

# Dental autopsy for the identification of missing persons

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## Abstract

Unidentified human remains require the complete collection of data during the autopsy stage to achieve, even belatedly, a positive identification. The very large number of people reported as missing in Italy (36,902) may represent an obstacle in the investigative process leading to the potential identity of the corpse, considering that 76.98% are foreigners. Add to this, the high number (1868) of “unidentified corpses” yet to be identified. A single case of a skeletonized corpse, listed in the list of nameless bodies is presented, with particular attention to odontology assessment. The case presented allows a broader definition of dental autopsy, which can no longer be considered a mere odontogram recorded by the medical examiner and/or a dentist with no forensic background. The case presented is not yet been identified also because no ante mortem (AM) identified data of compatible profiles has not been shared by the Police and consequently, no comparison of AM, and post mortem data could be possible. The failure to routinely employ forensic odontologists in the postmortem collection of identifying data of human remains of uncertain nationality and the reconciliation process will result in a reduction of additional findings, which, together with other circumstantial evidence and DNA profiles, can lead to a delay in positive identification.

**Key words:** Dental autopsy, forensic odontology, human identification, missing persons, human rights

## Introduction

Unidentified human remains require an accurate collection of data during the autopsy stage to achieve, even belatedly, a positive identification. It is possible to find those correspondences and compatibilities which allow for the process of personal identification of the corpse by comparing the results of the autopsy with the data regarding missing persons. The whole process becomes more complicated due to the high number of missing

persons – 36,902 – and because of the number of corps with unknown identity still awaiting identification. As of June 2016, the “Ufficio del Commissario Straordinario del Governo per le Persone Scomparse” (“Office of the Government Commissar for Missing Persons”) counted as many as 1868 unidentified human remains.<sup>[1]</sup>

On the April 1<sup>st</sup>, 2010, the national database “Sistema Ricerca Scomparsi” – “Ri.Sc.” (“Missing Persons Search System”) came into force regarding missing persons and unidentified corpses; this means that forensic odontologists are now able

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to have a more active role in the completion of the “Ri.Sc. form,” working alongside the medical examiner to gather both dental and radiological data from the corpse, as well as information from the families of missing persons to acquire better dental data for the police during the completion of the missing persons report. The information provided by the forensic pathologist will also have to take into account the collected dental data, which will contribute toward the creation of a generic profile of the unidentified corpse as well as accurately compiling the dental status, as provided for by the “Ri.Sc.” form. The generic identification of the corpse will allow, even in the absence of antemortem dental data, for the narrowing down of the investigative frame by defining sex, race, age, dental biography, socioeconomic profile, and geographical origin. These are, in brief, the elements which will allow the investigating authorities to narrow down the field of participants to be included in the comparison process, which is also provided by the “Ri.Sc.” database, and to direct the investigation through the possible gathering of data which might not necessarily be dental.

The aim of this casework is that of underlining the effectiveness of modern analysis techniques used by forensic odontologists through the description of a dental autopsy performed Pro Bono in 2009 on one of the participants in the list of unidentified corpses, for the public prosecutor’s office of Trapani (Sicily, South Italy).

## Case Report

In 2006, a decomposing corpse, skeletonised and with no mandible, was found along the coast of Valderice, in the province of Trapani, Italy. The public prosecutor’s office of Trapani authorized the autopsy, which was performed by a forensic pathologist working alongside a biologist. Various analyses, such as DNA sampling and the examination of the dimension and of the morphogenesis of the *Mytilus edulis* adhering to the body, were performed to estimate the length of permanence in the sea. In 2008, a human mandible was found in the same area where a corp with unknow identity had been found [Figure 1a and b]. In 2009, the public prosecutor’s office of Trapani authorized new technical dental and anthropological examinations of the body (skull and mandible), which had not been performed during the previous autopsy, so as to verify the compatibility of the human mandible with the previously examined body, thus integrating the existing profile written by the medical examiner with all those complementary elements which could lead to the identification of the body itself.

The body was exhumed, and it underwent a dental and anthropological postmortem examination. To compile a forensic odontological profile, the following examinations were performed: A complete radiographic examination of the maxillary and mandibular arches, inspection by and without ultraviolet (UV) light (395 nm), photographic examination



**Figure 1:** (a and b) Human dehydrated mandible and skull found along the coast of Valderice, in the province of Trapani, Italy. Perfect occlusion match can be observed

with and without linear referencing, impressions of the dental arches, sampling of dental enamel and sampling of dental material (composite resin and metal alloy taken from a dental inlay).<sup>[2]</sup> All the technical examinations were performed in the mortuary of the cemetery in Trapani using the personal equipment of the author, among which, the portable radiographic unit (Nomad Examiner, Aribex Inc., USA), which was associated with a sensor for digital radiography and connected to a laptop [Figure 2].<sup>[3,4]</sup> The oral inspection, assisted by a specific source of UV light, led to the identification of all the composite resin restorations, which are not always perceptible to the human eye due to the high degree of dental mimicry [Figure 3].

