



Importance of Dental Records in Post-mortem Identification: A Comprehensive Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/88268>

Review Article

**Received 11 April 2022
Accepted 22 June 2022
Published 02 July 2022**

ABSTRACT

Forensic dentistry or forensic odontology involves handling, examination and evaluation of dental evidence in criminal justice cases. Forensic dentists are involved in assisting investigative agencies to identify recovered human remains in addition to the identification of whole or fragmented bodies. Forensic dentists have also been known to use their investigative techniques to identify burn victims by using the victims previous dental records. Forensic dentists may also be asked to assist in determining age, race, occupation, previous dental history and socioeconomic status of unidentified human beings.

Keywords: *Disaster victim identification; human identification; radiology identification; forensic odontology; DNA analysis; bite marks.*

1. INTRODUCTION

Dental identity establishes a person's individuality, whether they are alive or deceased.

In the case of absconding criminals, troops, missing persons, impostors, escaped inmates, and other living people, dental identification may be required. When unclaimed bodies, hideously

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mutilated bodies, or skeletal remains are discovered, identification may be required. In forensic odontology, the utilisation of the distinctive features of the human teeth to aid in personal identification is well established. Although in a lot of situations, the individual's identity is unknown due to the lack of antemortem data. In such circumstances, a dental profile of the individual is created to aid in the identification of the person using dental indicators of age, ethnicity, habits, professional standing, and gender [1]. "These include identifying human remains in mass disasters (enamel is the body's toughest material, and unbroken teeth are frequently found), comparing post-mortem x-rays of the teeth to ante-mortem x-rays, and comparing bitemarks" [2].

"The essential ideas that underpin dental identification are comparison and exclusion. As long as the dental consultant has finished the data obtained during the patient's life in an exact, rational, and comprehensive manner, the comparison between ante-mortem and post-mortem information will be beneficial" [3]. A single characteristic might sometimes be so outstanding or distinctive that it is enough to achieve a definite identification. Regardless of the approach used to identify a disfigured face (person), the findings of comparing ante-mortem and post-mortem data will result in one of these four scenarios [4,5].

Positive identification: Because the items being compared are sufficiently unique in both the ante-mortem and post-mortem databases, there is no significant difference in the observations. Possible identification: There are a few common findings among comparable objects in the ante-mortem and post-mortem databases, but not enough to rule out a positive identification. One restoration among numerous post-mortem radiographs, for example. Insufficient evidence for identification: There is insufficient evidence to support a definitive identification based on a comparison of ante-mortem and post-mortem results, yet the identity of the deceased cannot be completely ruled out and is judged inconclusive [6,7]. Exclusion: In the ante-mortem and post-mortem databases, there are unexplained disparities between comparable entries [8]. Using the comprehensive review technique, the goal of this study was to raise awareness of the value of dental records in post-mortem identification.

