

A Review of Age Estimation: A Dental Application

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ABSTRACT:

Age is one of the key variables, which assume an imperative part in each part of life. Individual distinguishing proof is a critical part of forensic science. Age, gender, race, thus on is utilized for recognizable proof of a man. Sequential age as recorded by enrollment of birth date is referred all through an individual's life. Age is the valuable factor in clinical practice; research and court of law. In dental point of view the tooth is the important part of the body for evaluation of human age. Teeth demonstrate various age related changes and they have a tendency to stay in place under conditions, which may adjust or pulverize whatever remains of the skeleton. There are diverse strategies for age assurance. There are different methods for age determination. Gustafson (1950) suggested the use of six retrogressive dental changes that are seen with increasing age.

Keywords: Age evaluation, Dental radiographs, Kvaal's method, Pulp-tooth, Secondary dentine.

INTRODUCTION

Age estimation by the dentition is a not unordinary path for assessment of age of an individual. Undeniably age assessment utilizing teeth was initially doled out by Edwin Saunders in 1837, he expressed that teeth gave the most solid manual to age separated with age assessment from stature which was a typical system appropriated among this time. Dental radiology plays an essential role in the individual age assessment.¹ As radiographs are able to catch their distinct anatomical features, they become a valuable tool in forensic sciences. Radiographic assessments of age was a direct, non-prominent and reproducible approach that can be utilized both on living and dead.²

TECHNIQUE OF AGE EVALUATION

The different techniques are isolated into three classes:

1. Morphological Technique
2. Biochemical Technique
3. Radiological Technique.

1. Morphological Technique-

Morphological methods are based on an assessment of teeth. In early age detection,

Gustafson's given the 6 age-related changes in dentition.

Gustafson's Method (1950)³

Gustafson (1950) and Thoma (1944) reported the age variations occurring in the dental tissues and recorded six variations seen in tooth related to age.

They are:

- a. Attrition of the incisal or occlusal surfaces due to mastication (A)
- b. Periodontitis (P)
- c. Secondary dentin (S)
- d. Cementum apposition (C)
- e. Root resorption (R)
- f. Transparency of the root (T)

In the strategy stated, all sign was positioned and dispensed 0, 1, 2, 3 points. The point calculations of every age-change are added by the following formula.

$A_n + P_n + S_n + C_n + R_n + T_n = \text{points}$.

The exact equation calculated was: $y = 11.43 + 4.56x$, where, $y = \text{age}$ and $x = \text{points}$ according to the formula above.

The error of estimation was calculated by Gustafson (1950) was ± 3.6 years.

2. Biochemical Technique

The biochemical technique is proved on the racemization of amino acids. The racemization of amino acids is a reversible first request response and is sensibly compelling in living tissues in that processing framework are direct. Aspartic corrosive has been proposed to have the biggest racemization rate of every amino corrosive and to be put away amid maturing.⁴

3. Radiographic Technique

Radiology estimates an essential part in the individual age determination. Radiological images are used throughout the time contributed age evaluation, which is one of the key tools in recognizable evidence in forensic science. Different radiographic pictures that can be utilized as a part of age resolution are intraoral periapical radiograph, lateral oblique radiograph, Orthopantomograph, lateral cephalograph, digital imaging and advanced imaging technologies.

The radiological age resolution is based on assessment of different aspects as follows:

- Features of tooth buds
- Early delectation mark of mineralization or origin of mineralization
- Early mineralization in deciduous teeth during intrauterine life
- Crown completion
- Crown into the oral cavity
- Root completion of erupted or unerupted teeth.
- Resorption of primary teeth
- Measurement of open apices in tooth
- Physiological secondary dentine
- Tooth-to-pulp ratio
- Third molar development

DENTAL AGE ESTIMATION METHODS

These can be portrayed in four class's specifically clinical, radiographic, histological, physical, chemical analysis.

i) **Clinical or visual analysis:**⁴ Visual estimation of the stage of an eruption of the teeth and evidence of changes due to function such as mastication or Para functional habits

causes attrition can give an approximate estimate of age.

E.g. Old age people the teeth show attrition as compared to adults.

ii) **Radiographic analysis:**⁵Radiography can provide the gross stage of tooth evolution. The radiological age resolution is based on evaluation of several points as below:

- Jaw bones prenatally
- Tooth buds
- Early detection of mineralization
- Early mineralization in primary teeth
- Crown formation
- Eruption of the crown
- Degree of resorption of primary teeth
- Measurement of open apex in teeth
- Volume of pulp chamber and root canals

iii) **Histological analysis:** Histological methods need the formation of the tissues for specific microscopic analysis, which can define the exactly the stage of development of the dentition. Histology is the study of human tissues, from their complex composition to their many purposes in the body. This technique is more suitable for post-mortem situations. It is also important in evaluation of age of early development of dentition.⁶

iv) **Physical and chemical analysis:** The physical and chemical analysis of dental hard tissues to define changes in ion levels with age has been introduced. These technique is not so useful for forensic odontology.⁷

