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TECHNICAL NOTE

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Postmortem Dental Radiography*

ABSTRACT: Comparison of postmortem and antemortem dental radiographic films or digital images is a common procedure for establishing identity of human remains. This article describes some problems with producing postmortem dental radiographs in a medical examiner setting and gives methods for circumventing these difficulties. Resection of the jaws, when permitted, significantly simplifies the postmortem radiographic technique. When producing an actual postmortem panoramic dental radiograph (orthopantomogram) from a dry skull, stabilization of the specimen for exposure by the moving beam source may be accomplished simply by placing the specimen upside down on an anthropologist's skull ring. Image "burnout" in the anterior segment, which results from absence of the tissues of the neck, may be avoided by appropriate placement of radiodense objects such as "zippered" plastic bags filled with water or other fluid material, freezer gel packs, or a block of self-polymerizing acrylic. These methods may increase future postmortem dental radiography efficiency.

KEYWORDS: forensic science, dental identification, postmortem dental radiographs, panoramic dental radiographs, orthopantomogram

Comparison of antemortem and postmortem dental radiographs is a commonly used procedure for establishing identity of human remains (1–3). The antemortem specimens usually consist of clinical periapical radiographs (film or digital radiographs), bitewing radiographs and/or a panoramic radiograph (orthopantomogram).

Methods

There are many problems with producing postmortem radiographic images that are comparable to their antemortem counterparts. Many medical examiner laboratories are not equipped for producing the usual clinical types of dental radiographs. A dental X-ray unit is often not available, and the process is relatively difficult on deceased remains. Rigor mortis and incineration render use of actual dental films difficult—often impossible without gaining access by cutting adjacent tissues. Also problematic are the matters of duplicating angulation, employing paralleling technique, and duplicating the source to object and object to image receptor (film or digital) distances so that the postmortem and antemortem images may be effectively compared.

Because of these difficulties, simpler methods for producing postmortem radiographic images of the teeth and surrounding structures are desirable. The posterior teeth can often be visualized on lateral-oblique skull views, but there are usually complications of superimposition of the left and right dental quadrants, and distortion due to angulation. Either of these can make comparison with antemortem radiographs problematic.

A relatively simple postmortem procedure for producing dental radiographic images comparable to clinical images can be accomplished on resected jaws. (This, of course, can be used only when resection of the remains is permissible.)

The anterior teeth can be imaged from posterior to anterior, which is opposite from the clinical direction of exposure, after placing the jaw(s) on the film or digital receptor with appropriate angulation accomplished by using some radiolucent support material—e.g., soft dental wax, or even wadded paper towels (Figs. 1 and 2). For the posterior teeth, the maxilla and mandible can be divided into right and left quadrants sagittally at the midline, and radiographed (Fig. 3). Many odontologists prefer to image the posterior teeth from lingual to buccal, similar to the anterior teeth, because alignment comparable to clinical radiographs (±5°) is easier to accomplish. It has been found that positioning the resected jaws about 1 inch above the film or digital receptor will result in images similar in size to those in corresponding antemortem orthopantomagrams. Because the postmortem exposures are made in opposite directions from the antemortem views, one must exercise care in marking the left and right views on the radiograph.

Although periapical radiographs made as described above will usually suffice for identification, occasionally an odontologist will prefer to produce a postmortem panoramic dental radiograph for comparison with a corresponding antemortem view. The panoramic radiograph has become a standard diagnostic tool for clinical dentists. It consists of a panoramic view of all the teeth, both jaws and some other mid-face bones in a single exposure. Panoramic radiographs can be either film-based or in a digital format. This is accomplished by having the patient stand or sit in the panoramic machine holding his/her head in place while the X-ray tube exposes the image receptor—the tube and receptor are positioned opposite to each other with the patient's head between—making roughly a 180° rotation around the patient's head and face in the same direction.

There are many problems with making postmortem panoramic dental radiographs. These include the fact that panoramic machines are almost nonexistent in medical examiner laboratories, and the obvious difficulty in placing an intact deceased subject in the required standing or sitting position. Therefore postmortem panoramic dental radiographs are virtually limited to skulls transported

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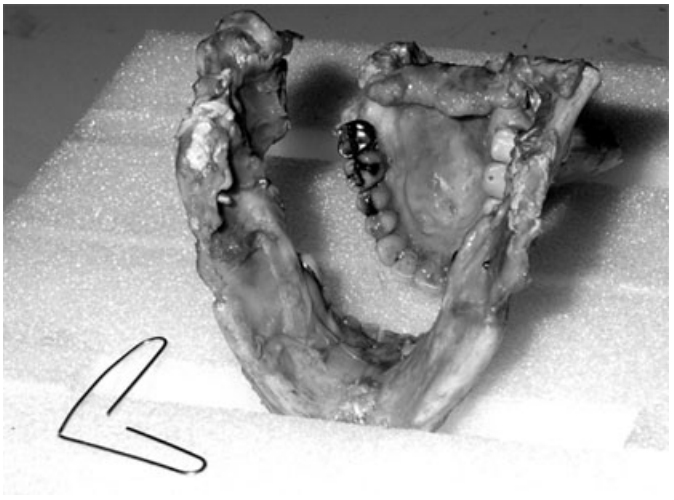

FIG. 1—*Positioning of resected jaws for postmortem radiography of the anterior teeth (courtesy of Dr. David R. Senn).*

