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## **Original Research**

## **Forensic Odontology**

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#### ABSTRACT:

The combination of dentistry and forensic science, termed as forensic odontology, plays an important role in identifying individuals in different forensic situations. A dentist plays a significant role in the forensic investigation team, using their expertise in dental records and other dental evidence. Regardless of the importance of this field, there is a lack of knowledge among a few dentists and legal professionals about the precious role played by dentists in forensic odontology. Both subjective and objective information about patients are attained in the form of dental records. These records play a vital resource in forensic sciences, helping in identifying an individual in scenarios of disasters, criminal investigations, and accidents. In order to address the gap between the dentist and forensic team, a comprehensive search was conducted using Google, resulting in the review of 27 relevant articles that show the importance of dental records in forensic odontology. The article sheds light on the role of dentists in forensic sciences, focusing on their potential offering to the field. By exploring different aspects of forensic dentistry, the articles focus on building the bridge between legal and dental fraternities. This combination highlights the significance of dental expertise in solving forensic cases.

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#### **INTRODUCTION**

The origin of the word fraternity comes from the Latin language. It arises from the Latin word "fraternitas" meaning "brotherhood". It refers to the social organization specifically males who share common goals, and values or think of themselves as brothers. It is commonly associated with educational departments like colleges, universities, or compasses where they have activities involving social, philanthropic, and academic. Dental fraternities are an organization that promotes oral hygiene by maintaining and raising the standard of clinical care, leadership, and honesty to their profession and patient preference. Forensic dentistry can be defined as the usefulness of dental knowledge to catch criminals and help civil laws that are applied by police agencies in making the system peaceful and bringing justice to society. Although the world is a beautiful place but unfortunately it is also a place for violence, crime, disaster, and accidents which occur on a daily basis. There is no way to stop this. But identifying the lawbreaker, bringing justice to the family of the victim, or recognizing the victim in the natural disaster can bring peace to the victim's family. Dentists play a very important role in forensic investigation. It can be challenging to put a name to someone who cannot be identified by face. (1) It is very important to recognize the need for dental information in identifying an unknown person in the forensic field. Research in forensic odontology plays a pivotal role in minimizing the gap between dental and broad forensic science communities. The team in forensic investigation includes law enforcement officials, forensic pathologists and odontologists, forensic anthropologists, and some other specialists. The composition of specialists comprises the particular circumstances of the case. One of the major factors in forensic investigation is the identification of the victim. A victim needs to be identified if their body is disfigured or mutilated during an accident or disaster but it can also help to know if there is any missing person from the crime scene. Dental records are of great significance specifically when visuals are uncleared. As dental features are unique to every person, this can serve as a reliable source for identifying victims. (2) Teeth are very hard with unique stable structures with distinctive shapes and sizes. Teeth are the most hard and indestructible part of humans. They can survive for many thousand years without decomposition. As other body structure decomposes easily, teeth can survive anything like disastrous environmental condition for example fire. This feature makes them a reliable source for identifying processes. (3) The Disaster Victim Identification (DVI) Guide: police 2009 says that the primary methods to identify a person in fingerprint analysis along with comparative dental analysis and DNA analysis. It also states that 100% correct identification is only possible when postmortem and antemortem dental records are acquired from the same person. (4) The need for dental odontology started back in heaven in the "Garden of Eve" where Eve convinced Adam to have a bite and put a mark on the apple but the dentist was nowhere at that time. But still, it is well documented in the Old Testament to make us know the importance of teeth, their marks, and in keeping dental records(5).

#### DENTAL RECORD

A record can help in various ways and it's a patient right. Generally, a record is defined as information attained by the patient about his/her condition through the organization's official contracts and the document can be used as a source of reference. (6) The dental record is an official document that includes a patient's diagnostic information, clinical notes, treatment history, and other details. This is of great significance for patients' oral health and maintaining the standards of their field. Here are some key components generally found in a dental record:

**Patient's information**: this included the patient's details like the patient's name, age, address, medical history, and contact information.

**Diagnostic Information**: findings that help in developing a patient's baseline for oral health treatment and diagnostic tests.

