LETTER TO THE EDITOR

A comparative study of the accuracy and reliability of multidetector CT and cone beam CT in the assessment of dental implant site dimensions: Author response

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We would like to thank the writers of this correspondence for their interest in our article “A comparative study of the accuracy and reliability of multidetector CT and cone beam CT in the assessment of dental implant site dimensions”¹ and for their enquiries and comments. The first point we would like to address is their comment regarding the Bland-Altman statistical method being a better method than correlation analysis for assessing agreement between two measurement techniques. The aim of the study was not to assess the agreement between the two techniques of multi-detector CT (MDCT) and cone beam CT (CBCT). The aims of the study were “to investigate the accuracy and reliability (reproducibility) of linear measurements of edentulous ridges obtained from MDCT [...] and CBCT [...] as compared with the gold standard of human dried skulls”, and “to compare the results from the two modalities”. The study evaluated the accuracy and reproducibility of measurements from each modality independently as compared with a true value (direct measurements from the skulls). The Bland-Altman statistical method was not designed for, nor intended for use with, true values. Bland and Altman were very clear in making that distinction when they presented their statistical method, stating that “This is very different from calibration, where known quantities are measured by a new method and the result compared with the true value or with measurements made by a highly accurate method.”² Therefore, it is our view that the statistical methods used in our study are the most appropriate to measure the degree of error and its statistical significance and in comparing the accuracy of the two techniques.

Regarding the comment that 0.3 mm is a wrongly chosen voxel resolution for an Iluma CBCT scanner (Imtek Imaging, 3M Company, St Paul, MN), at the present time we are not aware of a standard of care with respect to the best voxel size for implant site assessment. This issue is still open for investigation. Only by studying the effect on accuracy of changing different reconstruction and exposure parameters may a standard of care be developed. The fact that their study,³ which utilized

0.2 mm voxels, found that “the accuracy of measurements [...] was highly comparable to that of digital caliper measurements” cannot be taken to indicate a higher degree of accuracy than found in our study. The study by Kamburoğlu et al merely found that the test measures and real measures were “highly comparable”, without actually determining the exact measurement error, because the degree of measurement error was not calculated.³ They only assessed agreement between the images and the skulls by using the Bland-Altman method, which was not designed for this purpose. Furthermore, there was nothing in the methodology of their study to indicate that the plane of the physical sections and imaging sections were standardized, nor that the direction of measurements was standardized. Defining a standard of care regarding voxel size in implant site imaging requires further rigorously designed studies which measure the degree of accuracy.

As for the suggestion that intra and interobserver agreement should have been measured, agreement (or variance) is used to evaluate subjective or interpretive analytical methodologies and as such is inappropriate for use in this study, which investigated the accuracy of objective measurements. Reproducibility of objective measurements is best represented by intra and inter-observer reliability which was assessed in our study by correlation testing in addition to Cronbach’s alpha.⁴ The values reported in the paper for the interitem correlation and Cronbach’s alpha are identical to the intraclass correlation coefficient (ICC) for single and average measures, respectively.

With regard to the examiners who recorded the measurements, examiner 1 was an oral and maxillofacial radiology (OMFR) resident and examiner 2 was a professor of OMFR. At the time of conduction of the study, the examiners had 5 years and 7 years of experience, respectively, working with MDCT and CBCT dental, reformatting software. Regarding the enquiry about which observer’s result were taken into account in the preparation of Tables 1–3, Table 1 was merely a table of the distribution of the sample sites and as such is obviously not related to recorded

measurements of either examiner. For the reliability measurements presented in Table 2 the first and second measurements recorded by examiner 1 were used to calculate intraexaminer reliability, while the average of these two measurements and the measurements recorded by examiner 2 were used to calculate the interexaminer reliability. The absolute measurement errors presented in Table 3 as well as all histograms and bar charts, were calculated from the average of the two measurements recorded by examiner 1.

As such, we hope we have demonstrated that the expertise of the observers and the voxel size can in no way be construed to mislead readers and the statistical analysis used to evaluate the accuracy and reliability (reproducibility) of measurements was the most appropriate analysis to obtain an accurate and objective evaluation.

On a final note, we strongly agree that even if implant clinicians record the ridge dimensions on sectional images, an OMFR specialist should be involved in the interpretation of MDCT or CBCT data sets, especially those with

medium and large fields of view. Recommending that the clinician who places the implant should be the one to measure the ridge dimensions does not imply an OMFR specialist should not be involved in the process. This is a wide-ranging discussion which involves, among other issues, guidelines for prescription of MDCT and CBCT, dose reduction strategies and training in proper reformatting and interpretation of images, all of which are beyond the scope of our published study and its associated discussion.

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References

1. Al-Ekrish AA, Ekram M. A comparative study of the accuracy and reliability of multidetector computed tomography and cone beam computed tomography in the assessment of dental implant site dimensions. *Dentomaxillofac Radiol* 2011; **40**: 67–75.
2. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986; **1**: 307–310.
3. Kamburoglu K, Kılıç C, Özen T, Yüksel SP. Measurements of mandibular canal region obtained by cone-beam computed tomography: a cadaveric study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009; **107**: e34–e42.
4. Mitchell SK. Interobserver agreement, reliability, and generalizability of data collected in observational studies. *Psychological Bulletin* 1979; **86**: 376–390.