Finally, after judicial authorization, samples were taken of the dental enamel, composite resin and the metal alloy present in the subject’s mouth. The dental samples were subjected to geological analysis of the strontium,<sup>[5]</sup> while the specimens of dental material were subjected to scanning electron microscopy (SEM) and SEM-energy dispersive X-ray spectroscopy analysis<sup>[6]</sup> [Figure 4a and b]. On completion of all examinations, the body was once again interred in the local cemetery.

## Results

The good degree of preservation of the maxillary arch and the mandible allowed for a thorough assessment of both the

dentition and the dental treatment which had previously been carried out. The dental characteristics of both untreated and treated teeth (pigmentation, type and precision of the direct and indirect restorations, and periodontal conditions) were used to trace the dental biography and the biological profile of the subject.<sup>[7]</sup> The anthropological examination

and the type of restorations present in the mandible led to a positive confirmation that the mandible did belong to the skeletonized subject in question [Figure 1b].

Radiographic examination of the maxillary arch completed the judicial inspection, with endodontic treatments and previously extracted teeth being revealed. It was also possible to distinguish and confirm the dental elements which had been lost postmortem, by looking at the extracted dental elements. Finally, a digital elaboration of those elements was used to calculate the skeletal age of the subject: 58 years of age, with a variation of approximately 10 years.<sup>[8,9]</sup>

The results of the specimen analysis of composite resin and of the metal of the inlay provided valuable information regarding the producer and the brand of the material used, which were identified as the company Ivoclar Vivadent (Lichtenstein) and the composite known as Tetric Ceram. This allowed for a possible period to be worked out as to when the actual restorations had been placed (the material used for the composite restoration was sold in Europe starting from 2001), as well as an orientation regarding the geographical origin of the subject. The geological analysis of the strontium present in the dental enamel specimens, which was carried out through the ratio of the isotope  $87\text{Sr}/86\text{Sr}$ ,  $V = 0.70968$ , as well as the use of a geological map regarding its geographic distribution, confirmed that the subject came from central Europe, from the Bohemian Massif. Such data had already been assumed by the assessment of clinical and instrumental verifications of the dental material.

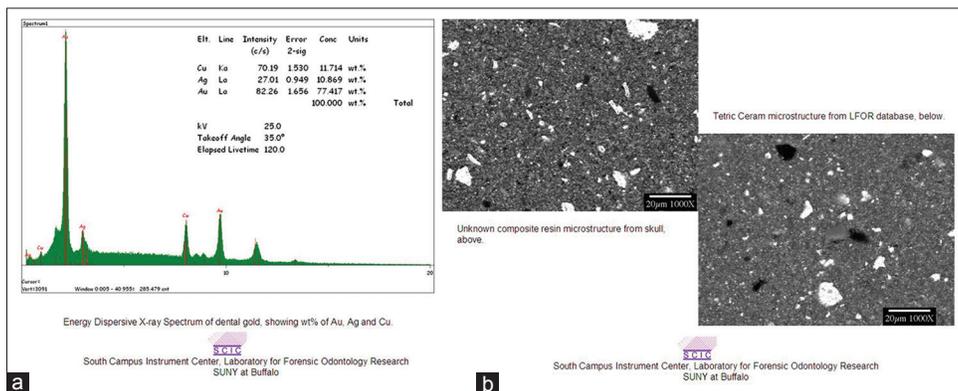
The general profile of the body which had to be identified, obtained thanks to the dental autopsy, was then transferred onto the Interpol form [Figure 5] since all the technical examinations, including that of the medical examiner, had confirmed that the subject was not of Italian origin.<sup>[10]</sup> Due to the difficulties in obtaining the great number of antemortem data of all the missing people in Europe, and because the



**Figure 2:** The portable radiographic unit (Nomad Examiner, Aribex Inc., USA) associated with a sensor for digital radiography



**Figure 3:** The oral inspection, assisted by a specific source of ultraviolet light, allows the identification of all the composite resin restorations, often not perceptible to the human eye



**Figure 4:** (a) the composite resin scanning electron microscopy-energy dispersive X-ray spectroscopy analysis; (b) the composite resin scanning electron microscopy analysis recognized as Tetric Ceram

