Assessment of dental age in Egyptian children using Demirjian method: Comparison of seven mandibular permanent teeth

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KEYWORDS
Dental Age,
chronological age,
Demirjian Method,
Children,
prediction equation.

ABSTRACT

The purpose of this research was to assess the accuracy of the Demirjian method for determining the chronological age of a sample of Egyptian children from the Delta region using the evaluation of seven permanent mandibular teeth in dental panoramic radiographs, and to create an age prediction formula appropriate for the population under study. In order to determine dental ages; 799 dental panoramic radiographs (DPTs) of children in good physical condition, aged 6 to 17 years were examined using the patient medical documentation who had previously visited Mansoura University Dental Hospital. This study was retrospective cross-sectional. The chronological ages ranged from six to seventeen years old with a mean 12.2 ± 2.7 years for girls and 12.3 ± 2.8 years for boys. Moreover, the mean dental ages were 11.9 ± 2.5 for girls and 12.2 ± 2.7 years for boys. The mean discrepancy between CA and EDA was 0.1004 in boys, and 0.3034 in girls. Girls were overestimated in many age groups (6-7), (7-8), (8-9), (9-10), (10-11) and (11-12) and for male groups (6-7), (7-8), (8-9), (11-12), (12-13), (13-14) were overestimated. A proposed algorithm for estimating dental ages was developed using linear regression. Demirjian's method might not be appropriate for Mansoura city's Egyptian children. An appropriate substitute would be the creation of a prediction equation to convert adjusted dental age into accurate chronological age adjusted for Egyptian children. It is necessary to test the newly created prediction equation on all Egyptian children.

Introduction

Background:

Estimation of age is one of the crucial criteria of identification. It is crucial to find out a dependable and accurate method to estimate age, especially in children (Wahdan et al., 2017).

When compared to other methods, odontology methods were less influenced by variations in nutritional and endocrine status, making them one of the best indicators for estimating the biological age of growing young children (Abu Asab, et al., 2011).

Among the most widely used techniques for determining dental maturation is the Demirjian method. The eight steps of the Demirjian method are A through H; stages A through D represent the crown development from cusp appearance to crown completion, and stages E through H represent the root formation from radicular bifurcation to apical closure (Mardiati et al., 2021). Each stage is given a score, and the sum of these scores is utilized in the dental maturity score

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(MS) calculation. This maturity score can be translated into dental ages (DA) utilizing percentile curves and available standardized tables (Demirjian and Goldstein, 1976).

It is quite different in medico-legal consequences if an individual with unknown age was considered to be below or above certain age. As a result, age needs to be calculated uniquely using variety of factors. Forensic age assessment in unidentified individuals should include left-hand plan radiography and physical dental examination followed by an ortho-pantomogram based on the recommendations of International Interdisciplinary Study Group on Forensic Age Diagnostics (AGFAD) (Schmeling et al., 2008).

The timing of teeth eruption has been reviewed extensively in forensic sciences (Marroquin et al., 2017; Bjørk and Kvaal 2018; Lopes et al., 2018). Teeth are a more reliable, accurate, and socially acceptable way to estimate age before the age of fifteen because at the same time there are multiple teeth at different developmental stages (Marques et al., 2015; Asif et al., 2019).

Previous studies reported the estimation of dental age in Egyptians individuals by different methods (El-Bakary et al., 2010; Zaher et al., 2011; El Morsi et al., 2015; Wahdan et al., 2017; El-Bakary et al., 2019).

One of the most popular radiography techniques is the approach outlined by Demirjian et al., who developed a standard utilizing a large sample consisting of 1446 French Canadian males and 1482 females (Demirjian et al., 1985).

Given that the Demirjian technique only consists of eight stages, its descriptive criteria are thought to be the most specific utilizing root's and crown’s relative lengths (Maber, et al., 2006).

Although the "corresponding" chronological age (CA) may differ, the Demirjian scoring method assumed that dental development was similar across populations (Demirjian et al., 1973). Other studies found discrepancies between DA and chronological ages and explained by the fact that the French-Canadian children of Demirjian were born between 1957 and 1961. A shift in geographical growth over the past 25 to 30 years could be one reason for the discrepancies (Agurto et al., 2009). Because of this, the approaches that developed a few years ago are no longer strictly appropriate due to developmental differences. Therefore, each population may require its own standard or conversion table, as there may be variations in dental maturity among different populations.

Considering these crucial concerns and the requirement for precisely ascertain these ages, the current study was done for the assessment of the specificity of the Demirjian approach to identify the ages in a sample of Egyptian children (Delta region), depending on the assessment of seven mandibular permanent teeth in dental panoramic radiographs. Moreover, we aimed to develop an age predictive formula appropriate for the studied groups.

Material and Methods:

The Egyptian children of known age and sex, who visited the departments of oral medicine, periodontology, oral diagnosis, and radiology at the Faculty of Dentistry, Mansoura University, between 2020 and 2022, as well as certain private dental clinics, were the subjects of this cross-sectional retrospective study using their archived dental panoramic radiographs (DPTs). The Mansoura Faculty of Medicine's institutional

research board gave the study approval (code: R.21.10.1499).

