

Review Article

Racial, Occupational, and Cultural Variations in Human Teeth: Teeth as Evidence in Forensic Identification

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ABSTRACT

Teeth are the strongest part of the human body which can withstand high explosions and are not damaged easily. Thus, teeth are more likely to be the evidence in mass fatal incidents where highly mutilated and dismembered dead bodies are beyond recognition. Each tooth possesses a set of unique characteristics called tooth class characteristics which form the basis of identification. Other features which help in identification are dental pathology, restorations, and dental anomalies. Age, sex, race/ethnicity, occupation, and habits can also be determined from teeth. The present review is an attempt to highlight the racial, occupational, and cultural variations seen in the teeth and their role as in forensic identification of victim/suspects.

KEY WORDS: Ethnicity, forensic odontology, identification, mass fatal incidents, occupation, race, teeth

INTRODUCTION

Forensic odontology is primarily concerned with the use of teeth and oral structures for identification in a legal context. Various forensic odontology techniques help in the identification of the human remains in incidents such as terrorists' attacks, airplane, train and road accidents, fires, mass murders, and natural disasters such as tsunamis, earthquakes, and floods. Forensic odontology has become an integral part of large international forensic educational organizations such as the American Academy of Forensic Sciences as well as the International Association of Identification. The primary utility of forensic odontology is in the identification of human remains based on the individual characteristics present in the teeth of different individuals.^[1]

Teeth are the strongest part of the human body which can withstand high explosions and are not damaged easily. Thus, teeth are more likely to be the evidence in mass fatal incidents where highly mutilated and dismembered dead bodies are beyond recognition.^[2,3]

Each tooth possesses a set of unique characteristics called tooth class characteristics which form the basis of identification. Other features which help in identification are dental pathology, restorations, and dental anomalies.^[4] Age, sex, race/ethnicity, occupation, and habits can also be determined from teeth.^[5]

The present review is an attempt to highlight the racial, occupational, and cultural variations seen in the teeth and their role as in forensic identification of victim/suspects.

RACIAL VARIATIONS

Coon in 1962, on the basis of phenotypic physical feature, classified the human race into Caucasoid, Mongoloid,

Australoid, Negroid, and Capoid.^[6] Careful examination of physical, skeletal, and dental structures may collectively support the racial identity of an individual; otherwise, it is impossible to specify any distinct anatomic characteristics exclusively to a particular race. Skin, hair, head shape, face type, eyes, nose skeletal size, and dentition are considered as distinguishing features. However, racial characters are not diagnostic features and they are considered as suggestive features in determining the racial origin of the individual. Teeth are the most important and reliable sources of information during racial differentiation.^[7]

Certain morphological features of the teeth are known to show population variation which can be used to distinguish the ethnicity or ancestry. However, the determination of race from morphological features of the teeth remains debatable. The dental characteristic features such as shoveling or scooping of the upper incisors (most common in Asiatic Mongoloids and Amerindians) [Figure 1], taurodontism, chisel-shaped incisors, Carabelli's cusp [Figure 2], hypocone, protostylid, and peg shaping of the teeth can be used to determine the ethnicity of the individual.^[8-10]

MONGOLOIDS

The most striking feature in the Mongoloid dentition is found on the lingual surface of the incisors. There is the accentuation of the lateral or marginal ridges which are fused with a raised cingulum and creates a deep lingual fossa. The ridge fades

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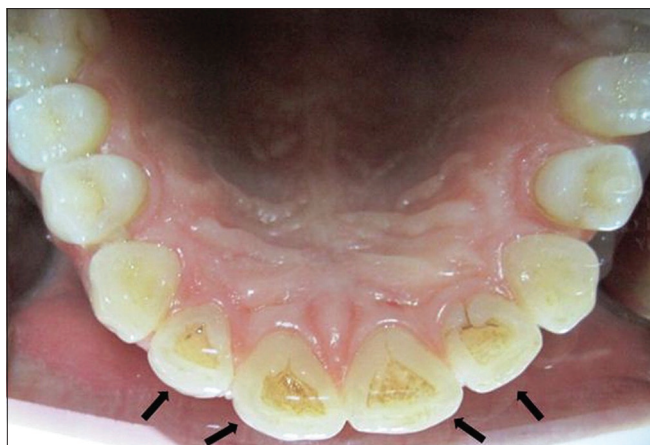


