Design of Bone Scaffold for 3D Printing for Pediatric Defects

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Figures with captions/labels of legible font

- Figures with appropriate labels (legible font that can be read in 100% zoom) and caption.

Student's Picture

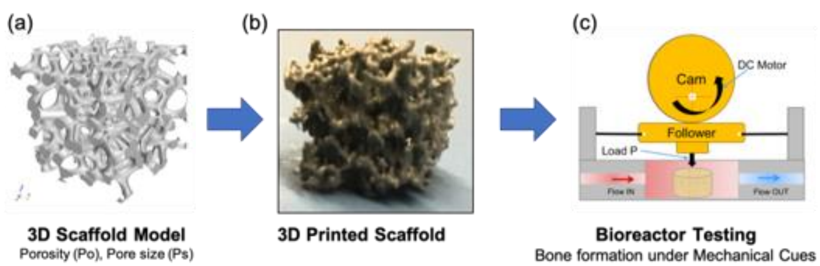

Figure 1: Proposed workflow from (a) Development of 3D scaffold with appropriate geometrical features to match pediatric bone, (b) 3D printing of scaffold, and (c) evaluation of printed scaffold for bone formation under mechanical cues

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Abstract

Pediatric bone defects requiring surgical interventions and implants include malignant and nonmalignant bone tumors and trauma fractures. Malignant bone tumors (MBT) such as Osteosarcoma and Ewing sarcoma are aggressive primary cancers that affect growing adolescent bones (10 to 19 years) and require complex reconstruction due to large bone excision during surgical interventions. Pediatric bone fractures requiring surgical interventions peak in 10 to 14 years and are a major public health concern in the US with an impact on patients, parents, and healthcare costs of approx. 350 billion. These diseases require bone tissue replacement in changing bones.

Bone reconstruction and medical implant design for growing pediatric bones have unique challenges due to active growth and there is a greater need for active, resorbable, and patient-specific implants to prevent growth impediments. The current available pediatric implant is limited in addressing these needs and is primarily addressed by static metallic implants designed for adults. We plan to work towards the design and synthesis of a bone scaffold by modifying a CAD model considering the size of the porosity in the structure of the pediatric bone. This modified model will be 3D printed and will be subjected to tests in order to evaluate the strength and composition of the scaffold. Leading to the cell culture of the scaffold in hopes of cellular

response for bone formation and cell regeneration, since a key factor to assess is whether the scaffold will grow with the bone, or the bone will grow with the scaffold. This is done to support the attachment of cells on the surface of the bone to actively support bone modeling processes under structural changes of growing bones.