ORIGINAL ARTICLE

DENTAL AGE ASSESSMENT OF PAKISTANI CHILDREN USING DEMIRIJIAN METHOD

[1]MUHAMMAD ISHAQUE, [2]ARSLAN ALI VISTRO, [3]SHAZIA PARVEEN RAJPAR, [4]PRIYA, [5]SADIA RIZWAN, [6]TASKEEN KHAN

ABSTRACT

The study was done to evaluate the accuracy of Demirijian Method when used for age determination in Pakistani children

A retrospective study was carried out at the department of orthodontics. Forty patients of 8.5-17 years of age having normal morphology of teeth and willing to participate were included in the study and patients with missing teeth (extracted or naturally missing) or having any medical disorder were excluded. The mandibular left quadrant excluding 3rd molars was assessed. Central incisor to second premolar teeth were examined in OPG and a separate score was given to each tooth according to the stage of its development seen from the available tables

The mean dental age ± SD evaluated by using Demirjian's method for the boys was 11.97± 2.38(8.5 to 16 years) whereas for the girls was 12.78 ± 2.64 (9 to 17 years).Dental age measured using Demirjian's technique for the female subjects was significantly over-estimated in the 9 year and 13–17 year age groups.

It was concluded from the results of this study that Demirijian Method resulted in over-estimation of age when compared to chronological age of the subjects.

Key words: *Dental age, Demirijian method, Eruption of teeth, Chronological age*

This article may be cited as: Ishaque M, Vistro AA, Rajpar SP, Priya, Rizwan S, Khan T. Dental age assessment of Pakistani children using demirijian method. Pak Oral Dent J 2020; 40(1):14-19.

INTRODUCTION

Physiological age can be defined as a period where a child is moving towards accomplishment of formation or maturity. Dental age is estimated by the calcification and developmental stages of teeth from radiographs. As children of same chronological age may have different growing phases,[1] dental age determination is important for planning treatment and utilization of growth period. Demirijian method is helpful in Maxillofacial surgery, Endodontics, Pedodontics as well as Orthodontics. In Orthodontics this method is helpful in treatment planning, as growth modification can be carried out if the dental age shows growing phase of the patient. It is also useful in Forensic medicine and legal cases especially when boys under the age of eighteen are to be jailed in prisons as placing them in adult prisons would be highly unsuitable for them.[2] Due to advance in technology, predicting the age of an individual has become relatively easy from nearly 15 years, which mainly focus on criminal and civilian cases of those individuals who lack valid documents or hide their true age.

We can estimate the stage of maturity of an individual by several methods such as dental examination, serial cephalomatric radiographs, hand-wrist X-rays, cervical vertebrae maturity.[3-5] Furthermore, age of a person can also be assessed by skeletal and sexual development indicators, but the most reliable is through dental development because it undergoes less variation

[1] **Correspondence:** Dr Muhammad Ishaque, BDS, MSc. Senior Registar, Department of Orthodontics Dr Ishrat-Ul-Ebad Khan, Institute Of Oral Health Sciences, Dow University Of Health Sciences, Karachi E-mail: ishaquelaghari@gmail.com Cell: 03332664181
[2] BDS, MSc, Senior Registrar, Bibi Aseefa Dental College, Larkana, Sindh, Pakistan
[3] BDS, MSc, Assistant Professor, Department of Community Dentistry, Faculty of Dentistry, Liaquat University of Medical & Health Sciences, jamshoro, Sindh, Pakistan
[4] BDS, MSc, FCPS Trainee, Department of Orthodontics , Dr Ishrat-Ul-Ebad Khan, Institute Of Oral Health Sciences, Dow University Of Health Sciences, Karachi
[5] BDS, FCPS, Assistant Professor, Department of Orthodontics, Dr Ishrat-Ul-Ebad Khan, Institute Of Oral Health Sciences, Dow University Of Health Sciences, Karachi
[6] BDS, Department of Orthodontics, Dr Ishrat-Ul-Ebad Khan, Institute Of Oral Health Sciences, Dow University Of Health Sciences, Karachi

Received for Publication: Nov 8, 2019
First Revision: Nov 14, 2019
Second Revision: Dec 13, 2019
Approved: Dec 22, 2019

due to tight genetic control. Hormonal status and food intake of both adults and children have a considerable impact on skeletal and sexual maturity indicators.[6]

However, simple methods to estimate dental age are available now a day out of which the one used by Demirijian and his companions is quite popular. It was first used in 1973 on a group of European children.[7]

Demirijian method is a simple method to estimate dental age. In this method development of teeth of lower left quadrant (excluding 3rd molar) are viewed in OPG.[8-11] The stages of tooth development are divided into eight stages, starting alphabetically from "A to H" that focus on the crown and root mineralization as well as closing of the apex s[12-14] and a supplementary stage 0, that signifies no calcification. Every stage allocate a number to 7 teeth of lower left quadrant respectively, which varies according to the gender of the children centered on the tables given by Demirijian.[7-12]

The aim of the present study was to evaluate the accuracy of dental age determination by Demirijian Method when compared to the chronological age of the participants.

