Original Article

Applicability of Demirjian Technique of Age Estimation on Children and Adolescents of Ahmedabad City

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Abstract
Background: Estimation of age is an important requisite in forensic, judicial and criminal proceedings. Although various methods for age estimation do exist, a universal system has not been achieved. Demirjians' radiological method is considered one of the most simple and reliable method for age estimation. **Aim:** To test the applicability of Demirjian's method for dental age estimation in children and adolescents of Ahmedabad city. **Materials and Methods:** The study sample comprised 170 dental panoramic tomographs of 85 boys and girls each. The chronologic age of the study samples ranged from 4 to 16 years. The study sample was categorized in to 12 groups each of 12 months duration. Chronological age was calculated from date of birth. Dental age was calculated from O.P.G. by using Demirjian's method. **Results:** statistically significant positive correlation was found in total male and female sample as well as in combined male and female sample. The mean difference between chronologic age and dental age for total sample as well as for total male sample and total female sample revealed statistically significant differences. **Conclusion:** Age estimation using Demirjian's method was found to be accurate when applied to Ahmedabad population.
Key words: Dental age, Chronological age, Demirjian method

Introduction

Age estimation is an important sub discipline of forensic sciences.[1,2] Estimation of a human corpse's age forms a pertinent part of forensics during the identification process of a cadaver that cannot be identified otherwise due to denaturation of the individual characteristics that would lead to an optical recognition.[3] The methods of age estimation using teeth include analyzing tooth development and eruption, studying tooth degradation and measuring biochemical and trace element changes in dental structures.[3,4] Age of an unknown person can be assessed by correlating the physical, skeletal and dental maturity of an individual. Many radiological methods involving dental maturity as an indicator have been

widely studied.[5-6] This includes age estimations based on measurement of open apices of teeth,pulp-tooth ratio and the staging of tooth development.[7-9] The Tooth Development Stages described by Demirjian and his co-workers is considered the most simple and reliable method as it has the highest values for both intra- and inter- observer agreement.[10] Demirjian et al. formulated the method of dental age assessment by reference to the radiological appearances of the seven teeth on the left side of the mandible.[11] The present study aims to test the applicability of Demirjian's method for dental age estimation in children and adolescents of Ahmedabad city.

Materials and Methods

The study sample comprised 170 dental panoramic tomographs of 85 boys and girls each. The chronologic age of the study samples ranged from 4 to 16 years. The study sample was categorized in to 12 groups each of 12 months duration. Chronological age was calculated from date of birth. Dental age was calculated from O.P.G. by using Demirjian's method. The state of calcification of 7 left permanent mandibular teeth was seen and dental age was calculated according to Demirjian's method and recorded on the Performa. The staging system recognizes eight stages starting from initial calcification to root completion. Tooth development was divided into eight stages and criteria for the stages were given for each tooth separately. Each stage of the seven teeth were given the scores according to a statistical model, which was used for assessement of skeletal maturity.[11] The sum of the scores of the seven teeth were converted into dental age according to the reference values given by Demijran.[11]

Results

T-test was applied and results were tabulated and evaluated statistically by using statistical package for the social sciences (SPSS). Statistically significant positive correlation was found in total male and female sample with a correlation coefficient of .996 ($p < 0.01$) and 0.995 ($p < 0.01$) respectively (Table 1). Furthermore, stastically significant positive correlation was also observed in male and female combined sample with correlation coefficient of 0.929 ($p < 0.01$) (Table 2). The mean difference between chronologic age and dental age for total sample as well as for total male sample and total female sample revealed statistically significant differences (Table 3, Table 4).

Discussion

Estimation of age is an important requisite in forensic, judicial and criminal proceedings. Although various methods for age estimation do exist, a universal system has not been achieved.[12] Dental age can be estimated from a dataset that has been prepared from a similar or a different population group. Demirjian and his co-workers proposed dental maturity scores from a French-Canadian population and this has served as a reference dataset for evaluation of age for various population groups.[11] Hagg and Matsson compared the reliability of three different methods for the assessment of dental maturity and concluded that the method described by Demirjian and Goldstein affords a high degree of reliability and precision.chaudhary.[13] The present study aimed to test the applicability of Demirjian's method for dental age estimation in children and adolescents of Ahmedabad city.