**Clinical Notes**: elaborated notes on every visit about the procedures performed or any new observations.

**Radiographs or images**: as per requirement as they provide visual information of oral health.

**Communication**: maintain good communication with patients regarding instructions for home care and follow-ups.

**Treatment history**: all the details and history of procedure performed, types of intervention, and outcome along with the dates. (7)Defense authorities suggest that after the completion of treatment the treatment records, radiographs study models and correspondence should be retained for 11 years.in the case of children, records should be managed until they are 25 years old. Original pre-operative and post-operative orthodontic models should be maintained

permanently. Any intermediates can be discarded after 5 years. (8) For collecting dental records, the procedure should conform to the relevant law and maintain confidentiality between patient and dentist. This confidentiality should be protected by law, without the consent of the patient no one should be authorized to make any changes such as the addition or removal of any information, and also with the permission letter from the law of the state. (9) In the scenario of a mass disaster, the "Disaster Victim Register (DVR)" process is required. An antemortem form is yellow-colored in which the data is collected from the victim's family, friends, doctors, and dentist. Post-mortem form which is pink colored should be filled for later comparison, separately. It helps to identify the victim's features. (10) A new electronic imaging called Dental Cross, described bv Dostalova et alin a study is used for dental records for identification. This shows a detailed examination on one screen and in a detailed manner. The dental cross is perceived as an alternative source of information that helps in searching for a victim. (11) This method is much better than adding records manually as it is easy to handle and transfer this data anywhere and anytime. Another major importance of dental records is they are more readily available than fingerprint databases and using these records consumes less time than other methods such as fingerprints and DNA analysis. (12, 13)

**Responsibility of a Person in Maintaining Dental Record:**Maintaining a record is not only a dentist's responsibility. A patient can also play a significant role in helping the dentist to do his/ her duty with dignity and honesty. A patient can help the dentist through various ways:

- 1. By providing accurate and updated personal knowledge including mailing address, phone number, and other updated data.
- 2. By providing accurate data about their medical status from the very first meeting and later updating it with follow-ups.
- 3. By taking an interest in the procedure that the dentist is performing, asking about their treatment plan, and telling them what is effective for them.
- 4. By checking all the paperwork done by the dentist before any procedure, particularly invasive procedures.
- 5. By following proper follow-ups or informing the dentist about availability and managing follow-ups.
- 6. By requesting a consent form for removing or fixing any dental appliances.
- 7. By requesting for transfer of dental records in case of a change of dentist to maintain the continuity of the record. (9)

# BENEFITS OF DENTAL RECORD IN IDENTIFYING UNKNOWN PERSON

**Examination of previous Dental Records:**Commonly the dental characteristic of a suspected person is compared with their previous dental records. For this method, a victim must have a pre-existing record, which includes knowledge related to tooth morphology, dental restoration, and some other important features. Forensic odontologists compare these records to the dental characteristics of the victim. The focus is on finding similarities and confirming identity based on these records.

**Post-mortem Dental Profiling**: In a case where there is no availability of previous dental records of a victim, another method is used which involves postmortem dental profiling. In this process, forensic dentists make a detailed record with a thorough examination of the dental characteristics of the deceased person`s remains. This examination includes root canals, tooth restoration, missing teeth, and other distinctive dental features. This gathered knowledge from post-mortem serves as the baseline information for making an ante-mortem dental profile. (3)

**Radiographic Records for Identifying Children:**Specific radiographic records, such as bitewings, are mentioned as helpful in identifying children without dental restorations. (14)

Identification through Records and Databases: Individuals who visit the dentist very often and get different treatments from them can easily identify through this process. Identity cards, bank cards, driving licenses, and vehicle registration numbers are some other identification methods that are temporary help and can be found near the body of a deceased person.

Comparison of AM and PM Records: The last step involves the comparing of ante-mortem records including radiographs and case history to the finding post-mortem to make an accurate through identification. (3) The dentist records different dental features, including the morphology of teeth and surrounding structures in the post-mortem record. taken Radiographs are during post-mortem observation. They should be taken on the same angle at which antemortem radiographs are obtained to facilitate more accurate comparison. Characteristics examined include various aspects of dental and anatomical features, such as erupted teeth, missing teeth. tooth malposition, occlusion. dental restorations, root canal treatment, dental anomalies, and more. (15)Inconsistence may arise when comparing antemortem and post-mortem radiographs as they contributed to change over time such as the victim may have an extraction or restoration. Unexplained differences may lead to difficulty in the identification process. (16) The American Board of Forensic Odontology classifies identification reports into four categories:

