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Cranial implant design applying shape-based interpolation method via open-source software

[Applied Sciences \(Switzerland\)](#) • Article • Open Access • 2021 • DOI: 10.3390/app11167604 [Abdullah, Johari Yap](#)^a ; [Abdullah, Abdul Manaf](#)^a ; [Hueh, Low Peh](#)^b ; [Husein, Adam](#)^a ; [Hadi, Helmi](#)^c ; [+1 author](#)^a School of Dental Sciences, Health Campus, Universiti Sains Malaysia, Kubang Kerian Kelantan, 16150, Malaysia[Show all information](#)

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Abstract

Reconstructing a large skull defect is a challenge, as it normally involves the use of sophisticated proprietary image processing and expensive CAD software. As an alternative, opensource software can be used for this purpose. This study aimed to compare the 3D cranial implants reconstructed from computed tomography (CT) images using the open-source MITK software with commercial 3-matic software for ten decompressive craniectomy patients. The shape-based interpolation method was used, in which the technique of segmenting every fifth and tenth slice of CT data was performed. The final design of patient-specific implants from both software was exported to STL format for analysis. The results of the Kruskal–Wallis test for the surface and volume of cranial

implants designed using 3-matic and the two MITK techniques showed no significant difference, $p > 0.05$. The results of the Hausdorff Distance (HD) and Dice Similarity Coefficient (DSC) analyses for cranial implants designed using 3-matic software and the two different MITK techniques showed that the average points distance for 3-matic versus MITK was 0.28 mm (every tenth slice) and 0.15 mm (every fifth slice), and the similarity between 3-matic and MITK on every tenth and fifth slices were 85.1% and 89.7%, respectively. The results also showed that the open-source MITK software is comparable with the commercial software for designing patient-specific implants. © 2021 by the authors.

Author keywords

3D reconstruction; Cranial implant; Craniofacial fracture; Image processing; Open-source

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