Study design:

Only radiographs from Egyptian children (6-17 years) with full permanent mandibular dentition were included in this study. Teeth with any pathology that modifies the tooth's surface area, severely damaged teeth, severe malocclusion, filled teeth, prosthetic crowns, illnesses, or genetic abnormalities that might impact dental and skeletal growth were all considered exclusion criteria, as well as DPT of poor quality that could not be recorded.

Sample size was determined using IBM© SPSS[a] Sample Power© version 3.0.1 (IBM[a] Corp., Armonk, NY, USA). In a sample of Korean juveniles and adolescents, the accuracy mean (in years) of Demirjian's method was 0.300 (SD 0.811), according to a prior study by Lee et al. (2011). A sample size of at least 516 participants is required to demonstrate a 0.1 difference in mean accuracy at significance level of 5% with 80% power.

Method:

Digitalized dental panoramic radiographs were evaluated by Demirjian's method (Demirjian et al., 1973; Demirjian and Goldstein 1976). The date of birth (DOB), medical history, and radiograph date (DOR) of the child were obtained by asking their parent(s) or caregiver.

For each child, staging for each tooth was given according to Demirjian's staging and maturity score (MS) was calculated from the sum of the score of the seven left lower mandibular teeth. Subsequently, this MS translated to estimated dental age (EDA) according to Demirjian's maturity scores standardized tables' method. The children's chronological ages (CA), expressed as years to two decimal places, were determined by subtracting their DOB from their DOR. A paired t-test was used to compare the children's EDAs and CAs. When a lower left tooth was lost or had trouble being read, the tooth on the opposite side was evaluated. The data was processed and stored in a Microsoft Excel 2010 database.

Statistical analysis

Version 27 of the Statistical Package of Social Science (SPSS) was used to code, summarize, and analyze the data. The paired sample t test used to analyze quantitative data, which expressed as mean ± SD, among Egyptian children, both male and female. A 5% threshold for significance was used. To predict the estimation of chronological age based on dental age, linear regression was employed.

Moreover, Bland-Altman plot was illustrated to indicate how closely the chronological and dental ages agree (test of normality). Limit of agreement range was calculated as mean ± 1.96. Probability (p) for each test was classified as follows: significant if <0.05, highly significant if <0.01, very highly significant if < 0.001, and non-significant if ≥ 0.05.

Results

Out of the 850 DPTs that were collected, only 810 met the requirements for this study's collection criteria. Moreover, eleven DPTs were eliminated after the selected DPTs were interpreted since their radiographic assessments showed DAs less

than six years old, as it is outside the scope of our study. As a result, the study included 799 DPTs, as shown in table 1.

799 ortho-pantomographs with known ages and sexes participated in the current study (461 girls and 338 boys) (Table 1). Twelve age levels were created by further subdividing the primary age groups based on the child's age (Table 2). Their chronological age ranged between 6 and 17 years, with a mean of 12.2 ± 2.7 years for girls and 12.3 ± 2.8 years for boys. Moreover, the mean dental ages were 11.9 ± 2.5 and 12.2 ± 2.7 years for girls and boys, respectively (Table 1). For boys, the mean variation between CA and EDA was 0.1004, whereas for girls it was 0.3034. Girls were overestimated in many age groups (6-<7), (7-<8), (8-<9), (9-<10), (10-<11) and (11-<12) years and for male groups (6-<7), (7-<8), (8-<9), (11-<12), (12-<13), (13-<14) years were overestimated (Table 2).

Table (1): Statistical analysis between dental age and chronological age (years) between female and male Egyptian children.

Sex	Chronological age Mean ± SD	Dental age Mean ± SD	Mean difference	t value, p-value
Girls (n=461)	12.2 ± 2.7 y	11.9 ± 2.5 y	0.3034	t= 6.444, p <0.001*
Boys (n=338)	12.3 ± 2.8 y	12.2 ± 2.7 y	0.1004	t= 1.839, p = 0.067

n: number, SD: Standard Deviation

The DA and CA's correlation:

A correlation analysis using linear regression was done to investigate the relationship between the CA and the DA. The two measures had a strong positive correlation, as evidenced by the scatter plot graph and the male and female beta regression coefficients of 0.960 and 1.03, respectively (Fig. 1, 2).

The R2 values were 0.865 and 0.868, meaning that 86.5 and 86.8% of difference in CA for females and males, respectively, were clarified by the scatter diagram which revealed a linear correlation with a 95% confidence interval between the dental age and chronological age of Egyptian children (Fig.1, 2).

Estimating the discrepancies between EDAs and CAs:

Bland-Altman plotted the discrepancies between the CAs and the EDAs (CA− EDA) against the (CAs+DA)/2. Children whose EDAs were near to their CAs are represented by the smallest values that are close to zero (~0). In the case of the female group, children whose EDAs are underestimated (-1.7 years maximum) are represented by values below zero, and children whose EDAs are overestimated (2.05 years maximum) by values above zero (Fig. 3). It was discovered that the EDA overestimated age in a number of age groups, with a mean variation between the studied females' CA and CA of 0.3034 (p <0.001) years (Tables1& 2).

