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Effect of layer thickness and printing orientation on mechanical properties and dimensional accuracy of 3D printed porous samples for bone tissue engineering

Arghavan Farzadi[1], **MehranSolati-Hashjin**[1,2], **MitraAsadi-Eydivand**[1] and **Noor Azuan Abu Osman**[1]
[1]University of Malaya, Malaysia
[2]Amirkabir University of Technology, Iran

Powder-based inkjet 3Dprinting method is one of the most attractive solid free form techniques. It involves a sequential layering process through which 3D porous scaffolds can be directly produced from computer-generated m¬¬odels. 3D printedproducts' quality are controlled by the optimal build parameters. In this study, Calcium Sulfate based powders were used for porous scaffolds fabrication. The printed scaffolds of 0.8 mm pore size, with different layer thickness and printing orientation, were subjected to the depowdering step. The effects of four layer thicknesses and printing orientations, (parallel to X, Y and Z), on the physical and mechanical properties of printed scaffolds were investigated. It was observed that the compressive strength, toughness and Young's modulus of samples with 0.1125 and 0.125 mm layer thickness were more than others. Furthermore, the results of SEM and μCT analyses showed that samples with 0.1125 mm layer thickness printed in X direction have more dimensional accuracy and significantly close to CAD software based designs with predefined pore size, porosity and pore interconnectivity.

arghavan@um.edu.my