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RELIABILITY OF 3-D-PRINTED MANDIBLES CONSTRUCTED FROM CONE BEAM CT VOLUMES OF DIFFERENT VOXEL SIZES.

S. VIJAYAN, D. ALHAZMI, V. ALLAREDDY, K. SHIN, V. ALLAREDDY. UNIVERSITY OF IOWA COLLEGE OF DENTISTRY AND DENTAL CLINICS, IOWA CITY, IA

Background: 3-D printing, also known as *additive manufacturing or rapid prototyping*, is a manufacturing process in which layers are sequentially added to create an object. 3-D printing is used in a wide variety of fields, ranging from dentistry and medicine to food manufacturing, toy manufacturing, house manufacturing, and automobile manufacturing and in the fashion industry. 3-D printed models can have a wide variety of uses in dentistry, ranging from anatomic models to surgical implants.

Objective(s): The aim of the present study was to establish the reliability of linear cephalometric measurements made on mandibles and their respective 3-D printed models created from different voxel sizes in cone beam computed tomography (CBCT) scans.

Study Design: Ten dry mandibles were used for this study. All mandibles were scanned using the i-CAT FLX cone beam CT unit (Imaging Sciences International, LLC, Hatfield, PA) using voxel sizes of 0.30 mm, 0.25 mm, and 0.20 mm at 16×8 cm field of view and 360˚ rotation arc. The 3-D models were reconstructed and saved as STL files using 3-D Slicer software and sent to a 3-D printer for printing. Two observers measured the 10 mandibles and 30 3-D printed models. The measurements were repeated on 50% of the samples after at least 1 week. Cronbach's alpha and intraclass correlation coefficient were calculated to measure reliability.

Results: Good to excellent interobserver and intraobserver reliability were achieved across most of the measurements. There was no difference in reliability across models made from different voxel sizes.

Discussion/Conclusions: The present study successfully showed that the reliability of measurements made on 3-D printed models of dry skull mandibles created using the fused deposition modeling technique with images of different voxel sizes from an iCAT FLX CBCT machine are valid, reproducible, and reliable and can be used for diagnostic and clinical purposes.

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METAL ARTIFACT REDUCTION IN STATIONARY INTRAORAL TOMOSYNTHESIS.

R. HILTON[A,B,C], C. PUETT[A,B,C], J. DEAN[A,B,C], A. MOL[A,B,C], E. PLATIN[A,B,C]. [A] UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL, NC, [B] NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC, [C] XINVIVO, MORRISVILLE, NC

Background: The first generation stationary intraoral tomosynthesis (sIOT) device, developed at University of North Carolina (UNC), provides 3-D information in intraoral imaging with a speed and dose comparable with those of traditional intraoral radiography. Initial research shows promise in several diagnostic tasks, including caries and fracture detection. However, the original iterative reconstruction produces artifacts adjacent to metal restorations. Two new iterative reconstructions with metal artifact reduction (MAR1 and MAR2) have been developed. MAR1 segments the metal out before reconstruction and adds it back after reconstruction. MAR2 minimizes the artifact amplified at each iteration by dividing the projected error by the number of slices.

Objective(s): The aim of this study was to compare the effectiveness of metal artifact reduction in tomosynthesis.

Study Design: Pilot samples of 2 extracted premolars with amalgam restorations were imaged by using the sIOT system. Reconstructions were generated using the original, MAR1, and MAR2 algorithms. Using line density plots, artifact pixel intensity and artifact width were measured for the original, MAR1, and MAR2 algorithms.

Results: The difference between average dentin pixel intensity and artifact pixel intensity for sample 1 was 8016, −5781, and 759 for the original, MAR1, and MAR2 reconstructions, respectively. Artifact width was 2.61 mm, 0.82 mm, and 1.38 mm, respectively. For sample 2, the difference in intensity was 8248, −5399, and 93, respectively. Artifact width was 1.71 mm, 1.06 mm, and 0.81 mm, respectively.

Discussion/Conclusions: MAR1 and MAR2 reduced the intensity of the artifacts; however, reduction by MAR2 was more pronounced. MAR1 produced radiopaque artifacts, whereas MAR2 produced radiolucent artifacts. MAR1 and MAR2 reduced the width of the artifacts, but the extent was reversed between the samples. The results support the value of MAR for tomosynthesis and suggests that MAR2 may be more effective. Continued development of artifact reduction techniques is needed with a more in-depth study using a larger sample size.

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