P <sub>ost</sub> M <sub>ortem</sub> (pink)		VICTIM IDENTIFICATION FORM		F2	
<b>DEAD BODY</b>					
Nature of disaster : _____		No : _____			
Place of disaster : _____		Sex unknown <input type="checkbox"/>			
Date of disaster : <input type="checkbox"/> Day <input type="checkbox"/> Month <input type="checkbox"/> Year		Male <input checked="" type="checkbox"/> Female <input type="checkbox"/>			
<b>86 DENTAL FINDINGS in permanent teeth (Notify temporary teeth specifically)</b>					
11	Missing post-mortem	Y	Missing post-mortem	Y	21
12	Missing post-mortem	Y	Missing post-mortem	Y	22
13	Missing post-mortem	Y	Missing post-mortem	Y	23
14	Missing post-mortem	Y	Missing post-mortem	Y	24
15	Sound	S	Missing post-mortem	Y	25
16	Resin	R, occ	Onlay Gold	g, mes, occ, dis	26
17	Onlay Gold	g, mes, occ, dis	Resin	R, occ	27
18	Missing ante-mortem	X	Missing ante-mortem	X	28
48	Missing ante-mortem	X	Missing ante-mortem	X	38
47	Resin	R, occ	Resin	R, occ	37
46	Onlay Gold	g, mes, occ, dis, lin	Onlay Gold	g, mes, occ, dis	36
45	Sound	S	Caries	C, dis	35
44	Remaining Root	W	Missing post-mortem	Y	34
43	Remaining Root	W	Missing post-mortem	Y	33
42	Missing post-mortem	Y	Missing post-mortem	Y	32
41	Missing post-mortem	Y	Missing post-mortem	Y	31

Figure 5: Interpol form F2 with the odontogram details of the unidentified body

“missing search” computer system of the Department of Public Safety was not yet operating at full capacity, the expert examination aiming at the personal identification of the subject – through the assessment and comparison of ante and postmortem data – is still being carried out.

The case presented is not yet been identified also because no ante mortem (AM) identified data of compatible profiles has not been shared by the Police and consequently, no comparison of AM and post mortem (PM) data could be possible.

## Discussion

The use of the Interpol forms, of portable digital X-ray units, of inspectional and photographic examinations through a specific source of UV light, together with the technical analysis of the dental material and the geological analysis of the strontium present on the dental enamel, all allow for a broader definition of forensic dental examination, respecting international procedures and scientific standards, which contemplate a multidisciplinary approach to forensic human identification. When visual identification or fingerprint identification is not possible, it is necessary to identify bodies through procedures and protocols which are strictly scientific and which contemplate the use of primary identifiers, such as fingerprints, odontological data and DNA.

Radiographic images, the particular resistance and preservation of hard dental tissues and the restorative treatment which has been carried out, combined with the different analysis which can be performed, all allow

the clinical expert to broaden the type and quality of postmortem dental examination. It would be negligent for the forensic odontologist to exclude radiographic examination from the postmortem examination of a body in need of identification, and to limit the examination to a mere odontogram.

The missing search system (“Ri.Sc.”) proposed by the Italian Government can allow a preliminary digital comparison of the registered antemortem and postmortem data to find compatible biological profiles. Nevertheless it would also be appropriate to involve forensic odontologists during AM and PM dental data comparison and reconciliation for better technical results and avoid errors.<sup>[11]</sup>

Other important issue is the use of an international form beyond the form in Italian. About 76.98% (28,410) of all reported missing in Italy<sup>[1]</sup> prove that recovered unidentified human remains are likely to be foreigners. For this reason, all identifying data should also be recorded using Interpol Unidentified Human Remains (PM) form.

More collaboration between the “Ufficio del Commissario Straordinario del Governo per le Persone Scomparse” (“Office of the Government Commissar for Missing Persons”) and odontologists experts in forensic odontology and disaster victim identification (DVI) could be particularly helpful in the identification of human remains of uncertain nationality, missing persons and migrants,<sup>[11]</sup> and in the reconciliation process of AM and PM dental recorded data.

## Conclusion

The respect for human rights, the dictates of the Interpol on DVI and missing persons, the data available in the literature and the broadened investigative potential, supported by more specific analysis performed by a forensic odontologist, make the latter a fast, effective, and fundamental research in all those cases where the identification of corps with unknown identity is necessary. Postmortem assessment, evidence, and data collection of any unidentified human remains of unknown nationality should follow Interpol DVI principles, and forensic odontologists should be involved not only in the PM data collection but also in the AM dental data input, comparison, and reconciliation. The failure to routinely employ forensic odontologists can lead to a delay in positive identification and human rights violations.

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## Conflicts of interest

There are no conflicts of interest.

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