F16 Cone-Beam CT as a Practical Tool in Forensic Dental Identification – A Preliminary Study

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After attending this presentation, attendees will understand how cone-beam computed tomography-derived images of the maxilla or mandible are similar enough to conventional radiographic images to allow for forensic odontological comparisons. Attendees will gain knowledge of cone-beam computed tomography (CBCT) imaging and will be familiarized with how CBCT volumes can be analyzed in multiple planes.

This presentation will impact the forensic science community by demonstrating how CBCT imaging offers a rapid postmortem imaging technique for use in dental identification. This technique could be utilized under circumstances when conventional techniques would be prohibited or difficult.

It is hypothesized that CBCT-derived images of the dentition are similar enough to conventional dental radiographs to allow for forensic comparisons in dental identifications.

Biological imaging techniques have been improving at a rapid rate over the last decade with improvements in ease of use, speed of imaging, and image resolution. In medicine, CT imaging is being used for virtual autopsy (virtopsy) in the forensic setting.[1,2,3] Conventional computed tomography (CT) has been investigated for dental profiling with limited results, mostly due to artifact seen from metal containing dental work.[4] In dentistry, cone beam CT technology is becoming more accessible and utilized than ever before. Many individual dentists have installed CBCT machines in their offices and use CBCT volumes for a variety of clinical applications, including treatment planning for dental implant placement, pre-surgical evaluation, and 3D orthodontic diagnosis and treatment planning.

CBCT data sets can be displayed in multiple ways and even in 3D. This unique ability is one which is proposed to apply in forensic odontology. There are times when it is impossible, difficult, or unsafe for forensic odontologists to take postmortem radiographic series; such situations may include the presence of toxic chemicals or radiation. CBCT scans can be acquired postmortem without the necessity to open the cadaver's mouth, and possibly even without removing the victims from a body bag. Here, images will be shown that are similar to conventional or digital periapical or bitewing radiographs can be generated from CBCT volumes of jaw specimens from cadavers previously used in anatomic training.

Digital dental periapical and bitewing images of human cadaver half heads and cadaver mandibles were taken utilizing a Gendex 770 dental x-ray unit and a Schick Elite digital sensor. Exposure settings were 70 kVp and 1/20 sec. Separately, CBCT scans of specimens were acquired with an i-CAT Platinum CBCT unit. Panoramic images of the jaws were reconstructed from each CBCT volume using i-CAT Vision software. Panoramic reconstructions were reformatted utilizing a developed protocol to repeatedly and rapidly generate images with the same anatomic coverage as typical periapical and bitewing images of the alveolar processes. CBCT-derived periapical, bitewing and panoramic images are presented side-by-side with intraoral periapical and bitewing images to demonstrate the similarity.

The CBCT images carry sufficient anatomic information for conclusive comparison with antemortem intraoral radiographs and that, in practice, images derived from CBCT volumes according to our protocol can be compared with antemortem images of the same area for forensic identification.

The presentation will demonstrate that CBCT technology can be used as an alternative to conventional and digital radiographic studies for comparison of dental radiographic images.

This pilot study lays the ground work for additional studies currently underway which will demonstrate the ease and accuracy of using CBCT derived images for dental identification.

It is believed that CBCT imaging is a viable time saving and resource sparing technique in such situations as mass disasters and for dental identification of cases which can not safely be imaged with conventional techniques (e.g., hazardous chemical, toxin or radiation contamination).

References:

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3. Pomara C, et. Al., Virtopsy versus digital autopsy:virtual autopsy. Radiol Med, 2009 Dec, 114(8)1367-82.

4. Thali MJ, et.al., Dental CT imaging as a screening tool for dental profiling:advantages and limitations. Journal of Forensic Sciences 2006 Jan; 51(1):113-9.

Cone Beam CT, Postmortem Imaging, Dental Identification

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