Comparable values were found for the male group, whose EDAs were overestimated as well (2.1 years maximum); children whose EDAs were underestimated (-1.09 years maximum) are indicated by values below zero (Fig. 4). The EDA was found to overestimate the ages of the males in many cases, with a

mean variation from the CA of 0.1004 (p=0.067) years (Table1, 2).

Moreover, limit of agreements indicated that there was poor agreement among dental and chronological age. This meant that the dental age couldn't be used as a substitute for chronological age.

Demirjian's method Applicability:

Statistically significant differences were observed when the examined female age groups (14-<15), (15-<16) and (16-<17) were subjected to Demirjian's method for DA assessment and for the male age groups (15-<16), (16-<17) and (17-<18) (Table 2). This indicates that the Demirjian method's criteria were not appropriate for Egyptian children. For accurate CA evaluation from DA, a prediction formula was created. The equations that are specific to a given gender for Egyptian children were formed to give more appropriate CA resolving according to X (x denotes value of dental age) as shown in figures 1 and 2.

Creation of a predictive equation:

The accuracy of EDA was defined as how it is close to the actual CA. Then, using a linear regression line with a 95% confidence interval, the efficiency of the relationship between CA and DA for Egyptian children was determined.

New equations were created for Egyptian children. The function used with 95 % confidence interval curve for the males and females was, respectively, [Y = 0.58 + 0.96 * X] and [Y = 0.03 + 1.03 * X], where the variable "X" represents value of dental age (Figures 1, 2). The result "Y" denotes calculated chronological age. For accurate calculation of CA, "X" was calculated from translation of MS to DA according to Demirjian's maturity scores standardized tables' method. Then, a format was created to encourage and make usage of it easier (Annex 1 and 2).

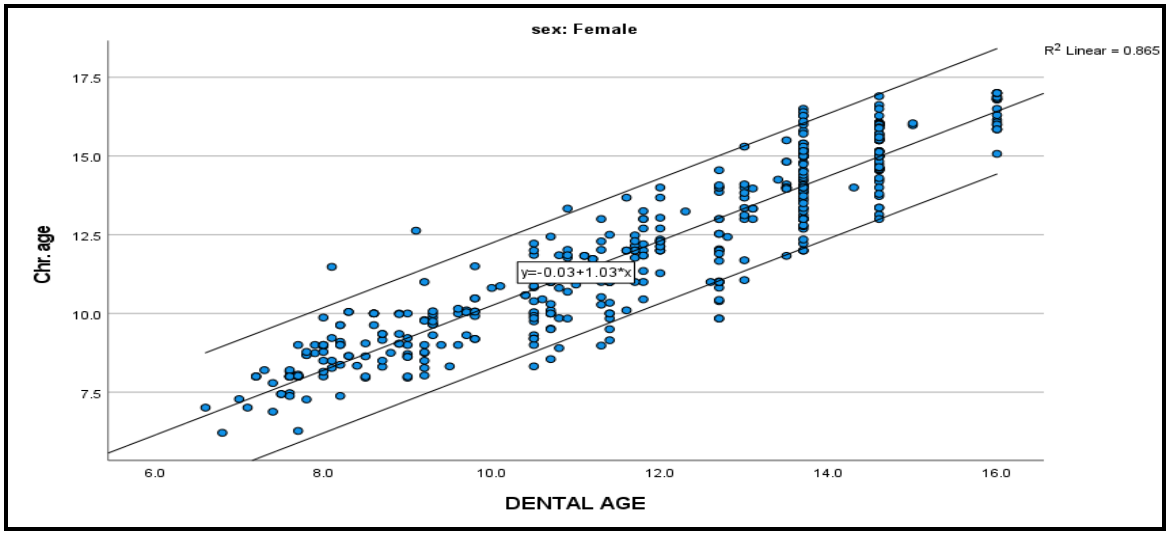

Fig. (1): Scatter diagram showed linear correlation with 95 % confidence interval between chronological age and dental age for female Egyptian children. β (Beta regression coefficients) = 1.03, Constant = 0.03, R2 (coefficient of determination) = 0.865, Model F (ANOVA test) =2952.3, P< 0.001.

