Is there a potential for the growth of organoids with 3D bioprinting in mimicking human organs?

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ABSTRACT

Introduction: Organoids are small, 3D structures grown from stem cells that mimic the function and structure of real organs, like the brain, liver, or intestine. These mini-organs are created in a lab by providing stem cells with the right conditions to develop and organise into tissues that resemble those in the human body to closely imitate real organs. However, the potential of the growth of organoids with 3D Bioprinting in mimicking human organs as an innovative approach in tissue engineering and regenerative medicine is still in question. Hence, this literature review is conducted to shed light on this possible potential. **Materials and Methods:** Literature reviews on journals and articles published between 2014 to 2019 from the electronic databases like Science Direct, Cell Press, Nature, IOPScience, Google Scholar, and ResearchGate were reviewed. Keywords used were "cells", "organs", "organoids", "3D bioprinting", and "human organs". **Results:** Lab-grown organ models derived from stem cells offer a platform for disease modelling and drug testing. However, limitations such as a lack of vascularisation and structural complexity hinder their full potential in creating fully functional and complex organs. Therefore, 3D bioprinting is designed to mimic human organs and is called organoid miniatures. The 3D bioprinting addresses the challenges by enabling the precise, layer-by-layer fabrication of complex tissues using bio-inks composed of living cells and biomaterials. Thus, the process of using 3D printing technology will create three-dimensional, functional structures that replicate human organs or tissues. Notwithstanding, this technique allows for the creation of more functional and physiologically relevant organ models, opening new avenues for personalised medicine, drug development, and potentially organ replacement. Cells in the printed organs need to remain healthy and able to communicate with each other. However, this is not always guaranteed, as the technology is still in development. There is a risk that bioprinted tissues may not survive or function appropriately in the long run. There are also ethical and social implications of this technology, particularly when it involves embryo formation. Moreover, the high cost of 3D bioprinting technology could limit access, benefiting only wealthy individuals or institutions. There are also concerns that the 3D bioprinting might be used for non-medical purposes, such as creating organ replicates. In the Muslim countries, the Islamic perspectives are also not well discussed. **Conclusion:** The use of 3D bioprinted organoids presents a promising future for a range of applications, including disease modelling, drug development, and organ replacement therapies. However, addressing the safety and ethical issues is crucial on top of the challenges in creating a viable, functional, and physiologically relevant organ model.

Keywords: Organoids, cells, 3D bioprinting, human organs, biotechnology