METHODOLOGY

A retrospective study was carried out from February 2017 to January 2018 at the department of orthodontics, Institute of Dentistry Liaquat University of Medical and Health Sciences Hyderabad/Jamshoro. Sample size of 40 patients was taken. Data was obtained from Orthodontics department.

Inclusion criteria for this study was patients of 8.5-17 years of age, without growth anomalies, having normal teeth morphology and whose radiographic records were clear, of good quality and with all the lower left permanent teeth present (erupted or un-erupted) in the OPG. Exclusion criteria were incomplete dental records of patient, missing teeth (extracted or naturally missing) from lower arch, and patients with any medical co-morbidity.

Approval was taken from the ethical committee of university, Informed and written consent was already taken at the start of treatment in the history form which clearly mentioned that their data can be used for research purpose.

Procedure

The mandibular left quadrant teeth excluding the 3rd molars were assessed. Central incisor to second premolar teeth were examined in OPG and a separate score was given to each tooth according to the stage of its development seen from the available tables[7-12] (Figure 1 and 2). The sum of the scores was added and the age given according to those tables. Each OPG X ray was examined carefully to assess the developmental stage of teeth. The patient's age assessed from the X rays was compared to the chronological age of the patient from the records to check the reliability of Demirijian method. Data was analyzed by using statistical package for social sciences (SPSS) software version 18. Mean and standard deviation were calculated for quantitative variables like age through Student T test. Frequency and percentages were computed for qualitative variables like gender and chronological age. Effect modifiers like age and gender were controlled by stratification, p value < 0.05 will be taken as significant. Chi-square was applied for post stratification.

RESULTS

A Total of 40 subjects were included in the study. The overall mean age of the subjects was 12.44± 2.54 years as shown in Table No.1

In the present study, 23 (58.0%) were girls while 17 (42.0%) were boys (Male to female ratio was 1:1.6).Out of 40 subjects, the mean dental age ± SD evaluated via Demirjian's method for the male subjects was 11.97± 2.38(8.5 to 16 years) whereas for female subjects was 12.78 ± 2.64 (9 to 17 years) as shown in Table No.2.

Table No.3 illustrates the chronological age of boys and girls for the single age groups. It is observed that female were more prone as compared to male subjects. Statistical analysis (t-test) for boys and girls showed that dental age measured with Demirjian's technique for the female subjects was considerably over-estimated in the 9 year and 13–17 years group of age. Dental age was over-estimated in all age groups of boys. The mean difference vacillated from –2.06 to –2.18 for the boys and remained–2.06 for the girls as seen in Table No. 4 and 5.

In the present study the mean variation in dental age and chronological age was 0·85 and 0·68 years for boys and girls respectively. The main finding is that boys and girls are more progressive in dental age than chronological age (0.85 and 0.68 for boys and girls respectively) as shown in Table No.6. (See also Table 7 & Fig 1 for further details).

DISCUSSION

In the field of orthodontics, various researchers around the globe have used Demirjian's method for the assessment of dental age.[15,16] Nevertheless, Demirjian's method may differ in results of different populations as French- Canadian standards were used to formulate it.[17]

This research was carried out in the Institute of Dentistry, LUMHS on 40 children to assess the accuracy of Demirijian method in Jamshoro population. This is useful in orthodontics as there are many appliances

TABLE 1: MEAN AGE OF THE SUBJECTS AND STANDARD DEVIATION (N=40)

Mean	**12.44**
Mode	11.00
Median	12.50
Standard deviation	2.54
Range	8.5 to 17 years

TABLE 2: MEAN AGE OF BOYS AND GIRLS AND THE RESPECTIVE STANDARD DEVIATION (N = 40)

	Boys (n = 17)	**Girls (n = 23)**
Mean	11.97	12.78
Mode	9.0	10
Median	12	13
Standard deviation	2.38	2.64
Range	8.5 to 16 years	9 to 17 years

TABLE 3: CHRONOLOGICAL AGE FOR BOYS AND GIRLS

Chronological Age	**Boys = 17**	**Girls= 23**	**Total**
10.56	1(5.9%)	0	1(2.5%)
11.06	3(17.6%)	2(8.7%)	5(12.5%)
12.06	1(5.9%)	4(17.4%)	5(12.5%)
13.06	3(17.6%)	3(13.0%)	6(15.0%)
14.06	1(5.9%)	2(8.7%)	3(7.5%)
15.06	3(17.6%)	3(13.0%)	6(15.0%)
16.06	2(11.8%)	3(13.0%)	5(12.5%)
17.06	2(11.8%)	1(4.3%)	3(7.5%)
18.06	1(5.9%)	2(8.7%)	3(7.5%)
19.06	0	3(13.0%)	3(7.5%)

