



Review Article

Forensic odontology: A new dimension in dentistry

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ABSTRACT

In order to ensure justice, forensic odontology is a subfield of forensic science that deals with the right gathering, handling, meticulous investigation, suitable interpretation, and preservation of dental evidence for future use. There have been substantial changes made to the data collecting, interpretation, and other procedures used in the field of forensic odontology. The purpose of this paper is to present an overview of the conceptualizations that are currently employed in forensic odontology as well as emerging developments in traditional approaches. Future prospects for the study of forensic odontology appear bright due to a number of rising trends in the discipline. Since the majority of the instruments rely on the records that dentists keep, it is imperative that dentists stay up to date on the latest developments in forensic odontology. In cases of bite mark analysis, age determination, child abuse, and identification fixing in mass disasters, the forensic odontologist applies his or her dental expertise. As a result, in a number of medicolegal cases in recent years, forensic odontologists have had more duty and obligation.

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1. Introduction

The use of dental science in legal investigations is known as forensic odontology. Its principal applications include the identification of human remains based on dental records and the identification of the perpetrator by matching dental records to bite marks found on the victim or at the scene. The principal use of forensic odontology is the identification of human remains using the unique traits found in each person's teeth. In situations where highly disfigured and mutilated dead bodies are recovered that are beyond recognition, such as in tsunamis, earthquakes, land slides, bomb blasts and terrorist attacks, air plane crashes, train and automobile accidents, etc., this discipline is crucial to the identification of human remains.^{1,2} There are three main applications for forensic

odontology as follows: (1) the identification of individuals, particularly casualties in criminal investigations and/or mass disasters; (2) the diagnostic and therapeutic examination and evaluation of injuries to jaws, teeth, and oral soft tissues; and (3) the identification, examination, and evaluation of bite marks, which are occasionally seen in cases of child abuse, sexual assault, and self-defense.³ Visual identification, personal information (such as height, build, age, and hair type), medical information (such as scars, tattoos, birthmarks, implants, amputations, and prosthetics), footprint records from a podiatrist or chiropractor, clothing, personal belongings, fingerprints, DNA profiling, and dental identification are the most often used techniques for identifying an individual.⁴⁻⁶ Given that dental tissues are frequently preserved long after a person is burned, dissected, skeletonized, or otherwise decomposed, dental identification becomes increasingly significant. Dental tissues are frequently utilized to ascertain an individual's

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age, sex, and ethnicity in order to classify them as a suspect or victim.

2. Dentist Role as Forensic Odontologist

In many circumstances, forensic odontologists examine dental evidence to support judicial authorities. They support in the,

1. Inspection and assessment of damaged jaws, teeth, and oral tissues as a result of various incidents.
2. Examination of all forms of dental restorations from unidentified people or bodies, whether they are full or fragmented
3. In the event of a mass or individual disaster, comparison of the dental data obtained before and after the death (AM/PM).
4. Gathering and examining bite marks from people and animals
5. They also testify in court as dental experts and provide evidence

3. Age Determination

When estimating a child's or adolescent's age, dental maturity is crucial.⁷ The order and quantity of teeth that emerge can be used to estimate an individual's age. In addition to providing additional details about the different phases of mineralization, radiographic techniques can also aid in a more precise age estimation.^{8,9} Since the stages of tooth mineralization are less impacted by changes in an individual's nutritional and endocrine status, teeth mineralization provides a more accurate estimate of chronological age than bone mineralization.¹⁰ In this sense, the teeth's developmental stages, as reported by Demirjian et al.,¹¹ are widely used to estimate chronological age worldwide. Gustafson created a technique for estimating an adult's age from a single tooth back in 1950.¹² The method makes use of the several stages of regressive changes in the teeth, including the degree of apical resorption, cementum apposition, loss of periodontal attachment, coronal secondary dentine development, occlusal attrition, and root transparency.¹⁰ The method Gustafson described—which is currently mostly employed by forensic scientists to estimate an adult's age—was improved upon by Johnson.¹³ Another technique for estimating an adult's age was devised by Kvaal et al.¹⁴ who used periapical radiography of the teeth to measure the pulp's size based on the patient's gender.

