TECHNICAL NOTE

The evaluation of two radiographic methods for age determination of children in an Indian population

B. Rai

PDM Dental College and Research Institute, Bahadurgarh, Haryana, India

ABSTRACT

The aim of the present study was to evaluate the applicability of the methods proposed by Nolla[7] and Nicodemo[9] for estimation of dental age and its correction with chronological age. Orthopantograms of 413 patients, aged 6-16 year (70-195 months) were selected to estimate the correlation between dental and chronological age. With both the Nolla and Nicodemo methods, the estimated age was lower than compared to chronological age except for the Nolla method in girls. There were significant correlations between chronological and estimated dental age (by Nolla and Nicodemo methods) in both genders.

(J Forensic Odontostomatol 2008;27:2:30-33)

Keywords: orthopantograms, Nolla method, Nicodemo method, dental age, age determination by teeth

INTRODUCTION

Dental development has been shown to be a useful method of age estimation, whose applicability decreases with increasing age.[1] While physical development can be affected by genetic, racial, nutritional, climatic, hormonal and environmental factors,[2-3] it has been reported that dental development is less affected by external factors.[4] Numerous methods have been developed to estimate dental age.[3-8] Variability may mostly relate to ethnic differences, but other factors, such as gender and age, may also play a role. The present study was designed to determine the dental age of children in North India and to correlate this with chronologic age. The use of correction factors was assessed the evaluation of the clinical application of the results obtained.

MATERIALS AND METHODS

I examined 413 orthopantomographs of patients from the Bhagwan Dental Clinic, Jind and Jain Diagnostic Centre, New Delhi (India), 207 males and 206 females between 70-195 months (6 to 16 years) of age. The criteria for inclusion in the sample was the availability of a orthopantomograph of adequate quality, and no history of disease (medical or surgical) that could affect the presence and development of permanent teeth, including third molars. The children were divided into 21, 6-months groups (at least n=24, 12M: 12 F) according to their chronological ages. Together with the radiographic examination, the chronological age was recorded. The analysis of the radiographs was applied when the result of the intra examiner test was considered adequate (by Dahlberg's formula error was less than 0.50 months). Dental age was assessed from orthopantomographs according to the methods proposed by Nolla[7] and Nicodemo.[9] Data were tabulated and subjected to statistical analysis with Student t test using SPSS version 11.0.

RESULTS

Table 1 shows that the mean chronological age for boys was 143.20 months, and for girls was 141.80 months. In both sexes the mean dental age was less than the chronological age in both methods, except with the Nolla method in girls ($p < 0.01$) and the differences were more pronounced in the older groups.

Table 1: *Mean (in months) and standard deviation (SD) of chronological age and estimated dental age using the methods proposed by Nolla and Nicodemo for North Indian boys and girls*

Groups	Age ranges (in months)	Boys (mean±SD)			Girls (mean ± SD)		
		Chronological age	Nicodemo	Nolla	Chronological age	Nicodemo	Nolla
1.	70 – 75	73.40±02.11	71.20±06.30	74.80±08.60	74.30±02.10	81.30±08.34	82.40±12.44
2.	76 – 81	79.20 ± 01.93	78.10±06.82	80.30±09.70	78.90±02.93	83.40±10.89	82.33±20.30
3.	82 – 87	84.50 ± 01.73	83.50±08.83	85.60±15.60	85.60±01.69	92.80±08.87	90.84±21.34
4.	88 – 93	91.10 ± 02.21	89.30±08.85	93.10±07.59	90.20±01.87	87.81±09.53	88.43±19.32
5.	94 – 99	95.50 ± 01.70	93.10±09.32	96.00±08.00	96.60±02.70	91.30±07.69	92.34±17.34
6.	100 – 105	103.10±01.85	101.20±11.30	94.99±03.89	102.80±2.85	112.40±8.90	114.36±18.70
7.	106 – 111	107.90±01.83	103.80±12.40	104.30±06.32	106.70±2.87	109.30±12.35	115.41±21.62
8.	112 – 117	114.00±02.13	107.40±12.80	101.70±08.59	113.80±2.63	109.40±11.62	116.32±21.34
9.	118 – 123	121.51±01.70	116.80±09.62	113.70±12.43	122.61±1.55	103.70±11.53	118.41±20.42
10.	124 – 129	127.80±01.69	120.40±09.69	112.84±11.08	128.20±1.53	110.89±11.63	119.32±09.54
11.	130 – 135	131.91±01.12	127.30±10.30	119.80±12.21	132.92±1.32	119.91±20.13	117.41±08.99
12.	136 – 141	138.10±01.83	133.90±09.80	128.50±11.79	139.20±2.34	121.54±11.93	118.32±09.32
13.	142 – 147	143.90±01.86	140.80±14.60	133.90±16.63	142.80±2.87	134.70±11.89	135.80±09.74
14.	148 – 153	150.50±01.10	145.80±15.50	133.82±21.32	149.40±1.89	137.50±12.87	138.60±11.87
15.	154 – 159	156.20±01.85	150.60±14.70	144.90±26.43	157.10±1.86	139.60±13.89	140.70±12.89
16.	160 – 165	163.20±01.87	160.20±13.80	151.80±12.83	162.30±1.88	142.50±14.39	143.87±13.79
17.	166 – 171	169.20±01.83	162.80±09.82	157.49±15.80	170.30±1.87	150.40±13.49	151.69±14.29
18.	172 – 177	175.30±01.69	171.90±10.80	156.50±12.30	176.40±1.70	164.32±09.77	167.82±09.63
19.	178 – 183	178.30±01.65	173.80±16.83	164.30±18.70	179.40±1.66	170.41±08.32	189.32±10.53
20.	184 – 189	187.40±01.70	182.82±09.92	171.80±19.23	188.50±1.75	176.62±14.32	192.76±11.89
21.	190 – 195	192.30±02.80	190.30±12.30	186.80±28.73	191.21±2.81	184.61±13.31	193.83±10.23
	TOTAL	**143.20±01.89**	**138.40±21.41**	**139.89±29.62**	**141.80±3.29**	**132.49±21.32**	**143.63±21.32**

