above to body temperature, while the need of introducing PVA is related to the optimisation of the viscosity of the ink solution to enable 3D printing with a continuous filament and to introduce interconnected porosity in the scaffold.[3] Our study aims to develop bioinks with appropriate viscoelastic properties, sol-to-gel transitions, load-bearing properties and biocompatibility to explore their suitability as scaffolds for either cartilage or bone tissue reconstruction using stem cell spheroids from autologous adipose tissue. Moreover, the radiation-induced chemical modification of kC is studied as a means of inducing noticeable modifications in the polymer molecular weight distributions and chemical structure of this polysaccharide, to optimize the printing properties of bio-ink formulations.

References

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