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Dentomaxillary anthropology as a method of forensic identification

Review Article

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SUMMARY

The number of disappeared individuals has increased notably in our country. It is well known that in isolated places within the Mexican Republic there are illegal sites for the deposit of unidentified bodies, a situation that represents a real challenge for forensic experts. Given the properties of perpetuity, hardness and resistance that characterize teeth and bones, it is possible to use them to guide investigations that aim to identify each of the victims found in those places. In addition to teeth, the skeletal elements that make up the skull and face can guide very accurately about the approximate age of the individual, the gender and the ethnic group to which it belongs. The objective of this article is to highlight the relevance that teeth and the cranial facial complex have for human identification.

Key words: *Dental anthropology, Forensic anthropology, Human identification, Forensic dentistry.*

INTRODUCTION

In Mexico, it is not uncommon to find multiple bones or human remains deposited in illegal sites such as clandestine graves, cliffs, dams, lagoons or others [1]. When this type of case arises, it is necessary for forensic experts to follow instructions and techniques necessary to proceed to the identification of deceased. Anthropologists must determine the exact number of individuals using a detailed anatomical analysis of each bone found to determine whether it is human or not, and if so, determine whether or not it corresponds to the same person. Dentistry is not isolated from these instances because sometimes there is only an intact or fragmented skull to carry out the anthropological investigations. The forensic anthropologist can request support from forensic dentists to provide all the information that may be valuable for the resolution of the case. (Figure 1a and 1b).

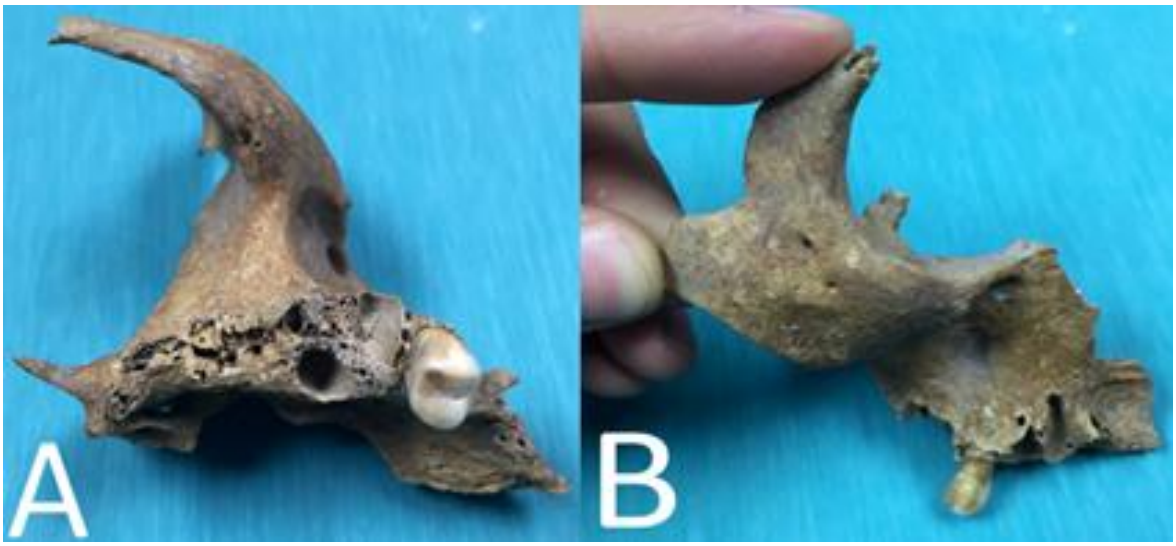

Figure 1 A. Lower face of a maxillary bone fragment. B. In a lateral view there is compatibility with a right maxillary bone.

When a bone is found, the forensic anthropologist must seek answers to the following questions: is it bone? Is it human? Which bone is it? What is its age? What is its gender? Answering these questions is essential because a bone element found in open places can be confused with natural structures such as wood, firewood, stones or minerals. And in case of positively identifying that it is a human bone, it is necessary to perform micro and macroscopic analyzes to rule out or confirm signs of physical trauma such as fractures, exposure to direct fire, chemical trauma by acids, etc.2 (Figure 2) or changes in its structure due to the effect of the environment.


Figure 2. Human bone exposed to direct fire. Due to its characteristics it is easy to confuse this biological structure with some rock, wood or mineral.

