OPEN ACCESS Freely available online

Journal of Bone Research

Commentary

The 3D Printing of Bone: A Brief Overview

Wei-Chiao Chang*

Department of Medical Genetics, Kaohsiung Medical University, Taiwan

DESCRIPTION

Bone is a complex and highly structured tissue that is essential for the support and movement of the human body. Bone defects and injuries are common, and can result in significant pain, disability, and loss of function. Traditional methods for repairing bone defects involve the use of autologous bone grafts, which can be associated with significant morbidity and complications. Recently, 3D printing has emerged as a promising approach for the fabrication of bone tissue substitutes, with the potential to revolutionize the field of bone tissue engineering.

3D printing of bone

3D printing, also known as additive manufacturing, is a technique for fabricating three-dimensional objects from digital models. In the context of bone tissue engineering, 3D printing involves the layer-by-layer deposition of biomaterials to create a 3D scaffold that can support the growth and differentiation of bone cells.

There are several approaches to 3D printing of bone, including extrusion-based printing, inkjet printing, and laser-assisted printing. Extrusion-based printing is the most commonly used approach, and involves the deposition of a biomaterial ink through a nozzle onto a substrate. Inkjet printing involves the deposition of droplets of a biomaterial ink onto a substrate using a print head, while laser-assisted printing involves the use of lasers to create a 3D structure from a powdered biomaterial.

Biomaterials used for 3D printing of bone include natural and synthetic polymers, ceramics, and composites. Natural polymers, such as collagen and chitosan, have good biocompatibility and mimic the extracellular matrix of bone tissue. Synthetic polymers, such as Polycaprolactone (PCL) and Poly Lactic-co-Glycolic Acid (PLGA), are biodegradable and can be tuned to have different mechanical properties. Ceramics, such as Hydroxyapatite (HA) and Tricalcium Phosphate (TCP), have good osteoconductivity and can promote bone regeneration. Composites, such as PCL-HA and PLGA-TCP, combine the advantages of different materials to create scaffolds with improved mechanical and biological properties.

Clinical implications

The use of 3D printing for bone tissue engineering has several potential clinical implications. Firstly, 3D-printed bone tissue substitutes can provide a readily available and customizable alternative to traditional bone grafts, which are associated with donor site morbidity and limited availability. Secondly, 3D-printed bone tissue substitutes can be designed to have patient-specific geometry and mechanical properties, which can improve the fit and functionality of the implant. Thirdly, 3D-printed bone tissue substitutes can be loaded with bioactive molecules, such as growth factors and drugs, to enhance bone regeneration and prevent infection.

The 3D printing of bone tissue substitutes is a promising approach for the repair and regeneration of bone defects. The technology allows for the creation of patient-specific, biomimetic scaffolds that can support the growth and differentiation of bone cells. There are several approaches to 3D printing of bone, each with their own advantages and limitations. Biomaterials used for 3D printing of bone include natural and synthetic polymers, ceramics, and composites. The use of 3D printing for bone tissue engineering has several potential clinical implications, including the provision of readily available and customizable bone tissue substitutes, patient-specific implants, and the ability to load the scaffold with bioactive molecules.

Correspondence to: Wei-Chiao Chang, Department of Medical Genetics, Kaohsiung Medical University, Taiwan, E-mail: drwcchang@tmu.edu.tw

Received: 03-Feb-2023; Manuscript No. BMRJ-23-22141; **Editor assigned:** 06-Feb-2023; PreQC. No. BMRJ-23-22141 (PQ); **Reviewed:** 20-Feb-2023; QC. No. BMRJ-23-22141; **Revised:** 27-Feb-2023; Manuscript No. BMRJ-23-22141 (R); **Published:** 06-Mar-2023, DOI: 10.35248/2572-4916.23.11.211.

Citation: Chang WC (2023) The 3D Printing of Bone: A Brief Overview. J Bone Res. 11:211.