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Three-dimensional analysis of reconstructed skulls using three different op...



Three-dimensional analysis of reconstructed skulls using three different open-source software versus commercial software

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Abstract This study aimed to compare the 3D skull models reconstructed from computed tomography (CT) images using three different

open-source software with a commercial software as a reference. The commercial Mimics v17.0 software was used to reconstruct the 3D skull models from 58 subjects. Next, two open-source software, MITK Workbench 2016.11, 3D Slicer 4.8.1 and InVesalius 3.1 were used to reconstruct the 3D skull models from the same subjects. All four software went through similar steps in 3D reconstruction process. The 3D skull models from the commercial and open-source software were exported in standard tessellation language (STL) format into CloudCompare v2.8 software and superimposed for geometric analyses. Hausdorff distance (HD) analysis demonstrated the average points distance of Mimics versus MITK was 0.25 mm. Meanwhile, for Mimics versus 3D Slicer and Mimics versus InVesalius, there was almost no differences between the two superimposed 3D skull models with average points distance of 0.01 mm. Based on Dice similarity coefficient (DSC) analysis, the similarity between Mimics versus MITK, Mimics versus 3D Slicer and Mimics versus InVesalius were 94.1, 98.8 and 98.3%, respectively. In conclusion, this study confirmed that the alternative open-source software, MITK, 3D Slicer and InVesalius gave comparable results in 3D reconstruction of skull models compared to the commercial gold standard Mimics software. This open-source software could possibly be used for pre-operative planning in cranio-maxillofacial cases and for patient management in the hospitals or institutions with limited budget.

Keywords

Author Keywords: 3D reconstruction; computed tomography; standard tessellation language; superimposition; open-source software; craniofacial reconstruction; surgical planning

Keywords Plus: CRANIOPLASTY; IMPLANTS; MODEL; CT; RESECTION; ACCURACY; SURGERY

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