TECHNICAL REPORT

Assessment of metal artefact reduction around dental titanium implants in cone beam CT

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Objectives: The aim of this study was to investigate if the metal artefact reduction (MAR) tool used in the software of the ORTHOPANTOMOGRAPH® OP300 (Instrumentarium Dental, Tuusula, Finland) can improve the gray value levels in post-operative implant scans.

Methods: 20 potential implant sites were selected from 5 edentulous human dry mandibles. Each mandible was scanned by a CBCT scanner, and images were produced under three different conditions: implant sites drilled but no implants inserted, implants inserted without application of MAR and implants inserted with application of MAR. Using Geomagic Studio 2012 (Geomagic, Morrisville, NC) and 3Diagnosys® v. 5.3.1 (3Diemme® SRL, Cantù, Italy) software, three scans of each mandible were superimposed. The mean gray value of identical regions of bone around the implants was derived for each condition. The differences between gray value measurements at implant sites derived from different conditions were assessed.

Results: A significant difference was found between mean gray values from the scans with no implants inserted and with implants inserted (with and without MAR) (p = 0.012). No significant difference was revealed for gray values measured from scans with and without MAR (p = 0.975).

Conclusions: The MAR tool in the software of the ORTHOPANTOMOGRAPH OP300 CBCT scanner does not significantly correct the voxel gray values affected by the metal artefact in the vicinity of an implant in human dry mandibles.


Keywords: cone beam computed tomography; artefacts; dental implants; titanium

Introduction

CBCT has become the imaging modality of choice in dental implantology. Because of its high accuracy for linear measurements, bone height, width and the proximity to adjacent normal anatomic structures, such as the maxillary sinus or the inferior dental canal, can be precisely evaluated.1 Additionally, bone quality evaluated by CBCT has been shown to have a good correlation with the primary implant stability.2

Although CBCT has several advantages over multislice CT (MSCT), metal artefacts caused by titanium implants in the path of the radiation can significantly deteriorate the diagnostic image quality.3,4 An implant can induce dark artefacts, induced by scattering, and streak artefacts,5 making anatomical structures ambiguous and influencing the contrast between adjacent regions. These effects can seriously interfere with the diagnostic yield of an image.5

Most of the studies on metal artefact reduction (MAR) have focused on MSCT scanners. Two methods for MAR