



Physical Anthropology Section – 2011

H88 Positive Identification Through Comparative Panoramic Radiography of the Maxillary Sinuses: A Validation Study

Angela Soler, MA*, Michigan State University, Department of Anthropology, 354 Baker Hall, East Lansing, MI 48824

After attending this presentation, attendees will learn the results of a validation study among forensic anthropologists and forensic odontologists conducting positive identifications by comparing antemortem and postmortem panoramic radiographs of the maxillary sinuses.

This presentation will impact the forensic science community by providing accuracy rates for the use of panoramic radiography and the maxillary sinuses to establish positive identification of unknown decedents. In addition, this presentation will discuss the effects of educational background and experience in comparative radiography when making a positive identification using panoramic radiographs and the maxillary sinuses.

According to *Daubert v. Merrell Dow Pharmaceuticals* (1993) all court admissible forensic techniques must comply with four standards: they have been or have the potential to be empirically tested; have known error rates; have been subjected to peer review; and have been generally accepted in the scientific literature. Furthermore, with the 2009 recommendations of the National Academy of Sciences and the 2010

Draft Outline of Forensic Reform Legislation there is an increasing push for the standardization and validation of forensic methods. As a result many studies have been conducted to validate positive identification in forensic anthropology and odontology. Validation studies on the use of comparative radiography have included a range of anatomical regions including: the lumbar spine (Wankmiller 2010); chest (Keuhn *et al.* 2002); hand (Koot *et al.* 2005); hyoid (Cornelison 2002); frontal sinuses (Christensen 2005); and the dentition (MacLean *et al.* 1994, Soomer *et al.* 2003). In recent years panoramic radiography has become a standard of care in many dental offices throughout the United States and now a larger percentage of positive identifications are being made through the comparison of panoramic antemortem radiographs. In addition, new technology is increasing the efficiency and use of postmortem panoramic radiography in the medical examiner setting (Du Chesne *et al.* 2000, Mincer *et al.* 2008). Although the dentition in panoramic radiographs has been validated as a viable positive identification method (Lee *et al.* 2004), the use of the maxillary sinuses and other osteological features has never been investigated.

This study evaluates panoramic radiography and the maxillary sinuses in positive identification by comparing antemortem and postmortem radiographs. Twenty fully skeletonized skulls from Michigan State University were selected for this project. Simulated "antemortem" panoramic radiographs were obtained using a Panorex radiography machine. The skulls were placed on a table and propped up with foam blocks. All crania were positioned in the Frankfurt horizontal plane with the central incisors resting on a notched bite stick. The frontal was placed onto a forehead block and the skull was steadied using the device's parietal head supports. Horizontal linear light beams on the lower border of the nasal aperture and vertical linear light beams on the left canine were used to maintain consistent positioning of the skull. Five crania were then randomly selected to simulate the "postmortem" matching films. Each of the five skulls were repositioned in the machine using the above method. All radiographs were digitized and then cropped to exclude viewing of the teeth. A web-based study was designed to invite forensic anthropologists and odontologists to match five "postmortem" radiographs from one of the twenty "antemortem" films. Data regarding the most helpful features, like the borders of the maxillary sinuses, nasal aperture, and inferior orbits was collected. Additional data regarding the participant's field of expertise, level of education, years practicing in forensics, and experience with positive identification was also analyzed.

Although the study is ongoing, so far a total of thirty-five forensic anthropologists, odontologists, and graduate students have participated in this study. The overall accuracy rate for correctly matching all five of the postmortem films was 65.7%; however, when the most challenging radiograph was withdrawn, the accuracy rate reached 91.4%. Only 57.1% of participants accurately identified postmortem film C, and 14.3% chose not to answer based on the poor quality of the antemortem film. Postmortem radiograph C was the most difficult to match due to a slight difference in the radiographic angulation and distance from the x-ray; however it highlights an important point. The ability to accurately identify individuals based on panoramic radiography of skeletal features other than the teeth relies heavily on the clarity of the films and exact duplication of the antemortem position of the skull within the panoramic radiography machine. Contingency tables and chi-square test results suggest that observer education, years in the field of forensics, and experience in positive identification did not significantly affect the ability to accurately identify the correct match for any of the postmortem radiographs, including postmortem film C. In addition, there was no significant difference in the way that experienced forensic anthropologists or odontologists performed in the study. However, it does appear that the key to



Physical Anthropology Section – 2011

correctly matching antemortem and postmortem films in this research was the ability to determine whether the antemortem films were of sufficient quality to perform an identification, which often comes with experience in comparative radiography.

Positive Identification, Panoramic Radiography, Validation