



Original Research Article

Age Estimation by Attrition of Teeth

Selukar Mangesh S*, Dope Santoshkumar A**@, Anandwadikar Suvarna V**, P.R.Kulkarni***

*Associate Professor, **Assistant Professor, ***Professor & HOD
Dept. of Anatomy, Government Medical College, Latur.

@Correspondence Email: drdopesantosh@yahoo.co.in

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ABSTRACT

Evaluation of age of unknown deceased person is a very important factor for identification purpose both in anthropology & forensic science. Bodies found in war or natural disaster are sometimes impossible to identify because of calcinations or putrefaction. Teeth which are particularly resistant to destruction by fire, bacteria or other agents can be used to evaluate the victims dental age by Gustafson method. No previous much data exists on estimating age from attrition of tooth. Present study on dental attrition of 77 teeth collected from dental department of Govt. Dental College, Aurangabad of known age group. The average age was calculated from the index value of attrition putting into regression formula of attrition. The actual age versus index values for attrition showed a linear relationship. Index value of attrition was found to be between 15.00-65.89, with a mean of 39.67, with a standard deviation of + 12.94. The value of $r=0.802$ between actual age and attrition represented a significant correlation coefficient at 0.01 level. Thus by this study the estimated age error was minimized to + 1.25 years. So, the age calculated by this method was found to be more accurate, reliable and reproducible.

Keywords: Attrition, Dental identification, Forensic Medicine, Gustafson Method, Regression Formula.

INTRODUCTION

The study of human Anatomy and its variations represents a confluence of basic science and clinical practice. Evaluation of age of unknown deceased persons is a very important in anthropology and forensic science. Teeth are resistant to destruction by fire, bacteria or other agents, so teeth can be used to evaluate the victims dental age. Dental identification is one of the most accurate methods of personal identification. Odontological data can constitute essential evidence for age estimation in forensic work.

Gosta Gustafson [1,2] described a method for ageing which was based upon the changes occurring in the teeth as the age progresses. Modification was proposed to the original Gustafson's method by Koteswara Rao. [3] The modification was to minimize the subjective nature of the scoring technique and to quantify the regressive changes in enamel, dentine and cementum. This was by using index values based on actual physical measurements. Nalbandion I and Sognnaes R. F. [4] proved that attrition in itself was rather an unsatisfactory criterion for age estimation.

Dahlberg A.A. [5] stated that in modern society attrition is caused by wear of tooth against tooth, bruxism and excessive grinding. Miles AEW [6] made an attempt to use tooth attrition more systemically for age estimation for archaeological purpose. Mendis BR RM and Daling A.I. [7] studied the variation in the amount of particular dentin with advancing age and its relation to attrition.

Present study is an attempt to estimate the age of an individual from regressive alteration of teeth.

Aims of Study:

- To evaluate the reliability of age changes in teeth, for estimation of actual age of an individual.
- To study the utility of determination of age from teeth in forensic science.
- To study the correlation between the degree of attrition and actual age.

MATERIALS & METHODS

The method of Gustafson [1,2] appears to be most widely used. Kashyap VK and K Rao NK [3] proposed the modification to the Gustafson method.

The proposed modification is to minimize the difficulties of regressive changes in attrition by using index value based on actual physical measurement. For present study 77 teeth were collected from dental department of known age group.

The criteria for selection of teeth were as follows:

- Tooth should not have fracture.
- Tooth should be caries free.
- Tooth should not have cervical abrasion.
- Tooth of older individuals (above 70 yrs of age) were not included.

The collected teeth were stored in 10% formalin. 2 mm or <2 mm sections were prepared through the central axis of each tooth using coarse model trimmer.

During grinding precautions were taken to avoid cracks or cleavages, and to reduce heat continuous water flow was provided. After grinding the teeth up to 2 mm the sections of 1 mm thickness were prepared on arkansas stone. Grinding action was in one direction to avoid irregularities in the section.

Tooth sections were mounted in DPX on glass slide for microscopic observation.

The microscopic observations were observed at magnification of 0.25 using stereo-microscope. At the eye piece micrometer was placed for accurate measurements.

