

Evaluation of Age of Individuals from the Physiological Changes of Teeth: A Forensic Study

Vaishali Sharma^{1*} Arvind Bhatheja² HS Indrakumar³ Manish Kumar⁴ Ahmad Danish Rehan⁵
Raju H Rathod⁶

¹Lecturer, Department of Anatomy, Dasmesh Institute of Research and Dental Sciences, Faridkot, India.

²PG Student, Department of Conservative Dentistry, Divya Jyoti College of Dental Sciences & Research, Modinagar, India.

³Reader, Department of Prosthodontics, Esic Dental College, Gulbarga, Karnataka, India.

⁴Senior Lecturer, Department of Oral Pathology, Tatyasaheb Kore Dental College and Research centre, Kolhapur, India.

⁵Lecturer, Department of Oral Pathology, Hazaribag College of Dental Sciences, Jharkhand, India.

⁶Reader, Department of Orthodontics, Tatyasaheb Kore Dental College and Research Centre, Kolhapur, India.

ABSTRACT

Background: Proper identification in forensic odontology is required for ethical, humanitarian and official records, in particular, the legal and criminal investigations. It enables us to construct a mortality profile of the deceased. A unique property of permanency is attributed by teeth since they are mineralized which makes them resistant to environmental insults. Hence; we planned the present study to evaluate the reliability of modified Gustafson's method of age estimation.

Materials & Methods: The present study included assessment of extracted teeth from the individuals of age group of 20 to 60 years. After pre-extraction examination, the teeth were obtained by the researcher in the Department. Recording of the following parameters was done: Degree of attrition, Degree of root transparency, Degree of secondary dentin deposition, Cementum apposition and Root resorption. 10 percent neutral buffered formalin solution was used for preserving the extracted teeth. The degree of attrition was recorded by visual inspection and modified while reading the section microscopically. The various parameters were recorded using Gustafson's criteria and evaluation was done. Plotting of the graph was done using the actual age on one side and total scores on the other. After doing the calculation, one regressive formula was obtained using different statistical equations. All the results were analyzed by SPSS software.

Results: In age group of 30 to 34 years, 4 patients were there while 6 patients belonged to the age group of 40 to 44 years. Maximum number of patients belonged to the age group of 7 years.

Conclusion: For age estimation, Gustafson's method with some proposed modification is a reliable method.

Keywords: Age, Identification, Rugae.

INTRODUCTION

Human identification comprises of important constituent i.e. age estimation from dentition. Proper identification in forensic odontology is required for ethical, humanitarian and official records, in particular, the legal and criminal investigations. It enables us to construct a

mortality profile of the deceased.¹ For the purpose of human identification, noting of the several points are done including age, sex, race and stature. Attesting of the identification of the deceased can be done from the human remains by the family and friends of the individual if the remains are visible, whereas in enigmatic situations such as mass

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*Correspondence Dr. Vaishali Sharma.

Department of Anatomy, Dasmesh Institute of Research and Dental Sciences, Faridkot, India.

Email: Not Disclosed

disasters and decomposed postmortem remains, where viewing is not possible, other means of identification are required to be used.^{2, 3} A unique property of permanency is attributed by teeth since they are mineralized which makes them resistant to environmental insults.⁴ Hence; we planned the present study to evaluate the reliability of modified Gustafson's method of age estimation.

MATERIALS & METHODS

The present study was conducted in the department of human anatomy and oral pathology of the institution and included assessment of extracted teeth from the individuals of age group of 20 to 60 years. After pre-extraction examination, the teeth were obtained by the researcher in the Department. Carious teeth were excluded from the present study. Recording of the actual age of the subjects in all the cases was done. Recording of the following parameters was done: Degree of attrition, Degree of root transparency, Degree of secondary dentin deposition, Cementum apposition and Root resorption. 10 percent neutral buffered formalin solution was used for preserving the extracted teeth. The degree of attrition was recorded by visual inspection and modified while reading the section microscopically. Lathe machine was used for grinding the extracted teeth followed by hand grinding using two Arkansas stone, one rough, and the other fine. Grinding was done first on the rough stone by making approximately equal grinding movements on either side so as to reach the center of the tooth. At the thickness of 1 mm, the section was held over printed material such that the printing could be read through the section and the grading of root transparency was noted. The thickness of Cementum was measured by using Motic 2.0 Image Analysis Software. Cementum thickness of 150-200 μ was recorded as normal. The various parameters were recorded using Gustafson's criteria and evaluation was done.⁶ Plotting of the graph was done using the actual age on one side and total scores on the other. After doing the calculation, one regressive formula was obtained using different statistical equations.

$$Y_c = a + bx$$

Where, Y = estimated age

X = sum of total points recorded, a and b = coefficients calculated by statistical analysis

All the results were analyzed by SPSS software. Chi-square test and multivariate analysis were used for the assessment of level of significance.

