

## Dentition as Marker for Establishing Individual Identity

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### Abstract:

*Forensic odontology is the scientific discipline that utilizes the principles of dentistry to aid in the positive identification of human remains. Forensic anthropologist work very closely with forensic odontologists who apply their knowledge of dentition, dental appliances and dental work in the area of positive identification and bite mark analysis. Dental features such as the morphology of the tooth, changes in shape and size, wear patterns, color and position of the tooth and other dental features and anomalies give every individual a unique identity. Thus, the assistance of forensic odontologists is often requested when human remains are decomposed, buried, skeletonized, or beyond the point of clear facial recognition due to severe facial disfigurement. The role and importance of odontology in the judiciary is fast growing and hence a depth knowledge of the same is justified. This paper aims at providing an overview of dental evidence and their use in forensic identification. It highlights the importance of the dental records in the efficient identification of the conflict victims. A case study has also been given to better understand the application of odontology in establishing individual identity.*

**Keywords-** Forensic Odontology, Positive Identification, Bite-marks, Facial Disfigurement, Dental Anomalies.

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## Introduction

Odontology is the study of teeth-their development, structure, function and degeneration. Odontology is the science behind the practice of dentistry. Forensic odontology is the use of dental information to those crook and common laws that are authorized by police organizations in a criminal equity framework. It is a branch of forensic sciences which uses the skill of the dentist for identifying people during mass calamities.

Teeth are the most durable structures in the human body; they are more resilient than bone and thus are often the only human remains recovered from forensic scenes and archaeological sites. Teeth are frequently recuperated in measurable cases, mass catastrophes, clashes, and mass graves related with basic freedom infringements. Due to the fact that teeth have vast post-mortem longevity, dentition plays a very important role in deciding the biological profile and individual's identity. The most important aspect of dentition which makes it useful in a forensic setting is that, just like fingerprints, each person's dentition is unique. The human permanent dentition comprises of 32 teeth. Each tooth can be virgin, restored, rotated, fractured or missing. When restored or fractured, one or more of the five different tooth surfaces may be involved for each of the 32 teeth. By analyzing the size, depth and anatomy of altered tooth surface, forensic odontologists can compare between the antemortem and postmortem dental radiographs (Thomas, 1995).

A high percentage of the general population seeks dental care regularly from time to time, thus providing criteria for positive identification in form of patient databases for different individual. In cases where the person's body is mutilated beyond recognition, teeth can prove to be very useful in providing important clues about the identity of the unknown individual. The dental proof is conceivable on the grounds that the hard tissues are saved even after death and can withstand high temperatures without the deficiency of its microstructure. Odontological identification depends on the systematic comparison of pre and postmortem dental characteristics of an individual which is based on dental records and supporting radiographs. The other features which help in identification are dental pathology, restorations, and dental anomalies.

This paper highlights the methods and utilization of forensic odontology in determining a person's identity. It also specifies the utilization of teeth in the identification process and its importance in the assessment of biological profile. The paper also points out the information that can be extracted about the

victim from the teeth using dental anomalies and other dental records.

## Determination of Age

Estimating age or establishing identity plays a crucial part in forensic analysis. Age of the teeth is one of those aspects of physiological development that is uniform from the age of infancy till late adolescence. Dental development assumes a significant part in the assessment of young ones and adolescents. The quantity of teeth and the arrangement in which the teeth erupt can decide the age of the person. Radiographic methods additionally help in establishing a more correct age. The mineralization of teeth gives a better idea of age than the mineralization of bone since teeth mineralization is less influenced by variation in the wholesome and endocrine status of the person. The ejection and calcification of teeth are two instances which are used to estimate dental age in adolescents and children.

Teeth start erupting at an age of six months and are completely erupted at an age of 2.5 years. The pattern of eruption of permanent teeth is determined by various attributes such as intraoral environment, infection, space and premature loss of tooth. Radiographic examination of the calcification process is considered for age estimation because calcification can be seen on radiographs for several years and it also helps in the estimation of the age of the period during which no eruption takes place (Klepinger, 2006).

Gustafson developed a method of age estimation from a single tooth in 1950. The technique utilizes several stages of regressive changes in the teeth such as coronal secondary dentine formation, amount of apical resorption and the transparency of the root. Johnson made some improvements in the technique described by Gustafson which is now mostly used by forensic scientists for age estimation in adults. Thus forensic odontologists take into consideration the estimates of a person's pathologic and physiologic age to derive an assessment of the nearest chronologic age at the instance of death (Burns, 2013).

## Determination of Sex

Determining the sex of unknown human remains is the next step in building a dental profile. Gender can be determined by taking help of the data from the craniofacial morphology and dimensions, sex differences in tooth, tooth morphology and by DNA analysis. Amelogenin (AMEL) is one of the significant matrix protein discharged by ameloblasts of enamel. The AMEL gene is situated on the X and Y chromosomes in humans. Along these lines, the

females (XX) have two indistinguishable AMEL genes but the male (XY) have two distinguishable genes.

