F8 Critical Effects of Improper Exposure of Digital Dental Radiographs Derived From PSP Plates

Richard A. Weems, DMD, Univ of Alabama, School of Dentistry, SDB Box 39, 1530 3rd Ave S, Birmingham, AL 35294-0007*

After attending this presentation, attendees will understand the potential for erroneous dental X-ray image orientation (right vs. left) resulting in reversed (mirrored) radiographic data when images are improperly obtained using digital X-ray systems based on some Photostimulated Luminescence (PSL) systems.

This presentation will impact the forensic science community by demonstrating the results observed when properly and improperly placed image receptors are exposed on an X-ray phantom using both the traditional film-based systems compared to the emerging technology used in digital dental radiography. An understanding of the results presented will provide information critical to the accurate victim identification through dental findings by helping to prevent errors.

Dental radiographs, whether film-based or digital, may be viewed from either the "front" or "back." Thus, if an observer evaluates the radiographic image from a viewpoint opposite from the image surface which was exposed, the determination of whether the structures seen are from the subject's right or left will be incorrect. This means, for example, that what may be perceived as the maxillary right first molar (tooth #3) in actuality is the first molar on the left side (tooth #14).

Any putative dental identification must be ruled out if any unexplainable disparities are noted between the antemortem and postmortem dental findings. Incorrectly orienting or viewing image media can erroneously create such disparities and prevent an accurate dental identification. Dental film manufacturers have traditionally placed a palpable "dimple" or "bump" on every film. This can be used to assure that the image is properly oriented when viewed. Additionally, a metal foil backing with a distinct pattern is included in the film packet behind the film to warn the viewer if the film was exposed from the improper side (from the non-exposure or "back" side).[1]

Typically, duplicated antemortem radiographic series do not provide the aforementioned physical bump for the examiner as a reference. This has been shown to be particularly troublesome when there are a very large number of decedents and when many of the antemortem images submitted are duplicated rather than original radiographs. There are several ways to determine the film's original orientation but most forensic odontologists accomplish this using the spatial location of the bump within the image itself. When the bump appears at either the lower right or upper left corner of the image, this assures that the dental structures are being viewed as if the viewer is facing the dental arches (bump-up). Bumps in the upper right or lower left corners of the images mean that the structures are being observed from the vantage point of the tongue (bump-down).[2,3] Also, panoramic images are typically labeled with "left" and "right" indicators in the image using letters either placed within the film cassette or on the device's head-holders.

However, there is a great potential for inadvertent spatial errors when interpreting improperly placed dental X-ray images captured by the Air Techniques ScanX™ Phosphor Storage Plate (PSP) system. PSP technology is considered an indirect digital radiographic system in which plates coated with photostimulable phosphor capture and store X-ray energy when images are taken. The exposed plates are then passed (scanned) through a laser which releases the stored energy in the phosphor as light. The light released varies according to the amount of stored energy, thus producing a radiographic image. The failure in the system arises from the fact that a plate which has been improperly exposed from the non-exposure side produces a "flipped" image with no indication after image processing that a spatial error has occurred. This is because the plates have no reference to indicate errors in that they lack the lead foils found in film packets. Also, the design of placing a reference letter "a" on the exposure surface of the plate is flawed and is not indicative of orientation as are the "bumps" in specified film corners previously mentioned. Additionally, this possible confusion concerning "left-and-right" orientation may occur with both intraoral and panoramic PSP images.

In conclusion, it is impossible to determine from a single digital radiograph if the portrayal of the decedent or victim's left or right is correct when created using the Air Techniques ScanX™ PSP system.

References:

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PSP Dental X-Ray, X-Ray Errors, Dental Identification

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