

Replacement of the Distorted Dentition of the Cone Beam Computed Tomography Scan Models for Orthognathic Surgery Planning

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Abstract : Purpose: At present Cone Beam Computed Tomography (CBCT) imaging does not record dental morphology accurately due to the scattering produced by metallic restorations and the reported magnification. The aim of this pilot study is the development and validation of a new method for the replacement of the distorted dentition of CBCT scans with the dental image captured by the digital intraoral camera. Materials and Method: Six dried skulls with orthodontics brackets on the teeth were used in this study. Three intra-oral markers made of dental stone were constructed which were attached to orthodontics brackets. The skulls were CBCT scanned, and occlusal surface was captured using TRIOS® 3D intraoral scanner. Marker based and surface based registrations were performed to fuse the digital intra-oral scan (IOS) into the CBCT models. This produced a new composite digital model of the skull and dentition. The skulls were scanned again using the commercially accurate Laser Faro® arm to produce the 'gold standard' model for the assessment of the accuracy of the developed method. The accuracy of the method was assessed by measuring the distance between the occlusal surfaces of the new composite model and the 'gold standard' 3D model of the skull and teeth. The procedure was repeated a week apart to measure the reproducibility of the method. Results: The results showed no statistically significant difference between the measurements on the first and second occasions. The absolute mean distance between the new composite model and the laser model ranged between 0.11 mm to 0.20 mm. Conclusion: The dentition of the CBCT can be accurately replaced with the dental image captured by the intra-oral scanner to create a composite model. This method will improve the accuracy of orthognathic surgical prediction planning, with the final goal of the fabrication of a physical occlusal wafer without to guide orthognathic surgery and eliminate the need for dental impression.

Keywords : orthognathic surgery, superimposition, models, cone beam computed tomography

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