**Development of a low-intensity pulsed ultrasound print-head to drive the differentiation of 3D bioprinted skeletal stem cells**

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Tissue engineering (TE) represents a new and functional alternative to conventional medicine to repair and regenerate damaged or diseased tissues. Currently, following bone fracture, standard clinical treatments include surgical reconstruction, application of mechanical implants and full tissue transplantation. However, these strategies have significant limitations, such as the size of repairable defects, inflammation, adverse reactions and limited donor availability. 3D bioprinting has come to the fore as promising platform to engineer new support for skeletal regeneration. An innovative approach proposed to overcome these challenges is based on the use of ultrasound (US) in regenerative medicine. Low intensity pulsed ultrasound (LIPUS) has been studied over the past two decades as a promising technology for bone repair. LIPUS applies mechanical stimuli with acoustic manipulation to initiate and enhance bone regeneration. In the following work, we propose to engineer a novel microfluidic 3D bioprinting head combined with LIPUS for the design of next-generation skeletal substitutes. The desired integration of 3D bioprinting and mechanical stimuli, aim to induce the differentiation of human bone marrow stromal cells (HBMSCs) to drive bone repair and fabricate new customised biodegradable implants.The ultimate goal of this work is to provide a new insight into tissue engineering in bone healing and to refine the efficacy of LIPUS-based therapies, paving the way for safe and targeted skeletal tissue regeneration. By overcoming current limitations and using this new technology, it is expected to offer an advanced therapeutic option to improve the quality of patients' lives with bone defects and reduce the associated socio-economic costs.