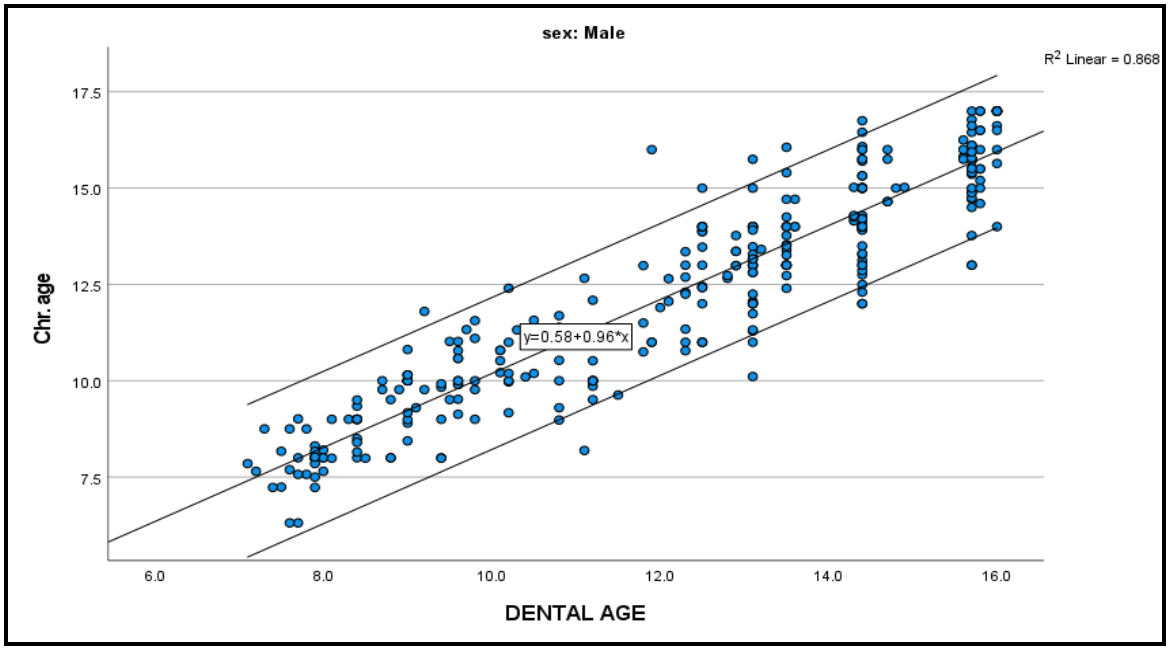

Fig. (2): Scatter diagram showed linear correlation with 95 % confidence interval between chronological age and dental age for male Egyptian children. β (Beta regression coefficients) = 0.960, Constant = 0.58, R^2 (coefficient of determination) = 0.868, Model F (ANOVA test) =2214.4, P< 0.001.

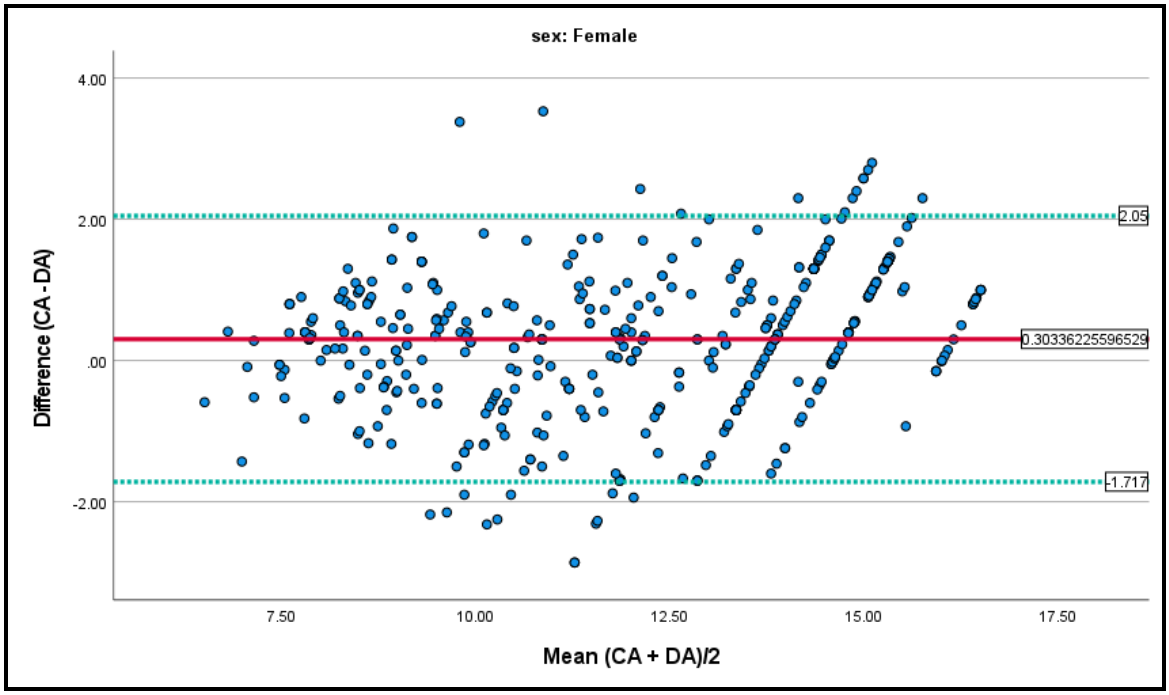

Fig. (3): Bland-Altman plot for chronological age (CA) and dental age (DA) within female Egyptian children.

