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Expert Opinion Article

Evaluation of Dental Age in western UP children using open apices method- A cross sectional study

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Abstract-
Context: forensic odontology has major role in evaluating dental age. Among different methods of age evaluation, Cameriere's technique is most widely used, for dental age estimation in children, which is based on measuring the open apices of teeth with length of developing permanent teeth using orthopantomogram .
Aim of the study: To evaluate dental age of western UP children, aged from (5year- 15years) using Cameriere's open apices method with Indian formula.
Material and methods: Total 1500 OPG's of subjects (aged from 5-15 years) over the period of 2 years, having various orthodontic treatment needs formed the sample for study with predefined inclusion and exclusion criteria. The chronological age (CA) for every case was computed by deducting the DOB from DOR (date of radiograph) using a simple formula in Microsoft Excel. The seven lower left quadrant teeth were evaluated for absolute root formation and closed apical ends (N0) and among the teeth with incomplete root development and open apices width and length of apices, were calculated.
Statistical Analysis: The sample size calculation was done using the 35.5% prevalence of malocclusion among 5-15 years of children with 95% confidence level, 90% power and 5% desired precision. For each individual, the morphological parameters, *xi*, *i* = 1, . . ., 7, *s*, N0, and subjects' gender, were entered in an Excel spreadsheet to use as predictive variables for estimating age in the following statistical analysis.
Results: In current study the regression analysis was carried out to estimate the dental age (dependent variable) based on width and length of apices (independent variable). A high degree of correlation between dependent and independent variables was found. The statistical difference between actual age and estimated age was non-significant (p value 0.121)
Conclusion: The present study, suggests that length and width of open apices are valuable age predictors.

Key words- Cameriere's method, Western UP population, age estimation

Introduction

Assessment of age is a significant endowment of forensic odontology for the recognition of living and deceased humans. Evaluation of dental age is significant where victims and suspects are to be identified in court of law. [1] Age assessment is significant in living individuals in legal matters such as adoption, child marriage, illegal cross-border immigration where subjects fail to provide identification documents.[2] In paediatric population age estimation is required for treatment planning and for orthodontic treatments, which is commonly done using radiographs of hand-wrist bones and teeth. [3] Various factors like hormonal, racial factors, environmental changes, and various diseases which affects the biological age. The age assessment is usually done by complete evaluation of the tissues or organs which are least affected by the damage [4] teeth are most resistant to all type of damage, follows a chronological order for eruption makes them a good age predictor [5] Among various radiographic techniques for determining dental age, most widely used are Demirjian's, Nolla's, and Cameriere's method of age estimation. The Cameriere's method of chronological age estimation was given for Italian children by deriving a linear regression formula. For assessing dental age, radiographic width of open apices and length of the tooth for the first seven mandibular teeth were measured in this method [6-8] lately Rai et al., developed, Indian formula using Cameriere's European formula for the Indian population which failed to yield correct value for western UP population. [9]

As the formula cannot be applied to the Western UP population, the present paper aims to develop a population-specific formula for assessing age in children of the Western UP population based on the method described by Cameriere et al.

Aim & Objectives of the study
To evaluate dental age of western UP children, aged from (5year- 15years) using Cameriere's open apices method. To check the accuracy of Cameriere's method in assessing dental age in the above-mentioned group. To provide regression formula for age evaluation in above mentioned population

Study design
It is a prevalence study which was performed using orthopantomogram of (5-15 years) of children. A total of 1500 randomly selected orthopantomograms from western UP population with age group of 05-15 years formed the sample for the study.
Inclusion criteria: OPGs with all mandibular teeth present
Exclusion criteria: OPG of children with developmental anomalies, image deformity affecting visualization of mandibular canine, with gross pathology pertaining to teeth, premature birth, nutritional and endocrine problems were excluded from the study.