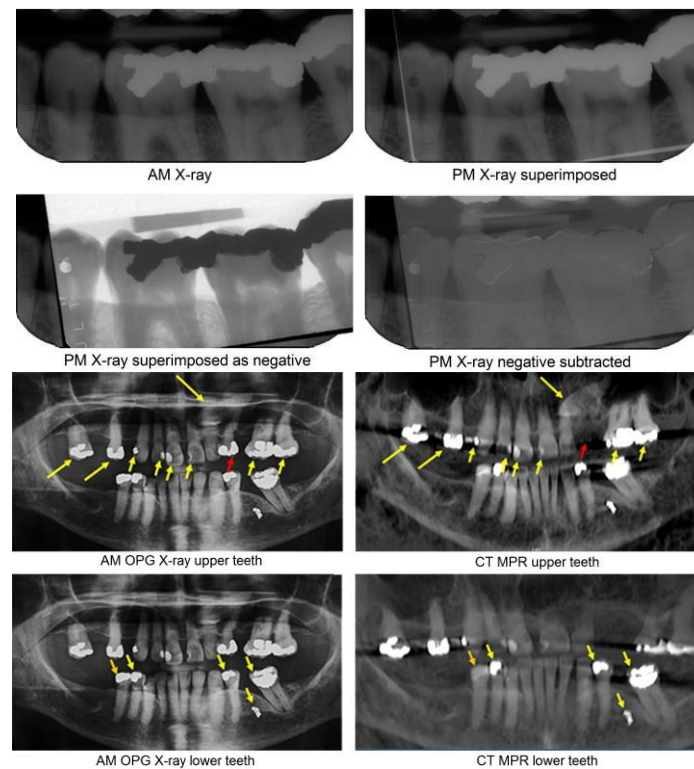
2. MASS DISASTER VICTIM IDENTIFICATION

Dental identification is one of the major components of the International Criminal Police Organization's disaster victim identification approach. The orodental structures and dental restorations are the only parts of the body that aren't affected. For verifying a body's identification, a careful comparison and matching of concrete antemortem evidence and post-mortem results is essential. It's unusual for two people to be identical in every manner, therefore some judgement is required [1]. Fillings, dental extractions, implants, prosthetics such as full or partial dentures, and a variety of surgical treatments are all examples of dental interventions. Teeth that have not fully developed may be missing. The presence of disease or pathology, such as periodontal (gum) disorders and dental caries (tooth decay), tooth crowding, or atypical configurations of teeth in a dental arch, and the relationships between teeth in the top and bottom jaws, can all add to the comparison" [9].

When good-quality antemortem data is available, forensic odontology traditionally identifies about 60% of victims and contributes to about 30% of additional identifications when used in conjunction with other identifying approaches. In a "traditional" occurrence, the fingerprints section makes the early matches, followed by a larger contribution from the dental part, and the DNA section provides late results, especially for youngsters lacking fingerprint or dental data. The DNA section can also relate pieces to a bodily part that has already been recognized [10]. Provide an excellent systematic review of the function of forensic odontology in significant mass disasters around the world.

3. SEX DETERMINATION

"In natural disasters, chemical and nuclear bomb explosion scenarios, sex determination is a very essential branch of forensic odontology that plays a key role in identifying unknown persons. There are four approaches that can be used" [11]. shape and dimension of the craniofacial region: The morphology of the skull and mandible, as well as the pattern generated by six traits such as the mastoid, supraorbital ridge, size and architecture of the skull, zygomatic extensions, nasal aperture, and mandible gonial angle, are all taken into account.



Sex difference in tooth dimension: The most straightforward and reliable approach for sex determination is to measure the mesiodistal and buccolingual dimensions. Males have more of both dimensions than females. Males have a more noticeable distal accessory ridge in their canines than females do. The number of cusps in the mandibular first molar is lower in females (distobuccal or distal). These characteristics may be due to an evolutionary reduction in the size of the female lower jaw. DNA analysis for sex determination: According to Das and his colleagues' research, sex might be determined by examining the X and Y-chromosomes up to four weeks after death.

4. THREE DIMENSIONAL (3D) SURFACE SCAN DATA

Traditional dental imprint procedures are being replaced by three-dimensional (3D) scanners [12]. "A suitable-sized tray containing a thick paste is introduced into a patient's mouth during the latter, and both the dentist and the patient must wait for the substance to solidify before removing it to reveal a space depicting the teeth and gums. This can be a frightening experience for both the dentist and the patient, especially for those who have a trigger gag reflex. A wand attached to a computer is passed over the teeth (or other item) and records data that is

processed in real time to produce a realistic 3 D virtual representation. A 3D printer can also be used to make this happen. These scans are clinically accurate and the process is highly relaxing for the patient, particularly if a powder-free approach is used" [12,13]. "3D surface scans are a new type of AM data that is becoming more widely used. Unlike X-rays and CT scans, they do not use ionising radiation and are unaffected by the presence of previous dental treatments. Unlike CT scans, they are equally useful whether or not the teeth have fillings (of any material)" [14].

5. DENTAL STUDY MODELS

"Dental imprints are traditionally deposited into rigid gypsum-based materials to create study models. They are three-dimensional castings of a dentition that are incredibly helpful because they serve as a proxy for the patient. Their surfaces can be recorded with a 3D scanner and compared to a scan of a deceased person's teeth" [14].

6. DENTAL APPLIANCES

Full or partial dentures, orthodontic appliances, occlusal splints, bleaching trays, and mouth guards are examples of dental appliances. All of these could be used to compare a person's

dentition or mouth to that of a deceased person. Not all of these appliances must be produced in a dental office. Mouth guards, for example, can be manufactured in schools for children who participate in contact sports, as well as expressly made for sports teams. There are other possibilities for making mouth guards at home [15,16]. Partial dentures are particularly useful because they are custom-made to fit only one mouth. Dentures are sometimes marked with a unique patient number or mark, especially in hospices and nursing homes [17] Dentures may be marked with identifying information, which is particularly common when victims have lived in a nursing home or other comparable facility. Several methods for labelling dentures have been presented throughout the years, but they are still considerably less frequent than forensic odontologists would want [1].