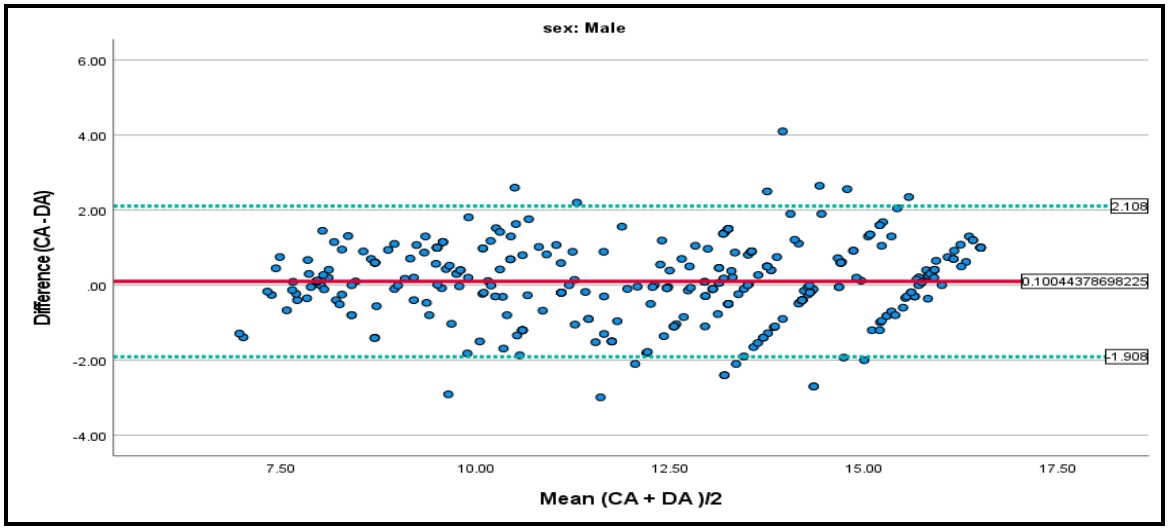

Fig. (4): Bland-Altman plot for chronological age (CA) and estimated dental age (EDA) within male Egyptian children.

Table (2): Bland-Altman limit of agreement among chronological age and estimated dental age across age groups of female and male Egyptian children.

Age groups (years)	n	Chronological age (CA) Mean ± SD	Dental age (EDA) Mean ± SD	Bland-Altman limit of agreement			*p*-value
				Mean difference (CA – EDA)	SD of the difference	Lower limit to Upper limit	
Female							
6-<7	3	6.5 ± 0.4	7.3 ± 0.5	- 0.847	0.5	- 1.847 to 0.153	0.101
7-<8	10	7.3 ± 0.2	7.4 ± 0.4	- 0.083	0.4	- 0.883 to 0.717	0.517
8-<9	53	8.3 ± 0.3	8.3 ± 0.9	- 0.005	0.8	- 1.605 to 1.595	0.961
9-<10	54	9.4 ± 0.3	9.5 ± 1.2	- 0.118	1.1	- 2.318 to 2.082	0.450
10-<11	48	10.3 ± 0.3	10.3 ± 1.1	- 0.007	1.0	- 2.007 to 1.993	0.963
11-<12	42	11.3 ± 0.4	11.5 ± 1.1	- 0.125	1.1	- 2.325 to 2.075	0.483
12-<13	44	12.2 ± 0.3	12.1 ± 1.0	0.123	1.0	-1.877 to 2.123	0.430
13-<14	50	13.3 ± 0.3	13.3 ± 0.9	0.023	0.9	- 1.777 to 1.823	0.860
14-<15	49	14.3 ± 0.3	13.8 ± 0.7	0.493	0.6	- 0.707 to 1.693	< 0.001
15-<16	63	15.3 ± 0.3	14.3 ± 0.6	1.037	0.6	- 0.163 to 2.237	< 0.001
16-<17	41	16.2 ± 0.3	14.9 ± 0.8	1.350	0.7	- 0.05 to 2.75	< 0.001
17-<18	4	17.0 ± 0.0	16.0 ± 0.0	1.000	0.0	1 to 1	NA
Male							
6-<7	2	6.3 ± 0.0	7.7 ± 0.1	- 1.340	0.1	- 1.54 to – 1.14	0.024
7-<8	11	7.5 ± 0.2	7.6 ± 0.3	- 0.088	0.4	- 0.888 to 0.712	0.480
8-<9	31	8.2 ± 0.3	8.3 ± 0.7	- 0.094	0.8	- 1.694 to 1.506	0.522
9-<10	33	9.4 ± 0.4	9.3 ± 1.0	0.063	0.9	-1.737 to 1.863	0.692
10-<11	36	10.2 ± 0.3	10.2 ± 1.1	0.090	1.1	-2.11 to 2.29	0.613
11-<12	36	11.2 ± 0.3	11.3 ± 1.1	- 0.062	1.2	- 2.462 to 2.338	0.751
12-<13	29	12.4 ± 0.3	12.9 ± 1.1	-0.519	1.1	- 2.719 to 1.681	0.016
13-<14	43	13.3 ± 0.3	13.5 ± 0.9	- 0.142	1.0	- 2.142 to 1.858	0.346
14-<15	42	14.2 ± 0.3	14.1 ± 1.0	0.082	0.8	- 1.518 to 1.682	0.530
15-<16	38	15.4 ± 0.3	14.9 ± 0.9	0.475	0.8	-1.125 to 2.075	0.001
16-<17	27	16.2 ± 0.3	15.2 ± 0.9	0.978	0.9	- 0.822 to 2.778	<0.001
17-<18	10	17.0 ± 0.0	15.9 ± 0.1	1.070	0.1	0.87 to 1.27	<0.001

