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Age estimation using physiological changes of teeth

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ABSTRACT

The aim of the study was to study the physiological changes of teeth according to the Gustafson's criteria and to estimate the age according to these physiological changes. The study was carried out in the department of Oral and Maxillofacial surgery Jaipur Dental College Jaipur. Cases received for extraction. The armamentarium used in this study is Electric lathe, Carborundum stone (rough and smooth), Alcohol and Xylene, Formalin, Microscope and slides. On comparing the means of both the calculated age and the actual age, it was observed that the difference between them was statistically significant except in the age group of 40-50 years group. On calculating the age mean error was found to be ±4.86.

Keywords: Physiological changes of teeth, Age estimation, Root translucency.

INTRODUCTION

Examination of teeth in many ways form a unique part of human body as they are most durable and resilient part of the skeleton. The science dealing with establishing identity of a person by teeth is popularly known as Forensic Odontology or Forensic Dentistry [1]. Many variables have been used as age determinants and even dental histological techniques can contribute to age estimation. [2]. The choice to use teeth for age determination is well accepted due to their longevity ability of being resilient to change[3] There are various physiological changes which are related to age such as Attrition, Periodontal bone loss, Root resorption, Root translucency, Cementum apposition and Secondary dentin deposition.[4] Thoma[5] in 1944 described the age changes occurring in the dental tissue and notes attrition of enamel, sclerosis of dentin, denticles in the pulp, deposition of cementum, continuous eruption of the teeth and alteration in the periodontal structures.Gustafson[6] in 1950 suggested the use of six retrogressive changes and ranked them on arbitrary scale, allotting 0-3 points according to degree of the change. Dalitz [7] re– examined Gustafson method and suggested a five point system from 0 – 4 instead of the four

point system that was previously used. This change was proposed in order to give a slightly greater efficacy. Bang and Ramm[8]suggested a totally new approach in age estimation. They found that the root dentine appears to become transparent during the third decade starting at the tip of the root and advancing coronally with age. This alteration is believed to be caused by increasing intratubular calcification in dentinal tubules. [9] Johanson [10] in1971 in his research used same six criterions but different ranking scale and then estimated the age of an individual. Solheim [11**]** used in situ teeth and eight variables which included two of color estimate, two for periodontosis, and two for attrition, crown length and sex. None of the changes took singly proved more accurate than when these were studied together. [12]

MATERIALS AND METHODS

The research project was carried out in the department of oral Pathology of Jaipur Dental College; Jaipur Cases received for extraction by Department of Oral & Maxillofacial Surgery Jaipur Dental College 20 cases were studied (age group of 20 to 60 years). The following dental parameters were studied in each case; Attrition, Periodontal disease, Cementum apposition, Secondary dentine deposition, Root translucency and Root resorption. The armentarium used in the study are Electric lathe, Carborundum stone (rough and smooth), Alcohol and Xylene, Formalin, Microscope and slides. The extent of periodontal disease was recorded before the extraction of the tooth. Ground section was prepared by hand grinding which was done first with lathe and then with rough Carborundum stone until a section of 1 mm was obtained and at this thickness, the root translucency was noted. Grinding was further done using fine stone until the section of 0.25-mm thickness is left. Finally, cleaned and dried section was mounted on slide and viewed under microscope for secondary dentine, cementum apposition and root resorption. Normal healthy teeth with class 1 occlusion were included in this study. The order of preference was Premolar – Canines – Incisors. While Third molar, patients with medical & drug history, trauma from occlusion, abnormal oral habits, congenital anomalies of teeth, pathologies affecting teeth were excluded. The scores obtained were tabulated. By plotting actual age on one side and the calculated score on the other side then the regression formula obtained [13] then age estimation was done, deviation of estimated age from actual age noted and results subjected for statistical analysis.

Four point allotment system as per Gustafson's method [**14]**

Attrition (A):
A0- No Attrition,
A1- Attrition limited to enamel level,
A2- Attrition limited to dentine level,
A3- Attrition up to pulp cavity.

Periodontal disease (P):
P0-No obvious periodontal disease,
P1-Beginning of periodontal disease but no bone loss,
P2-Peridontal disease more than 1/3rd of the root,
P3-Peridontal disease more than 2/3rd of the root.

Secondary dentine (S):
S0-No secondary dentine formation,

S1-Secondary dentine up to upper part of pulp cavity,
S2-Secondary dentin up to 2/3rd of the pulp cavity,
S3-Diffuse calcification of entire pulp cavity.

Root translucency (T):
T0- No translucency,
T1- Beginning of translucency,
T2- Translucency more than 1/3rd of the apical root,
T3- Translucency more than 2/3rd of the apical root.

Cementum apposition (C):
C0- Normal cementum,
C1- Thickness of cementum more normal,
C2- Abnormal thickness of cementum near the apex of the root,
C3- Generalized abnormal thickness of cementum throughout the apex of the root.

