Xournals

Academic Journal of Anthropologial Studies

ISSN: 2581-4966 | Volume 06 | Issue 01 | April-2023

Estimation of Age from Developed Teeth

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Available online at: www.xournals.com

Received 10th February 2023 | Revised 02nd March 2023 | Accepted 24th March 2023

Abstract:

A significant aspect of establishing a person's identity in various legal, forensic, or anthropological study contexts is age estimation. There is evidence that hormonal issues and poor nutrition have a relatively lower impact on dental development than skeletal development. Determining dental age is basically done using two methods: radiographically and clinically. The development of teeth determines the clinical approach to measure dental age. This tactic is better because it is more practical, doesn't require any special equipment, and is less expensive. The best choice for determining age is based on tooth arrangement because it has less variation than other advancement factors. One of the changes that can be clearly seen among the many distinctive ones that take place from tooth development to the final shedding of teeth is the emission of teeth.

Keywords: *Age estimation, dental age, forensic, tooth development.*

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Introduction

A critical task that is regularly performed in the medical and legal domains is age estimation. When administering justice to a party in a civil or criminal case, it is frequently required to determine the age of the subject. While the permanent teeth will aid in determining age from six years to twenty-five years, the temporary teeth will guide from six months to thirty-three months. It is well-recognized that dietary, climatic, racial, and geographic variables have a greater impact on tooth emergence **(Hachem *et al.*, 2020)**.

The branch of forensic medicine that deals with the examination of teeth is called forensic odontology. When it comes to criminal responsibilities, identification, judicial punishment, consent, rape, criminal abortion, employment, reaching the age of majority, kidnapping, and prostitution, law enforcement agencies in developing nations like India must be able to access the date of birth of a sizeable portion of the population **(Pathak *et al.*, 1999)**. Dental age can be determined clinically and radiographically by observing the growth of new teeth.

It is feasible to observe the development of tooth crowns and roots, as well as their calcification, using radiographic techniques. By seeing the calcification of roots, this is somewhat doable when a child is small, but as they become older, it becomes impossible. The appearance of teeth in the mouth is the foundation for the clinical procedure to determine dental age. This method is better because it is more practical, less expensive, and doesn't need any specialized tools or knowledge.

The best method for determining age is tooth development because there are fewer differences than with other development variables. Charts and tables are provided for the estimation of age during the period of tooth development, emergence, and calcification. The table of Krenfild and Logan, which was later modified by Kronfild and Schour (1939), is commonly used for this purpose, according to McDonald and Avery (1998).

Literature Review

According to Gonzales et al., a person's teeth during childhood and adolescence can properly identify their age. Except for the third molars or wisdom teeth, all permanent teeth erupt between the ages of twelve and fourteen years after the eruption of the first permanent tooth **(Polson *et al.*, 1967)**. A child's first tooth often erupts when they are age group of six and eight months, according to Polson. When all of a baby's baby teeth fall out, the child is roughly two years old. Boys typically get their first permanent molars between the ages of 73 and 74 months, while girls typically do so between the ages of 70 and 72 months. It took boys and girls, on average, 72 to 84 months and 69 to 79 months, respectively, for the central incisors to erupt. The eruption of third molars varies, and they are susceptible to impaction. When they are present, one is older than 17 years old **(Smith *et al.*, 1955*).***

According to Smith, teeth in the lower jaw erupt more quickly than those in the upper jaw. The eruption of the lower central incisors marks the beginning of temporary dentition, which lasts until the eruption of the second molars at 24 months of age. Third molar (wisdom teeth) eruption occurs age group of 17 to 21 to complete the permanent dentition, which starts at age 6 with the eruption of the first molar behind the second maxillary temporary teeth. Wisdom teeth seldom erupt before the age of seventeen, and their eruption is extremely varied **(Dahiya *et al.*, 2013)**.

Grewal noted that children's baby teeth begin to erupt age group of six and seven months for lower central incisors, seven to nine months for upper central incisors, upper lateral incisors, and ten to twelve months for lower lateral incisors. First molars appear at one year, canines at 18 months, and second molars at 24 months. The central incisor appears age group of seven and eight years, the canine age group of eleven and twelve, the central premolar age group of nine and ten, the post premolar age group of ten and twelve, the first molar age group of six and seven years, the second molar age group of twelve and fifteen, and the third molar at the age of seventeen to twenty-five or any age after this **(Billewiz *et al.*, 1975)**.

In a study by Billewicz et al., 635 West African (Gambian) kids between the ages of 4.5 and 14.0 were the subjects. Homologous permanent teeth erupted at the same time on the left and right sides of the same jaw. Teeth erupted in the lower jaw, with the exception of the first and second premolars. The eruption first affected females before males. One can determine the calendar age from the permanent dentition with an inaccuracy of 0.5 years for one to ten teeth and over one year for twelve teeth or more **(Sharma *et al.*, 2001)**.

In a cross-sectional sample of 483 children age groups 6 and 13, Sharma and Mittal examined the patterns of secondary tooth eruption in Gujjars. They noticed that female teeth emerged more quickly than male teeth, but there were no sex differences in the order in which they appeared. Only 14.29% of men's central incisors, or mandibular first molars, and females' lateral maxillary incisors emerged between the median right

and left sides. Mandibular teeth frequently emerge earlier than their maxillary counterparts, with the exception of the premolar **(Ilieva *et al.*, 2002)**.

Ilieva, Veleganova, and Belcheva performed a study to determine the emergence of the first permanent molars in 928 children between the ages of four and eight in Plovdiv. They found no statistically significant gender- or jaw-specific differences in the ages of the first permanent molar eruption. They discovered that the first permanent molars usually emerge age groups of five and six, with the mean age falling between six and seven and the latest age falling between seven and eight **(Nayyar *et al.*, 2016)**.

