

TECHNICAL NOTE

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Photographic Superimposition in Dental Identification. Is a Picture Worth a Thousand Words?

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ABSTRACT: This paper reports a controversial case involving the dental identification of the skeletal remains of an Air Force pilot whose F-105D aircraft crashed in North Vietnam. Only a portion of the maxilla less the teeth was recovered and used in the dental comparison and positive identification. A statement was made to the brother of the victim that the dental comparison removed any doubt as to the identification. This was interpreted by the brother as the following: "Without the maxilla there was no positive ID." The brother was not familiar with dental terminology and anatomy and was disoriented when trying to interpret the odontological narrative. The principles of photographic superimposition were used for general information and orientation to clarify the odontological narrative after the internment of the skeletal remains.

KEY WORDS: odontology, human identification

As the science of forensic dentistry advances, particularly in the area of dental identification, the forensic odontologist is professionally obligated to be especially thorough in recording the dental evidence at hand by all the means available to him. It is important that he interprets and records both the antemortem and postmortem dental evidence giving the basis on which identification was established. The odontological narrative should be complete and scientifically correct in the event that it is later challenged in court. It describes, using medical and dental terminology, the specific areas affecting the identification.

In some cases, however, the layman who may be a concerned relative of the victim being identified and who is not familiar with oral anatomy and the descriptive terminology in the odontological narrative may need further clarification and orientation of the oral struc-

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tures so that he may better perceive what the odontologist has described regarding the positive identification.

The following report describes a case in which a positive identification was established and the victim's skeletal remains were interred at a national cemetery. The victim's brother, however, was not convinced that the dental evidence was substantial or accurate prior to internment and wrote a letter to the Air Force asking additional questions about the identification of the remains. In the letter he enclosed photographs of the maxillary fragment in question; he had numbered some areas on the photographs and listed his questions to correspond to the designations on the photographs (Fig. 1). It was obvious that he misinterpreted the oral structures and that there was confusion on his part as to the difference between interseptal bony trabeculae and the bony sockets of the teeth. This letter was forwarded to the Central Identification Lab in Honolulu, Hawaii for the purpose of further clarification of the dental evidence even though a statement was made to the brother that the dental comparison removed any doubt as to the identification. This statement was interpreted by the brother as the following: "Without the maxilla there was no positive ID."

The problem was one of communication. Even though the forensic odontologist was thorough and accurate in his descriptions, the brother, being a layman, could not properly interpret the odontological language and unless a visual depiction of the specific areas being questioned was demonstrated, he might have been forever plagued with doubt. A satisfactory solution to this problem was attained by applying the principles of photographic superimposition using an antemortem periapical X-ray and a postmortem photograph of the maxillary bony fragment. It is emphasized that this method is for general information only, as stated by Devore [1], and is not used to establish a positive identification since the magnification and angulation of the original clinical picture are not known but only estimated.

Case Report

A 34-year-old Air Force pilot of an F-105D aircraft was on an armed reconnaissance mission over North Vietnam. His was the lead aircraft in a flight of four F-105s. Their target was a railroad bridge. The flight was inbound to the target at 915 m (3000 ft) when

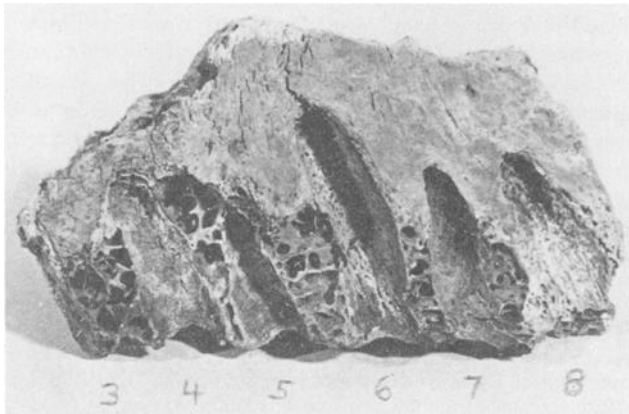


FIG. 1—Photograph of the maxillary fragment denoting tooth sockets as interpreted by the brother. Note the erroneous indication of Tooth Socket 3.

just prior to increasing altitude the lead aircraft appeared to be hit by flak. His aircraft yawed violently to the right and the right wing began to disintegrate. The trailing aircraft called for the lead pilot to eject as lead's plane was out of control and there was fire in the cockpit area.

