

## ORIGINAL ARTICLE

# Dental maturation in Peshawar: Applicability of Demirjian's standards

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## ABSTRACT

The determination of dental age is important for orthodontic treatment as well as in forensic issues requiring age estimation. The Demirjian method based on crown and root calcification is one of the most frequently used methods for this purpose. However its applicability in different populations is not uniform and the need for developing standard maturity scores for different populations and ethnic groups has been stressed.

**Objectives:** The aim of this study was to know if the Demirjian standards were applicable to the population of Peshawar and to develop maturity tables that could be used in the local population if Demirjian tables were not applicable.

**Methods:** We studied the 100 patients reporting for orthodontic treatment and compared their dental age calculated by the demirjian method with their chronological age.

**Results:** The Demirjian standard could not be used in the population of Peshawar due to statistically significant different in dental age and chronological age. New table relating the dental maturity scores with the chronological age is presented.

**Key words:** Demirjian method, Dental maturity, Chronological age.

## INTRODUCTION

The determination of dental age is important for achieving the best results in orthodontic treatment<sup>1</sup>. The beginning, progression, timing and prognosis of orthodontic treatment are dependant on tooth formation<sup>2</sup>. It is also important to determine age in forensic issues<sup>3,4</sup>. Several methods have been described to determine dental age. One of the earliest methods is based on times of eruption<sup>5</sup>. Radiographic methods use the length of the tooth, crown or root as an indicator of dental age<sup>6,7,8</sup>. Currently the most frequently used method is Demirjian's method<sup>9,10</sup>.

This method is based on 8 calcification stages representing crown and root calcification to the apex closure for the seven left permanent mandibular teeth. A score is allocated for each stage, and the sum of the scores gives an estimation of the subject's dental maturity. The overall maturity score can then be converted into dental age by using available tables or graphs<sup>10</sup>.

Various studies have shown different patterns of dental maturation in different populations in Europe<sup>3,4,11,12,13,14</sup>, Asia<sup>15,16</sup>, America<sup>17</sup> and Australia<sup>18</sup>. Several authors note an overestimation of dental age from studies based on another population if Demirjian's standards are used<sup>19,20,21</sup>.

These results show the necessity to create databases representative of each population. These databases would cover the inter-ethnic differences that can present a major bias in age estimation. The necessity to have standards for different population groups has been stressed by Demirjian et al themselves<sup>10</sup>.

The aim of this study was to evaluate the suitability of the French-Canadian standards of Demirjian in the population of Peshawar and to develop a new standard for the population of Peshawar, in the event of inappropriateness of the Demirjian standards.

## SUBJECTS AND METHODS

The one hundred subjects; fifty three males and forty seven females were patients at the department of orthodontics, Khyber College of dentistry. Only patients between ten and fourteen years of age were included in the study. They were of varying socio-economic status. Patients with history of bone disease or severe nutritional deficiency were not included. Patients with extractions in the left lower quadrant were excluded from the study.

Orthopantomograms of all subjects were taken at the department of dental radiology, Khyber College of Dentistry. The dental age was determined according to Demirjian's method revisited<sup>9,10</sup>. The seven teeth of the left lower quadrant were examined and each tooth was given a point value depending on the stage of mineralization of the tooth and the gender of the subject. The overall figure for assessment of dental

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age was obtained by adding together the separate values for the seven teeth and looking up this figure in the conversion chart for dental age determination given by Demirjian<sup>9,10</sup>. The chronological age and the dental age were compared using paired sample t-test. Pearson correlation coefficient was calculated for chronological age and the cumulative points of tooth mineralization for that individual. Linear regression analysis was carried out and 95% mean prediction interval and 95% individual prediction interval were calculated. A formula for calculating the dental age from the cumulative dental score emerged after two outlying observations were excluded. A chart for calculating the dental age from the degree of dental mineralization was developed for use in the population of Peshawar for subjects between ten and fourteen years of age.

**RESULTS**

There were fifty three males and forty seven females in the study. The age and sex distribution of the subjects is given in table I.

Table I: Age and sex distribution of the cases

Age (in years)	Males	Females
10	13	15
11	11	14
12	17	14
13	12	04
Total	53	47

The mean chronological and dental age in males and females showed a difference of 0.5 years in males and 0.76 years in females with the population of Peshawar being advanced as compared to the French-Canadian children reported by Demirjian (Table II).

