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Comparative analysis of bone density measurements by using multislice spiral and cone-beam computed tomography

KEYWORDS
Bone density;
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The use of cone-beam computed tomography (CBCT) has increased tremendously in implant dentistry.[1,2] However, some studies have recently reported that bone density values in Hounsfield units (HU) derived from CBCT and multislice spiral computed tomography (MSCT) are not identical for the same areas.[3–5] A few reports speculated that projection data discontinuity, artifacts, the position of the object, and various scatter levels might be the plausible reasons for this discrepancy.[3–5] This study aimed to compare the bone density values of implant recipient sites by using MSCT and CBCT.

Four human cadaver jawbones (2 maxillae and 2 mandibles) were used in this study. Eight implant recipient sites (central incisors, canines, second premolars and second molars) were designated for each maxilla and mandible. Radiopaque markers (gutta percha in 1-mm thickness) were attached to the alveolar crest of each jaw to mark all implant recipient sites (Fig. 1A). Each jaw was scanned with a multislice computed tomography (MSCT) scanner (Siemens AR-SP 40, Munich, Germany) (Fig. 1B), and also a cone-beam computed tomography (CBCT) scanner (i-CAT, Imaging Sciences International, Inc., Hatfield, PA, USA). Statistical analysis was performed by using the paired t-test analysis and Pearson's correlation coefficient (SPSS Inc., Chicago, IL, USA). Statistical significance was set at $p < 0.05$.

When all 32 implant recipient sites were considered, the mean bone density values were 310 ± 63 HU from MSCT and 353 ± 80 HU from CBCT, indicating statistically significant difference ($p < 0.05$). Also, a strong correlation ($p < 0.01$) was observed between the bone density values derived from MSCT and CBCT.

When 16 implant recipient sites in the mandible were considered, a significantly lower mean bone density value was found from MSCT images (342 ± 53 HU) than from CBCT images (393 ± 91 HU) ($p < 0.05$). Moreover, a significantly lower mean bone density value was also noted from MSCT (278 ± 74 HU) than from CBCT (314 ± 89 HU) for 16 implant recipient sites in the maxillae ($p < 0.05$).

When evaluating 8 anterior implant recipient sites in the mandible, the mean bone density values derived from MSCT (378 ± 69 HU) and from CBCT (431 ± 110 HU) revealed statistically significant difference ($p < 0.05$). For 8 posterior implant recipient sites in the mandible, the mean bone density value from MSCT (306 ± 37 HU) was significantly lower than that from CBCT (355 ± 72 HU) ($p < 0.05$).

When assessing 8 anterior implant recipient sites in the maxillae, the mean bone density value from MSCT (310 ± 88 HU) was significantly lower than that from CBCT (347 ± 101 HU) ($p < 0.05$). For 8 posterior implant recipient sites in the maxillae, the mean bone density value from MSCT (246 ± 60 HU) was also significantly lower than that from CBCT (280 ± 77 HU) ($p < 0.05$).

The outcomes of this study suggest that the bone density can be objectively measured with both MSCT and CBCT scanners, and the bone density values of implant recipient sites from MSCT are lower and more reliable when compared to values from CBCT. Further clinical studies are

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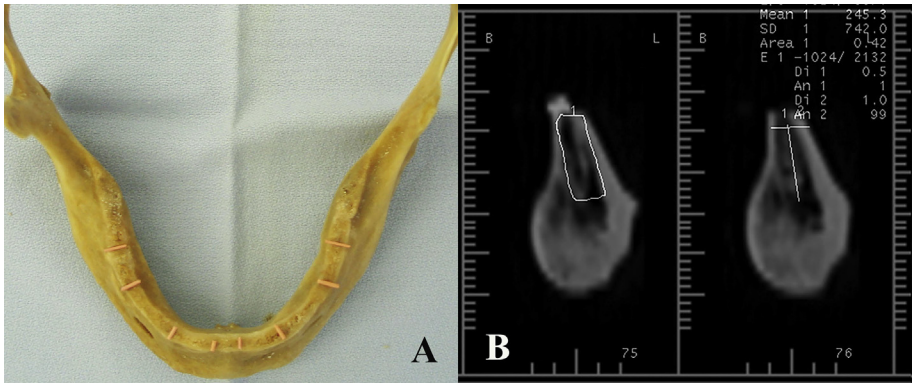

Figure 1 Occlusal view of the mandible with radiopaque materials prior to MSCT imaging (A). Sagittal (cross sectional) views of an implant recipient site in the anterior mandible used for bone density measurement after MSCT imaging (B).

needed to determine the reliability of bone density measurements from CBCT.

Declaration of Competing Interest

The authors have no conflicts of interest relevant to this article.

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