As the right wing came off, the trailing aircraft saw the canopy release and the pilot eject, with the parachute starting to deploy. At that time, while taking evasive maneuvers, the trailing aircraft lost sight of the pilot but gave a general location of the grid coordinates of the location of the incident. The trailing aircraft called for search and rescue but because of the extremely hostile location this was not carried out. No one observed a fully deployed parachute.

The unidentified skeletal remains were turned over to the U.S. government twelve years after the ill-fated reconnaissance mission. Figure 2 shows a diagram of the portions of the skeletal remains recovered. The blacked-out portions were not recovered. The physical anthropologist stated that the paucity of the skeletal remains and the damages resulting from high-temperature incineration precluded the finding of the possible cause of death. Note that a portion of the right maxilla and fragments of the ramus and angle of the right mandible were recovered, but only the portion of the right maxilla was significant as dental evidence for comparison with antemortem records. The medical specimen denotes the area of the maxilla recovered (Fig. 3).

Figure 4 shows the maxillary fragment of the remains and the exposed lingual aspect of the apical halves of Tooth Sockets 3 through 8. On the extreme left only a one-fourth portion (apical half of mesial wall) of the entire socket for the mesio-facial root of Tooth 3 is retained intact. Also note that the axis of each socket is not perpendicular to an imaginary alveolar plane of the maxilla. The apical portion of the socket of Tooth 4 curves more distally than does that of Tooth 5. Also significant is the fact that the space between Sockets 5 and 6 is about twice that of the space between Sockets 4 and 5. Also, Socket 5 is shorter than that of Tooth 4. The trabecular pattern between the apical ends of Sockets 4 and 5 is unique and significant, as will be shown in the superimposition of the photograph and X-ray. The geometric patterns formed by the sockets and trabeculae are infinite and only a few of the more obvious patterns are discussed in this odontological narrative of the recovered fragment.

Comment

It is important to note that the geometric patterns combined with the individual specific areas of congruence are meaningful to the forensic odontologist but may be vague or meaningless to the layman unfamiliar with dental terminology related to dental anatomy. The superimposition for orientation and general evaluation of the maxillary fragment with the antemortem dental X-ray provided almost immediate orientation for comparison (Fig. 5) and clarification.

Photographic Technique

The photographic principles and materials used to attain superimposition for this particular case are outlined as follows:

1. The antemortem periapical radiograph was used to make a positive print three times larger than the original radiograph, a practical size that corresponds to the film used in Steps 2 and 3. Polycontrast F, nonexpansive resin-coated paper was used to make the positive enlargement. It may be developed with a light amber light. The paper should be hung at room temperature to dry. This print was used to make an initial visual comparison with the maxillary fragment by simply overlapping the two over a light source.

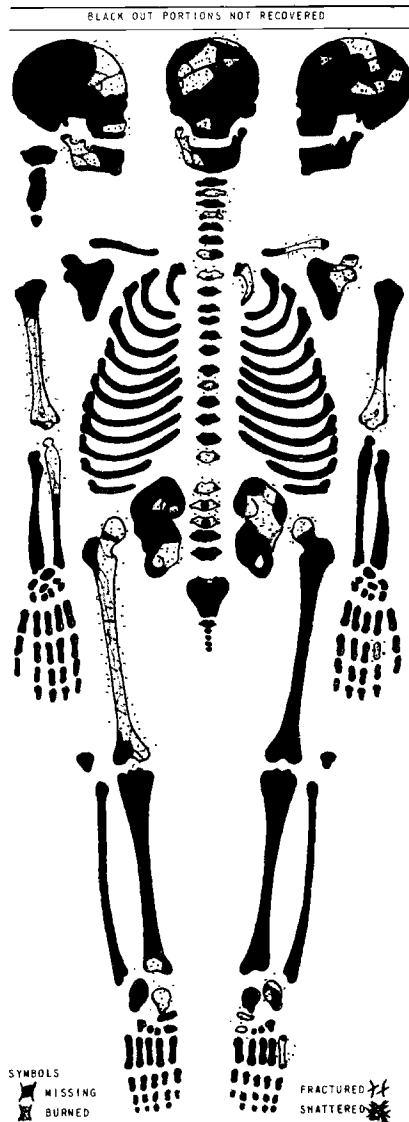


FIG. 2.—Diagram of skeletal remains recovered. The blacked-out portions were not recovered.