Highly significant if <0.01; Very highly significant if <0.001; Non-significant if ≥0.05 and Significant if <0.05

Discussion:

We suggested the current study to examine the Demirjian method's accuracy for age identification in a sample of Egyptian children (Delta area) because to the necessity for population-specific dental development standers in order to conduct accurate DA analyses, particularly in forensic medicine.

The overestimation of age when compared to other populations was the main outcome of the Demirjian method (Chaillet et al., 2004; Hegde and Sood 2002), and this come in accordance with our results, which showed that the majority of age groups were significantly overestimated.

The present results reported an overestimation of the difference between the CAs and EDAs (0.303 years) in female group. Similar results were reported for female residents of Tanta and Minia, Egypt (0.325, 0.294 years) (Azzawi et al., 2016; Moness Ali et al., 2019), Saudi Arabia (0.4 years) (Al-Emran, 2008) and Norway (0.3 years) (Nykanen et al., 1998). This consistency is probably due to the fact that, Egyptians share many of the same geographic traits with these populations (El-Bakary et al., 2010).

In male group, a difference between the CAs and EDAs was found (0.1004 years) and this result is in agreement with studies reported for children in Iran (0.34 years) (Mohammed et al., 2015), in Serbia (0.45 years) (Djukic et al., 2013), in Netherland (0.4 years) (Leurs et al., 2005), in France (0.47 years) (Urzel and Bruzek, 2013) and in southern Turkia (0.52 years) (Gungor et al., 2015).

On the other hand, observations were reported differently for girls and boys in Kuwait (girls: 0.67 years and boys: 0.71 years) (Qudeimat and Behbehani, 2009), in Tunisia (girls: (0.26 - 1.37 year) and (boys: 0.3 - 1.32 year) (Aissaoui et al, 2016), and in South India (girls: 2.82 years and boys: 3.04 years) (Koshy and Tandon, 1998). The variations in sample size, age categories, and populations analyzed could account for the differences that exist in age estimates between our research and these previous investigations.

Based on the mean differences between CAs and EDAs, which were 0.3034 and 0.1004 years for females and males, respectively, the current results showed that dental growth and development were more advanced in the examined females than in the investigated males. Furthermore, a notable distinction was documented in the groups of females. These are consistent with certain research that found that women's EDA accelerates more quickly than men's (Aissaoui et al., 2016; Mohammed et al., 2015; Azzawi et al., 2016). On the other hand, Duangto et al. (2016) concluded that EDA in men may be higher than the EDA in women.

Our analysis demonstrated that the age groups under investigation differed significantly from one another as well as the lack of any particular trend. Consequently, we found that the CA in the sample under analysis not accurately estimated by Demirjian's initial standards, and that the EDA overestimated the CA as a whole when Demirjian's technique used on various demographics populations.

As suggested by other studies (Davidson and Rodd, 2001; Agurto et al., 2009; Moness Ali et al., 2019), the results of our study demonstrated the necessity of dental development standards specific to Egyptian population in order to accurately assess DA. Additionally, a number of studies with larger sample sizes suggested developing a racial specific equation in order to prevent the overestimation that results from applying Demirjian's method (Nour El Deen et al.,

2016; Aissaoui et al., 2016; Saade et al., 2017).

To establish a mathematical formula that gives the maximum relationship between the real CA and the EDA we used a linear regression analysis; a widely used and more accessible modelling method (Lee et al., 2008).

The proposed new equations created for Egyptian children were: [Y = 0.58 + 0.96 * X] for boys and [Y = 0.03 + 1.03 * X] for girls. Where; the variable "X" represents value of dental age, the result "Y" denotes calculated chronological age.

The fact that our sample only included residents of Mansoura city meant that it might not be representative of all Egyptians, which was a limitation on the present research. Therefore, before being applied to the entire Egyptian population, the established prediction equation needs to be modified.

Conclusions

Demirjian's method may be unsuitable for Egyptian children living in Mansoura city. To convert the maturity score and the dental age to accurate chronological age suitable for estimation of Egyptian children ages, a prediction equation could be appropriate substitutes. All Egyptian children should be used to assess the newly created prediction equation's validity.

Acknowledgments

Amal A. El-Bakary and Eman Abdelrazik examined panoramic radiographs, collect data and interpreted the results. Nada M. El-Hadidy established the statistical analysis and prediction equation. All the authors wrote, revised the manuscript, and approved the submitted manuscript. Authors funded the research completely.

