TWO POSITIVE IDENTIFICATIONS ASSESSED WITH OCCASIONAL DENTAL FINDINGS ON NON-DENTAL X-RAYS

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ABSTRACT

The cases reported here show typical difficulties of dental identification procedure in the face of a lack of AM data for the missing person and an almost edentulous mouth in the body. In the first case the image of an included third molar found in an AM CT of the skull represented the decisive evidence for identifying the corpse; the identification of the body in the second case was possible only for an oversight of the radiologist during the performance of AM x-rays. They offer the occasion to describe the decisive importance of some occasional dental findings on non-dental x-rays and to stress the need of a comprehensive AM data collection and of a truly multidisciplinary approach to the collection and examination of x-rays. Furthermore, the cases underline that some radiographic features require skill, not only to be interpreted but also to be recognized.

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INTRODUCTION

The importance of intraoral structures for identification purposes in severely damaged bodies is well known[1] and the relative simplicity and the low cost of the odontological techniques that compare the Ante Mortem (AM) and the Post Mortem (PM) records or radiographs, render such methods frequently used in the first place in mass disaster and in single identification cases.[2] As underlined by many authors[3] radiographic data are very useful to identify altered corpses for whom morphological features (finger prints, face traits, etc.) are lost. Furthermore, modern dentists use systematic radiographic examinations (teleradiography, panoramic, periapical, bitewing, etc.) for routine dental care and hence dental archives are often rich in radiograms, especially after the increasingly widespread use of digital x-rays.[4,5]

It is well known that dental x-rays are useful for identification and often a single intraoral x-ray may show enough details for a positive identification. Such concentration of useful traits in dental x-rays often allows the observer to overcome those difficulties due to some inevitable differences between the confronted PM and AM images[6]. Some differences consist in inhomogeneous dimensions, different accuracy or definition of the images that can be appropriately and sensibly reduced with a software elaboration. On the other hand, a factor than can affect the comparison and is not so easy to check or to improve, is the different orientation that results from geometric distortion of the represented structures. That mis-orientation is principally caused by:

- different or uncertain techniques for taking the x-rays compared to identification procedure;
- different kinds of AM and PM x-rays used for the identification.[7] Typical circumstances are the comparisons between an AM panoramic or intraoral radiogram and the images of the maxillary structures provided by a PM cranial radiography. In spite of the great difference between an OPG and a lateral x-ray of the skull, our previous research showed a high comparability of these kinds of radiographies for the lateral portion of dental arches (bicuspid and molar portion).[8]

The obvious limits to the odontological methods based upon the comparison of AM and PM dental radiographies are represented by:

1. the lack of AM x-rays to be compared with PM files obtained from the corpse;
2. the lack of those teeth represented by AM x-rays in the corpse, because the subject, during life, lost some or all teeth becoming partially or completely edentulous.

With reference to the first point, Wilcher *et al*[4] have strongly recommended the necessity of acquiring comprehensive AM files, and especially all available x-rays. The odontologist might find some images of jaws, teeth or maxillary sinus in x-rays not specifically addressed to detect these structures and could proficiently use them for comparison. Minaguchi K *et al*[9] have reported the importance of jaw-dental images included in chest radiographs. Edentulous identification is well known to be a complicated factor of dental identification, because it often carries with it both the above-mentioned difficulties and limitations. Many teeth are not available in the dead person's mouth and the AM dental records, especially dental x-rays are often scarce or absent.[10] Clearly, the edentulous require less frequent dental care and rarely x-rays compared to dentate subjects. The specific forensic difficulties unique to edentulous have been well outlined by Richmond's *et al*[11] research that showed only in 18% of the examined cases, the dental files could grant the identification of an edentulous.

CASE REPORTS

The following cases seem interesting because they show some difficulties discussed above due to the lack of AM data for the missing person and to the large number of missing teeth in the corpse's mouth.

Case 1

During the summer of 2006, a corpse in an advanced state of skeletonization was found in a wood near a hamlet on the outskirts of Florence. The skeleton was complete except for some phalanges of hands and feet. The autopsy assessed as a probable cause of death, cranial trauma due to falling on a big stone. Examination of the mouth revealed a removable prosthesis almost complete applied to the upper arch (all teeth were lost during lifetime except, the second bicuspid and the first molar on the left, and the third left molar, included and severely destroyed by caries). In the lower jaw a removable prosthesis substituted nine teeth, whereas five were missing after death. The prostheses were not labelled nor did they have serial numbers that allowed them to be identified. After the first identification screening the police were informed that the missing person was probably a Caucasoid male, over 65. A white male of 78 years of age, affected by a degenerative neurologic pathology, disappeared 15 months