Through anthropometry, the maxillary and cranial bones can provide important information about the gender, ethnic group and approximate age of the individual; visible and measurable findings such as size of jaws and bones of the skull, the degree of synostosis of the cranial and palatal sutures, the type of dentition present and the size and morphology of the dental organs are included [2, 3] (Figure 3a, 3b, 3c and 3d).

Figure 3. A and B represent views of the anterior and inferior portions of the frontal bone; C and D represent anterior and inferior views of a fragment of the maxillary bone.

Forensic anthropological methods for gender determination based on craniomaxillofacial structures

According to Udo Krenzer, bones of skull and face allow to determine the gender in 80-92% of cases. It is possible to face situations where it is required to determine gender of skeletons of subadult and adult individuals. In subadults, the determination of gender is very difficult because during childhood there have been no hormonal changes that allow defining the anatomical characteristics of men and women; these morphological changes, known as secondary sexual characteristics, do not appear at an early age until the beginning of puberty.

However, it has been observed that in children jaw is very useful for gender determination using degree of chin pronouncing, being in males more angled, broad and pronounced unlike women that is tenuous, narrow and sometimes acute. Likewise, shape of arch in males is wider and canine prominence is more bulky with respect to arch of a woman [3] (Figure 4a and 4b).

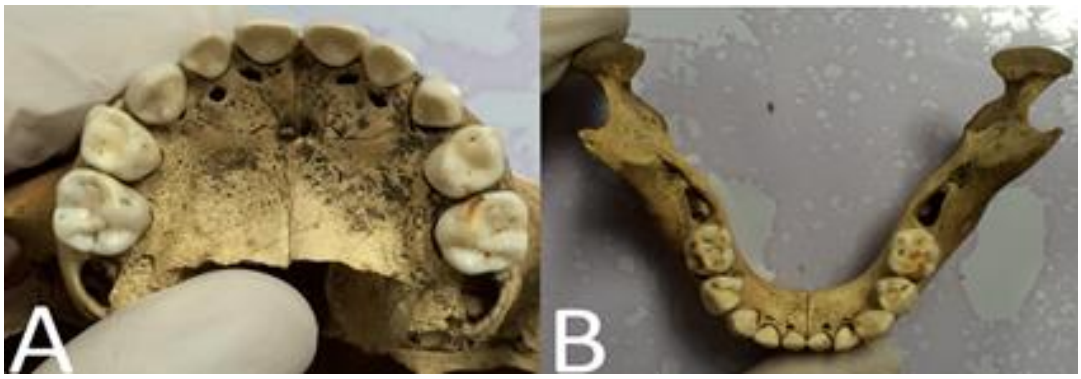

Figure 4 A and B. Maxilla and jaw of an underage individual. Notice the shape of jaw and both dental arches that according to Udo Kenzer's specifications are bones compatible with an individual of female sex.

With respect to determination of gender in adult bones, authors such as Buikstra and Ubelaker, specify certain characteristics that allow to determine if it is a woman or a man (Table 1).

It is difficult, if not impossible, for teeth per se to be able to guide us in an absolute way to determine gender of an individual [4], so it must always be accompanied by the analysis of other bones of the body that can provide useful information. For example, the pelvic bones indicate very accurately if it is a woman or a man, because in women, the pelvic and hip bones are wider because biologically the female body is structured to house the product during pregnancy [2, 3, 5].

Hueso.	Femenino.	Masculino.
Esqueleto facial.	Más estrecho, pequeño.	Más ancho, masivo.
Espina nasal	Pequeña.	Grande.
Huesos palatinos.	Pequeño, corto.	Alargado y ancho.
Dientes.	Pequeños, ovalados.	Grandes, alargados, especialmente caninos.
Mentón.	Redondo, puntiagudo.	Cuadrangular, prominente.
Arco dental.	Parabólico.	Forma de U.
Cuerpo mandibular.	Delgado, llano.	Grueso, rugoso, alto.

Table 1. Compilation of craniofacial anthropological references for sex determination of Buikstra and Ubelaker.