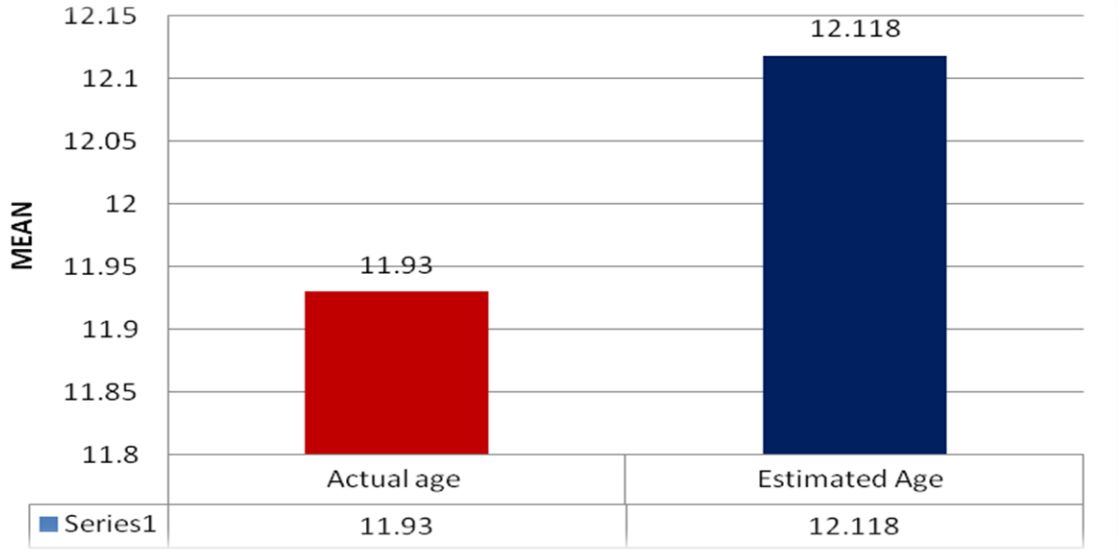
Material and methods:
An excel sheet was formed for entering the demographic details along with the Chronological age which was figured by deducting the date of birth to the time radiograph was taken. Assessment of OPGs was done using ImageJ software.

Statistical analysis-The sample size calculation was done using the 35.5% prevalence of malocclusion among 5-15 years of children with 95% confidence level, 90% power and 5% desired precision. For each individual, the morphological parameters, *xi*, *i* = 1, . . ., 7, *s*, N0, and subjects' gender, will be entered in an Excel spreadsheet to use as predictive variables for estimating age in the following statistical analysis.
Chronological age was figured by deducting the date of birth to the time radiograph was taken. Assessment of OPGs was done using ImageJ software.

Results:

Table 1: Shows statistical difference between actual age and estimated age

	Mean	Std Dev	Std Error	P value	
Actual age	11.930	3.061	0.079	**0.121**	**Non-Significant**
Estimated Age	12.118	1.775	0.045		

