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A Biomechanical Perfusion System for Microfluidic 3D Bioprinted Structure

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Abstract : Tissue engineering has reached a significant milestone with the integration of 3D printing for the creation of complex bioconstructs equipped with vascular networks, crucial for cell maintenance and growth. This study aims to demonstrate the effectiveness of a portable microperfusion system designed to adapt dynamically to the evolving conditions of cell growth within 3D-printed bioconstructs. The microperfusion system was developed to provide a constant and controlled flow of nutrients and oxygen through the integrated vessels in the bioconstruct, replicating in vivo physiological conditions. Through a series of preliminary experiments, we evaluated the system's ability to maintain a favorable environment for cell proliferation and differentiation. Measurements of cell density and viability were performed to monitor the health and functionality of the tissue over time. Preliminary results indicate that the portable microperfusion system not only supports but optimizes cell growth, effectively adapting to changes in metabolic needs during the bioconstruct maturation process. This research opens perspectives in tissue engineering, demonstrating that a portable microperfusion system can be successfully integrated into 3D-printed bioconstructs, promoting sustainable and uniform cell growth. The implications of this study are far-reaching, with potential applications in regenerative medicine and pharmacological research, providing a platform for the development of functional and complex tissues.

Keywords : biofabrication, microfluidic perfusion system, 4D bioprinting
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