Utility of Spacing for Third Molar Teeth Along with its Eruption, for Determination of Age of an Individual: A Pilot Study

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Abstract

Background: Determination of individuality of person is one of the main objectives in any medico-legal examination. Age of an individual is one of the key indicators to establish identity. Eruption of third molar teeth is used frequently by forensic experts all over the world for age determination. Spacing for third molar is another known phenomenon and few studies have been done so far to establish its use in age determination. However we did not find any study to seek combined use of spacing for third molar and eruption of all third molar teeth, for age determination.

Aims and Objectives: To establish utility of spacing for third molar along with eruption of third molarin each socket for determination of age; and to devise an equation by using these characteristics to determine age.

Material and Methodology: Current study is descriptive observational type of a study, conducted on 201 consenting individuals of age ranging from 17 to 22 years, after applying inclusion criteria. Oral examination of individual was done and gathered information was later statistically analyzed using Microsoft excel.

Results: Alinear regression equation– BJGMCFMT equation (Y = 0.149 x + 15.57) is devised for age determination, by using unique scoring system for parameters like spacing for third molar tooth and its eruption.

Conclusion: Combined use of parameters like spacing for third molar and its eruption can be quantitatively used for age determination with certain amount of accuracy and precision.

Keywords: *Third molar, spacing, age, BJGMCFMT equation, cumulative score.*

Introduction

Identification means the determination of the individuality of a person.[1] Article 6 of universal declaration of human rights states that everyone has the right to recognition everywhere as a person before the law.[2] One of the factors helping in the complete identity of a person, either living or dead, is Age.[3] The process of deterioration of different systems and morphology of the body occurs with aging of a subject. Resultant changes help us to determine the age of the person. Age of a person in the post-natal life can be estimated from physical or morphological features, laboratory test, teeth eruption, ossification activities and growth of bones.[4]The estimation of age from teeth, with some degree of accuracy from after birth and during developing years by the presence of deciduous dentition and its stages of eruption, the period of mixed dentition, stages of eruption of permanent teeth can only be possible up to 17 to 25 years of age.[5]

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The time of eruption of the third molar tooth or wisdom teeth is more uncertain and it may also be impacted. After the eruption of second molar tooth the body of the jaw grows behind and ramus is elongated to make a room for the appearance of third molar tooth. Hence during the examination of minor for determination of his age a note should always be made as to whether there was space in the jaw behind the second molar teeth, if the third molar were absent.[2] Overall prevalence of third molar impactions in the study population was only 27.4 percent.[6] It mean around 72.6 had normal third molar eruption. This gives hint to use morphological parameters like third molar eruption and spacing for third molar, together, for age determination of an individual. Hence current study was performed on pilot basis to establish any utility of these parameters for age determination.

Material

Current study was done at Department of FMT, BJGMC and SGH Pune after approval of institutional ethics committee. It is a descriptive and observational type of study. The sample population for study was selected after applying following inclusion criteria.

Inclusion Criteria:

1. Individuals giving voluntary consent for oral physical examination.
2. Individuals not having any dental deformity/ abnormality/injury or any of them.
3. Individuals in which second permanent molar tooth is erupted fully, in each socket.

Individuals satisfying criteria of inclusion were further examined and others were excluded from study.

Methodology

After taking consent from each individual, oral examination was done with the help of torch to illuminate posterior and darker portions of oral cavity. Details regarding appearance of retro-molar space and/ or eruption of third molars in each half of maxilla and mandible were noted in master chart. Accordingly a fixed score was given to each parameter. (Table no. 1) Later for each individual a cumulative score was calculated by adding scores for different parameters. Thus, for an individual highest cumulative score was 40 and lowest was zero. The data was then analyzed using Microsoft excel.