Conflict of interest:

Authors confirm that there are no declarations of interest. **Amal A. El-Bakary** is one of the coauthors and the managing editor of the Mansoura Journal of Forensic Medicine & Clinical Toxicology journal. She declares that she did not review the paper nor was included in the team handling the paper till acceptance by independent reviewers who were blind about the authors of the paper.

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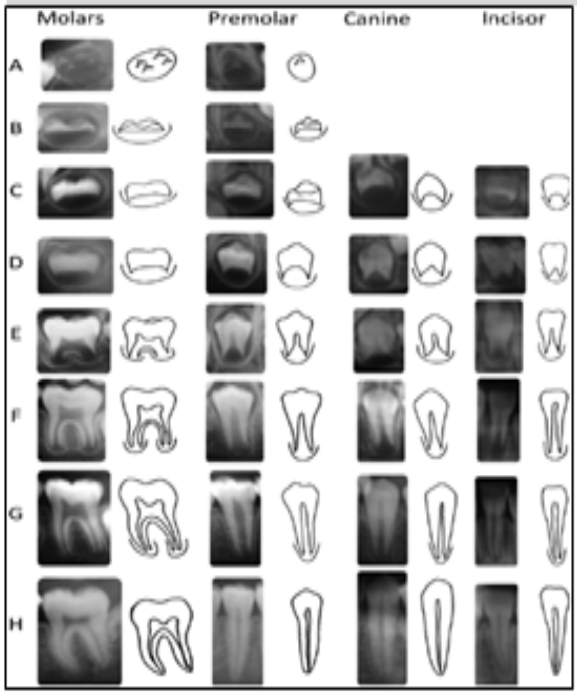
Calculated chronological age for male Egyptian children



Conversion of Maturity Score to Dental Age (7 Teeth)

Age	Score	Age	Score	Age	Score	Age	Score
			Boys				
3.0	12.4	7.0	46.7	11.0	92.0	15.0	97.6
.1	12.9	.1	48.3	.1	92.2	.1	97.7
.2	13.5	.2	50.0	.2	92.5	.2	97.8
.3	14.0	.3	52.0	.3	92.7	.3	97.8
.4	14.5	.4	54.3	.4	92.9	.4	97.9
.5	15.0	.5	56.8	.5	93.1	.5	98.0
.6	15.6	.6	59.6	.6	93.3	.6	98.1
.7	16.2	.7	62.5	.7	93.5	.7	98.2
.8	17.0	.8	66.0	.8	93.7	.8	98.2
.9	17.6	.9	69.0	.9	93.9	.9	98.3
4.0	18.2	8.0	71.6	12.0	94.0	16.0	98.4
.1	18.9	.1	73.5	.1	94.2		
.2	19.7	.2	75.1	.2	94.4		
.3	20.4	.3	76.4	.3	94.5		
.4	21.0	.4	77.7	.4	94.6		
.5	21.7	.5	79.0	.5	94.8		
.6	22.4	.6	80.2	.6	95.0		
.7	23.1	.7	81.2	.7	95.1		
.8	23.8	.8	82.0	.8	95.2		
.9	24.6	.9	82.8	.9	95.4		
5.0	25.4	9.0	83.6	13.0	95.6		
.1	26.2	.1	84.3	.1	95.7		
.2	27.0	.2	85.0	.2	95.8		
.3	27.8	.3	85.6	.3	95.9		
.4	28.6	.4	86.2	.4	96.0		
.5	29.5	.5	86.7	.5	96.1		
.6	30.3	.6	87.2	.6	96.2		
.7	31.1	.7	87.7	.7	96.3		
.8	31.8	.8	88.2	.8	96.4		
.9	32.6	.9	88.6	.9	96.5		
6.0	33.6	10.0	89.0	14.0	96.6		
.1	34.7	.1	89.3	.1	96.7		
.2	35.8	.2	89.7	.2	96.8		
.3	36.9	.3	90.0	.3	96.9		
.4	38.0	.4	90.3	.4	97.0		
.5	39.2	.5	90.6	.5	97.1		
.6	40.6	.6	91.0	.6	97.2		
.7	42.0	.7	91.3	.7	97.3		
.8	43.6	.8	91.6	.8	97.4		
.9	45.1	.9	91.8	.9	97.5		

Self-Weighted Scores for Dental Stages 7 Teeth (Mandibular Left Side)

	Boys							
	Stage							
Tooth	0	A	B	C	D	E	F	G	H
M_2	0.0	2.1	3.5	5.9	10.1	12.5	13.2	13.6	15.4
M_1				0.0	8.0	9.6	12.3	17.0	19.3
PM_2	0.0	1.7	3.1	5.4	9.7	12.0	12.8	13.2	14.4
PM_1			0.0	3.4	7.0	11.0	12.3	12.7	13.5
C				0.0	3.5	7.9	10.0	11.0	11.9
I_2				0.0	3.2	5.2	7.8	11.7	13.7
I_1					0.0	1.9	4.1	8.2	11.8