Table 2 shows the difference between chronological age and dental age for both methods and for male and female subgroups using Student t test and Pearson correlation coefficient, all correlations were at the $p < 0.01$ level of statistical significance.

Table 2: *Statistical correlation between chronological and estimated dental age for both sexes*

	Chronological	Nicodemo	Nolla
Male	1.000	0.821	0.931
Female	1.000	0.923	0.931

p < 0.01 at all levels

DISCUSSION

Age estimation for medico legal (age at death, age of a criminal) and clinical purposes represents an important task for the forensic dental profession. Various methods have been developed for this over the years.[1-8] It has repeatedly been shown that dental development relates more closely to chronological age than skeletal, somatic or sexual maturity.[2] Tooth formation has proved more accurate than tooth eruption for assessing dental maturation because it is a progressive process that can be followed radiographically, and a number of teeth can be evaluated at the examination. There are several methods for estimating dental age, among them, the two methods proposed by Nolla[7] and Nicodemo.[9] I tested these methods because they are easy to use, accurate, and often used by paedodontists. Even if the ethnic factor appears to be most important, individual (genetic), nutritional, climatic, hormonal and environmental factors may have some influence[2,6,7]. Hence, considering regional differences in a big country region like India, establishing specific parameters for each would be important. Most recent studies point out that the individual (genetic) factors are responsible for most of the variability.[7-12] In the present study, the applicability of two methods was tested in the age estimation for a North Indian population. The 70-195 month age range was chosen because most maturity occurs during this period. In the present study, the mean dental age for boys was underestimated by both methods and the differences were larger in the older groups (p < 0.01, Table 1) which is in agreement with a previous study.[10] In girls, the mean dental age was also underestimated with the Nicodemo method, but overestimated with the Nolla method (Table 1, p < 0.01) which is contrary with to a previous study.[10] This may be due to differences in geographical or other unknown factors. It has been reported that the Nolla method overestimated the ages off younger children and underestimated the ages of older children of southeast Brazil.[11] In contrast, Davis and Hagg[12] have shown that dental age is significantly higher than chronological age among children when using the method by Demirijian.[8] Many authors have suggested that the methods of conversion to dental ages must be adjusted for the ethnicity of the individual to be aged.[10,12] Hence, correlation factors must be established to make the methods (Nolla and Nicodemo) applicable to the Indian population.

REFERENCES

1. Kullman L. Accuracy of two dental and one skeletal age estimation Method in Swedish adolescents. Forensic Sci Int 1995;75:225-36.

2. Lewis AB, Garn SM. Relationship between tooth formation and other maturational factors. Angle Orthod 1960;30:70-7.

3. Moorrees CF, Fanning EA, Hunt EE. Age variation of formation stages for ten permanent teeth. J Dent Res 1963; 42:1490-502.

4. Green LJ. The interrelationships among height, weight and choronological, dental and skeletal ages. Angle orthod 1961;31:189-93.

5. Thorson J, Hagg U. The accuracy and precision of the third mandibular molars as an indicator of chronological age. Swed. Dent J. 1991;15:15-22.

6. Kullman L, Johanson G, Akesson L. Root development of the lower third molar and its relation to chronological age. Swed Dent J 1992;16:161-67.

7. Nolla CM. The development of permanent teeth. J Pent child 1960;27:254-66.

8. Demirijian A, Goldstein H, Tanner JM. A new system of dental age assessment. Hum Biol 1973;45: 211-27

9. Nicodemo RA, Moraes LC, Medici FE. Tabela Cronologica da, mineralizacao dos dentes permanentes entre brasileiros. Rev Fac odental Sao Jose Compos 1974;3:55-6.

10. Kurita LM, Menezes AV, Casanova MS, Haiter heto F. Dental maturity as an indicator of chronological age : radio graphic assessment of dental age in a Brazilian population. J Appl oral Sci. 2007;15:99-104.

11. Souza Freitas JA, Tavano O, Alvares LC, Lopes ES. A plicacao Odonto-legal de algumas tabelas cronologicas da evalucao dental. Estomatol cult. 1970;4:181-200.

12. Davis PJ, Hagg U. The accuracy and precision of the "Demirjian System" when used for age determination in Chinese children. Swed Dent J 1994;18:113-6.

Corresponding Address
Dr. Balwant Rai, Vill. Bhangu,
distt. Sirsa,
P.O. Sahuwala (Haryana) INDIA
Mobile +91 - 9812185855
Email: raibalwant29@rediffmail.com