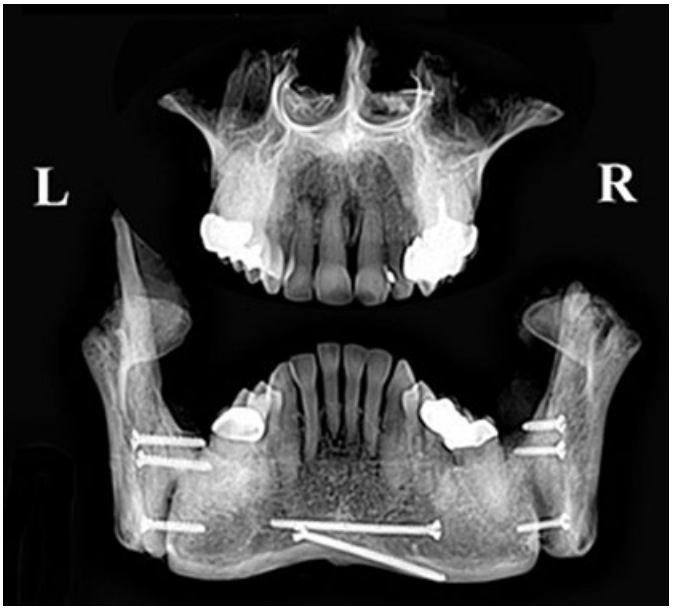

FIG. 2—*Postmortem radiograph of the anterior teeth in resected jaws (courtesy of Dr. David R. Senn).*

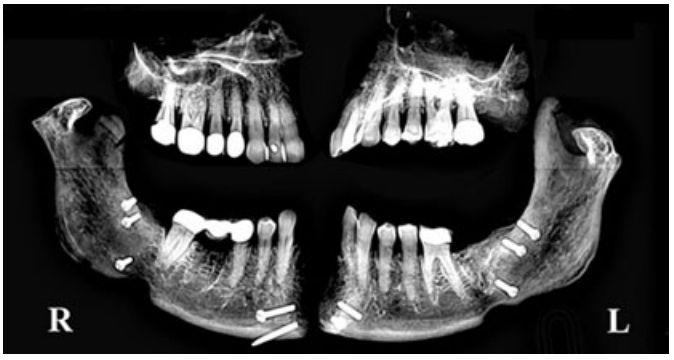

FIG. 3—*Postmortem radiograph of the posterior teeth in resected jaws (courtesy of Dr. David R. Senn).*

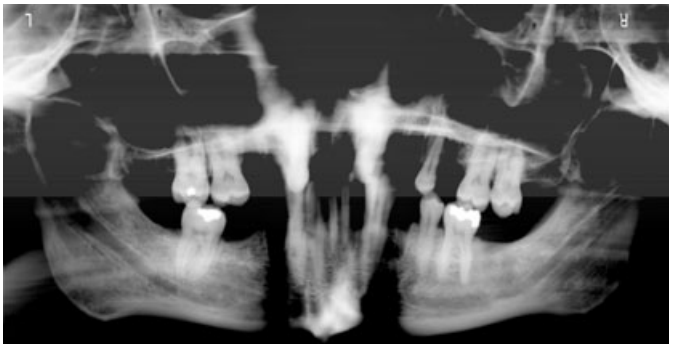

FIG. 4—*Postmortem digital panoramic dental radiograph taken on an inverted dry skull without compensating for anterior "burnout."*

to dental offices or other facilities equipped with panoramic machines. In these cases, the skulls can usually be appropriately positioned and secured in place by various means such as attaching them to the unit with adhesive tape. Some odontologists have produced panoramic radiographs by the simple expedient of placing an inverted skull on an anthropologic skull ring at the proper level (e.g., atop a cardboard box).

Another complication is that many of the more modern panoramic units are preset so that adjustment of the kilovoltage peak (kVp) to a level low enough to compensate for the lack of soft tissue on a skull specimen is below the available range. A simple remedy for this problem on some film-based machines is to add a film, which has previously been exposed to light and developed, to the panoramic cassette before the exposure. The exposed film is inserted between the unexposed film and the intensifying screen. This will decrease the necessary exposure of the original film by as much as one half, well within the operable range.

Perhaps the most complex problem associated with producing a panoramic dental radiograph on a skull is related to the fact that these machines are designed to produce the images of the anterior teeth and jaws by automatically increasing the kVp, or mA (milliamperage), or both of the X-ray tube resulting in sizeable increase in radiation dosage to compensate for radiation absorption by cervical vertebrae and soft tissues of the neck. As a result when exposing a dry skull, the anterior teeth and jaws are greatly overexposed and the resulting image shows significant burnout in the anterior region (Fig. 4).

Forensic odontologists have developed several possible solutions to this problem. Some have suggested manually decreasing the kVp as the unit head moves to this area. Others have used various methods of blocking a portion of the radiation by placing objects between the radiation source and the skull. Among these are "zippered" plastic bags filled with water (or water mixed with wheat flour), freezer gel packs, a plexiglas sheet or paper pad of appropriate size and thickness, or a block of self-polymerizing acrylic.

Finally, radiographs, both antemortem and postmortem, are often less than optimal for interpretation by odontologists. Fortunately, in most cases they can be adequately improved by appropriate enhancement with a computer imaging program such as Adobe Photoshop®. With most digital radiographic systems, the included viewing software provides several features such as controls for brightness, contrast, edge sharpening, etc., for enhancing the images.

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References

1. Clement JG. Dental identification. In: Clement JG, Ranson DL, editors. Craniofacial identification in forensic medicine. London, Sydney, Auckland: Arnold, 1998;63–81.
2. Goldman AD. Techniques for postmortem dental radiography. In: Bowers CM, Bell GL, editors. Manual of forensic odontology, 3rd rev. ed. Saratoga Springs, New York: American Society of Forensic Odontology, 1997;14–5.
3. Stimson PG, Mertz CA, editors. Forensic dentistry. Boca Raton and New York: CRC Press, 1997.

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