

“Age Assessment In Children By Two Methods, Measuring Tooth Root Apex: A Radiographical Forensic Study”

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Abstract

Background And Objectives: Age estimation in children is a fundamental question in forensic medicine and in treatment planning. It is needed to estimate the age of living individuals to answer a variety of legal questions like status of majority and criminal liability such as in child marriage, commercial and sexual harassment, in situations where birth data is lacking or doubted. Various methods have been proposed for assessment of the dental maturation, but the most widely applied method of dental age estimation is being proposed by Demirijian et al. In 2006, Cameriere also developed a new method of assessing chronological age in children based on the relationship between age and measurement of open apices in tooth roots. With this background, the present study was conducted to estimate the dental age of the children from open and closed apex.

Methodology: 99 digital panoramic radiograph of patients aged between 5 and 15 years were taken randomly using digital panoramic machine after taking consent of patient's parents. Dental age estimation was performed using maturity score and equations by Demirijians and Cameriere method. The number of teeth with complete root development, i.e., apical ends of the roots completely closed (NO), were counted. Teeth with incomplete root development, i.e., with open apices, were also examined and the distance between the inner sides of the open apex was measured.

Results & Conclusion: Both the methods were found to be statistically significant with p-value <0.001. Both the methods can be used for age estimation. In Demirijian's method, the accuracy was found more comparative Cameriere's method. The maximum accuracy was seen in 11-12 years of age in Demirijian's method where as in Cameriere's method the accuracy was almost same in all the age groups and the precision was seen in males than in females, on comparison, the great accuracy was found in Cameriere's age estimation method when compared to the Demirijian's method. Dental maturity can be used to assess chronological age in children either by Demirijian's or Cameriere's method, among these Demirijian's method found to be more accurate.

Keywords : Forensic science, age estimation, open apex, panoramic radiographs

INTRODUCTION

Identification of an individual, living or dead is based on the fact that all individuals are unique. Hence, personal identification has become increasingly important in legal medicine. Physiologic age is based on the growth and maturation of one or more tissue systems and is measured by the occurrence of one or a sequence of irreversible events.¹ The age assessment of living individuals is an area of increasing interest in our community, due to the progressively higher number of persons are not in possession of any document of identity or whose birth certificate may be suspected to be wrong, who have immigrated illegally or committed crimes, whose real age must be known in order to decide whether they can be charged.²

Age estimation of adults may be essential in post-mortem identification, verifying age in immigrants, in refugees with disputed birth records, and in persons of criminal antecedents reluctant to reveal their age. Age estimation in children is a fundamental question in forensic medicine and in treatment planning as it is needed to estimate the age of living individuals to answer a variety of legal questions including status of majority and criminal liability such as in child marriage, commercial and sexual harassment, in situations where birth data is lacking or doubted.³ Several methods have been advocated for age estimation in children. Among all, Skeletal maturity has been considered as the most reliable method but this method has certain drawbacks in view of the considerable variability in bone maturation which is influenced by various environmental factors, so the dental structures are more suitable tools for age estimation in children as the calcification rate is more controlled by their genes than environmental factors.⁴ In many ways the teeth are unique organs of the body, they are the most durable part of the skeleton, these hardest bodily structures are among the reliable tools in the process of age estimation.¹ Various clinical and radiographic methods have been proposed for

dental age estimation. These are based mainly on the stages of tooth development, sequence of eruption and regressive alterations in teeth. Estimating chronological age by means of the dental mineralization stage is not a straightforward analysis, and it is fundamental to ascertain the validity of these methods and their applicability to younger populations.² With the above background it was empirical to estimate age among children using dental maturity on panoramic radiograph.

AIMS & OBJECTIVES: To estimate the dental age and comparison in children using by Cameriere's open apex method and Demirijian's method.

Materials & Method

The present study was conducted in Department of Pedodontics, Sardar Patel Dental College, Lucknow. The study subjects were taken randomly from the Outpatients attending the Department of Pedodontics, Sardar Patel Dental College, Lucknow. 99 panoramic radiographs of patients aged between 5 to 15 years were taken with no agenesis or extraction of teeth in the left mandibular quadrant and panoramic radiographs should be in Good quality.