Figure 1: Scooping of upper incisors seen in Asiatic Mongoloids

toward the incisal edge, and this gives the tooth a shovel or scoop shape. This feature is seen in approximately 90% Mongoloids inclusive of Eskimos and American Indians.^[8]

Frequently, a double shovel-shaped incisor is seen, i.e., the prominent lingual marginal ridge extends on to the labial surface producing a mesio-distal concavity of the labial surface.

The premolar of the Mongoloids may display a tubercle on the buccal cusp. This tooth is known as Leong's premolar or oriental premolar, and this condition is Dens evaginatus.

The enamel extends below the general contour and sometimes between the bifurcation of the roots. There may also be the presence of protostylid cusp which is on the buccal surface of the mesiobuccal cusps of lower permanent molars. Enamel pearls are low in occurrence. The absence of cusp of Carabelli is another notable feature in this race.

Considering the dental arch, Mongoloids have a parabolic arch with large incisors, canines, small premolars, and large molars behind them.^[8]

CAUCASOID

The anterior teeth of Caucasoids are chisel-shaped incisors. They are smaller and have smooth lingual surface. The lateral incisors are usually peg shaped.^[11] The second molars have four cusps as opposed to five in some races. The cusp of Carabelli is another noted feature. Common among 37% of Caucasoids^[12] present on the mesio-palatal cusp of the maxillary first permanent molars and the maxillary second deciduous molars.^[8]

Caucasoids usually have narrow "v-" shaped arch giving rise to crowding of teeth.^[13] All molars show a greater frequency of bent and slayed roots.^[8]

AUSTRALOID

Shovel-shaped incisors and the cusp of Carabelli are usually absent in this race. The dental arch of the Australoids is usually large naturally accommodates large teeth (megadont). Midline diastema is usually present. There is a reduction of incisogingival length of teeth resulting in spatulate teeth. The



Figure 2: Carabelli's cusp

lack of intercuspation of teeth results in a typical edge-to-edge relationship. Mesial drift of teeth is a notable feature caused due to wear of contacting proximal surfaces resulting in a reduction of mesiodistal crown size.^[14]

NEGROID

The Negroid race tends to show an increased tendency for the existence of supernumerary teeth. The teeth are small with spacing and midline diastema. Third molars are always present and rarely impacted. The presence of cusp of Carabelli and shovel-shaped incisor is uncommon.^[8]

OCCUPATIONAL VARIATIONS

Teeth are affected in a number of occupations. Workers may develop disorders of teeth because of physical factors or exposure to chemical substances, organic or inorganic specific to their occupation.^[15] Therefore, teeth can provide important evidence regarding the habits and occupation of the individuals.^[1]

Generalized abrasions are usually found among cement and sand workers, grinders, stone cutters, and miners.

Greenish stains on teeth are due to the inhalation of copper dust. It is also reported to occur among musicians who use brass instruments which impinge on the front teeth. Inhalation of nickel dust also produces a similar pigmentation on teeth.

Workers in iron mines develop a fine black line on the teeth approximately 1 mm above the gingival line and in crevices. Workers exposed to cadmium during various operations in zinc smelting plants, rolling mills, nickel-cadmium battery factories, electrical industry, automotive engines, aircraft engines, marine engines, electroplating welding, and soldering processes. These workers may get yellow or gold brown stains on the labial surface of the front teeth, and these stains are more intense on the neck. Grayish and chalky white blotches and streaks scattered over the entire tooth surface involving all the teeth. With minute irregular shallow pits in the enamel suggests an exposure to fluoride or workers of aluminum factories. Decalcification of enamel and dentine occurs following exposure to acid among workers in factories manufacturing explosives or acid dipping.