RESULTS

Table 1 and graph 1 show the distribution of patients according to age. 2 patients belonged to the age group of 20 to 24 years and 25 to 29 years. In age group of 30 to 34 years, 4 patients were there while 6 patients belonged to the age group of 40 to 44 years. maximum number of patients belonged to the age group of 7 years.

DISCUSSION

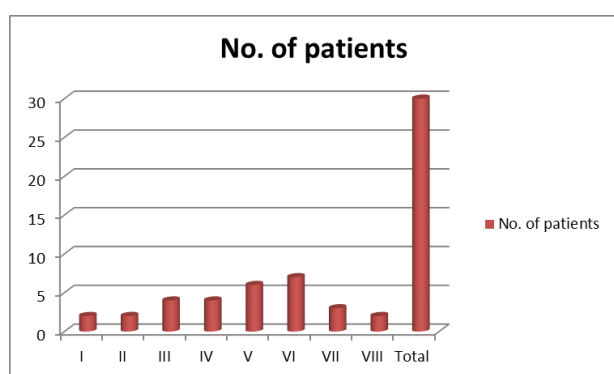
Dental component forms a unique and indispensable component of human body since it comprises of human skeleton.⁶ Dental evidence in forensic medicine can be invaluable in personal identification especially when data relating to the deceased is unavailable. The method of estimation should be as accurate as possible, since it will cut down the search within the police missing person's files and enables a time saving approach.^{7, 8} Hence; we planned the present study to evaluate the reliability of modified Gustafson's method of age estimation.

In the present study, we observed that the mean age difference between actual age and the estimated age was less than 3 years. The results were in accordance with the previous results who observed significant applicability of Gustafson's criteria with some modification in estimation of age.

Shrigiriwar et al conducted the a study to know the changes in teeth with advancement of age. In their study, 80 cases in the age group of 26-70 years were studied, out of which 58 were men and 22 women. The six physiological changes in teeth, viz. attrition, periodontosis, secondary dentin deposition, root translucency, cementum apposition and root resorption, were studied with each parameter having score ranging from 0 to 3. Total score was calculated by

Table 1: Distribution of patients according to age

Group	Age group (years)	No. of patients
I	20- 24	2
II	25- 29	2
III	30- 34	4
IV	35- 39	4
V	40- 44	6
VI	45- 49	7
VII	50- 54	3
VIII	55- 60	2
Total		30



Graph 1: Distribution of patients according to age.

adding the scores of all the six physiological factors. The regression analysis was done by plotting the total score allotted against the actual age of the person. The average age difference between known and estimated age in this study was found to be ± 4.43 years.⁹

Bommannavar et al described a method to measure root dentin translucency on sectioned teeth using a custom built software program Adobe Photoshop 7.0 version. A total of 50 single rooted teeth were sectioned longitudinally to derive a 0.25 mm uniform thickness and the root dentin translucency was measured using digital and caliper methods and compared. The Gustafson's morphohistologic approach is used in this study. Correlation coefficients of translucency measurements to age were statistically significant for both the methods and linear regression equations derived from both methods revealed better ability of the digital method to assess age. The custom built software program used in the present study is commercially available and widely

used image editing software.¹⁰ Selvamani et al investigated the amount and distribution of apical translucent dentin in group-matched vital and non-vital teeth. Study was conducted on 70 extracted teeth, which were subjected for vitality test before extraction, and divided into two groups (vital & non-vital teeth) with a minimum of 35 teeth in each group. Ground sections of 150 μ thickness were observed under Stereomicroscope and photographed. The present study revealed significant differences ($p < 0.05$) in apical translucency of dentin, when both vital and non-vital teeth types were compared. There was more apical translucency present in non-vital when compared with vital teeth at any given age.¹¹ Kumar et al assessed the accuracy of Gustafson's age estimation criteria in a population of known age. A total of 50 patients were selected for the study between the age group of 25-80 years who were undergoing extraction. Ground sections of the teeth were prepared. Modified Gustafson's criteria were used for the age estimation. Results: Age estimation by Gustafson's formula shows a great variation from the real age when compared to Maples formula and newly derived age estimation formula. Applicability of Gustafson's formula in age estimation in our study group is not relevant.¹²

CONCLUSION

From the above results, the authors concluded that for age estimation, Gustafson's method with some proposed modification is a reliable method.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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