Mandibular cuspid is another feature which shows maximum sexual dimorphism. If the mesio-distal diameter is found to be less than 6.7mm then the sex is female, whereas if the mesio-distal diameter is more than 7mm then it is male. The mandibular canines are displayed to show more prominent sexual dimorphism than the maxillary canines. According to Joseph et al., the overall accuracy rate of odontometric sex determination is 72%. Another feature- 'canine distal accessory ridge' situated on the lingual surface in between the medial lingual ridge and the distal marginal ridge has been proven to show sexual dimorphism. This ridge is more marked in males as compared to females.

A more developed method of determining sex from teeth is the sex chromatin or Barr bodies which are present in the pulp of the teeth. This method was formulated by Barr and Bertram. Although determining sex from teeth is not very conclusive, in the absence of other evidence, teeth can give a clue regarding the sex of the person.

### Determination of Race and Ancestry

Establishing the biological race (ancestry) of skeletal remains is an important part of forensic identification. Race apart from sex, stature, and age is one of the major factors used when ascertaining the biological identity of a person in a forensic context. Caucasoids, Mongoloids, and Negroids are the major racial groups of the world. Characteristics such as narrow arch, presence of cusp of Carabelli in 37% of the population, and chisel-shaped anterior teeth distinguish Caucasoids from other races. The existence of midline diastema and supernumerary teeth is more prevalent in Negroids. The aborigines and the Melanesians tend to have a large teeth with a wide crown. The Bushmen people have relatively smaller teeth (Burns, 2013).

Dental restorations also help in indicating the culture pattern of the individual as methods of restorations in different countries and regions may be unique and not used at another place. Further, the use of costly restorations may suggest the economic background of the individual. Other dental characteristics such as shovelling are common in Asiatic Mongoloids. Taurodontism, chisel-shaped incisors, peg fashioning of the teeth and other such peculiarities can be used to in the determination of the ethnicity of the individual.

### Case Study

The greatest challenge to the realm of the forensic odontologist team is the international mass casualty situation. The Asian Tsunami that took place on December 26, 2004, provides an excellent case study demonstrating the execution of dental methodology to the successful identification of mass casualties. The tsunami was the result of an Indian Ocean earthquake. This natural disaster left an estimated 230,000 dead in 11 countries. The tourist resorts of Thailand were badly affected. Half of the reported victims were foreign nationals. Overall victims were citizens of 58 different countries.

This created a great need for efficient communication between the victim's home countries, where antemortem data would be located, and the teams for victim identification working at the multiple scenes. In later cases, because of prolonged immersion of the remains, chaotic body recovery, and lack of refrigerated storage facilities, facial and fingerprint identification became extremely problematic. Dentistry clearly came out as the most practically applicable and efficient means of identification. Approximately 80% of the identification made on non-Asians involved dental matching (Black and Ferguson, 2011).

### Bite-Mark Analysis

Bite marks represent patterned injuries in skin produced by teeth or marks caused by teeth either alone or in combination with other mouthparts. These marks may be inflicted by humans or animals, they may be on tissue, food items or other such objects. Bite marks found in heinous crimes such as homicide, sexual assault, child abuse and domestic violence are of forensic significance. The human bite can be differentiated from an animal bite as the human bite is broader, U-shaped and somewhat circular or oval. Whereas the animal bite is narrower anteriorly, V-shaped and elongated. Bite marks inflicted by teeth are considered to be highly individualistic to a person and are hence of considerable importance from a forensic point of view.

Bite marks may also be found on the victim's body on cheeks, buttocks, legs, lips, or any other part of the body. It can also be found on the arm of the attacker against whom the victim might have tried to defend. The impression of the bite marks can be made or photography of the desired area can be done and then these can be compared with the original impressions of the teeth (Fulton, 1984).

Cameroon has given a classification of the different types of bite marks. He divided them into two types- First the representatives that produce the mark such as animals, humans, mammals or reptiles. Second the substances and matter that exhibit the marks. For the bite mark analysis, the attributes of the suspected person's dentition are compared and used by forensic odontologists in solving criminal cases.

If the bite is present on objects such as apple, beer, chocolate etc. often yields more information of lack of distortion of the material and a good impression of biting edges can be taken. Taking swabs from this object may reveal the blood group and then DNA analysis is possible.

Misplaced teeth, distorted teeth, ruptures, cram of the teeth, diastema and other unusual characteristics of the teeth aid in the process of comparison based on these unique characters.

### Conclusion

Odontological identification is built on the comparison between postmortem evaluation and antemortem data concerning the dental status. Characters such as malformations, anomalies, pathological and traumatic alterations, and therapeutic peculiarities are by many

considered amid the majority of the important factors for personal identification. However, morphology is also important. One has to consider the fact that improving oral health condition decreases the need for dental work, and thus leads to the need for identification methods based on simple morphological traits.

Presently, forensic odontology remains one of the most authentic, affordable, and swift means of authenticating human identity. In the near future, many of these identification engagements are likely to be answered by strengthening in the field of molecular biology. As forensic experts are playing an important role in calamity victim identification and other cases pertaining to medical as well as law, there arises an immediate need to further this speciality. In spite of advances in the leading identification techniques such as DNA profiling, fingerprints and facial reconstruction, the comparison of dental records play a significant character in the recognition of the deceased. If the antemortem records are not available for comparison, then forensic anthropologist or odontologist can give clues regarding the age, race and sex of the deceased from the dental evidence recovered from the scene.

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