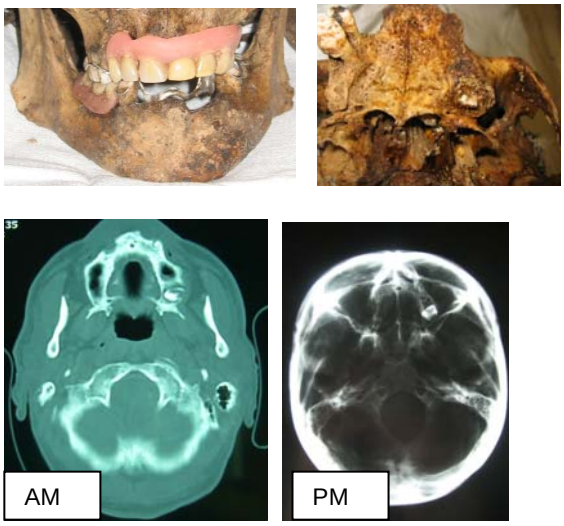

Fig.1: *Top - the jaws with both prostheses and the left third molar retained in the bone and severely destroyed by caries. Bottom - on the left, the last radiograph of the CT scan of the missing person's skull, on the right, a direct x-ray of the skeleton's skull.*

before the skeleton finding, was proposed for the comparative procedure. During the AM data collection, the relatives did not remember any past fractures or bone pathology that could have been found on the skeleton. Regarding dental information, the relatives remembered that he had lost most teeth many years before his disappearance, and during the last years he was taken to the dentist' s surgery only to repair the prostheses. The dentist confirmed the rare visits for prosthetic maintenance, that the last visit dated some years ago and he had not found it necessary to perform any dental radiographs. The dental files reported an amalgam dental filling on the first left molar. An amalgam filling was found in the correspondent tooth in the corpse's mouth, but this correspondence was judged insufficient to identify the subject. Since the lack of AM dental data or x-rays, it seemed very hard to identify the subject trough his dental features. The identification team comprisied of an odontologist and a specialist in legal medicine, addressed the AM collection to different sources (medical files, hospital archives, etc.) and a CT of the skull that the subject required for a cranial trauma 10 months before disappearance, was found in the hospital archives (Fig.1). The accurate examination of the CT revealed that the last scan (in cranial-caudal direction) had reproduced the upper left third molar, abnormally high in the bone because of the inclusion. It is to be noticed that the third molar image represented a detail

inside a radiogram of a few centimetres (about 4 by 5 cm) that shows the whole skull. The concordance of the position and the morphology of the included third molar, in consideration of the infrequency of this finding at least in elderly people, plus the correspondence to the biological features of the missing person (age, gender, race, stature, etc) to those assessed for the body, allowed one to identify the unknown skeleton as the missing person.

Case 2

The remains of a severely burnt corpse were found in a completely destroyed car. The use of petrol inside and outside the car gave rise to an intense fire lasting not less than four hours with a temperature of 700-800 ° C. The long bones were calcinated and fractured in numerous fragments, the cranium teca reported an explosion and the face and nasal bones were eroded by the flames. The autopsy did not reveal the cause of death as either the result of a murder or a suicide. On both dental arches there were two removable prostheses damaged by the fire and without any label, sign or serial number: the upper was an almost complete removable prosthesis with full coverage of the palate, the lower substituted six teeth and three teeth were missing after the death. The owner of the car had disappeared; he was a male of 59 years of age, physician, in good health and without any psychological issues. A suicide motive evoked by the police for the fire was strongly denied by the relatives of the missing person. The AM data collection revealed that the subject had not required any dental care for some years and no dental files or x-rays were available at the dental office where the subject was treated during the last two decades of his life. Also in this case, the forensic team requested of the family all other x-rays of the deceased and all information about traumatic events, pathologies, hospital records, etc. and the wife remembered that some years before going missing, the subject required a attention for light cranial trauma. An inquiry was made to the hospital and double projection (anterior and lateral) x-rays of the skull were found in the archives of the emergency room. The AM lateral radiogram showed practically only the neurocranial structures (probably of interest for the traumatic event) and included just a small part of the maxilla (palate). This radiogram was used for a digital comparison through a transparent overlapping with the correspondent PM x-ray taken from the corpse,