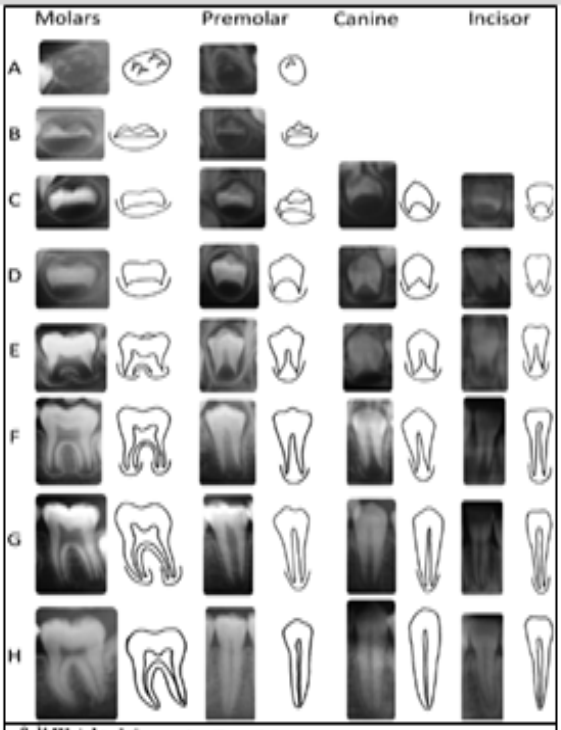
MS= SCORE I_1+I_2+C+PM_1+PM_2+M_1+M_2

Chronological age for male

Y = 0.58 + 0.96 * X

(X denotes value of dental age)

Calculated chronological age for female Egyptian children



Self-Weighted Scores for Dental Stages 7 Teeth (Mandibular Left Side)

Girls

Tooth	Stage 0	A	B	C	D	E	F	G	H
M_2	0.0	2.7	3.9	6.9	11.1	13.5	14.2	14.5	15.6
M_1				0.0	4.5	6.2	9.0	14.0	16.2
PM_2	0.0	1.8	3.4	6.5	10.6	12.7	13.5	13.8	14.6
PM_1			0.0	3.7	7.5	11.8	13.1	13.4	14.1
C				0.0	3.8	7.3	10.3	11.6	12.4
I_2				0.0	3.2	5.6	8.0	12.2	14.2
I_1					0.0	2.4	5.1	9.3	12.9

NB: Stage 0 is no calcification

MS= SCORE I_1+I_2+C+PM_1+PM_2+M_1+M_2

Conversion of Maturity Score to Dental Age 7 Teeth (Mandibular Left Side)

Age	Score	Age	Score	Age	Score	Age	Score
			Girls				
3.0	13.7	7.0	51.0	11.0	94.5	15.0	99.2
.1	14.4	.1	52.9	.1	94.7	.1	99.3
.2	15.1	.2	55.5	.2	94.9	.2	99.4
.3	15.8	.3	57.8	.3	95.1	.3	99.4
.4	16.6	.4	61.0	.4	95.3	.4	99.5
.5	17.3	.5	65.0	.5	95.4	.5	99.6
.6	18.0	.6	68.0	.6	95.6	.6	99.6
.7	18.8	.7	71.8	.7	95.8	.7	99.7
.8	19.5	.8	75.0	.8	96.0	.8	99.8
.9	20.3	.9	77.0	.9	96.2	.9	99.9
4.0	21.0	8.0	78.8	12.0	96.3	16.0	100.0
.1	21.8	.1	80.2	.1	96.4		
.2	22.5	.2	81.2	.2	96.5		
.3	23.2	.3	82.2	.3	96.6		
.4	24.0	.4	83.1	.4	96.7		
.5	24.8	.5	84.0	.5	96.8		
.6	25.6	.6	84.8	.6	96.9		
.7	26.4	.7	85.3	.7	97.0		
.8	27.2	.8	86.1	.8	97.1		
.9	28.0	.9	86.7	.9	97.2		
5.0	28.9	9.0	87.2	13.0	97.3		
.1	29.7	.1	87.8	.1	97.4		
.2	30.5	.2	88.3	.2	97.5		
.3	31.3	.3	88.8	.3	97.6		
.4	32.1	.4	89.3	.4	97.7		
.5	33.0	.5	89.8	.5	97.8		
.6	34.0	.6	90.2	.6	98.0		
.7	35.0	.7	90.7	.7	98.1		
.8	36.0	.8	91.1	.8	98.2		
.9	37.0	.9	91.4	.9	98.3		
6.0	38.0	10.0	91.8	14.0	98.3		
.1	39.1	.1	92.1	.1	98.4		
.2	40.2	.2	92.3	.2	98.5		
.3	41.3	.3	92.6	.3	98.6		
.4	42.5	.4	92.9	.4	98.7		
.5	43.9	.5	93.2	.5	98.8		
.6	45.2	.6	93.5	.6	98.9		
.7	46.7	.7	93.7	.7	99.0		
.8	48.0	.8	94.0	.8	99.1		
.9	49.5	.9	94.2	.9	99.1		

Chronological age for female

$$Y = 0.03 + 1.03 * X$$

(X denotes value of dental age)