G6 Computed Tomography (CT) -Based Dental Identification—Changing the Paradigm and Practice of Dental Identification

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Learning Overview: After attending this presentation, attendees will understand how the harvesting of anatomically important data from medical CT images were used with Cone Beam CT (CBCT) software to aid in dental identification of a small multiple-fatality incident.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by outlining the methodology to create postmortem images suitable for the efficient identification of deceased individuals and eliminate biological/body substance or radiation exposure to the operator.

Comparison of postmortem dental findings to antemortem dental records is a well-established, frequently used scientific means of human identification. Its initial use is deeply rooted in history dating back to the Battle of Bunker Hill during the American Revolution where the first dental identification of a soldier was made by a dentist and has been widely used since as a well-accepted means of establishing identity.[1] Present-day dental identification relies heavily on the comparison of antemortem and postmortem dental records and most frequently involves the comparison of both antemortem and postmortem dental radiographs because they are objective data.

Many medical examiner facilities either have dedicated CT units or access to conventional CT scanners that are used as part of the normal hospital practice. The mathematics behind CT radiography was developed in 1917 by Joseph Radon. Its application was adapted by Sir Godfrey Hounsfield—whose surname is immortalized as a measure of density—for clinical use in commercial CT scanners since 1971.[2,3] Dentistry has adapted a form of CT scanning that uses a cone-shaped beam and is thus termed CBCT. CBCT is presently being used in many aspects of dentistry, including osseo-integrated implant planning, orthodontics, endodontics, investigation of pathology, and assessment prior to complex dental extractions.[3]

All modern CT scanners store their files in either a proprietary software or, for portability sake, in a universally readable format known as Digital Imaging and Communications (DICOM). DICOM images from mortuary medical CT scanners can be imported, read, and manipulated in third-party image processing and viewing software found in oral and maxillofacial radiology practices and elsewhere. This presentation will discuss the means by which the harvesting of anatomically important data from medical CTs and conversion of these DICOM files from medical CT scans can be formatted to provide crisp, clear postmortem dental images for ulterior forensic comparison. This was first done in the context of a small multiple fatality incident involving seven passengers in a small plane crash in Ontario, Canada. Medical CT scans for each of the severely damaged victims in this incident were acquired without needing to open the sealed body bag. The maxillofacial DICOM files from the medical CT scanner were manipulated with commercially available CBCT software used in dental applications to provide postmortem pantomographic-type images and compared to available antemortem records. A collaborative effort of experts allowed expeditious identification of all seven individuals killed in a small airplane crash.

This novel adaptation of existing technology can be performed very quickly and avoids any biological/body substance or radiation exposure to the operator. It requires no dedicated intraoral radiation sensors nor conventional films and processing chemistry. There is no need for the pathology assistant, medical imaging technologists, or forensic odontologist to touch the body. Further, there is no need to alter the position of the body as this can be corrected in the program. Images can be manipulated with respect to position, contrast, density, volumes examined, and can be exported to other programs such as Adobe® Photoshop® for further refinement. The original data set of DICOM images is maintained and the steps in the process can be archived for the sake of continuity of evidence. It is this study's contention that this technology is a boon to both single body and multiple fatality situations where postmortem images can be rapidly acquired and processed and in situations where single or multiple comparisons need to be made.

Reference(s):

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Forensic Odontology, Human Identification, Cone Beam Computed Tomography

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