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Designing 3D prosthetic templates for maxillofacial defect rehabilitation: A ...



Designing 3D prosthetic templates for maxillofacial defect rehabilitation: A comparative analysis of different virtual workflows

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Abstract Objective: To design and compare the outcome of commercial (CS) and open source (OS) software-based 3D prosthetic templates for rehabilitation of maxillofacial defects using a low powered personal computer setup.

Method: Medical image data for five types of defects were selected, segmented, converted and decimated to 3D polygon models on a personal computer. The models were transferred to a computer aided design (CAD) software which aided in designing the prosthesis according to the virtual models. Two templates were designed for each defect, one by an OS (free) system and one by CS. The parameters for analyses were the virtual volume, Dice similarity coefficient (DSC) and Hausdorff's

distance (HD) and were executed by the OS point cloud comparison tool.

Result: There was no significant difference ($p > 0.05$) between CS and OS when comparing the volume of the template outputs. While HD was within 0.05-4.33 mm, evaluation of the percentage similarity and spatial overlap following the DSC showed an average similarity of 67.7% between the two groups. The highest similarity was with orbito-facial prostheses (88.5%) and the lowest with facial plate prosthetics (28.7%).

Conclusion: Although CS and OS pipelines are capable of producing templates which are aesthetically and volumetrically similar, there are slight comparative discrepancies in the landmark position and spatial overlap. This is dependent on the software, associated commands and experienced decision-making. CAD-based templates can be planned on current personal computers following appropriate decimation.

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