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Applications of 3D Printing in Healthcare - Challenges and Considerations in Biomedical Engineering

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Abstract: 3D printing, a form of additive manufacturing, has demonstrated potential to revolutionize various aspects of biomedical engineering, from medical device prototyping, producing replacement parts to extend product life cycle, patient specific implants, and anatomical models for surgical planning. Biomedical and clinical engineering departments can benefit from 3D printing technologies to better support medical devices with shorter turnarounds due to quicker repairs. This paper will aim to address the challenges and considerations to be made for biomedical engineering teams in hospitals looking to incorporate 3D printing technology into shops across the region in British Columbia (BC). This paper focuses on biocompatibility, device modification, intellectual property, and infection prevention and control (IPAC). The paper also explores different clinical 3D printing activities in the province at cancer centers, research institutes, and biomedical engineering shops, exploring their current processes and similarities. Data was collected through research, stakeholder interviews, and on site printing activities at Surrey Memorial Hospital. Different methods of 3D printing are explored and assessed for their suitability for this use case. Different biocompatible 3D printing materials on the market are looked at, as well as common filaments used in fused deposition modeling (FDM) printing and their properties and potential for the clinical space. Computer aided design (CAD), slicing, and segmentation software are also discussed and the role they can play in the workflow. This data was used to develop a workflow tool to assist biomedical technologists in printing custom parts 'in-house' through 3D printing, this tool includes IPAC considerations as well as material and printer recommendations for specific 3D printed part cases.

*Keywords***:** Additive manufacturing, 3D Printing, medical device repair, risk assessment, biomedical technologist

Conflict of Interest: The authors declare that they have no conflict of interest.