

Jig prototype for computer-assisted total knee replacement and its flow simulation

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Abstrak

This paper discusses the design and development of a prototype of a knee surgery cutting jig, the jig holder, and the jig injection mold by Rapid Prototyping (RP). The aim of this study is to design a jig and a jig holder that allow surgeons to correctly, precisely, and consistently perform knee replacement surgery. The design concept for the surgery jig and jig holder was selected using the Pugh method with medical-grade 316L stainless steel for material fabrication. A rapid prototype model was built directly from its CAD model in stereo lithography (STL) format by using the Fused Deposition Method (FDM). MasterCAM and Moldflow simulation were performed to generate G-codes and a possibility of jig fabrication using Metal Injection Molding (MIM), respectively. The Moldflow result provided an enhanced interpretation of the injection mold design. A conceptual mold design was again developed by the FDM. The prototype of the cutting jig and its holder underwent a machining process. The prototype was then tested on dummy bones to determine the functional performance and efficiency of the said prototype. Results indicated an increase in cutting accuracy and cutting time compared with computer-assisted total knee surgery without the jig system.