7. BITE MARK

“The bite mark is described as a physical change in or on a medium caused by tooth contact. It has been observed in a few criminal incidents that the defendant or victim has left tooth marks on another person or inanimate item” [18]. “Bite mark evidence is a fascinating notion that dates back to Roman times. There will be an outer border of arches, as well as a sequence of abrasions, with or without laceration, that reflects the size, form, and arrangement of class characteristics of dentition's incisal or occlusal surfaces” [19]. “In more violent bites, the attacker may suck the soft tissues into the mouth, revealing images of the palatal and incisal surfaces of the teeth. Bites exhibit tissue laceration and petechial haemorrhages in the wound's centre. The skin may not be entirely pierced in less violent bites, resulting in oval marks, mainly on the anterior teeth. Bite marks on living and dead animals change over time. If the bite occurs on a living human, the tissue will show post-injury changes such as bleeding, edoema, and discoloration. If the bite occurs on a deceased person, images of the bite marks are obtained using a standardised method” [20].

8. BITES ON OBJECTS

“When bite is present on objects such as apples, beer, chocolate, and so on, the lack of distortion of the material frequently offers more information, and we can get a good impression of biting edges. Taking swabs from this object is critical since it may disclose the assailant's blood group and allow for DNA analysis” [1].

9. LIP PRINT

Cheiloscopy is a type of forensic examination that uses lip traces to identify people. Individual aspects of the lip print wrinkling pattern are similar to those of finger prints [21]. Lip prints are a distinctive pattern formed by the wrinkles and grooves on the labial mucosa. Because lip prints are consistent throughout life, they can be used to verify a person's presence or absence from a crime. Santos was the first to categorise lip grooves in 1967. Straight line, Curved line, Angled line, and Sine shaped line are the four forms of lip grooves [22]. A regular and acceptable technique for collecting, developing, and recording lip prints must be devised in order to ensure comparison [20].

10. ORTHODONTIC TREATMENT

Radiographs: One of the most noticeable findings on a post-treatment radiograph is the presence of a tumour. Orthopantomograph is the term used to describe the generalised root resorption that occurs as a result of orthodontic therapy [23]. Because orthodontic therapy often necessitates the extraction of a few teeth for correction, the post-treatment radiograph can be a useful tool in identifying the victim.

The importance of assessing and recording post-treatment findings cannot be overstated. Has the potential to cause severe damage to both hard and soft tissues [24,25] and is referred to as Orthodontic scars, which can aid in the identification procedure. The following are a few that are relevant to forensic odontology: Enamel lesions include enamel decalcification and white spot lesions [26,27]. Enamel degradation caused by physical forces Periodontal tissues, Gingival recession [28] Dark Triangles [29]; Enamel Wear/Enamel Fracture; Periodontal Wear/Enamel Fracture; Damage to soft tissues, Direct damage caused by appliances and their parts: Lacerations (Lingual arch, TPA (Trans Palatal Arch), Loops, Arch wires, brackets, bands, and so on); Impingements (Lingual arch, TPA (Trans Palatal Arch), Loops, Arch wires, brackets, bands, and so on); Impingements (Lingual arch, TPA (Trans Palatal Arch) (E.g.: brackets, molar tubes, ligature ties etc.). Brackets, molar tubes, ligature ties, and other dental appliances can cause ulcers. Damage to the eyes [30,31](E.g.: Headgears, Face-bow injury). While soft tissue injuries produced by bands, brackets, and arch wires heal rapidly and may not be of much use, injuries to enamel and

periodontal tissues, if left untreated after orthodontic treatment, can result in lasting damage.

11. RECOMMENDATIONS

1. The unique characteristics of the teeth allow the forensic dentist to compare anti-mortem and post-mortem dental registers and to conclude on the identification of the victim.
2. Forensic nurses, dentists, pathologists, and forensic pathologists should all be educated in this area of medicine and work together for the preservation of evidence anti-mortem.
3. The criteria for abusive injury and reporting mechanisms should be understood to ensure that the concerned authorities respond correctly.

12. CONCLUSION

AM profiles are the most important dental records for comparison with the deceased person. The future of forensic odontology in disaster victim identification will increasingly depend on 3D datasets including CT and 3D surface scan data. Digital data can be easily and rapidly transmitted with no loss of accuracy or detail, and this can greatly speed a response in a disaster victim identification operation

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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 The peer review history for this paper can be accessed here:
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