Chronology of Tooth Development

From the time of conception until early adulthood, the process of the dentition's creation is ongoing. Prenatal mineralization of the deciduous teeth begins with the central incisor. Following the canine are the second molar, canine, lateral incisor, and first molar. The second molar, canine, lateral incisor, and first molar come next. Usually, the central incisors and first molars of the maxilla stand out more than those of the jaw. The maxilla's lateral incisors develop first, even though the mandible grows first. While the canine on the mandible develops first, the second molars in the maxilla and mandible both begin to mineralize at the same time. The central incisor in a set of deciduous teeth is the first to begin prenatal mineralization. Second molar, canine, lateral incisor, and first molar come next. The mandibular canine minerals come first, then the maxilla. A single tooth takes a long time to erupt; it can take as long as two to three years for deciduous teeth and as long as eight to twelve years for The secondnent teeth. Numerous factors, including diet, genetics, and others, have an impact on the complex process of tooth eruption. The complex process of tooth eruption can be influenced in a variety of ways by a number of factors, including genetics, diet, preterm delivery, gender differences, socioeconomic circumstances, craniofacial morphology, hormonal influences, and other systemic disorders. In the permanent dentition, girls' dental development is usually more advanced than boys' compared to those with deciduous teeth.

Teeth As Evidence For Age Estimation

In forensic investigations, determining a person's age by their teeth has become crucial, especially when attempting to identify human remains discovered at a crime scene. It is widely acknowledged that teeth are the most reliable evidence of age, owing to their ability to remain intact for thousands of years after death. Additionally, they have a reputation for having excellent resistance to fire damage, which makes them a useful source of knowledge in a variety of situations. As a result, age determination by means of teeth has become an essential method in forensic science, allowing detectives to learn critical information about the identification of unidentified remains.

When it comes to identifying victims of calamities like plane accidents, forensic dental age assessment has become a vital technique. In the 2014 Nepal Airlines crash, two deceased children were identified using this technique after having their teeth examined, which has made it possible to estimate age accurately. Age assessment by teeth is an important process that has become possible. This procedure involves looking at the degree of dental crown development, root configurations, and the stage of eruption that occurs between conception and the middle of the third period of life.

Dental records that include information about fillings and implants are also useful in this regard. Understanding the importance of teeth in determining age is essential for professionals to make precise predictions. Age estimation is a crucial process that uses a number of methods to determine an individual's estimated age. The evaluation of the mineralization phase on radiographic images, which is then compared to the standard phase to estimate age, is one of the most popular techniques. Another approach involves using different radiographic methods, such as intraoral per apical radiographs, lateral oblique radiographs, panoramic radiographs, and digital imaging, to estimate age based on antemortem and post-mortem dental radiographs. It is essential to ensure that the radiographic photos focus on the important teeth to obtain accurate age estimation results **(Demirjian *et al.*, 1973)**.

Dental Age Estimation in Adult

Clinically, the permanent dentition is complete when the third molar erupts age group of 17 and 21, beyond which radiographic age assessment becomes impossible. The volume of teeth and the growth of the third molar are the two most widely used methods.

- Estimation of the volume of teeth
    1. Kvaalb's method of calculating the pulp-to-tooth ratio.
    2. Index of the Coronal Pulp Cavity

- Growth of the third molar.
    1. Method of Harris and Nortje
    2. Van Heerden method

- **Method of Harris and Nortje**

Five stages of third molar root development were identified by Harris and Nortje, with corresponding mean ages and mean lengths (converging root canal walls): Stage 1 (cleft rapidly enlarging—one-third of the root formed), Stage 2 (half of the root formed), Stage 3 (two-thirds of the root formed), Stage 4 (diverging root canal walls), and Stage 5 (diverging root canal walls).

- **Van Heerden System**

In order to assess age (he utilized a five-stage approach in this technique), a panoramic radiograph was used to analyze the growth of the third molar's mesial root.

Conclusion

Between the ages of 5.81 and 7.91, the primary molars in both jaws started to erupt permanently. The permanent central incisors of the upper and lower jaws first appeared between the ages of 6.08 and 8.71. Between the ages of 7.64 and 9.98, permanent lateral incisors in both jaws begin to erupt. Between 9.28 and 11.2 years, with a mean age of 10.14 to 0.46 years, the first permanent premolars erupt. For both the upper and lower jaws, the eruption of the second permanent premolars occurs between the ages of 10.01 and 11.36. The canines, which erupt between the ages of 10.61 and 11.96 in both the upper and lower jaws, are the following set of permanent teeth. The upper jaw's right half erupts between 12.01 and 14.15 years with a mean eruption age of 13.32, while the upper jaw's left half erupts between 12.01 and 14.14 years with a mean eruption age of 13.30. The lower jaw's second permanent molars both erupt between the ages of 11.94 and 14.14. Third permanent molars erupt between the ages of 17.02 and 24.96 for the right half of both jaws, with a mean age of 21.56 2.28 years for the upper jaw and 21.35 2.28 years for the lower jaw. Third molars on the left of both jaws erupt age group of 17.0 and 24.96 years, with the mean being 21.39 2.35 years for the upper jaw and 21.29 2.35 years for the lower jaw. In comparison to their maxillary counterparts, the mandible's permanent teeth emerged earlier. The relationship between sex and the eruption of permanent teeth varied. First premolars, second premolars, and all three molars erupted sooner in males than in females, although the difference was not statistically significant. Females also had earlier eruptions of the central incisor, lateral incisors, canines, and central incisors.

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