Micrometry:

Measurements of tooth sections were done from eye piece. Micrometry consists of ocular & stage micrometer. Ocular micrometer had 0 to 100 divisions placed in eye piece. Stage micrometer had 0 to 100 divisions in 1 millimeter. So, 1 division of stage micrometer is equal to 10 micrometer or 0.01 mm, which is least count of stage micrometer. Standardization of ocular micrometer was done by comparing the divisions of ocular with that of stage micrometer. So, value of 1 division of ocular micrometer was 15 micrometer or 0.01 mm. Readings taken by ocular micrometer were multiplied by least count of ocular micrometer i.e. 0.015 mm.

Measurement of Attrition (A):

The attrition index was calculated as the width of attrited area measured in relation to width of the tooth at cervical margin.

The value of attrition in incisor, canine, premolar and molar was taken separately because incisor and canine had single attrited area, whereas premolar and molar had two attrited facet areas.

I. Incisor and canine attrition index.

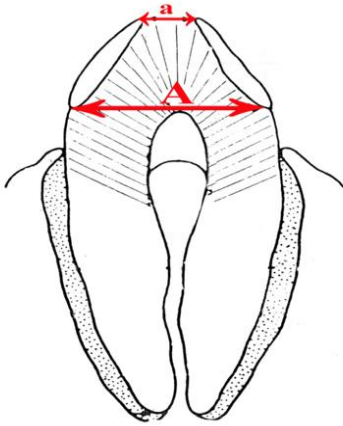


Fig.-1. Shows measurement of attrition index for Incisor or Canine.

Values were calculated as follows:

$(A) = a / A \times 100$. Where 'a' is width in mm of attrited tooth at the incisal tip. 'A' is the width in mm of the tooth at the cervical margin.

II. Premolar and molar attrition index

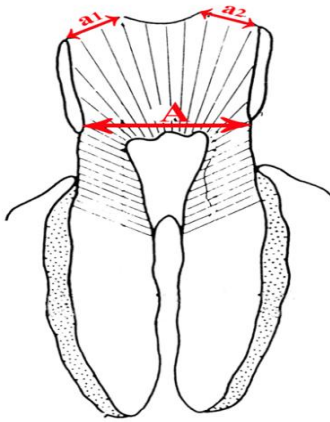


Fig.-2. Shows measurement of attrition index for Premolar or Molar.

values were calculated as follows:

$(A) = a1 + a2 / A \times 100$. Where 'a1' and 'a2' are the width in mm of the attrited tip of buccal and lingual sides. 'A' is width in mm at the cervical margin.

The average age was calculated from the index value of attrition putting into regression formula of attrition.

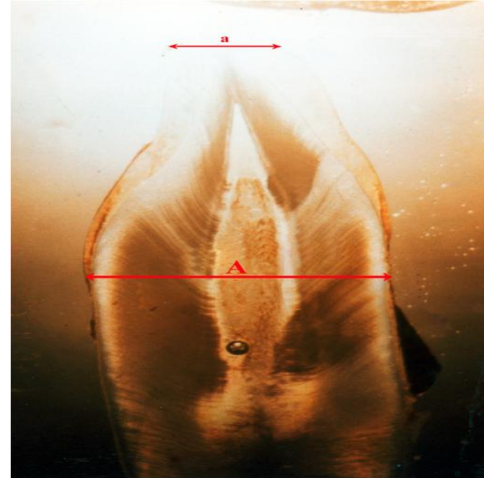


Fig.-3. Shows photograph of Incisor tooth taken from microscope.

(Where 'a' is width in mm of attrited tooth at the incisal tip.

'A' is the width in mm of the tooth at the cervical margin.)

RESULTS

Table No. 1: Information of Attrition, Actual Age and Estimated Age of 77 Cases.

Sr. No	Variable	Range	Mean	S D	C V %
1	Attrition	15.00-65.89	39.67	12.94	32.61
2	Actual age	20.00-70.00	47.71	11.24	23.55
3	Estimated age	20.57-69.81	47.79	10.97	22.95

Table No. 2: Shows Total Number of Samples of Incisors, Canines, Premolars and Molars.

Sr.No.	Character	Frequency
1	Incisor	17
2	Canine	09
3	Premolar	33
4	Molar	18

Table No. 3: Shows Correlation Coefficient (r) Among Actual Age (AA), Attrition (ATT) and Estimated Age (EA).

	AA	ATT	EA
AA	-	-	-
ATT	0.8022**	-	-
EA	0.993**	0.814**	-

** = Correlation is significant at the 0.01 level

This table gives information regarding the relationship between parameters under investigation. The relationship is expressed in the form of correlation of coefficient (r). All values of (r) obtained were positive indicating positive correlation between various parameters. All values of (r) were statistically significant at p = 0.01 level.