Forensic anthropological methods for estimating age through cranial and maxillofacial structures

While it is impossible to determine the exact age that individual had at the time of death there are specific and perfectly studied markers to estimate age in a very approximate way. As we know, the cranial sutures are reliable elements for estimation of age because in the infantile and juvenile population they are totally open, and with the passage of the years they are gradually obliterated until their absolute synostosis. (Figures 5a1, 5a2, 5b1, 5b2, 5c1 and 5c2).

Mann et al specifies that sutures of the palatal bone are faithful structures for the estimation of age, which are more evident in young palates and less visible in old palates; based on the appearance of the sutures and the degrees of synostosis classifies them as follows [6, 7]:

- Grade 0 - Open. No evidence of closure is presented.
- Grade 1 - Minimum synostosis. Formation of minimal bony bridge around the suture, reaching up to 50% of site synostosis.
- Grade 2 - Significant synositosis. Obliterated marked degree but without complete closure, more than 50% obliterated.
- Grade 3 - Obliteration and complete merger of the region.

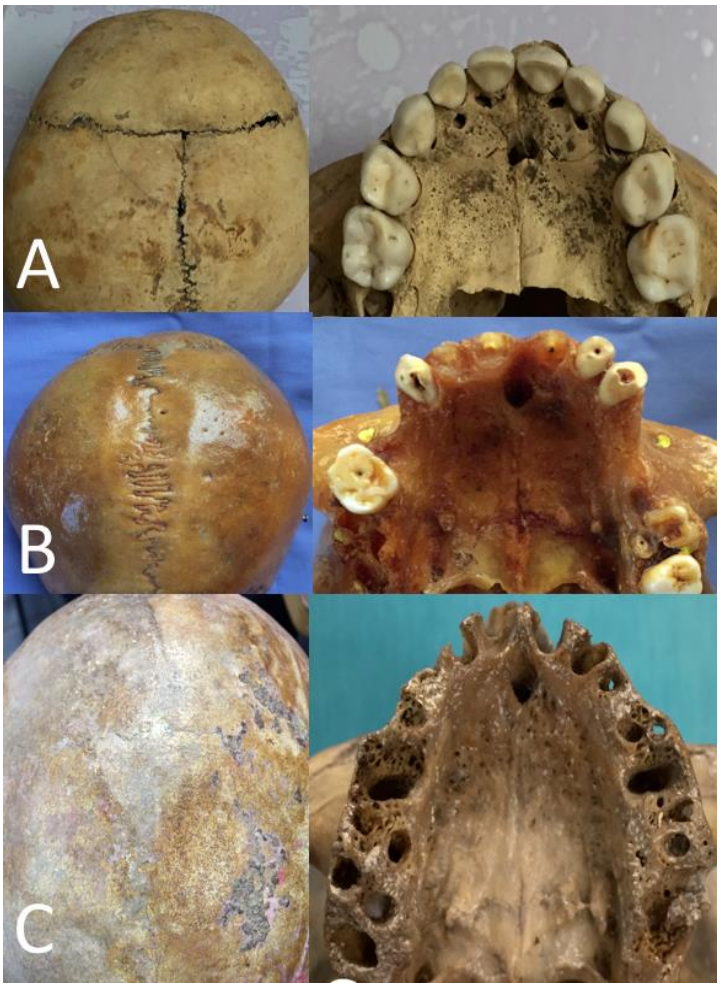

Figure 5. A Ectocranium and palatal vault of the same individual (child) where the cranial sutures are seen separately and the palatine ones are very apparent. B Ectocranium and palatal vault of the same individual where the sutures are easily visible and compatible with an adult. C Ectocranium and palatal vault of the same individual; note that sutures are no longer visible, which is indicative of old age.

Dental attrition is an alternative for estimating age. Several authors have described and classifyed degree of tooth attrition to estimate age; one of the most accepted methods is that of Brothwell that considers degree of attrition in the three molars of each hemiarcade taking into account that during development of the mixed dentition there are six years difference between the eruption of the first molar (M1), the second molar (M2) and the third molar (M3) respectively [7] (Table 2).