4. Tongue Prints

The tongue is the only internal organ that can be readily exposed for examination and protrudes from the body, making it distinctive in both shape and surface texture for each individual. The application of tongue prints to

forensic identification is now in its infancy. To ensure the effectiveness of this approach, the tongue impression or antemortem image must be accessible. The alginate molding process can be used to replicate the minute characteristics that are specific to each individual while preserving the lingual morphological aspects. The lingual impression and accompanying photo may provide safe techniques for identification in forensic dentistry.^{15,16}

5. Lip Prints

The term for the study of lip prints is cheiloscopy. Lip prints serve as indicators for victim and suspect identification. It has been discovered that no two people have the same skin lip print pattern.¹⁷

6. Palatal Rugae Patterns

Rugoscopy is the study of palatal rugae patterns. These are the ridges that might be straight, curved, round, or wavy in the anterior hard palate. They are helpful since they are the best soft tissue that is protected and is easily accessible both during and after life.¹⁸

7. Bite Mark Analysis

After gathering dental evidence, the forensic odontologist examines and contrasts the bite marks. Variations in the bite mark over time on living organisms, the location of the bite mark, harm to soft tissue, and individual differences in dentition can all have an impact on how accurately the bite mark is identified. Photographs, imprints, and measurements of dental features are additional criteria.¹⁹

8. Significance of Denture Labeling in Forensic Investigations

In situations involving amnesia or senility, memory loss, mental health issues, murder, suicide, victims of fire, explosion, floods, earthquake, plane disaster, or war, the denture marker helps identify an unidentified denture wearer. Names alone or in combination with other information like social security number, driver's license number, and city code should be on the denture label. Generally speaking, a denture's usage of a name and identification number inside helps greatly and reduces the chance of misidentification or identification delays. Cobalt-chromium appliances, in contrast to acrylic, do not melt, even when burned residues are present.^{20,21}

9. Role of Saliva in Forensic Odontology

Saliva from bite marks should be extracted as soon as possible for group testing. Saliva samples can be used in conjunction with forensic DNA analysis to determine whether or not there is a relationship between a person and the forensic evidence. Age-related diseases are influenced

by changes in methylation, which is a chemical alteration to one of a person's DNA's four building blocks.²²

10. Facial Reconstruction

Every person born into this earth from the past has a unique face. Face is an invaluable asset to humanity and is essential to human identity. It is important to forensic sciences because, in cases where a deceased person's face is unaltered, forensic experts are not necessary to determine the identity of the deceased person. A laser video camera interfaced with a computer or with CT scanning is used in the computerized facial reconstruction procedure. After this, a completely shaded 3D surface is imaged using the skull data.²³ Computer software can be used to draw the face.

11. Dental Records

It is crucial to preserve the dental records in addition to keeping them up to date. Accurately documented data facilitates identification. Loss or damage to documents also presents an issue. Denturebase, which can be recovered in the event of an accident, can be used to code or mark dentures. Dentures are often resistant to acids and can withstand higher temperatures without losing their quality.

12. Habits

Distinctive patterns on the teeth's surface, like smoking or chewing betel nuts, might be used to identify a person. Univocal wear patterns are seen in other habits like smoking cigarettes or pipes, or having carpenters or tailors place nail pins in their teeth. Changes are even visible in orthodontic treatment from the past. The quality, quantity, and presence or absence of dental treatment can all be used to determine a patient's socioeconomic position.

13. Conclusion

The medical and dental sciences have traditionally included forensic dentistry as a crucial component. Better technology is now available, which has caused us to reconsider how we view the field of forensic odontology. However, there is still room for enormous advancement that would improve and transform the postmortem processes. In order to ensure the future of forensic odontology, interdisciplinary knowledge and comprehension are essential. In some circumstances, teeth may be used as weapons since they can reveal a biter's identity. In order to identify maltreatment in people of all ages, forensic odontologists are crucial. Maintaining correct dental records and keeping them around for a long time is crucial. The majority of the information in these records that is required to identify unidentified individuals and to identify fraud, abuse, negligence, and malpractice can be given to legal authorities.

In forensic investigations and legal proceedings, the utilization of distinct characteristics and variances

in the morphology of teeth for personal identification is widely acknowledged. The matching of dental records—observations and radiographs from the dentist—plays a crucial role in identifying the deceased in mass fatality incidents like air plane crashes, other major accidents, terrorist attacks, and natural disasters, despite advancements in the most advanced identification techniques like DNA profiling, fingerprints, and facial reconstruction. An odontologist or forensic anthropologist can make inferences about the age, race, and sex of the deceased from dental evidence retrieved at the scene if the ante-mortem dental records are not available for comparison.

However, as different demographic groups exhibit differing degrees of human variability in dental features, one should exercise caution when determining age and sex from teeth. This overview aims to explain the significance of different dental evidence types, as well as the procedures and methods utilized in forensic odontology for identification. The field of forensic odontology needs to be promoted immediately because of its significant involvement in DVI and other medico-legal situations. Initiatives like raising awareness of forensic odontology among dental science graduates and requiring dentists with relevant casework experience to join investigation and identification teams can aid in the establishment of forensic odontology as a distinct specialty within the field of dental sciences or forensic sciences.

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15. Conflict of Interest

None.

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