TABLE 4: VARIANCE IN CHRONOLOGICAL AND DENTAL AGE EVALUATED BY DEMIRIJIAN'S METHOD FOR BOYS (= 17)

Age group	**Age range**	**Mean chronological age (SD)**	**Mean dental age (SD)**	**Mean difference**	**P value**
1(n =1)	8.5 to 8.99	10.56(0.30)	8.50(0.42)	-2.06	<0.0001
2(n =3)	9 to 9.99	11.06(0.51)	9.00(0.51)	-2.06	<0.0001
3(n =1)	10 to 10.99	12.41(0.65)	10.00(0.24)	-2.41	<0.0001
4(n =3)	11 to 11.99	13.65(0.77)	11.00(0.33)	-2.65	<0.0001
5(n =3)	12 to 12.99	14.04(0.28)	12.00(0.41)	-2.04	<0.0001
6(n =1)	13 to 13.99	15.52(0.36)	13.00(1.20)	-2.52	<0.0001
7(n =3)	14 to 14.99	16.48(0.43)	14.00(1.55)	-2.48	<0.0001
8(n =2)	15 to 15.99	17.46(0.54)	15.00(1.45)	-2.46	<0.0001
9(n =1)	16 to 17	18.18(0.73)	16.00(0.86)	-2.18	<0.0001

that are given to patients at particular age during growth. Demirjian's method, according to the findings of present study inclines to evaluate dental age that is more progressive to the chronological age.

A statistically significant difference was found in this study between the estimated dental age and chronological age that is 0.68years in the girls and 0.85years in the boys. For majority of the children the age was over-estimated evidently, over-estimation was observed at maximum in 8.5 to 17 years old-age groups in girls, and similarly in boys' age groups.

In comparison to this study other researches also found statistically significant differences of 0.23 years and 0.25 years in Bangladeshi children[18], 0.6 and

TABLE 5: VARIANCE IN CHRONOLOGICAL AND DENTAL AGE EVALUATED BY DEMIRIJIAN'S METHOD FOR GIRLS SUBJECTS (N = 23)

Age group	Age range	Mean chronological age (SD)	Mean dental age (SD)	Mean difference	P value
1(n =2)	9 to 9.99	11.06(0.10)	9.00(0.26)	-2.06	<0.0001
2(n = 4)	10 to 10.99	12.06(0.26)	10.00(0.45)	-2.06	0.344
3(n = 3)	11 to 11.99	13.06(0.54)	11.00(0.27)	-2.06	0.12
4(n =2)	12 to 12.99	14.06(0.66)	12.00(0.31)	-2.06	0.36
5(n = 3)	13 to 13.99	15.06(0.25)	13.00(0.38)	-2.06	<0.0001
6(n = 3)	14 to 14.99	16.06(0.32)	14.00(1.19)	-2.06	<0.0001
7(n = 1)	15 to 15.99	17.06(0.44)	15.00(1.40)	-2.06	<0.0001
8(n = 2)	16 to 17	18.66(0.56)	16.60(0.78)	-2.06	<0.0001

TABLE 6: COMPARISON BETWEEN MEAN CHRONOLOGICAL AND MEAN DENTAL AGE FOR BOTH GENDERS (N = 40)

	Dental age	Chronological age	Difference	P value
Male (n = 17)	11.97 ±2.38	11.12 ± 2.12	0.85	0.02
Female (n = 23)	12.78 ± 2.64	12.10 ± 2.13	0.68	0.01

TABLE 7: DEVELOPMENTAL STAGE OF TOOTH WITH ITS MATURITY SCORE FOR BOYS AND GIRLS

Boys				**Stages**					
Tooth	**0**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
M_2	0.0	1.7	3.1	5.4	8.6	11.4	12.4	12.8	13.6
M_1				0.0	5.3	7.5	10.3	13.9	16.8
PM_2	0.0	1.5	2.7	5.2	8.0	10.8	12.0	12.5	13.2
PM_1		0.0	4.0	6.3	9.4	13.2	14.9	15.5	16.1
C				0.0	4.0	7.8	10.1	11.4	12.0
I_2				0.0	2.8	5.4	7.7	10.5	13.2
I_1				0.0	4.3	6.3	8.2	11.2	15.1
Girls				**Stages**					
Tooth	**0**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
M_2	0.0	1.8	3.1	5.4	9.0	11.7	12.8	13.2	13.8
M_1				0.0	3.5	5.6	8.4	12.5	15.4
PM_2	0	1.7	2.9	5.4	8.6	11.1	12.3	12.8	13.3
PM_1		0.0	3.1	5.2	8.8	12.6	14.3	14.9	15.5
C				0.0	3.7	7.3	10.0	11.8	12.5
I_2				0.0	2.8	5.3	8.1	11.2	13.8
I_1				0.0	4.4	6.3	8.5	12.0	15.8