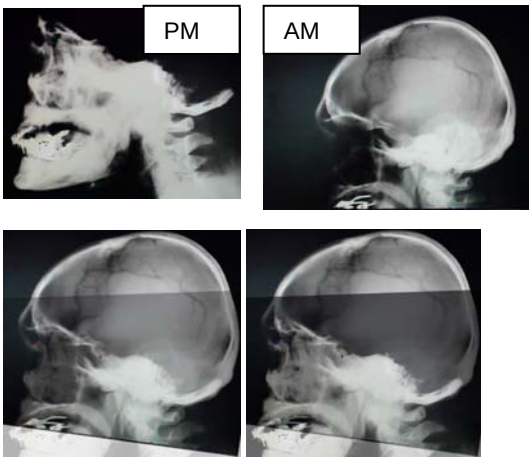

Fig. 2: *Upper on the left the PM lateral x-rays of the skull that denotes the severe destruction of cranial bones. On the right the AM lateral x-rays of the skull that reproduced only the neurocranial part of the skull. Lower the superimposition of the images (35% and 55% of transparency) that shows the perfect correspondence of the cranial base profiles.*

and it allowed one to note the perfect congruence of the cranial base profiles in the confronted x-rays (Fig.2). On the contrary it was impossible to evaluate the congruence of profiles of the cranial teca and of the anterior part of the frontal sinus, because these structures were almost completely destroyed in the corpse. The anterior projection radiogram showed the whole skull, but the tooth images were *per se* not very useful for comparison, because they were fused with the prostheses images and showed poor definition. On the other hand the x-ray revealed good images of metallic component of both removable prostheses applied in the mouth. The finding allowed three different digital superimpositions (right part, central part and left part) between the AM images of the lower prostheses obtained from the cranial radiogram, and the PM intraoral x-rays taken from the corpse. The AM and PM were analogical radiograms and, as for the lateral x-rays of the skull, they were photographed with a digital camera, homogeneously dimensioned and then overlapped using Adobe Photoshop (Fig.3). For the best appreciation of the profile correspondence, the metallic component of the prosthetic device was coloured in the AM image before the transparent superimposition. Since these prosthetic parts are hand-made and thus unique, the perfect congruence of their metallic profiles is highly significant and

decisive in spite of the great diversity of the two compared x-rays.

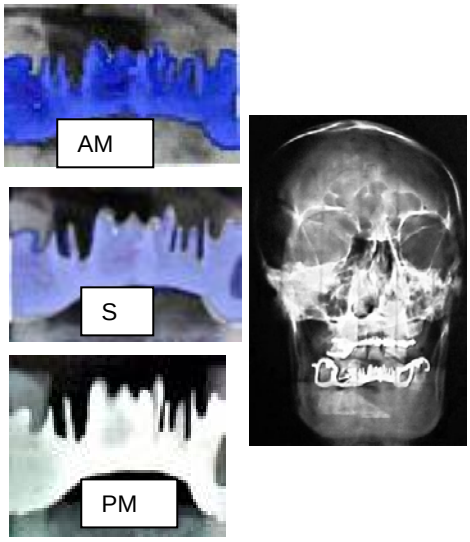

Fig. 3: *On the right the AM x-rays of the skull that shows both prostheses in the mouth. On the left the AM and PM radiographs of the anterior part of the mandible. The AM image is a detail of the x-rays of the skull. In the middle the superimposition (S) show (50% of translucency) of the AM and PM images alternatively coloured for simplifying the visualization.*

DISCUSSION

The cases presented here point out the importance of tooth, jaw radiographic images found out in non-specific x-rays. In the first case the scan of a cranial CT, that incidentally contained a third molar, and in the second case the casual mistake of a radiologist who left a removable prosthesis during the examination, allowed the identification of two subjects otherwise difficult to be identified by the odontologist. This underlines that the odontologist should not limit the AM data collection to the dental archives or exclusively to stomatognatic radiographs, but he/she has to request/examine x-rays addressed to other anatomical areas (skull, neck, chest, etc.). As recommended for other identification procedures[12,13] the radiographic approach needs a truly multidisciplinary forensic team, which includes a forensic odontologist as an active member during the collection and the examination of x-rays, at least before the individuation of the available and useful data for assessing identity. In fact we suggest that an excessively sectional management of identification procedure with strong separation between specialists causes a lack or undervaluation of the data, specially the radiographic data. The radiographic data requires high skills not only in interpretation, but also in recognition, especially when it is a tiny and specific detail in a wider radiographic contest.[14] The research of Soomer *et al*[15] stresses the importance of training and experience of an odontologist in evaluating x-rays, especially for the most difficult cases and that the best performances are achieved by private practitioners with respect to odontologists employed by the government or by the academy. We conclude that the best performances in interpreting x-rays will be assured by the forensic odontologist that practices as a dentist. Daily professional practice as a dentist improves the knowledge and the use of the current and ever more sophisticated radiographic techniques (CT, dentascan, etc.) and this practice allows the odontologist to have a developed skill in reading radiographic data.

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