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Original Research Article

DETERMINATION OF AGE BY TOOTH PULP VOLUME MEASUREMENT

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Abstract

Background & Methods: The aim of the study is to determine ge by tooth pulp volume measurement. All the CBCT images used for the establishment of the mathematical model collected to validate the precision and accuracy of the model for age estimation. The numerical value of the volume of pulp tooth ratio put into the mathematical models, to get the estimated age of these subjects. The actual age and estimated age of the subjects were then compared to determine the precision and accuracy of the established model.

Results: The ANOVA test for successful prediction of age of the patient. The table shows that the p value is less than 0.05 indicating that the ratio of teeth of males and females is successful in predicting the age of the patients.

Conclusion: Human age estimation can be done on the basis of pulp–tooth ratio of canine. This mathematical model to be evaluated on broad scale with different geographical population with larger sample size, and broader age groups in order to see for more accuracy in age estimation to get more substantial statistical results.

Keywords: age, tooth, pulp & measurement.
Study Design: Observational Study.

1. Introduction

Age estimation is a sub discipline of the forensic sciences and should be an important part of every identification process, especially when information relating to the deceased is unavailable. The estimation should be as accurate as possible since it narrows down the search within the police missing files and enables a more efficient and time saving approach. [1] Age estimation is of broader importance in forensic science, not only for the identification purposes of the deceased victims, but also in connection with crimes and accidents. In addition, chronological age is important in most societies for school attendance, social benefits, employment and marriages. Estimation of human age is a procedure adopted by anthropologist, archaeologist, and forensic scientist. [2&3]

Age estimation can be done from dentition by clinical methods such as eruption sequence; radiographic features like appearance of tooth germs, commencement of mineralization,

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degree of mineralization of various teeth, degree of crown and root completion, degree of root resorption of deciduous teeth, open apices, pulp to tooth ratio, volume of pulp chambers and root canals, third molar eruption, digitization of available radiographs; histologic features like neonatal line, incremental lines of cementum, dentin translucency, dentin predentin interface using scanning electron microscopy and biochemical characteristics like C14 levels and racemization of dentin. [4]

2. Material and Methods

Total 100 CBCT images of 50 maxillary and 50 mandibular canines collected from 50 female (25 maxillary and 25 mandibular canines) and 50 male patients (25 maxillary and 25 mandibular canines) whose age between 10 and 70 years.

The inclusion criteria of the teeth: no caries, no excessive tooth wear, no dental restorations, no artifacts due to metal restorative materials present in adjacent teeth, and no pulpal calcification. All the samples are divided into six different age groups. Group A consist 10 to 20 years Group B consist 21 to 30 years Group C consist 31 to 40 years Group D consist 41 to 50 Group E consist 51 to 60 and group F consist 61 to 70 years of age.

All the CBCT images used for the establishment of the mathematical model collected to validate the precision and accuracy of the model for age estimation. The numerical value of the volume of pulp tooth ratio put into the mathematical models, to get the estimated age of these subjects. The actual age and estimated age of the subjects were then compared to determine the precision and accuracy of the established model.

3. Result

Table 1- Showing age vise distribution of total teeth observed.

Age Groups	**No. of Sample**
A	11
B	12
C	06
D	10
E	38
F	23

Represents age wise distribution of total teeth observed. Group A (10-20 years of age) showing 11, Group B (21-30 years of age) showing 12, Group C (31-40 years of age) showing 06, Group D (41-50 years of age) showing 10, Group E (51-60 years of age) showing 38 and Group F (61-70 years of age) showing 23 teeth evaluated for age estimation.

Table 2- Showing the ANOVA test for successful prediction of age of the patient.

Anova				
Model	Sum of Squares	Df	Mean	Sig.
Regression	278.915	3	91.638	.000b
Residual	59142.665	195	303.764	
Total	59429.580	197		

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Showing the ANOVA test for successful prediction of age of the patient. The table shows that the p value is less than 0.05 indicating that the ratio of teeth of males and females is successful in predicting the age of the patients.

Table 3- Showing the coefficients of age predicted using the equation.

Model	Unstandardized Coefficients		Sig.	95.0% Confidence Interval for B	
(Constant)	52.790	5.270	.000b	Lower Bound	Upper Bound
Ratio	0.053	0.461		31.495	43.594
				0.209	.871

The coefficients are statistically significant as the p value is less than 0.05.

4. Discussion

Age estimation is of broader importance in forensic medicine, not only for identification purposes of the deceased, but also for living subjects. In living adults, the number of age estimation methods is greatly reduced because the skeletal processes are completed.[5] In this situation, some dental methods can be used because teeth are considered as the most reliable human body structures for forensic age estimation since it is usually minimally affected by the environmental and taphonomic process.[6]

There is various proposed dental age estimation approach in forensic odontology practice like attrition. Root dentine transparency, tooth cementum annulations, racemineralization of aspartic acid and secondary dentin apposition. Among this secondary dentin apposition is considered as most valuable method for age prediction in adult because despite having different contents and arrangements, the pulp and dentine have common embryonic origin. These two tissues share close relationship in terms of physiologic and pathologic reactions. Any one thing that disturbs the dentine will affect the pulp and vice versa. The odontoblasts are the most prominent cells of the pulp-dentine complex and are responsible for the dentine formation throughout the life.[7]There are three types of dentine in the human tooth: primary, secondary, and tertiary dentine. Primary dentine commences from odontogenesis until the tooth becomes functional and the formation of secondary dentine is produced immediately and continues throughout the life. The tertiary dentine is a reactionary dentine which is laid in specific regions in response to an injury. [8] It is a recognized fact that secondary dentine formation increases with age and as a result the volume of the pulp cavity shrinks. Therefore, the researchers calculated the pulp volumes and utilized it as predictor for estimating age.

Previous reports describe the correlation between secondary dentine deposition along the pulp chamber walls and age, as well as the possibility of detecting and measuring these changes on periapical or panoramic radiographs that are routinely used non-destructive techniques in dentistry..Pulp/tooth area ratio as an indicator of age. This method requires a radiographic image of an examined tooth, computer-aided drafting software and trained personnel. However, these radiographs are 2D and fail to provide volumetric information regarding the teeth and related structures. [9] However, application of the two-dimensional imaging methods (panoramic and intraoral periapical radiographs) is difficult in the case of malpositioned (e.g., rotated or crowded) tooth. So, 3D Tomographic techniques are a

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valuable method as they eliminate any complications of tooth malposition and any image superimposition.

5. Conclusion

Human age estimation can be done on the basis of pulp–tooth ratio of canine. This mathematical model to be evaluated on broad scale with different geographical population with larger sample size, and broader age groups in order to see for more accuracy in age estimation to get more substantial statistical results.

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