



F1 Skeletal and Dental Image to Photo Superimposition: Two Reliable Methods of Forensic Identification

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The learning objectives of this presentation are to demonstrate the usefulness of the techniques of skull image and dentition image to photograph superimposition for forensic identification of human remains when there is an absence of clinical antemortem records.

Many forensic scientists have used superimposition of craniofacial structure images over facial photographs of missing individuals to identify unknown human remains. Even though the scientific knowledge extracted from various research papers has found inaccuracies of the results due to several known factors, standards have been established to evaluate the result of this technique.

Two criminal cases under the investigation by Mexican police authorities from the states of Nuevo León and Chihuahua, México will be presented.

Case No. 1: On November 17, 1998, a dead body wrapped in plastic bags and fastened with duct tape was found on the side of interstate highway 44 at the border line (Nuevo León side) between the states of Nuevo León and Coahuila, México. After the package was unwrapped, the medical examiner found the decomposed body of a female with multiple perforating cuts on the soft tissue of the face probably to prevent visual identification. Hand wrist X-Rays revealed a skeletal estimate between 15 and 17 years of age. Police investigators immediately started gathering information about female missing persons between the ages of 15 and 20 years. Three photographs of a 17-yearold girl missing since the end of October 1998 from the town of Saltillo, Coahuila were collected from police officers in charge of the case. Two photographs were taken in June 1995, and the other one during the year of 1997. After requesting the medical history on the missing girl, as well as clinical records taken at hospitals and medical or dental offices, the police investigators confirmed that no records or medical history on the missing girl were found.

The three photographs from the missing girl were transferred to a computer by a digital scanning method, and prepared for the photo superimposition study. In order to preserve the integrity of the soft tissues of the head and face due to the nature of the criminal investigation, it was decided that instead of using the victim's skull image for the superimposition study, that an X-Ray image would be taken of the victim's head duplicating the same position shown on the comparison photographs of the missing girl. A frontal (Posteroanterior) X-Ray image from the unknown body's head was taken with a portable X-Ray unit, from a distance of 93 centimeters, due to space limitations within the autopsy room facility. After development of the X-Ray film, the skull image was transferred to the computer by a digital scanning method. In order to know the magnification values for the X-Ray image, a new X-Ray was taken under the same circumstances, utilizing instead of the body's head, a plastic natural size skull fitted with several metal markers, located at the principal anatomical landmarks of the skull and mandible. The X-Ray image with the metal markers was measured and compared to the measurements of the original markers located on the plastic specimen in order to describe the magnification values at each landmark location.

The X-Ray image of the victim's head was compared with the most recent photograph of the missing girl, by means of a digital process done by computer graphics. The face on the missing person photograph was prepared by drawing eight reference lines, five horizontal and three vertical; the lines indicated specific anthropometric landmarks for the superimposition study. The X-Ray image of the skull was prepared by drawing fourteen reference marks; these marks represented the specific anthropometric skull and mandible landmarks for the comparative study. The results are presented graphically, and the X-Ray image magnification percentages are presented in a tabular form.

Case No. 2: On September 18, 2000, a cardboard box containing one human skull, one human mandible, two color photographs and one ID card from a missing male person, was sent to the Department of Legal Medicine by the Attorney General's office from the state of Chihuahua, in order to know if the bones were related to the person shown on the photographs. The partial remains belong to an unidentified body found death outside the city of Hidalgo del Parral, approximately two years before. The ID card and the photographs belonged to a male individual 30 years of age from a suburban town nearby the city of Monterrey, reported last seen in the city of Chihuahua, several days before the date the death body was found in Hidalgo del Parral.

After receiving the package the local police collected five additional color photographs of the missing person. All the photographs depicted the missing individual smiling and showing his anterior dentition. The investigators located two dentists who attended the missing man few years ago, but no dental records were obtained from their offices.

The degree of obliteration on the cranial sutures of the victim's skull gave a compound estimate of twenty-five to forty-four years, with a mean of 34 years of age, at the time of death. The external morphological characteristics of the skull and mandible gave an estimate of ambiguous sex, with a tendency



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to a male subject. Discriminant function analysis and the cranial index, reported a white dolichocranial female individual.

The mandible was attached to the cranium by gluing the upper and lower teeth together in full occlusion utilizing a standard procedure, prior to mounting the skull on an articulating vertical stand fixed over a turntable. This setup was used to photograph the remains in all the different positions, duplicating the head positions shown on the collected photographs. Standard medium telephoto portrait images of the skull were acquired from a fixed distance, with a digitally equipped camera in six different positions, following standard procedures. The resulting digital images were transferred to a computer and prepared for their analysis.

The missing person photographs and ID card were transferred to a computer by a digital scanning method and were prepared for the image comparison studies. The frontal photograph on the ID card of the missing person was fitted with the reference facial lines, and the position related skull image was also fitted with the corresponding skull landmarks. The two images were compared digitally on a computer, and the results of the study are presented graphically.

The remaining photographs were compared with their skull image counterparts, directing the superimposition analysis to the dental structures. The results of these comparisons are presented graphically for their forensic evaluation.

Conclusion: Even though the image superimposition methodologies used on the two cases presented could not derive a positive identification of either human remains, the results were very conclusive on the high similarities found, which confirmed the usefulness of the technique on forensic cases where no antemortem records exist.

Forensic Identification, Computer Aided Image Superimposition, Forensic Odontology