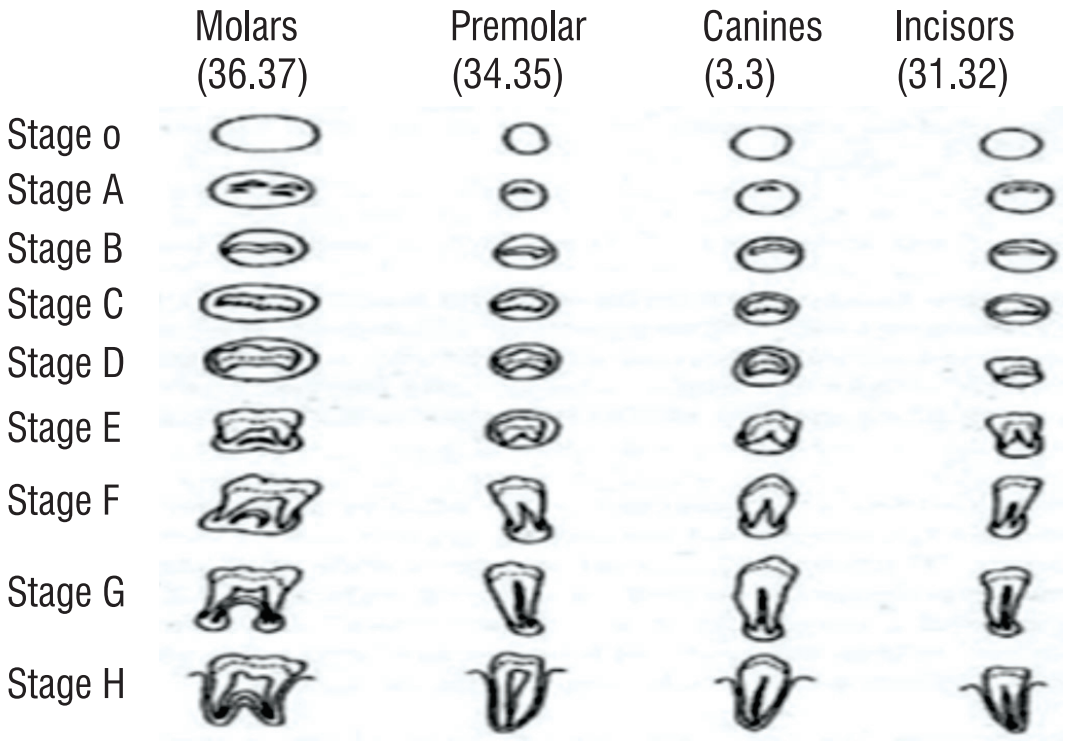

Fig 1: Demirijian system of tooth development

0.4years in Dutch children[19], 0.51 and0.73 years in British children[20], and 0.61 and 0.75 years in Malaysian children[21] in girls and boys, respectively.

In Brazilian children, compared to chronological age the mean dental age over-estimation was 0.62 and 0.68years in girls and boys respectively. In case of children with older group there was a greater and significant difference ($p< 0.001$).[22] An over estimation of 2.82 years and 3.04 years in girls and boys respectively was given by Demirjian's method in a study carried out by Koshy and Tendon[23]. They also found that over-estimation was more prominent in 12 to 15year-olds. The mean and differences in age over-estimation between this study the studies mentioned above could be due to the different population and the small sample size taken in this study (more specifically in 6 years old group).

In a study conducted by Sukhia RH et al.[17], Demirjian's method yielded a mean variance in the dental age and chronological age of -0.83years for females and -0.59 years for male samples. This Pakistani study resulted in over-estimating of dental age as compared to chronological age similar to the current study.[17]

In a recent study conducted on population of southern Turkey, the assessed mean variance in dental age and the chronological age ranged from 0.04 to 0.85 years in boys0.02 to 0.79 years in girls.[23]

Similar to findings of a study conducted on northern Turkish populations[24] current study presented significantly advanced dental maturity.

Limitations of this study

As this was a descriptive study and the data was collected from department of orthodontics the data below 8 years of age was not included due to the limited subjects available in this range.

CONCLUSION

It is concluded from the results of this study that Demirijian Method resulted in over-estimation of age when compared to chronological age of the subjects.

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CONTRIBUTIONS BY AUTHORS

1 Muhammad Ishaque:	Intro, Discussion Writing, Methodology Results.
2 Arslan Ali Vistro:	Data Collection.
3 Shazia Parveen Rajpar:	Proof reading.
4 Priya:	Literature searching.
5 Sadia Rizwan:	Critical Analysis.
6 Taskeen Khan:	Editing & References.