Formula used = Y= 4.07x + 10.35 (Y = Age in years, X = Total score)

Table. 1 shows age wise distribution of the patients

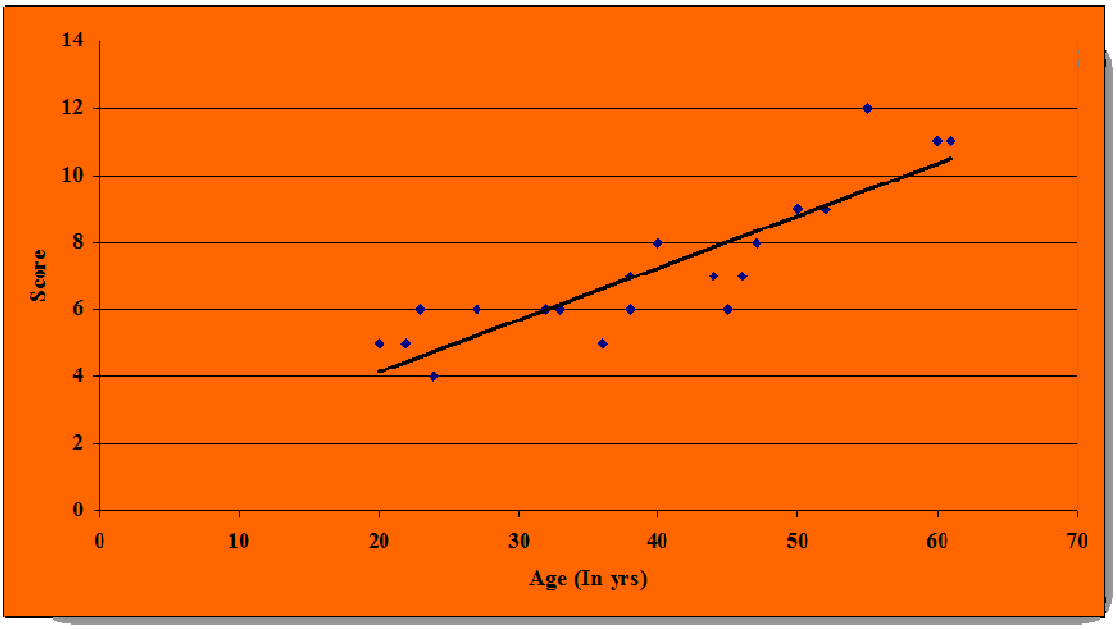
Age group (In yrs)	No.	%
20-29	5	25.00
30-39	5	25.00
40-49	5	25.00
≥ 50	5	25.00
Total	20	100.00

Table 2 shows the difference between actual age and estimated age

S. No.	Age	estimated	difference
1	20	30.7	10.7
2	22	30.7	8.7
3	23	34.77	11.77
4	24	26.63	2.63
5	27	34.77	7.77
6	32	34.77	2.77
7	33	34.77	1.77
8	36	30.7	-5.3
9	38	38.84	0.84
10	38	34.77	-3.23
11	40	42.91	2.91
12	44	38.84	-5.16
13	45	34.77	-10.23
14	46	38.84	-7.16
15	47	42.91	-4.09
16	50	46.98	-3.02
17	52	46.98	-5.02
18	55	59.19	4.19
19	60	55.12	-4.88
20	61	55.12	-5.88

RESULTS

Four groups of the patients were made (20 -29, 30 -39, 40-49 and ≥ 50) 5 patients from each groups were selected.



Graph shows a positive correlation between age and scores

Table 3 shows Correlation and the significance of age groups with estimated age

Age group (In yrs)	Estimated age	Significance
20-29	31.51 ± 3.04	Sig
30-39	34.77 ± 2.57	Sig
40-49	39.65 ± 3.04	NS
≥ 50	52.68 ± 4.88	Sig

DISCUSSION

Total of 20 cases taken in this study and 6 physiological changes were recorded. Cases were divided into 4 different age groups from 20 – 60 yrs of age 41% males & 59% females 55% non-vegetarian & 45% vegetarian.

The mean age difference of the calculated age was ± 4.86 years which was contrary to the findings of Gustafson who found the age difference of ± 3.63 years and also differs with the findings of Singh. A et al.[15] Who found the mean age difference of ± 2.16 years. It was observed that the total score increased with the increasing age & the increase was statistically analyzed and was found to be significant (Pillai & Bhaskar 1974) **[14]** on comparing the means of both the calculated age and the actual age, it was observed that the difference between them

was statistically significant except in the age group of 40-50 years group. On calculating the maximum and minimum difference between actual age and the calculated age, least difference in actual age and calculated age on basis of 6 physiological criteria's in all 4 age groups. In our study we got the mean age difference of ± 4.86 which was greater then some previous studies in our opinion it was most likely due to the small sample size.

CONCLUSION

Age estimation from human teeth is well established. Different techniques and numerous studies have been published for age estimation, each one shows different accuracy and reliability. Error is present in every approach; to minimize the error one should perform repetitive measurements and calculations in order to reach a reliable conclusion. Physiological changes like attrition, periodontal disease, secondary dentin formation, root translucency, cementum apposition & root resorption noted in this study that could help in the age estimation. It was also observed that the total score increased with the increasing age

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