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Research In-Progress

Evaluation of 3D Printing Capabilities of Polymeric Gyroid Bone Scaffolds

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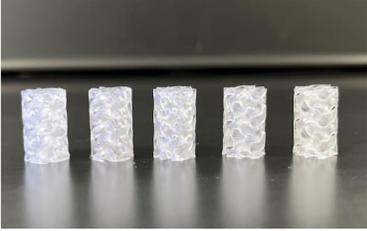
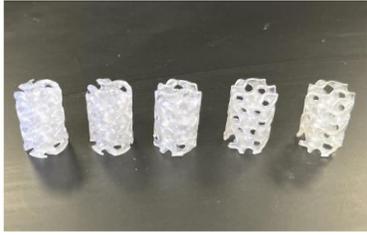
Introduction: Polymers are rising as an optimal material in the field of tissue engineering due to their versatility and modifiability. Among polymer-based designs, biocompatible gyroid scaffolds, a design in the class of triply periodic minimal surfaces (TPMS), are emerging as a candidate in bone regeneration applications. Gyroid architecture consists of a continuous, interconnected network of pores that creates a large surface area and inherent curvature. The size of pore unit cell, level of porosity, and level of curvature all play a role in properties such as chemical transport, mechanical behavior, and degradation - features specific and critical to different tissue types. Advances in resin-based digital light 3D printing have enabled vat photopolymerization of gyroid scaffolds, allowing precise fabrication of this intricate, biomimetic geometry. The purpose of this study is to evaluate the 3D printing capabilities of gyroid scaffolds using Formlabs printers.

Methods: Gyroid scaffolds were fabricated using resin-based digital light 3D printing with the Formlabs Form 3B+ printer. Three biocompatible resins, supplied by Formlabs, were used to evaluate printer capability.

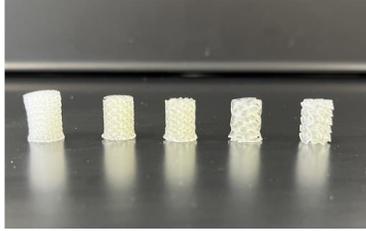
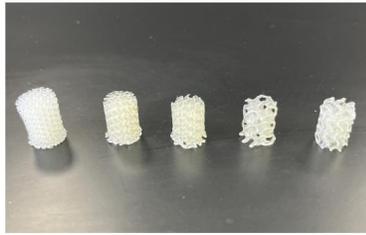
Preliminary Results: The Formlabs Form 3B+ printer was able to accurately 3D print gyroid topology of bone scaffolds for a range of porosity and unit cell size.

Next Steps: Polymeric gyroid scaffolds are promising as an option for bone regeneration applications due to their large surface area, similar geometry to trabecular bone, and adjustability of chemical and mechanical properties. Further research is currently being done to determine the effect of porosity and unit cell size on scaffold mechanical properties, with the ultimate goal of synthesizing a custom polymer resin that is tailorable to the chemical and mechanical needs of bone growth.

Biomed Clear



Elastic 50A



Tough 2000

