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Paper Title: Validation of parameter for bioink Hydroxyapatite/Gelatin Scaffold by 3D extrusion bio-printing for orthopedic surgery

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Abstract

] It is well known that large bone defects present significant challenge in orthopedic surgery, especially critical-sized defects, which can cause a trauma to the patient. The current treatment for this problem is underwhelming and often agitated with complications. Additive manufacturing of 3D bioprinting offers a solution by allowing the replacement of osteogenic cells and artificial components of bone, where additive biomaterials and bioactive signaling can mimic native tissue. This study aims to verify the parameter that affect the fabrication process of 3D bioprinting by extrusion with composite Hydroxyapatite with gelatin and gelatin methacryloyl (GelMa) scaffold. Furthermore, it will evaluate the biocompatibility with osteoblast cells and fibroblast cells for bone tissue engineering. [Methods] Preliminary result was conducted by preparing the gelatin with Hydroxyapatite. The concentration of Hydroxyapatite and gelatin bioink was prepared. The effect of printing parameter on pore ratio and printability and pore ration were calculated to discuss the validation of parameter. Biocompatibility is being tested by MTT assay and cell viability to evaluate the cytotoxicity by counting kit. [Results] Increasing of velocity of printing increased stable forming of scaffold while the temperature kept remaining. The results showed the pore printability that affected by velocity and pressure in each temperature. Cytotoxicity results demonstrated that hydroxyapatite/gelatin reconstituted bioink is friendly environment to cell similar to controlled group. [Conclusion] Printing with a lower temperature bio-ink, increasing the pore ratio required a higher increase in pressure of tips compared to an increase in speed of tips. Pore printability, there is a positive correlation with speed, while there is a negative correlation with pressure. This printability can be used as a reference for mechanical properties evaluation. 1% Hydroxyapatite/ 20% Gelatin hydrogel has a good biocompatibility (cell viability/ cytotoxicity) but cell proliferation is lower than in FM environment, it is due to the concentration of hydroxyapatite.