Modifications of the teeth by abrasions occur among shoemakers, upholsterers, glass blowers, dress designers, dressmakers, and seamstresses. They result from holding nails, tucks, needles, glass tubes, and threads reinforced by metals between their teeth.^[15] Certain habits such as pencil and pen biting, opening tops of bottles with the teeth also cause localized modifications of the teeth.^[16] Pipe smoking, cigarette smoking, and tobacco chewing can also leave their mark on the teeth.^[17]

CULTURAL VARIATIONS

A deliberate modification of the shape of human teeth – Tooth mutilation has been reported in various regions of the world, including the Pacific, Asiatic, African, South and Central American area. The intentional alteration of traumatic origin including tooth extraction and modification of the tooth surface or shape (by filling, notching, drilling, grooving, grinding, staining, and chipping) has been documented in human remains since prehistoric times.^[18]

The major tooth mutilations discussed in this review followed among different ethnic groups are more commonly avulsions/extractions, fillings/morphological modifications, tooth coloring, and tooth decoration.

AVULSIONS/EXTRACTIONS

Ritual avulsion of incisors still abounds among the people of South Africa, especially those belonging to low socioeconomic families.^[18] The practice of tooth extraction is common among indigenous African tribes, but it is mainly a Nilotic custom in Kenya, Tanzania, and Sudan.^[19] In the rural villages of South-Saharan regions, people extract the lower incisors shortly after their eruption as a rite of passage to enhance beauty, to show their tribal identity, and to allow the emission of specific linguistic sounds [Figure 3]. In some Australian aboriginal tribes, tooth ablations as a rite of passage or as a sign of mourning is a very common practice.^[18]

FILLING AND MORPHOLOGICAL MODIFICATIONS

In Cameroon, Congo, Guinea, Zaire, and Uganda, the teeth are sharpened to resemble those of a crocodile.^[18] Some South



Figure 3: People of South Saharan region with lower incisors extracted

American Indians of Amazon Valley modify their central incisors to a sharp shape as a means of imitating the piranha fish.^[20] In Tanzania, the upper and lower incisor enamel is chipped off so that the teeth appear peg shaped.^[21] Among Java, Sumatra, and Borneo groups, the incisors are thinned and shortened.^[18]

TOOTH COLORING AND TOOTH DECORATION

Teeth blackening are performed in Borneo, Jivaro Indian people of Northern Peru and Ecuadorians. Tooth lacquering and dying are performed in Vietnam, Laos, Thailand, Indonesia, and the Philippines. Red staining is common in Morocco; it is the consequence of chewing mahua fruit. Ancient Mexicans used precious stones as inlays in teeth. The natives of Borneo, apply a thin brass plate called “lios” worn over the incisors and hooked on to the molars.^[18] More recently, the application of a dental grill among African-American community in the US is a demonstration of high social status [Figure 4].^[22]

CONCLUSION AND FORENSIC CONSIDERATIONS

The use of unique features and morphological variations of the teeth in personal identification is well accepted in Forensic examination and in the court of law.^[23] 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 role in the identification of the deceased in mass fatality incidents such as airplane crashes, terrorist attacks, and natural disasters. If the antemortem dental records are not available for comparison, then forensic anthropologist or odontologist can give clues regarding the age, race, sex, and occupation of the deceased from the dental evidence.^[1]

Although determining the racial affinity from teeth is very difficult, caution must be exercised in concluding the racial identity of an individual from the teeth as a specific skull may lack certain traits or may exhibit other traits. Determining occupation from the teeth is possible only when specific identifying features are present. Moreover, if present they may provide sufficient clues in the identification of the victim/suspect. Finally, the geographical distribution of the dental mutilations may be useful for forensic identification,



Figure 4: Dental Grill

to determine the geographical area, ethnic and cultural background of individuals.

Dental mutilations arouse medical-legal interest which goes beyond personal identification. These practices raise ethical as well as legal issues as they are performed by healers in unsafe environments and poor hygienic conditions with possible health consequences.^[18]

Forensic odontology plays a relevant role in the identification of the unknown individual, but when the findings are nonspecific, the identification will be very difficult. Therefore, this review is an attempt to summarize the possible considerations in determining the race, occupation, and ethnic background from the teeth for the identification of the individual.

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