RESEARCH

Influence of cone beam CT scanning parameters on grey value measurements at an implant site

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Objectives: The aim of this study was to determine the grey value variation at the implant site with different scan settings, including field of view (FOV), spatial resolution, number of projections, exposure time and dose selections in two cone beam CT (CBCT) systems and to compare the results with those obtained from a multislice CT system.

Methods: A partially edentulous human mandibular cadaver was scanned by three CT modalities: multislice CT (MSCT) (Philips, Best, the Netherlands), and two CBCT systems: (Accuitomo 170°, Morita, Japan) and (NewTom 5G°, OR, Verona, Italy). Using different scan settings (62 and 24 scans) were obtained from the Accuitomo and the NewTom, respectively. The scans were converted to digital imaging and communications in medicine 3 format. The analysis of the data was performed using 3Diagnosys® software (v. 3.1, Mincieme, Canti, Italy) and Geomagic studio® 2012 (Morrisville, NC). On the MSCT scan, one probe designating the site for pre-operative implant placement was inserted. The inserted probe on MSCT was transformed to the same region on each CBCT scan using a volume-based three-dimensional registration algorithm. The mean voxel grey value of the region around the probe was derived separately for each CBCT. The influence of scanning parameters on the measured mean voxel grey values was assessed.

Results: Grey values in both CBCT systems significantly deviated from Hounsfield unit values measured with MSCT (p = 0.0001). In both CBCT systems, scan FOV and spatial resolution selections had a statistically significant influence on grey value measurements (p = 0.0001). The number of projections selection had a statistically significant influence in the Accuitomo system (p = 0.0001) while exposure time and dose selections had no statistically significant influence on grey value measurements in the NewTom (p = 0.43 and p = 0.37, respectively).

Conclusions: Grey-level values from CBCT images are influenced by device and scanning settings.


Keywords: cone beam CT; registration; grey values; bone density

Introduction

The amount and quality of available bone at a proposed implant site determine its resistance to fracture and directly influence treatment outcome.1 Previous research has demonstrated a higher failure rate for oral implants inserted in jawbones with insufficient quantity or poor quality.1,2 In dental implants, bone dimensions expressed by width and height measurements are always assessed by the practitioner prior to implant insertion by means of clinical inspection and radiographic evaluation. In comparison, alveolar bone density measurements at...