Results

Present study was conducted on total 201 participants after applying inclusion criteria, of which 120 were males and 81 were females. (Table 2) Considering both sexes together, majority of participants were from age group of 20 - <21 years (29.85%), followed by 19 - <20 years (25.87%). (Table 2)

To find whether there is any significant difference between means of cumulative scores calculated for each age group, ANOVA test was performed. ANOVA test suggested P value of less than 0.01, meaning highly significant difference between means. Further as ANOVA test yielded significant results, to find correlation between age and cumulative scores, coefficient of correlation and coefficient of determination was calculated using Microsoft Excel, which showed value of coefficient of correlation as 0.98 and coefficient of determination as 0.96 (Table 3). Both these values suggest highly significant positive correlation between age groups and cumulative scores. This means with increase in cumulative score there is an increase in age. Hence regression analysis of the data was done, which yielded regression equation stating linear correlation between parameters under study. Henceforth, the regression equation is named as BJGMCFMT equation and is as follows,

$$y = 0.149 x + 15.57.$$

Where ‘y’ is ‘dependent variable’ i.e. age in years, ‘x’ is ‘independent variable’ i.e. cumulative score and constant of equation (b) is 0.14. It means for every unit rise in ‘x’ (cumulative score), there is 0.149 unit rise in ‘y’ (Age in years).

Table 1: Scoring System

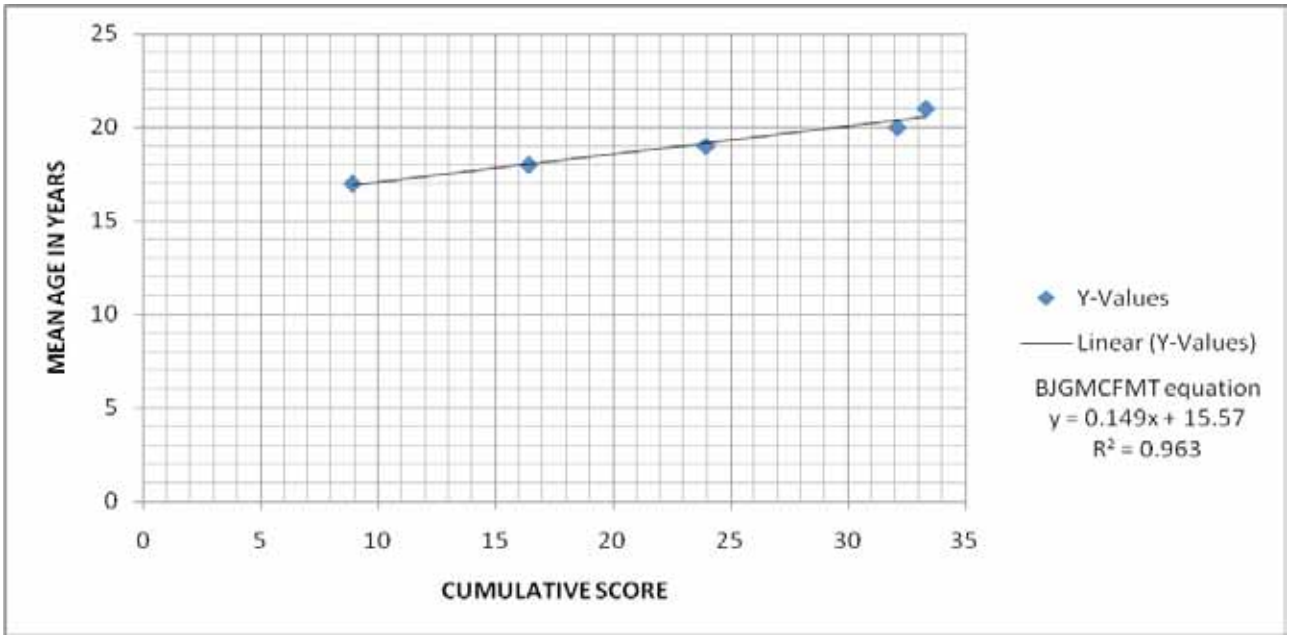
Sr No	Parameter	Cumulative Scoring
01	No spacing/Spacing absent	0
02	Spacing present	2.5
03	Third molar erupting	5
04	Third molar erupted completely	10

Table 2: Age and Sex wise distribution of cases.

Sr No	Age	Male	Female	Total	Percentage (n=201)
01	17 - <18	10	13	23	11.44
02	18 - <19	19	13	32	15.92
03	19 - <20	37	15	52	25.87
04	20 - <21	32	28	60	29.85
05	21 - <22	22	12	34	16.92
	Total	**120**	**81**	**201**	**100**

Table 3: Table of statistical analysis.