Tooth formation is superior to tooth emergence in age determination because

emergence is a fleeting event disturbed by different exogenous factors, such as infection or premature extraction, crowding, ankylosis and determination of precise time in emergence is very difficult. It can only be applied up to the age of 30 months (completion of the deciduous dentition) and after the age of 6 years (eruption of the first molar) till approximately 12 years of age (last permanent tooth emergence), excluding third molars. Whereas calcification in developing tooth is a continuous process which can be assessed by using radiographic study as a permanent record.[12],[14] Demirjian system utilizes panoramic radiographic technique as it is easier to take than intraoral radiographs in young or nervous children and use less radiation dose than a full mouth radiograph.[12]

In the present study, chronologic age and dental age were correlating and statistically significant (p < 0.001, r = 0.996 in males and r = 0.995 in females). These findings are in agreement with Cheraskin and Hagg et al who found a high correlation level (r = 0.7-0.9) between true and estimated age in children between 3.5 and 6.5 years, regardless of the methods used.[15],[16] Statistically significant correlation between chronological age and dental age assessed by Demirjian method was found in different populations.[12]

Demirjian system utilizes eight stages of development for each of the seven left mandibular teeth, altogether 56 stages of which only the late 26 stages are given separate scores, specific for sex. According to the figures on median age of attainment, 16 out of 26 stages are attained within the younger group of present study (6-9 years), and 12 to 13 stages within the older age group (10-13 years).[9]

Staaf Vera et al studied precision and accuracy of three different methods; Haavikko, Liliequist-Lundberg and Demirjian. The outcome of the study showed that when Demirjian method was applied, age estimated was too high, and it was found that charts made from Scandinavian population gave good precision while one from Canadian population gave consistent overestimate.[12,17] Furthermore as already stated before, Davis and Hagg suggested the accuracy and precision of Demirjian method for estimation of chronological age based on tooth formation in Chinese children of 5 to 7 years of age group. This indicated that Demirjian method cannot be used accurately to estimate chronologic age of 5 to 7 years age group. An explanation to this could be relatively less sample size which cannot be fully comparable to the subjective index in the reference study of French-Canadian population. No two individuals grow and develop at the same rate.[12,13] Nystrom et al emphasized that differences in overall dental maturity do exist not only in group of nations but also amongst the groups of children in a nation with a relatively homogeneous population.[18]

Conclusion
In the light of the findins of the present study it can be conclude that the assessment of dental age, stage of calcification can be reliable indicator as the teeth progressively calcify with the definite age. It is independent of somatic growth and is the least susceptible of these systems to change, both over the centuries and to environmental influences.[12]

Table 1: Comparison of chronologic and dental age for males and females

Gender		Mean	S.D	S.E	Correlation	Sig.
Females	Chronological Age	.181	3.0588	3318	0.996	<.001**
	Dental Age	.404	3.0858	3347		
Males	Chronological Age	.094	2.9959	3194	0.995	<.001**
	Dental Age	.342	3.0364	3237		

Table 2: Difference of means for combined sample

	Paired Differences					t	Df	sig. (2- Tailed)
	Mean	S.D	S.E	95% Confidence Interval Of The Difference				
				Lower	Upper			
Chronological Age	-	0.28	021				17	<.001**
Dental Age	0.235	3		0.277	0.193	11.03	2	

Table 3: Difference Of Means For Males And Females

Gender		Mean	Paired Differences				t	Df	Sig. (2- Tailed)
			S.D	S.E	95% confidence Interval of The difference				
					Lower	pper			
Females	Chronological Age	0.22	0.26 43	0.02 87	0.27 94	0.16 53	7.7 56	84	<.001**
	Dental Age	24							
Males	Chronological Age	0.24	0.29 59	0.03 15	0.31 04	0.18 50	7.8 53	87	<.001**
	Dental Age	'							

Table 4: Comparison Of Chronologic And Dental Age For Combined Sample

	Mean	N	Std. Deviation	Std. Error Mean	Correlation	Sig.
Chronological Age	11.137	170	3.0185	.2295	.996	.000
Dental Age	11.372	170	3.0520	.2320		

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