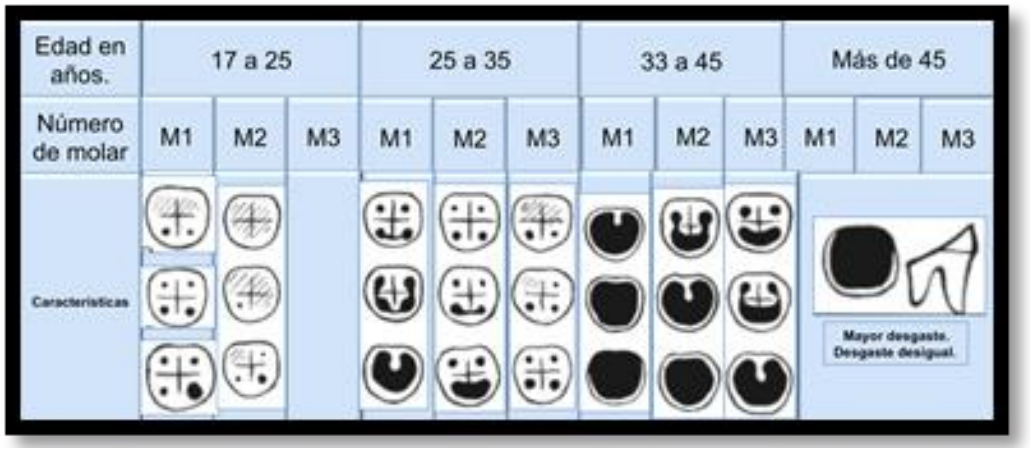

Table 2. Classification of Brothwell dental attrition. The first molars erupt first with respect to the others; so they will always present a greater degree of attrition.

In 1968, Zoubov created a classification for age estimation by dental attrition, taking into account the degree of attrition in incisors, canines, premolars and molars unlike the Brothwell technique that only considers the degree of molar attrition.

Zoubov classifies the degree of attrition in the following grades:

Premolars and molars.

- Grade 0 - No attrition.
- Grade 1 - Facets of attrition on the surface of the crown, the cusps have flattened.
- Grade 2 - Isolated points of dentin at the tips of the cusps.
- Grade 3 - Attrition of the entire crown and formation of large spaces of exposed dentin. Respected enamel in furrows and pits.
- Grade 4 - Attrition all the enamel, the entire occlusal surface is made up of dentine.
- Grade 5 - Attrition the crown to half its height.
- Grade 6 - Attrition the crown to the neck.

Incisors and canines.

- Grade 0 - Absence of attrition, mamelons are observed in the incisal edge.
- Grade 1 - Attrition of mamelons, canines with slight flattening of its cusp.
- Grade 2 - Thin strip of dentin visible on the incisors and a point of dentine visible on canines.
- Grade 3 - Wide dentin surface in both incisors and canines.
- Grade 4 - Attrition the crown to half its height.
- Grade 5 - Total attrition of the crown to the neck.

From this classification, a table was created that specifies the approximate age based on the degree of attrition. (Table 3).

Edad	10-13	13-14	14-16	16-18	18-20	20-25	25-30	30-35	35-40	40-45	45-50	60-70
I	0	0-1	1	1-2	2-3	2-3	3	3	3	3-4	3-4	5-6
C	0	0	0	1	2	2	2	2-3	3	3-4	3-4	5
P	0	0	1	1	2	2	2-3	2-3	3	3-4	3-4	5-6
M1	0	0	0	1	2	2	2-3	3	3-4	4	4	5-6
M2	0	0	0	0	1	2	2	2-3	3	3-4	3-4	6

Table 3. Zoubov´s table. Age range is shown in the box above and the degree of attrition the incisor teeth (I), canine teeth (C) premolars (P) and molars (M1 and M2) should have in relation to age is specified below.

However, the author of this article considers that dental attrition is highly subjective for the estimation of age, because the degree of attrition depends a lot on the consistency of the diet, the habits of the individual and the presence or absence of parafunctions where, as a consequence, a young adult can have generalized attrition and tear, indicating an age that is not compatible with the tables described by various authors (Figure 6).

Figure 5. Individual of 35 years-old; note the excessive attritions due to bruxism. Some individuals, due to their specific conditions, deviate from the possibility of estimating their age using tooth attrition.

CONCLUSION

Anatomy of the craniomaxillofacial region has different morphological characteristics that allow us to inquire about the identity of an individual. Based on biological findings such as cranial sutures, cranial and maxillofacial anatomy, and the type of dentition present, it is possible to extract relevant information to support forensic investigations. The identification techniques in bones of unknown subjects is a multidisciplinary work in which the forensic dentist plays an important role.

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