Sr. No	Age group (in years)	Total no	Mean + S.D For cumulative score	Coefficient of variation (C. V.)	ANOVA–P	Coefficient of correlation (r)	Coefficient of determination (R^2)
01	17 - <18	23	8.91 +1.47	0.16	<0.01 (Highly Significant)	0.98 (Strong positive correlation)	0.96
02	18 - <19	32	16.4+4.25	0.25			
03	19 - <20	52	23.94+2.54	0.10			
04	20 - <21	60	32.08+6.68	0.21			
05	21 - <22	34	33.3+8.86	0.26			



Graph 1: Regression analysis of mean age in years versus cumulative score.

Discussion

From 14 to 20 years, dental age estimation is based upon, the stage of development of third molar. There is much variation in these, and the accuracy of dental age estimation during this period varies by about, plus/minus three years.[7] In one of the studies it is suggested that the third molar to an extent, is a reliable indicator for age estimation in adolescents and adults.[8]

Considering the prevalence of eruption of third molar, one of the study conducted on population of 180 students between age group of 17 -24 showed that, 3.33 percent of third molar are congenially missing, approximately 94% of subjects had all four third molars, 2.78 percent had three molar, 1.11 percent had two third molar, and 0.5 percent had one third molar with 1.67 % having agenesis of all third molar.[9] This means a large

number of population shows eruption of third molars. It is also known that body of jaw grows posteriorly and ramus is elongated after eruption of second molar teeth.[7]

Thus along with third molar eruption, spacing for third molar is an important morphological feature, for age estimation; especially in places where radiological facilities are not available to comment on impacted third molars. Eruption of third molar is part of dental growth process and it does not occur at same time and pace in each socket. This makes appearance of spacing for third molar an important parameter to look after for age determination. Secondly considering details of spacing for third molar tooth and eruption of third molar tooth in each socket collectively makes it more stringent activity for good amount of precision and accuracy. Hence in present study, a scoring system was devised including parameters like third molar eruption as well as presence of spacing for third molar in each socket.

In research, there are the different method of measuring data to be analyzed. The reason for these is to measure the level of dispersion. Dispersion is the tendency of values of variable to scatter away from the mean or midpoint.[10] It is known fact that large value of standard deviation is an indication that the data points are far from their mean (or far from each other), while a small value indicates that they are clustered closely around their mean.[11] Considering statistical analysis of present study, standard deviations for age groups 17 to <20 years is lower, as compared to that of for 20 to <22 years. (Table 3).

Coefficient of variation, measures the variability of a series of numbers, independently of the unit of measurement, used for these numbers.[12] Higher the coefficient of variation, greater the level of dispersion around the mean. If the value measure one (or 100%), standard deviation equals mean. In present study C.V is less than one for all age groups, which means standard deviation is less than mean; i.e. lesser degree of variability.

Where there is linear relationship between two variables, there is said to be a correlation between them. The strength of that relationship is given by Correlation coefficient (r). Value of r between 0.8 to 1, is said to have very high correlation. R^2 value closer to 1 is also suggestive of higher correlation.[13] In the present study 'r' value is 0.98 and 'R^2' value is 0.96.

Presence of all the four third molars indicate that the subject is over 18 years of age, but their absence gives no certain idea about age.[5] In the present study eruption of all four third molar teeth gives a score of 40, which if incorporated in the BJGMCFMT regression equation, yields age as 21.53 years of age, i.e. more than 18 years.

Considering all these statistical facts, current pilot study can be considered as statistically significant study showing reasonable amount of correlation between parameters under study.

Conclusion

From current study it is concluded that, morphological features like third molar tooth eruption along with spacing for third molar, together can be used for age estimation with the help of statistically formulated regression analysis, with reasonable amount of accuracy and precision.

Limitations of Study:

1. Current study has not commented about any effect of parameters like nutritional status of an individual on cumulative score and age.
2. For scoring of different parameters, only end parameters have been chosen for scoring.
3. Study is conducted on small population size.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Obtained from IEC.

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