

Integrated design based on 3D Bioprinting and Bioreactor for skeletal muscle tissue engineering

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In recent years, great efforts have been spent to create engineered muscle constructs recapitulating the 3D architecture and applying external stimulations. In this regard, tissue engineering approaches could be very promising in regenerating skeletal muscle, in which bioprinting techniques have produced encouraging results especially regarding tissue 3D architecture and geometry [1]. Tensile stimuli showed a fundamental role in regulating the behavior of muscle cells both in terms of 3D organizations and protein expression [2, 3]. Despite this promising premise, the combination of 3D bioprinting and mechanical stimulation in muscle tissue has been poorly investigated. To this aim, the present work proposes the design, manufacturing, and benchmarking of a bioprinting-integrated mechanical platform conceived for mechanically stimulating a 3D muscle model directly printed into the bioreactor to promote the integration of 3D bioprinting and stimulation. The study consists of three main steps: 1) the design, fabrication, and mechanical characterization of stretchable supports suitable for bioprinting and long-term cell culture; 2) the design, assisted by computational tools, and the fabrication of the smart petri dish containing the stimulation mechanism and of the final cyclic mechanical platform; 3) the *in-vitro* validation of the proposed platform in terms of transmission of the mechanical stimulation to the constructs and the biological effect of dynamic culture on 3D bioprinted murine muscle cells. The results highlighted excellent viability and demonstrated that the external stimulus influences the murine myoblasts (C2C12 cells) behavior already after 7 days of culture. In conclusion, prototypes are now available of a mechanical platform that integrates the 3D bioprinting and is capable of stimulating 3D biological constructs for applications in the field of muscle tissue engineering.

References:

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