- Positive identification: Records that match with no discrepancies
- Possible identification: AM and PM records with consistent features, but there is doubt in the quality of evidence
- Insufficient evidence: Cases without sufficient evidence to arrive at a conclusion
- Exclusion: Records that clearly do not match. (17)

Post-Mortem Dental Profiling: This is helpful in scenarios where conventional methods are not applicable. In this process, the dentist performs a thorough demographic analysis to confine the population pool to which the victim is likely to belong. (18) Information on demographics, ancestral background, sexual and socioeconomic status, occupation, dietary habits, habitual behaviors, and dental/systemic conditions is obtained. (19) Sex and ancestry can be confirmed by interpreting the information from skull shape and form. Tooth features such as such as cusps of Carabelli, shovel-shaped incisors, enamel pearls, and dental pulp-shaped and multicusped premolars can also help in determining ancestry. (20) Presence or absence of Y chromatin can be seen in microscopic examination of teeth which can help in determining sex. The most common method for the revelation of sex is DNA analysis. The victim's age can be determined through teeth. Teeth can be used as weapons to attack someone or to taper off an attack. This can leave marks which are helpful in comparison of tooth shapes and sizes. Along with that DNA evidence can be found through saliva, which may be dried out but DNA has deposited on the victim's skin. (21) Generally, age estimation can be done by using radiographs which show roots and crown formations, closure of apical foramen, calcification changes, and the eruption of the pattern but children's age, even the age of fetuses and neonates can be marked by analyzing tooth development and comparison of developmental chart. The third molar is used for determining age in adults. (22) Teeth can tell a lot about our habits, for example, pipe smokers who keep pipes at one location in their teeth, this habit can make a unique pattern in their teeth. Teeth erosion is seen in victims who drink cold beverages excessively. External stains are seen on individuals who drink tea and coffee. Abrasions are seen in individuals who work in an environment full of dust for example cement factories. hence documented knowledge of the habits and occupation of a victim in dental record help in identifying the unknown person associated with other factors. (15)In mass disaster or single identification cases, dental techniques that compare the antemortem with postmortem or radiographs are used. In the times of digital world, digital ante-mortem is compared with digital post-mortem which digs deeper into the length and

width ratio of teeth especially in mass disasters. (23) However, the orientation of digital radiographs can cause problems if not taken with care before starting any procedure. Radiographs should not be scanned in the reverse order. (24) Other methods of forensic odontology that can help In identifying unknown persons where dental records include sex differentiation done through patterns of palatal rugae on dental casts palatal rugae, orthodontic wires, dental implants, and dentinal translucency. (25) DNA fingerprint analysis and extraction of DNA from teeth enamel with the help of polymerase chain reaction can be used in the identification process. Saliva and oral mucosal cells contain DNA which can also be extracted and proven to be helpful in positive identification. (26)Dr. David Tesni invented a tooth print, which is an arch-shaped thermoplastic dental impression wafer, that basically records the individual's dental features, teeth occlusion, and position. Saliva in the mouth of the victim is also collected simultaneously by this method, later from which DNA can be extracted. Toothprint records can help identify a missing child, particularly when the record is taken at the age of 3 years and updated at the age of 6-7 years, or the age of 12-13 years. (27) Coding can also be very helpful in crime scenes particularly in missing cases, a microchip with code can be situated in a child's permanent teeth. The code can be visible on x-ray examination. Interpol should know about these codes as this can help in finding a missing child. (27)

#### CONCLUSION

Forensic dentistry is of great help in the identification of an individual chiefly in cases where the body is disfigured and mutilated. Dental records play a fundamental role in this process and should include detailed information to help in accurate identification. As mentioned in the text, these records include personal information, dental specifics, morphology of teeth and mucosa, and radiographs. These records help in comparing post-mortem findings which contribute to the positive identification of individuals. The importance of dental records is highlighted particularly during mass disasters, where traditional methods make it difficult to identify a victim. For large-scale causalities events such as earthquakes, floods, cyclones, epidemics, and accidents, in such events, the use of dental records can be very helpful in identifying victims. It is the social responsibility of every dentist to maintain an accurate dental record and these should be released under the appropriate protocols. Moreover, each government should have a systematic approach to expedite the identification process in times of need.

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