Patients' identification number, gender, date of birth and date of X-rays were recorded. Their parents had signed agreements with dental institutions that dental records and radiographs could be used only for research and educational purposes, without the possibility of personal identification.

Digital Panoramic dental radiographs were taken of the patient aged between 5-15 years were taken, and the images were recorded on the computer with patient's identification number, sex, date of birth and date of radiograph taken. Both methods perform on all subjects and comparison done. The chronological age were calculated by subtracting the date of radiograph taken from the date of birth

Panoramic images obtained were recorded on computer files, permanent developing mandibular teeth, except third molar, were evaluated. Several authors have shown that there are no significant differences between the right and left sides and that the rate of growth is approximately the same on both sides, so the left side was chosen to maintain the uniformity. The nomenclature to classify the teeth is the two-digit numbering system that proposed by the F.D.I. (Federation Dentaire Internationale).⁵ All recorded data were analyzed by Demirijian's age estimation and Cameriere's method and compare to each other.

Statistical analysis & Results:

Table:-1 Comparison between DEA-CA and CEA-CA

Summary of Data			
	Comparison between DEA-CA and CEA-CA		
	DEA-CA	CEA-CA	Total
N	99	99	198
$\sum X$	1065.3	126.8	1192.1
Mean	10.7606	1.2808	6.021
$\sum X^2$	12579.77	456.6	13036.37
Std.Dev.	3.3753	1.7326	5.4536
The f-ratio value is 618.05607. The p-value is < .00001. The result is significant at p < .05.			

Table 1 showed comparison between demirjian,s age estimated chronological age and Cameriere's estimated age – chronological group has mean value higher in DEA-CA comparative CEA-CA and found p value present <0.05 so obtained value is significant.

Table 2: comparison between DEA and CEA

Summary of Data			
	Comparison between DEA and CEA		
	DEA	CEA	Total
N	99	99	198
$\sum X$	1653.1	714.6	2367.7
Mean	16.698	7.2182	11.958
$\sum X^2$	28413.05	5510.12	33923.17
Std.Dev.	2.8743	1.8952	5.3364
The f-ratio value is 750.57274. The p-value is < .00001. The result is significant at p < .05.			

Table 2 showed mean value higher in DEA method comparative CEA method of age estimation and p value <0.05 found.

Table 3: comparison among Age, DEA, DEA-CA, CEA, and CEA-CA

Comparison among						
	Comparison among all analytical groups					
	Age	DEA	DEA-CA	CEA	CEA-CA	Total
N	99	99	99	99	99	495
$\sum X$	587.8	1653.1	1065.3	714.6	126.8	4147.6
Mean	5.9374(M ₁)	16.698(M ₂)	10.7606(M ₃)	7.2182(M ₄)	1.2808(M ₅)	8.379
$\sum X^2$	3566.1	28413.05	12579.77	5510.12	456.6	50525.64
Std.Dev.	0.8813	2.8743	3.3753	1.8952	1.7326	5.6506
The f-ratio value is 607.05919. The p-value is < .00001. The result is significant at p < .05.						

Table 3 showed mean value of DEA group was higher followed by DEA-CA, CEA, Age and CEA-CA and p value found <.00001 which is < 0.5 so it is highly significant.

Table 4: Comparison among each other on the bases of mean value and showed p value

<i>Comparisons</i>		HSD _{.05} = 0.9047 HSD _{.01} = 1.0815	Q _{.05} = 3.8721 Q _{.01} = 4.6284
AGE:DEA	M ₁ = 5.94 M ₂ = 16.70	10.76	Q = 46.05 (p = .00000)
AGE:DEA-CA	M ₁ = 5.94 M ₃ = 10.76	4.82	Q = 20.64 (p = .00000)
AGE:CEA	M ₁ = 5.94 M ₄ = 7.22	1.28	Q = 5.48 (p = .00114)
AGE:CEA-CA	M ₁ = 5.94 M ₅ = 1.28	4.66	Q = 19.93 (p = .00000)
DEA:DEA-CA	M ₂ = 16.70 M ₃ = 10.76	5.94	Q = 25.41 (p = .00000)
DEA:CEA	M ₂ = 16.70 M ₄ = 7.22	9.48	Q = 40.57 (p = .00000)
DEA:CEA-CA	M ₂ = 16.70 M ₅ = 1.28	15.42	Q = 65.98 (p = .00000)
DEA-CA:CEA	M ₃ = 10.76 M ₄ = 7.22	3.54	Q = 15.16 (p = .00000)
DEA-CA:CEA-CA	M ₃ = 10.76 M ₅ = 1.28	9.48	Q = 40.57 (p = .00000)
CEA:CEA-CA	M ₄ = 7.22 M ₅ = 1.28	5.94	Q = 25.41 (p = .00000)