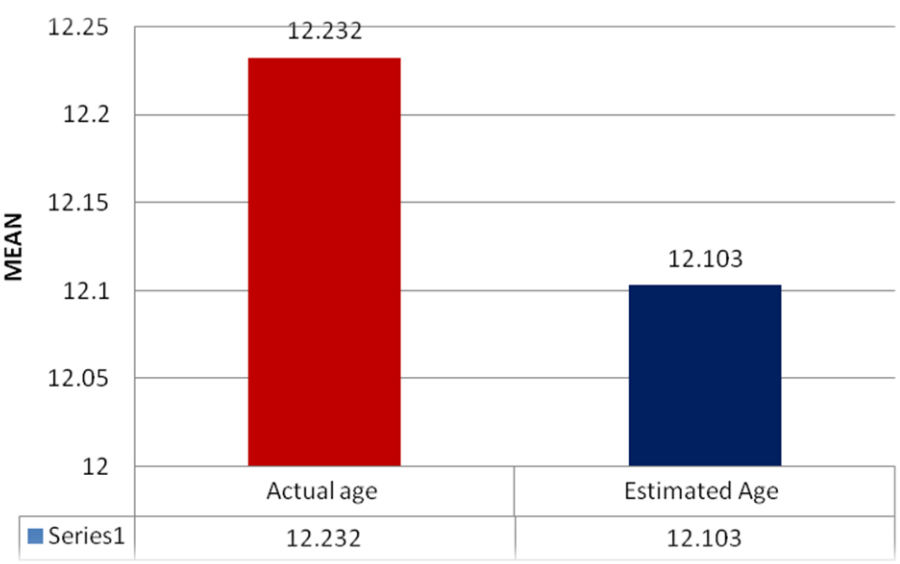


Graph 1 Showing statistical difference between actual age and estimated age

The mean actual age in the study sample was 11.930(sd=3.061) whereas the estimated age on the basis of regression model was 12.118 (sd=1.775). There was a statistically non-significant difference between the actual age and mean age.

Table 2: Shows statistical difference between actual age and estimated age among females

	Mean	Std Dev	Std Error	P value	Significance
Actual age	12.232	3.047	0.100	**0.721**	**Non- Significant**
Estimated Age	12.103	1.688	0.055		

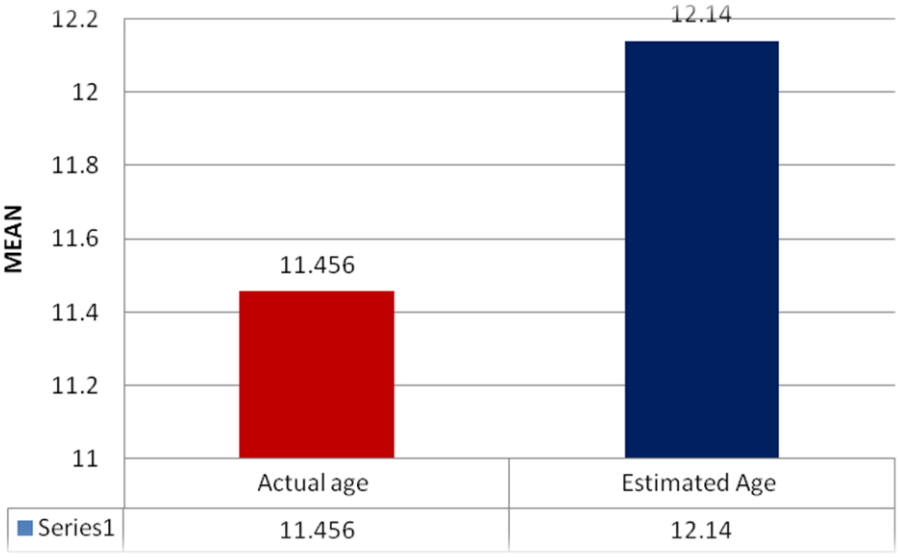


Graph 2: shows statistical difference between actual age and estimated age in females

Results found to be Non- Significant among the females. The mean actual age in the study sample was 12.23 (sd=3.047) whereas the estimated age based on the regression model was 12.103 (sd=1.668).

Table 3: Shows Statistical difference between actual age and estimated age among males

	Mean	Std Dev	Std Error	P value	Significance
Actual age	11.456	3.024	0.125	**0.078**	**Non-Significant**
Estimated Age	12.140	1.906	0.079		



Graph 3 : Shows Statistical difference between actual age and estimated age among males

Among the males the mean actual age in the study sample was 11.456 (sd=3.024) whereas the estimated age based on the regression model was 12.140 (sd=1.906). There was a statistically non-significant correlation.

Table 4: Shows Dental age in Indian population using cameriere's method

	Mean	Std. Deviation	Std. Error Mean
Female	12.103	1.688	0.055
Male	12.140	1.906	0.079
Overall Age	12.118	1.775	0.045

