



F2 Digital Enhancement of Dental Radiographs to Facilitate Identifications

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After attending this presentation, attendees will understand the difficulties that poor quality antemortem or postmortem dental radiographic images can make impeding victim identification and how readily available simple digital enhancement tools can reduce these challenges in the identification process.

This presentation will impact the forensic science community by giving an overview of image quality issues and the digital enhancement tools that are available to make acceptable and non-acceptable corrections to these images without affecting the evidentiary value of the image.

Whether it is a multiple fatality incident or single person identification, the use of dental radiographs as a tool for biometric comparison and identification is well documented. Dental features can withstand severe conditions and resist the degradation that affects other body tissues. Dental radiographs not only reveal dental restorations but tooth morphology, bony trabeculation patterns, root and crown morphology, tooth size, rotations, spacing between the teeth, and sinus patterns. As dental caries rates decrease, more odontological identification decisions will be based on inherent dental features.¹ Dental radiographs often suffer from poor image quality which can affect the identification process. Development of a stringent protocol of acceptable image enhancement techniques is essential for the forensic odontological community.

Acquisition of diagnostic images requires the use of either a flatbed/transparency adaptor digital scanner to digitize analog dental radiographs or a digital sensor to obtain images directly. Numerous issues exist that can be detrimental to image quality. Equipment issues such as exposure time, MA/KV, film age, film processing chemical quality, and/or the actual storage of the image or images can lead to poor image quality that can increase the challenges of the identification process. If working with analog radiographs, efforts should be made to acquire the original radiographs, as scanned second or third generation images of poor quality can impede the identification process.

By either rescanning analog x-rays with different scanning parameters or by incorporating the enhancement tools available for digital films, many of the difficulties for making identification can be overcome. Current forensic dental standards such as the ANSI/ADA Specification 1058 advocate scanning resolution sizes of 96 DPI for screen viewing, 150 DPI for lower resolution viewing and printing, 300-600 DPI for higher resolution viewing and laser quality printing and greater than 600 DPI for photographic viewing and printing.² This presentation will demonstrate support of these settings as well as color/grey scale depths to aid the odontologist in the understanding of the relevancy of these guidelines. In addition, this presentation will show the effects of additional scanning software settings to show how they can also enhance an image at the time of scanning.

The ANSI/ADA Specification 1058 specifies that a radiographic image should be of sufficient quality to ensure that an enlargement of any section will not result in an unacceptable image.¹ In addition to image resolution, the type of file format used to store the image can also affect image quality. This presentation will expand on the types of file formats that meet the standards criteria while promote ease of data access through the use of standard interoperable file formats.²

Essentially, the enhancement of a dental radiograph is the process of producing an improved quality image out of a degraded quality input while preserving the evidentiary value of the radiograph.² Although the enhancement process improves the visibility of objects of interest and thereby increases an image's diagnostic yield, it is vital that it does not alter the image in an unacceptable manner to enhance artifacts to the level that they are considered an anatomical feature.

This presentation will show various images reflecting several of the image management tools such as: contrast and brightness, sharpness and clarification, inversion, colorization, relief, subtraction, stereo, and invert logic that can help assist the forensic odontologist in the identification process.

References:

- ¹ American National Standard/American Dental Association Specification #1058, **Forensic Data Set, 2010**, Radiographic Data Set, P56, P58.
- ² EyadHaj Said Gamal Fahmy, Dina Nassar, and Hany Ammar. Lane Department of Computer Science and Electrical Engineering West Virginia University, **Dental X-ray Image Segmentation**, research is supported in part by the U.S. National Science Foundation under Award number EIA-0131079, the research is also supported under Award number 2001-RC-CX- K013 from the Office of Justice Programs, National Institute of Justice, U.S. Department of Justice.

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