

Volume 79, Issue 1
(January 2009)

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April A. Brown, William C. Scarfe, James P. Scheetz, Anibal M. Silveira, Allan G. Farman (2009) Linear Accuracy of Cone Beam CT Derived 3D Images. The Angle Orthodontist: Vol. 79, No. 1, pp. 150-157.

Original Articles

Linear Accuracy of Cone Beam CT Derived 3D Images

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Abstract

Objective: To compare the in vitro reliability and accuracy of linear measurements between cephalometric landmarks on cone beam computed tomography (CBCT) 3D volumetric images with varying basis projection images to direct measurements on human skulls.

Materials and Methods: Sixteen linear dimensions between 24 anatomic sites marked on 19 human skulls were directly measured. The skulls were imaged with CBCT (i-CAT, Imaging Sciences International, Hatfield, Pa) at three settings: (a) 153 projections, (b) 306 projections, and (c) 612 projections. The mean absolute error and modality mean (\pm SD) of linear measurements between landmarks on volumetric renderings were compared to the anatomic truth using repeated measures general linear model ($P \leq .05$).

Results: No difference in mean absolute error between the scan settings was found for almost all measurements. The average skull absolute error between marked reference points was less than the distances between unmarked reference sites. CBCT resulted in lower measurements for nine dimensions (mean difference range: 3.1 mm \pm 0.12 mm to 0.56 mm \pm 0.07 mm) and a greater measurement for one dimension (mean difference 3.3 mm \pm 0.12 mm). No differences were detected between CBCT scan sequences.

Conclusions: CBCT measurements were consistent between scan sequences and for direct measurements between marked reference points. Reducing the number of projections for 3D reconstruction did not lead to reduced dimensional accuracy and potentially provides reduced patient radiation exposure. Because the fiducial landmarks on the skulls were not radio-opaque, the inaccuracies found in measurement could be due to the methods applied rather than to innate inaccuracies in the CBCT scan reconstructions or 3D software employed.

Keywords: [Cephalometry](#), [Computed tomography](#), [Cone beam](#), [Radiography](#), [Cephalometric](#)

Accepted: March 2008;

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An International Journal of Orthodontics and Dentofacial Orthopedics

79

A Publication of the Edward H. Angle Society of Orthodontists and
the EH Angle Education and Research Foundation

Volume 79 (1)
January 2009

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ISSN: 0003-3219

Frequency: Bimonthly

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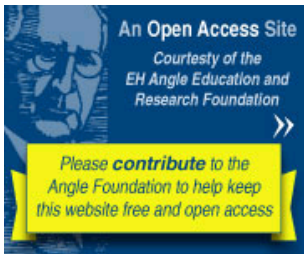
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