Factors used for the age determination using dentition⁸

The factors are:

1. Formation tooth germs
2. Trace of mineralization
3. Degree of completion of tooth
4. Formation of the neonatal line
5. Clinical eruption
6. Completion of roots of erupted teeth
7. Degree of resorption of deciduous teeth
8. Attrition of the crown
9. Formation of physiologic secondary dentin

10. Formation of cementum
11. Transparency of root dentin
12. Gingival recession
13. Root surface resorption
14. Discolouration and staining of teeth
15. Changes in the chemical composition of Teeth

AGE ESTIMATION UTILIZING THE DENTITION CAN BE GATHERED INTO THREE PHASES⁹

- i. Age estimation in pre-birth, neonatal and early postnatal child
- ii. Children and adolescents
- iii. Adults

Age estimation in prenatal, neonatal and postnatal child

Age evaluation in this group of individual can be the very important task. Histological methods are used to determination of age in this group individual. The neonatal line is present on primary teeth dentin which is formed partly before and partly after birth. The prenatal and postnatal dentins are separated by contour line that is called as the neonatal line. The incremental line of von Ebner appears as fine line striations in dentin. They run at right angle to the dentinal tubules and the distance between lines varies from 4 to 8 μm in the crown. As an age increases the incremental lines are increased in number on microscopic examination.

Age estimation in children and adolescents¹⁰

Tooth ejection and tooth calcification are the two structures that can be utilized to measure dental age in kids and teenagers. Radiographically confirmation of development of crown and root culmination has been utilized for this age bunch. Schour, Massler's outline was the main aim to study dental age estimation.

This outline allows close relations with radiographs. Demirjian's technique built up an age estimation strategy that made utilization of a scoring framework. In this strategy, seven mandibular teeth on the left side were isolated

into 8 phases and development score was assessed. Age estimation can be measured utilizing mandibular third molars as a part of which framed some portion of root was digitized yet the accuracy of the age estimation was somewhat sub-par contrasted and the standard strategy.

Age estimation in adults

Maximum of the techniques used in adults uses numerous reverse changes of hard and soft tissues of the teeth.¹¹ Gustafson (1950) studied the changes happening in individual teeth and resulted in assessing the age with some accuracy. He did 6 dental differences related with aging namely, attrition, apical migration of periodontal ligament, deposition of secondary dentin, cemental opposition, root resorption and transparency of the root dentin. Age was estimated using the formula.

Age = $11.43 + 4.56x$ where x is the total score. It was found that an increase in the total score corresponds to an increase in age.¹² the average error with this method was 3.6 years.

Johanson adjusted Gustafson's strategy by different relapse examination and suggested a more particular recipe for age assessment with a standard mistake of 5.16 years. Testimony of optional dentin can be assessed relating periapical radiograph to gauge age. Mash distance across to crown breadth proportion and mash/root length, mash/root width was measured.

The level of racemization of aspartic corrosive in the coronal dentin of ordinary perpetual teeth can be connected to assess the age of a man at the season of death. As age advances L-aspartic corrosive will change over into the D-aspartic corrosive. An intriguing strategy utilizing centralization of fluorescence as a part of dentin and cementum,¹³ which decides the solid relationship between age, extending of the shade of the tooth and increment in the power of fluorescence.

The shading varieties in the cementum and dentin are initiated by mixture of deterioration items from erythrocytes.¹⁴ The incremental lines of cementum will choose the period of

grown-ups. A noteworthy disadvantage of this method is the prerequisite to concentrate on area the tooth. Root dentin begins to wind up translucent due to the expanded intratubular calcification. Dentin translucency will ascend with age. Confinements of this technique incorporate underestimation of age in more established age gathers because of backing off of dentin sclerosis and the unpredictable intersection at translucent and non-translucent zones will make troubles in measuring the length.

Kashyap and KoteswaraRao excluded periodontosis and root resorption from Gustafson's strategy and computed the list estimations of various parameters experiencing reverse changes. Their adjusted strategy gave an error of +1.59 years and Spearman coefficient estimation of 0.998. Age assessment from the grown-up tooth is more right with altered Gustafson's technique when numerous variables are utilized.¹⁵

RADIOGRAPHIC METHOD OF KVAAL

Kvaal developed a method that used measurements of six teeth observed on periapical radiographs. The measurement includes several lengths, width radio such as pulp-root length (P), pulp-tooth length (R), tooth-root length (T), pulp-root width at CEJ (A), pulp-root width at mid-root level C, and pulp-root width at mid-point between level C and A.^{16,17}

CONCLUSION

Age evaluation is a great assignment for a now a days. Teeth are essentially beneficial in age evaluation because as an age increases the so several variations observed on the tooth. It's a simple method for detection of the accurate age of the human and dead person.

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