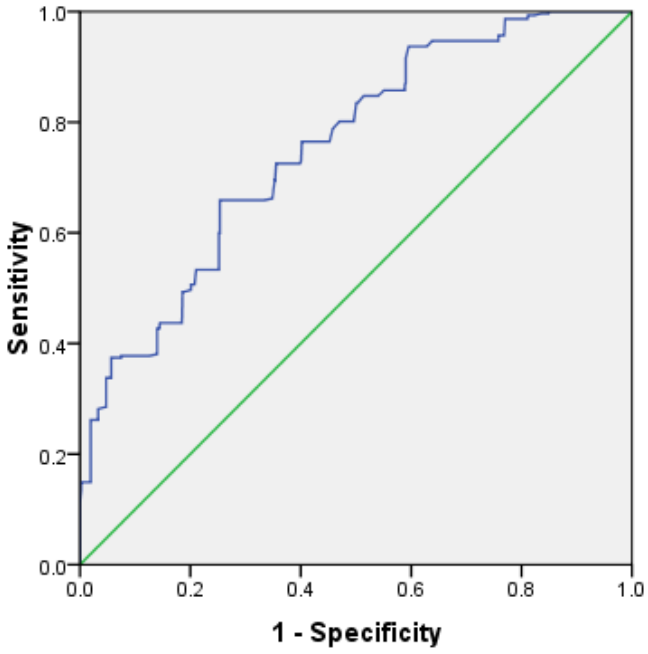
Table 5: Shows inter-observer variability in age estimation

	Mean	**Std Dev**	**Std Error**	**P value**	**Significance**
Observer -1	12.118	1.775	0.045	**0.568**	**Non-Significant**
Observer -2	12.223	1.876	0.036		

The inter-observer variability is non-Significant to the study between Observer-1 and Observer -2.

Hence, the difference between the actual age and estimated age which indicates that simple regression based on length and width of apices can be valuable predictor of the age estimation.

ROC-Curve



Diagonal segments are produced by ties.

AUC for this particular logistic regression model is **0.754**, which is high. This indicates that the model does a good job of predicting age.

Regression analysis

Table 6: Depicts the regression equation can be derived from coefficient tables as under

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.714	.149		58.339	0.001
	Width	-.002	.002	-.063	-1.395	0.016
	Length	.004	.000	.603	13.348	0.001

Estimated Age =8.714-0.002(WIDTH)+0.004 (Length)

Therefore, new regression formula has obtained for western up population i.e., **Estimated Age =8.714-0.002(WIDTH)+0.004 (Length)**

Discussion

Various studies have performed to show significant correlation amidst age and apical opening for the determination of chronological age which can be approvable method for investigation in disaster management. In our present study there is an attempt to get new regression formulae for the western up population to estimate the chronological age which is in accordance to Cameriere R, Ferrante L, Cingolani M (2006)[8]who Conducted a study for assessing the chronological age of 455 Italian white children (213 boys, 242 girls) aged between 5 and 15 years. Pearson's correlation coefficients between age and these variables showed that the correlations between age and the open apices in teeth were significant and negative. Similarily Cameriere R, Ferrante L, Cingolani M (2007) [10]also done a study to give a usual formula useful for dental age estimation for various European countries using Orthopantomography taken from 2,652 European Caucasian children (1,382 boys, 1,270 girls) aged between 4 and 16 years and given a regression model, yielding the following linear regression formula: Age = 8.387 + 0.282 g - 1.692 x 5 + 0.835 N 0 - 0.116 s - 0.139 s x N 0. According to Hostiuc S, Diaconescu I, Rusu MC et al (2021)[11] who evaluated the actual variability of between chronological and dental age using the Cameriere method of open apices and to test its accuracy in variable age groups. And noticed that Cameriere method is useful for estimating the chronological age, with errors of lower than one year which is contradictory to research be seen that regression analysis based on length and width of apices can be valuable predictor of the age estimation. Central Incisor is considered to be more favourable teeth for age estimation, and age estimation for females are more accurate then male which can be variable because of the population considered in the study.

Conclusion

In present study we reached to conclusion that age is independent variable, while length and width measurement of apices are dependent variable to foresee the age of individual and the formula for calculating the age is always different for each population so in present study we got new regression formula for western up population.

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Tables and graph legend:

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Table 2: statistical difference between actual age and estimated age among females
Graph 2: shows statistical difference between actual age and estimated age in females
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Table 5 interobserver variability in age estimation
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