ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 04 | April - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

AGE ESTIMATION IN FORENSIC DENTISTRY- A REVIEW

Oral Pathology

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ABSTRACT

In order to create a biological profile from human skeletal remains, age estimation is a crucial step. The primary source of data for forensic odontological age estimation is dental findings evaluated by radiography. There are two main approaches for estimating age from teeth, particularly in children, adolescents, and young adults. Eight stages of tooth development were reported by Demir Jian et al., starting with crown formation and ending with the closure of the root apices of the seven remaining permanent mandibular teeth (excluding the third molar). In this paper, the Demir Jian and Gustafson age estimation method is used to examine age estimation in forensic dentistry.

KEYWORDS

forensic odontology, age estimation , Demir Jian method

INTRODUCTION

For a sake of creating biological profile from human skeletal remains, age estimation is a crucial step. The forensic anthropologist's goal is to help medical and legal authorities identify the deceased by providing a range of the deceased's likely ages [1]. The age of young people has been estimated using a variety of techniques that have been developed and tested [2].

Due to its applicability, age range based on facial features was deemed the best method [3]. Since 1982, techniques of estimating age have utilised dental radiography, a non-destructive and straightforward technique frequently used in dental practise. Dental findings assessed by radiography are an important source of information in forensic odontology age determination.

Many situations call for the use of biological features to determine chronological age.. Hereby, forensic age determination is an important approach both in the discovery of unknown dead bodies to establish identity and in the age assessment of asylum seekers without paper or identity documents [4,5,6].

Identification is aided by estimating the victim's age at death and determining the victim's or the remains' sex. Particularly in the first and second decades, teeth rank among the most trustworthy indicators of age. One of the most trustworthy markers for determining the victim's age is the victim's stage of development. [7]

There are two main techniques for determining age from teeth, particularly in children, adolescents, and young adults: the tooth eruption method, which involves observing the eruption of the teeth into the mouth, and the dental development methods, which use radiographic evaluation.

The dental changes associated with ageing that are most closely examined on radiographs as various dental age estimation methods include root resorption, colour changes, tooth eruption, tooth calcification, attrition, periodontal diseases, secondary dentin deposition, root translucency, cementum apposition, root resorption, and increase in root roughness.

METHODS

Demir Jian et al. described the eight tooth development stages from crown formation, to closure of the root apices of the seven, left permanent mandibular teeth (excluding the third molar)(9)

Stage	Definitions
A	"In both uniradicular and multiradicular teeth, a (sic) beginning of calcification is seen at the superior level of the crypt in the form of an inverted cone or cones. There is no fusion of these calcified points."
B	"Fusion of the calcified points forms one or several cusps which unite to give a regularly outlined occlusal surface."
C	"Enamel formation is complete at the occlusal surface. Its extension and convergence towards the cervical region is seen." "The beginning of a dentinal deposit is seen." "The outline of the pulp chamber has a curved shape at the occlusal border."
D	"The crown formation is completed down to the cemento-enamel junction." "The superior border of the pulp chamber in the uniradicular teeth has a definite curved form, being concave towards the cervical region." "The projection of the pulp horns, if present, gives an outline shaped like an umbrella top. In molars the pulp chamber has a trapezoidal form." "Beginning of root formation is seen in the form of a spicule."
E	Uniradicular teeth: "The walls of the pulp chamber now form straight lines, whose continuity is broken by the presence of the pulp horn, which is larger than in the previous stage." "The root length is less than the crown height." Molars: "Initial formation of the radicular bifurcation is seen in the form of either a calcified point or a semi-lunar shape." "The root length is still less than the crown height."
F	Uniradicular teeth: "The walls of the pulp chamber now form a more or less isosceles triangle." "The apex ends in a funnel shape." "The root length is equal to or greater than the crown height." Molars: "The calcified region of the bifurcation has developed further down from its semi-lunar stage to give the roots a more definite and distinct outline with funnel shaped endings." "The root length is equal to or greater than the crown height."
G	"The walls of the root canal are now parallel and its apical end is still partially open (Distal root on molars)."
H	"The apical end of the root canal is completely closed (Distal root on molars) The periodontal membrane [ligament] has a uniform width around the root and the apex."

Figure 1. Pictures of tooth development stages (adapted from Demirjian et al)[9]

ROOT DENTIN TRANSLUCENCY

The majority of the tooth is made mostly of dentin. From childhood to puberty, dentin develops consistently. The dentin experiences physiological changes such as sclerosis after adolescence.

According to Miles, the root apex's translucency appears to have the most trustworthy or the closest straight line association with age. First, Bang and Ramm used a naked eye examination to measure the root length and the separation between the apex and the transition between transparent and opaque dentin on intact teeth[10].

It is widely acknowledged that the amount of translucent dentin rises with ageing and that the growth of translucency moves from the coronal to the apical area of the tooth[12]. The degree of root dentin

translucency can therefore be measured, and this measurement can be used to estimate age[13].

Cementum Apposition

Even after a person's growing has finished, the hard tissue of the tooth root known as cementum continues to be deposited on teeth over the course of their lifetime (Mein et al. 2008). This cyclic pattern of regular cementum deposition results in the appearance of dark and light bands. Each year, an increment is deposited and is represented by one pair of dark and light bands (Katerere and Gruppe 2001). The tooth cementum annulation (TCA) method, which counts cemental annulations to determine the age at death, was formerly only applicable to historical bones and cremations. It is currently used in forensic situations.

Color Changes

Because the enamel, dentin, and cementum change with age, tooth colour is dynamic and exhibits a pattern with chronological age. [14] The combined influences of inherent and extrinsic colorations define the colour of the teeth. [15] The enamel and dentin's capacity to scatter and absorb light is related to the intrinsic tooth colour. [16]

Extrinsic colour is connected to the materials' absorption onto the enamel surface, particularly the pellicle coating, which leads to extrinsic stain. Examples of these substances include tea, red wine, chlorhexidine, and iron salts. [17]

Age Estimation Using Gustafson Method

The first technique for age estimation based on the assessment of certain regressive alterations in teeth was given by Gosta Gustafson in 1947 and 1950. applicable on single-rooted teeth.[18]

Age Changes Are:

- Attrition of the enamel (A)
- Secondary dentin deposit (S)
- Alteration/recession of periodontal ligament (P)
- Cementum apposition ©
- Root resorption ®
- Transparency/translucency of dentin (T).

$A_n + P_n + S_n + C_n + R_n + T_n$ = total score (Y)
(n = score of individual criteria)
Age = 11.43 + 4.56 × Y (total score)

Limitations of Gustafson's method are:
It cannot be used in living individuals.
Periodontal ligament assessment is difficult in decomposed bodies.

CONCLUSION

Age estimation is one of the important steps for identification in forensic odontology when predicting the age of a deceased patients. Age estimation using radiographic tooth development proposed by Demir Jian et al is widely used in population. Hence these are the gold standards methods in estimating age of deceased population.

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