DISCUSSION & CONCLUSION:

Age is one of the essential factors in establishing the identity of the person. Estimation of the human age is a procedure adopted by anthropologists, archeologists, and forensic scientists.⁶ Age can be estimated in different ways by using chronological age, skeletal age and dental age. Estimation of the age of sub-adult individuals at death is currently based on the synostosis of secondary ossification centers and the development & eruption status of the teeth.⁷ Although several parts of the body can be used for age estimation, the poor condition of the remains often prevent their use, particularly in crashes and fire accidents. In the case of recently dead, the body dampens and burial conditions in elderly subjects may make many parts of the body unusable.

Dental maturity is expressed as dental age which is an indicator for the biological maturity of growing children. Various methods have been proposed for assessment of the dental maturity, but the most widely applied method of dental age estimation is the one proposed by Demirijian et al. In 2006, Cameriere also developed a new method of assessing chronological age in children based on the relationship between age and measurement of open apices in tooth roots.⁸ With this background, the present study was conducted to estimate the dental age of the children from open and closed apex.

In the present study, the maximum accuracy was seen in age group of 11-12 years in males and 9-10 years in females using Demirijian's method which was in accordance with previous studies conducted by Nykamen et al⁹, Mohammad et al.¹⁰ In our study, Demirijian's estimated age is overestimated in younger age which is in contrast with the studies done by Koshi et al¹¹ Nykamen et al⁹, Mohammad et al¹⁰, and Prabhakar et al.¹² The probable reason for difference may be attributed to environmental factors such as socio-economic status, nutrition and dietary habits that may vary in study population.

The difference in chronological age and dental age in our study using Demirijian's method was ± 2 years for the older individuals these findings agree fairly well with other previous studies done by Hagg et al¹⁴ and Davis et al¹³ The overall findings of Demirijian's age estimation in the present study reveal that the dental age was overestimated when compared to chronological age in all the age groups studied, which did not vary significantly with age, although there was a slight tendency towards greater overestimation in younger children which was similar to the studies conducted by Koshi et al,¹¹ Tandon et al, Prabhakar et al, Nykamen et al⁹, Eid et al.¹⁵ Liversidge et al¹⁶ at the belief that the overestimation in dental age in recent findings using Demirijian's method in different populations may be partly explained by a positive secular trend in growth and development during the last 25 years. Nystron et al suggested that difference in overall dental maturity reflects on their dental estimated age which exist not only between the nation, but also between groups of children in a nation with a relatively homogenous population.

The present study conducted by using Cameriere's method is based on seven mandibular left healthy permanent teeth for assessing dental age by measurement of open apices in teeth. Statistical analysis showed a significant correlation with chronological age, morphological variables in correlation with the study done by Cameriere et al³ on Italian population and also with a study done by Rai et al.⁷²

The present study shows that the dental maturity correlates with the chronological age and both the Cameriere's and Demirijian's method can be used for accessing biological age in which Cameriere's method of age estimation was found to

be more accurate when compare to Demirjian's method. Further studies or research should be done aiming at acquiring even more large sample sizes in order to reduce standard errors of estimates and also at investigating the effect of race and culture in the model parameters. The maximum accuracy was seen in in Demirjian's method where as in Cameriere's method the accuracy was not up to the mark in all the age groups and the precision was seen in males than in females, on comparison, the great accuracy was found in Cameriere's age estimation method when compared to the Demirjian's method. The results of this study highlights that the both Demirjian's and Cameriere's methods are useful in the assessment of age in children. Demirjian's method. proved to be more accurate than Cameriere's method Using the larger sample size future research should aim at verifying whether the regional background, gender, chronological age distribution of the sample and statistical procedures represents major factors controlling accuracy and reliability in children dental age assessment.

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