

Title:	Bone quality evaluation at dental implant site using multislice CT, micro-CT and cone beam CT
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Abstract:	<p>Objectives: The first purpose of this study was to analyze the correlation between bone volume fraction (BV/TV) and calibrated radiographic bone density Hounsfield units (HU) in human jaws, derived from micro-CT and multislice computed tomography (MSCT), respectively. The second aim was to assess the accuracy of cone beam computed tomography (CBCT) in evaluating trabecular bone density and microstructure using MSCT and micro-CT, respectively, as reference gold standards.</p> <p>Material and methods: Twenty partially edentulous human mandibular cadavers were scanned by three types of CT modalities: MSCT (Philips, Best, the Netherlands), CBCT (3D Accuitomo 170, J Morita, Kyoto, Japan), and micro-CT (SkyScan 1173, Kontich, Belgium). Image analysis was performed using Amira (v4.1, Visage Imaging Inc., Carlsbad, CA, USA), 3Diagnosis (v5.3.1, 3diemme,</p>

	<p>Cantu, Italy), Geomagic (studio (R) 2012, Morrisville, NC, USA), and CTAn (v1.11, SkyScan). MSCT, CBCT, and micro-CT scans of each mandible were matched to select the exact region of interest (ROI). MSCT HU, micro-CT BV/TV, and CBCT gray value and bone volume fraction of each ROI were derived. Statistical analysis was performed to assess the correlations between corresponding measurement parameters.</p> <p>Results: Strong correlations were observed between CBCT and MSCT density ($r = 0.89$) and between CBCT and micro-CT BV/TV measurements ($r = 0.82$). Excellent correlation was observed between MSCT HU and micro-CT BV/TV ($r = 0.91$). However, significant differences were found between all comparisons pairs ($P < 0.001$) except for mean measurement between CBCT BV/TV and micro-CT BV/TV ($P = 0.147$).</p> <p>Conclusions: An excellent correlation exists between bone volume fraction and bone density as assessed on micro-CT and MSCT, respectively. This suggests that bone density measurements could be used to estimate bone microstructural parameters. A strong correlation also was found between CBCT gray values and BV/TV and their gold standards, suggesting the potential of this modality in bone quality assessment at implant site.</p>
Keyword:	bone density; bone volume fraction; dental implants; multislice computed tomography; micro-computed tomography; cone beam computed tomography; computed-tomography; cancellous bone; mechanical-properties; maxillofacial region; density assessments; voxel values; in-vitro; reliability; accuracy; cbct
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