

# When the Dead Speak - Forensic Odontologic Identification

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## ABSTRACT

Forensic odontology (FO) is a specialized branch of forensic medicine that is concerned with appropriate handling and examination of dental evidence. The most common utilization of FO is toward finding the identity of unidentified remains of deceased persons by examination of the dental fragments, i.e., postmortem dental identification. This specialization assumes vital importance as part of the combat medical support team, especially in low-intensity conflicts or a theater of active operations. The main rationale for this is the high probability of aircraft or vehicular accidents, terrorist attacks, blast injuries, and similar incidents which result in mass casualties among both civilians and troops. It has often been seen that some of the dental structures and dental restorations may be the only parts of the body that is not destroyed and they can be useful even though they may be scattered over a wide area or may be recovered after a significant time. Recovered dental prostheses or postmortem dental radiographs may be invaluable to identify a deceased individual by comparing them with accurate antemortem records. These may be diagnostic enough to warrant a positive identification where other means are not conclusive.

**Key words:** Forensic dentistry, dental identification, post-mortem identification

## INTRODUCTION

Forensic odontology (FO) is a specialized branch of forensic medicine that is concerned with appropriate handling and examination of dental evidence for assistance to the application of both civil and criminal justice systems. This is a crucial and an important facet of the combat medical support team, especially during low-intensity conflicts or even in a theatre of active operations. This is due to the increased risk of mass casualties due to aircraft or vehicular accidents,

terrorist attacks, blast injuries, and the like, for troops on active duty. Fortunately, the dental structures and dental restorations are not easily destroyed and they can be useful even though they may be scattered over a wide area or are recovered after a significant time.<sup>[1,2]</sup> Recovered dental prostheses or postmortem dental radiographs may be invaluable to identify a deceased individual by comparing them with accurate antemortem records.

Forensic dentistry or FO is defined as "that branch of forensic medicine which, in the interest of justice, deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings."<sup>[3]</sup> Most often, FO deals with the tracing the identity of unidentifiable bodies of deceased persons by dental means, i.e., postmortem dental identification. Apart from this, dental identification may also be useful when it is necessary to confirm the identification of living persons, for example, high-profile prisoners, terrorists, foreign nationals, etc., whose identity needs to be established

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immediately; for persons who cannot communicate for any reason or those suffering from memory loss or advanced Alzheimer's disease.

## **RATIONALE OF FORENSIC DENTAL IDENTIFICATION TEAM**

The primary reason the armed forces need to have an established forensic dental identification capability is to assist in the identification of human remains. In most of the situations, it includes identifying their own men in uniform, but in certain situations, it requires identification of civilians who have been unfortunate to be involved in the attack or the blast.<sup>[4]</sup>

The legal requirements for such identification are as follows:

### **Wills and Bequeathed Property**

The possession of a valid death certificate is mandatory for the confirmation of the last will and testament and subsequent transfer of any inheritance, title, portion of wealth, etc., to the next of kin of the deceased individual. A positive identification is an absolute necessity for issuance of a death certificate by appropriate authorities. Without positive identification, this process could be delayed until the person is declared legally dead or after a 7-year waiting period.

### **Insurance Purposes**

Positive certification of death is once again a mandatory requirement before the beneficiaries receive the payment benefits from any life insurance or similar policy held by the victim. It is often the case, that in those when a positive identification is not possible, the payment of benefits to the beneficiaries gets indefinitely delayed. This is a pitiable state for a family to be caught up in, as it is the exact opposite of the outcome for which people buy a life insurance policy. At times, this administrative hurdle ends up denying or delaying the family crucial payments that are essential for their existence.

### **Legal Requirements**

Yet, another crucial matter is the initiation of legal action such as malpractice or wrongful death lawsuits. Unless there is proof of death and a death certificate is

issued, it is very difficult, if not impossible, to initiate a wrongful death case in the courts of law.

Dental identification also helps to prove the innocence or guilt of an accused person in crimes, especially those related to murder or sexual assault. In such cases, bite marks from the victim or on the alleged attackers body can be used to ascertain if the accused was involved in the crime or not. Legal history is replete with many interesting cases where dental records were the only means to link the person to the crime or in some cases prove that they were innocent and uphold the principles of justice.