Table No. 4: Shows Regression Equation and Values for Correlation Coefficient Indicating Attrition and Estimated Age Whose Actual Age Is Independent.

Sr. No.	Dependent	b1	b0
1	Attrition	0.9239	-4.4144
2	Estimated Age	0.97	1.5091

Regression equation:
 Actual age = Attrition index(A%) + 4.4144 / 0.9239
 Estimated age (EA) = 0.97 X Actual age + 1.5091

Using regression equation, the age of the subject can be calculated. The b1 & b0 are the constant parameters. It is proved from the study that the regression equation would be of great use in calculating or predicting the age of the person.

Table No. 5 : Chi-square Test for Actual Age of Observed Sample and Estimated Age.

Age Group	Sample Observed	Estimated
20-30 yrs	04	04
31-40 yrs	15	14
41-50 yrs	26	25
51-60 yrs	21	21
61-70 yrs	11	13

Chi-square = 0.419
 D. F. = 4
 P Value = 0.981
 P Value = 0.981 > 0.05

There is no significant difference between Actual age of samples and estimated age so the hypothesis is accepted.

DISCUSSION

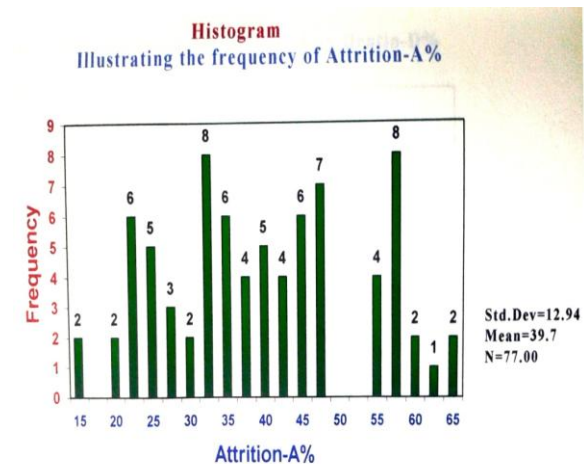


Fig.-4. Illustrating the frequency of Attrition.

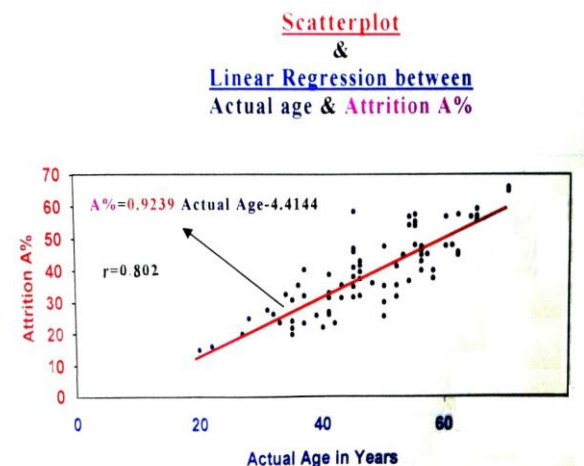


Fig.-5. Linear Regression between Actual Age & Attrition.

In this study of Histogram illustrating frequency of attrition(fig.-4) & the plotted curve (fig.-5) for actual age versus index values for attrition showed a liner relationship .Index value of attrition was found to be between 15.00-65.89,with a mean of 39.67, with a standard deviation of + 12.94.

The relationship between the parameters was expressed by correlation of coefficient. The value of $r=0.802$ between actual age and attrition represented a significant correlation coefficient at 0.01 level.

The cementum apposition and attrition showed significant positive correlation ($r=0.480$) whereas for secondary dentin and attrition ($r=0.545$) which were of significant positive correlation.

Though attrition varies according to functional variation, it can be used as a reliable index in age estimation, but it is more reliable when used in combination with other variables

This method is relatively simple and objective for age determination.

In the study by K Rao ^[3] the average error in estimation of age was found to be + 8.13 years by Gustafson's method. ^[1,2]

In present study the estimated age error was minimized to + 1.25 years.

CONCLUSION

The age calculated by this method was found to be more accurate, reliable and reproducible. Thus, the old saying ' DEAD TELL TALES' sounds true as due to advancement in technology, it is possible to

estimated the age of the individual which is great helpful to mankind.

It can be also concluded that if possible only anterior teeth should be used in assessment of the age changes since different changes are less accessible to examination in premolars and particularly in molars.

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