2. The antemortem periapical radiograph was again used to make an enlarged inversed transparent radiograph equivalent to the positive print. Kodak Contrast Process Orthochromatic 4154 film (Estar base, 0.18-mm [0.007-in.] thick; film size, 102 by 127 mm [4 by 5 in.]) was used to attain the transparency three times the size of the X-ray. On this transparency the radiopaque areas were black and the superimposition contrast appeared dark and unsatisfactory.

3. The enlarged inversed transparent radiograph in Step 2 was then transposed 1:1 onto another transparency. On this transparency, however, the radiopaque areas were white and suitable contrast was attained for superimposition.

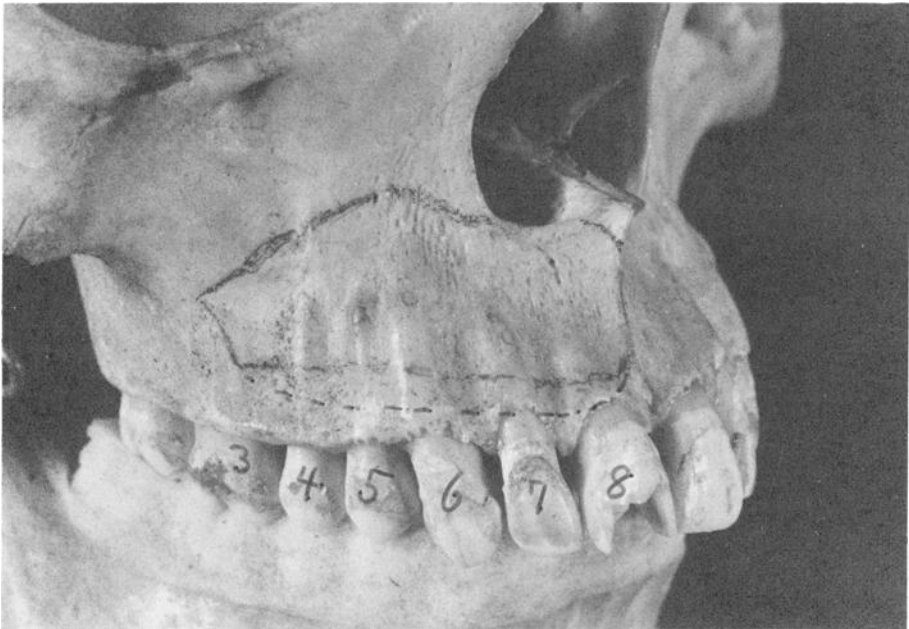


FIG. 3—Medical specimen denoting area of maxilla recovered.

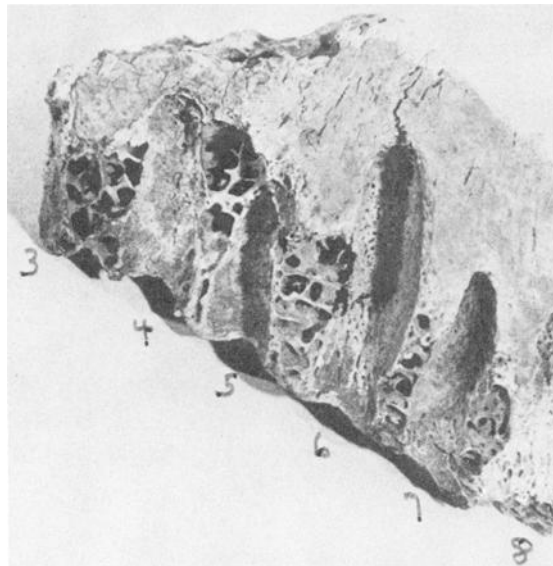


FIG. 4—Photograph of maxillary fragment to be used in superimposition.