### **Psychological Aspects**

The sudden death or demise of a loved one is tragic event for anyone. Unless there is some proof that the concerned individual has perished in the accident, there is a lack of closure for the near and dear ones. In certain cases, the family is unable to grieve as they do not have definite proof of death. At times, there is lingering hope that the missing family member will return someday since there is no proof of death. It is a known fact that without proof, it becomes a huge challenge for some people to accept the death of their child, parent, sibling, or spouse.

### **Manpower**

The unfortunate loss of trained workforce is major sequelae to a mass disaster, accident, or incidence of violence. There is a legal need to identify the exact number of casualties so that their deficiency can be restored and the military unit returned to a complete state of combat readiness.

### **Tactical and Administrative Requirements**

The higher echelons in the Government or Military HQ's need to be aware of the number and status of the deployed troops, exact details of the fatalities sustained by a particular unit and the actual losses in terms of capability. Added to this, an important aspect of military strategy is the concern that when civilians are involved in the attack, it is important to distinguish between the casualties as being either perpetrators or innocent bystanders. This may also be related to demands for compensation that is announced by the government following mass disasters.

## PROCESS OF FORENSIC DENTAL IDENTIFICATION

It is very important, therefore, to have good quality, comprehensive, accurate, and legible antemortem dental records. These become invaluable when needed for comparison purposes with postmortem dental records so that postmortem identification can be proved or disproved. This is not always the situation as the very few practitioners maintain good quality and accurate antemortem dental records and this also varies considerably. It becomes an almost herculean task for the forensic dentist involved in dental identification to compare postmortem chartings and radiographs with incomplete and/or inaccurate antemortem dental records.<sup>[5]</sup>

Some of the commonly observed lacunae in maintenance of dental records include lack of accurate recording of the dentition with the treating dental surgeons, lack of uniformity in charting, inadequate or poor quality of dental radiographs, illegible or incomplete dental records, and finally, the dynamic nature of the dentition. Human error plays a significant role in all of these yet can be minimized with adequate education and training of the dental team and parodontal staff.

A single feature such as a missing tooth cannot be present found later on or an endodontically treated tooth in the antemortem radiograph cannot be seen as untreated (normal) in the postmortem radiograph.<sup>[5,6]</sup> This becomes useful exclusion criteria to rule out the identity of a person. The possibility of the patient having undergone further treatment still remains as an option that must be factored in when comparisons are made. Time period is an important factor in this estimation and the expertise of the forensic dentist will help to come to a decision.

## AIDS TO SUCCESSFUL FORENSIC DENTAL IDENTIFICATION

### Dental Radiographs

Dental radiographs provide the most reliable and important element of the antemortem data upon which to base a postmortem identification. As few as, one unusually shaped restoration or one endodontic filling may be all that is needed to make a positive identification. Bitewing radiographs are of great advantage as they will provide detail of the crowns of the upper and lower molar and premolar teeth. They

also provide detail of the interdental region, levels of crestal bone, crown morphology, size and shape of pulp chambers, shape of dental restorations, overhanging margins of restorations, lining material, caries, and supra- and sub-gingival calculus deposits. Education and regular training of the parodontal staff to ensure that all radiographs are of excellent quality in routine dental services are of paramount importance.<sup>[5-10]</sup>

The FO should reproduce as accurately as possible the angulation and the positioning of the X-ray tube as that was used for the antemortem radiograph. When radiographs of just skeletal remains have to be carried out, a reduction of approximately 25% is made in the kilovolts (kV) and milliamperes (mA) and/or exposure time to compensate for the absence of soft tissue. Shrinkage of the osteoid tissue and effect of high heat or impact all have to be factored in depending on when and how the remains were found or recovered.

Orthopantomograms are often taken routinely as an antemortem screening radiograph, and they provide invaluable information about the teeth and associated bony structures.<sup>[9,10]</sup>

## USE OF STUDY CASTS TO AID POSTMORTEM IDENTIFICATION

It is a good practice that study casts as dental records should be kept until personnel are on active duty. They can be very useful in the identification process for comparison. Casts should always include the name of the patient, name of the dental practitioner, name of the dental unit, and the date the casts were made.<sup>[11]</sup>

### Dental Sources of DNA

DNA is relatively resistant to decomposition and, in the case of mitochondrial DNA, can survive in bone for thousands of years. DNA testing is a valuable technique for association of body parts in circumstances where no other method is suitable. Teeth provide a rich source of DNA and they are well protected by the hardest tissue in the human body - enamel.<sup>[12]</sup> It has been shown that there is sufficient quantity of DNA in the crown body, root body, root tip, and crown tip. Individuals in high-risk occupations such as military pilots may have antemortem blood samples stored as routine procedure for future comparison.

There are many methods for carrying out DNA fingerprinting for identification. These may be either by process of restriction fragment length polymorphism

or by polymerase chain reaction or both. Each method looks at the repetition of polymorphic regions of DNA, including single nucleotide polymorphisms (SNPs) and short tandem repeats (STRs). The identification of a person accurately and definitively is correlated with the size and the number of repeated sequences examined. DNA fingerprinting for human identification makes use of special probes that focus only on human-specific DNA. This ensures that identification can be accurately done even if there are chances of contamination of the sample by DNA that is of non-human origin.<sup>[13]</sup>

Human mitochondrial genome (mtDNA) typing is now being routinely used in forensic identification and may be the only method to be applied where the biological samples are minimal or in highly degraded state. This technique has great potential because the high mutation rate of the mtDNA makes it an important biomarker even in the cases of monozygotic twins with rare SNPs for the federal and investigating agencies. This has major implications because routinely even monozygotic twins cannot be separated by STR profiling. What is crucial to note is that when the samples obtained consist of degraded skeleton, teeth, bones, or skull remains; the FO needs to examine the samples and compare them with human reference samples to confirm their origin.<sup>[14]</sup>

## DENTURES AND DENTURE MARKING

Removable dental prostheses or dentures are another useful aid to postmortem identification. This is useful if they have some form of identification marking incorporated into them at time of manufacture.<sup>[11]</sup>

There are many different methods available for the marking of dentures. They fall into two distinct categories: (1) Surface marking techniques and (2) inclusion marking techniques.

### Surface Marking Techniques

An identifying mark by the use of a dental bur or other sharp objects may be imprinted on the polished surface of the denture. A permanent wash-proof marker may also be used to write on the denture surface and covered with a clear varnish or resin.

### Inclusion Marking Technique

The best method is by incorporation of a metallic or non-metallic strip with details of the patient or laboratory in

a suitable portion of the denture. Although more time consuming, it is the better technique as it is likely to be more durable. In the armed forces, dentures may be marked with the individual's army registration number which is a unique and immediately identifiable number.

## CONCLUSION

Forensic dental identification though dealing with deceased subjects plays a key role in ensuring that the morale of the survivors of tragedies is kept up and also fulfills the social and legal obligations of the next of kin.<sup>[6,15,16]</sup> All dental practitioners need to be made aware of their responsibility in maintaining dental records of all the patients they treat. It is pertinent to note that with the advent of digitization of most forms of dental radiographs and even dental photography, it has become easier and more efficient to store and transfer the dental records. All the members of the dental team need to be educated about the long-term benefits of maintaining accurate dental records. This will play a key role someday in the future and be the only piece of evidence that will help in the positive identification of a person.<sup>[6,8]</sup> It may even save an innocent person from being found guilty and being wrongfully accused and punished. It may not restore the life of a deceased person but will ensure that the family members and loved ones find closure and can get the monetary benefits that will allow them to survive the tragedy of losing a loved one under traumatic circumstances.

FO is still in a nascent phase in India. There are only few FOs who are practicing in the country and most of them have been trained abroad. As regards the formal training, FO is taught by the specialties of oral pathology and oral medicine.<sup>[17]</sup> It is hoped that this article will increase awareness and raise interest in this exciting and rapidly developing field. There are numerous applications and employment opportunities, and the regulatory authorities need to take note and make the requisite changes in the curriculum to establish this branch of dental sciences in the country.

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