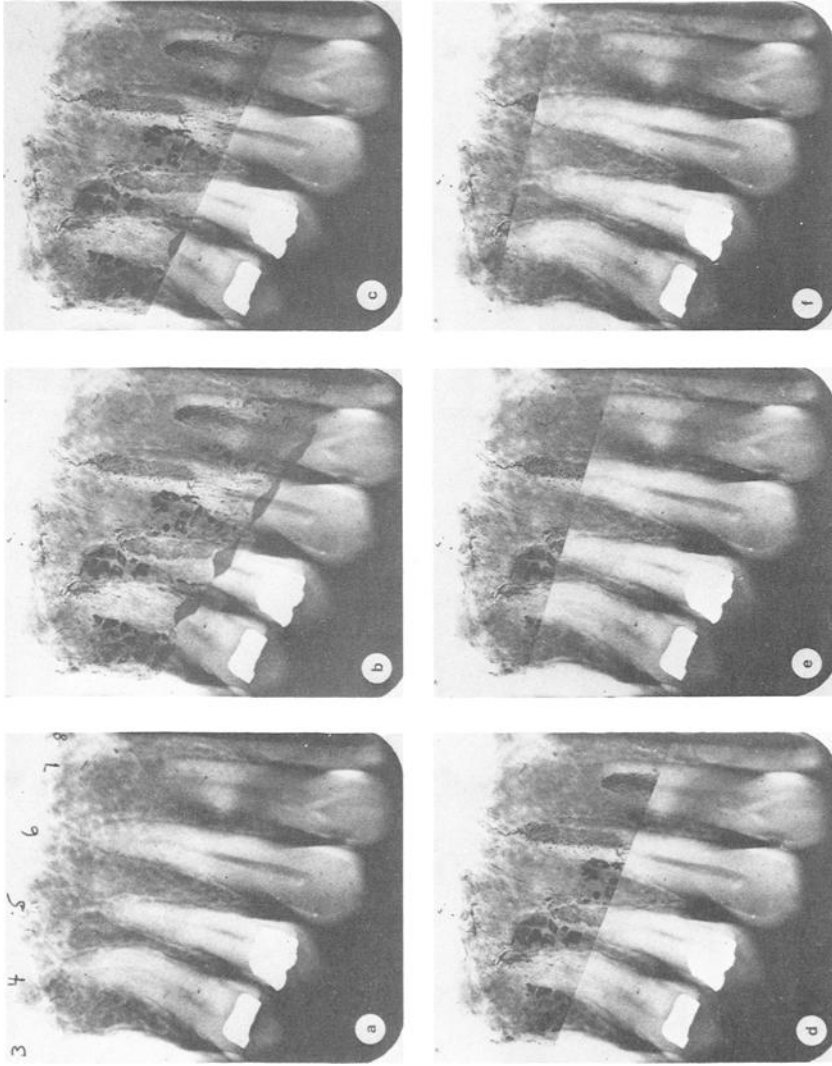


FIG. 5—Photographic superimposition sequence of the antemortem X-ray and postmortem photograph. (a) Antemortem X-ray before superimposition. (b) First in sequence showing full superimposition of maxilla and the antemortem X-ray. (c) Second in sequence: $\frac{1}{5}$ superimposition. (d) Third in sequence: $\frac{2}{5}$ superimposition. (e) Fourth in sequence: $\frac{3}{5}$ superimposition. (f) Fifth in sequence: $\frac{4}{5}$ superimposition.

Development and printing of Orthochromatic Film 4154 in Steps 2 and 3 have to be performed in total darkness or with a red safety light.

For the superimposition, the transparency from Step 3 was placed over the photograph of the maxillary fragment with a plain white paper slide between the two. Superimposition of the maxillary fragment occurred when the white paper slide was moved up or down between the two layers (see Fig. 5).

Conclusion

After a detailed analysis of the comparison of the maxillary fragment with the antemortem X-ray, a number of areas were significant, such as socket lengths, curved sockets, distances between sockets, apical distances, trabecular patterns, and the overall geometric pattern of these structures in combination as seen in the superimposition sequence (Fig. 5).

The photograph of the maxillary fragment was suitable for superimposition because the fragmented bony specimen itself exposed those areas needed for dental comparison. In this unique case, the forensic odontologist might conclude after studying the superimposition (Fig. 5) that a positive identification could be established by the superimposition itself, that is, that no matter what the magnification and angulation of the original laboratory photograph of the maxillary specimen, if the geometric pattern formed could be superimposed to show a favorable comparison of the myriad of lines and angles involved, a positive identification might be construed from the superimposition. However, such a general conclusion stating that superimposition can lead to a positive identification cannot be made from this particular case report [1]. Perhaps further research into photographic superimposition with regard to object distance and angulation will provide the physical anthropologist and the forensic dentist with mathematically precise tools so that such superimposition can be used for positive identification rather than for general information and orientation.

Reference

- [1] Devore, D. T., "Radiology and Photography in Forensic Dentistry," *The Dental Clinics of North America*, Vol. 21, No. 1, Jan. 1977, pp. 69-83.

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