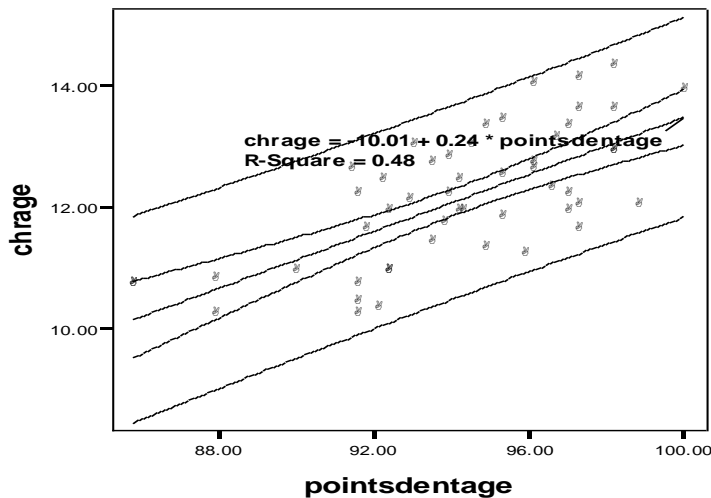
Table II: Means ± SD of Chronological and Dental Age

Age	Males	Females
Chronological age	12.03 ± 1.17	11.58 ± 1.05
Dental age	12.53 ± 1.87	12.34 ± 1.77

Paired sample t-test performed to know if the differences in mean ages were statistically significant; showed that the differences were statistically significant with a P-value of .015 in males and .005 in females. The large statistical difference between the chronological age of the subjects in Peshawar and the standards for French-Canadian children means that Demirjian's standards cannot be used for children in Peshawar.

In order to produce new maturity scores for dental age in the population of Peshawar that could be used to estimate chronological age, linear regression analysis was carried out between the chronological age and the maturity points for dental age. The graph between chronological age and the maturity points for dental age in males is given in Figure I.

**Scatter Diagram**



Linear Regression with  
95.00% Mean Prediction Interval and  
95.00% Individual Prediction Interval

This gives the following formula for calculating chronological age from the points of dental age in the male population between 10 and 14 years of age.

Chronological age = -10.01 + 0.24 (points dental age) with R-square of 0.48.

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Based on this analysis the following table for chronological age based on the maturity points for dental age is considered suitable for the male population of Peshawar between the age of 10 and 14 years.

Table III: Table for calculating chronological age based on dental maturity scores

Points dental age	Chronological age
85.99	10.20
86.41	10.30
86.84	10.40
87.26	10.50
87.69	10.60
88.11	10.70
88.54	10.80
88.97	10.90
89.39	11.00
89.82	11.10
90.24	11.20
90.67	11.30
91.09	11.40
91.52	11.50
91.94	11.60
92.37	11.70
92.80	11.80
93.22	11.90
93.65	12.00
94.07	12.10
94.50	12.20
94.92	12.30
95.35	12.40
95.77	12.50
96.20	12.60
96.63	12.70
97.05	12.80
97.48	12.90
97.90	13.00
98.33	13.10
98.75	13.20
99.18	13.30
99.60	13.40
100.03	13.50

There was a poor correlation between chronological age and dental age in the female subjects. The correlation was such as could not be used to calculate the chronological age from the dental maturity scores.

## DISCUSSION

The Demirjian system for evaluation of dental age is not applicable to the population of Peshawar as the difference between the chronological age and dental age calculated by this method is 5 months and 22 days ( $p=.015$ ) in males and the difference in females is even greater i.e. 9 months and 13 days ( $p=.005$ )

with dental age being advanced compared to the Demirjian criteria.

This is supplemented by the fact that a moderate correlation ( $r=.643$ ) between chronological and dental age existed in males whereas in females this correlation was low ( $r=.313$ ). This non applicability of the Demirjian system which was conducted on the French-Canadian population<sup>22</sup> has been shown in other parts of the world including India<sup>15</sup>, Australia<sup>18</sup>, Korea<sup>22</sup>, and the United Kingdom<sup>12</sup>.

Most studies have reported an overestimation of the dental age by the Demirjian method varying from one<sup>11,12,22</sup> to three years<sup>15</sup>. In our study the differences were closer to the European population as compared to those of South India. This could probably be because of the origin of the people of NWFP who mostly have their origins related to central Asia and Europe.

Dental age gives a stronger correlation with chronological age as it is under strong genetic control<sup>7</sup> and is relatively less affected by malnutrition, disease and mental stress<sup>2</sup>. One disadvantage of this study is that all subjects were undergoing orthodontic treatment and so may not represent the general population.

A larger sample size and addition of the third molar as has been done in some studies<sup>4</sup> may sort out our inability to develop maturity tables in the female population. The inclusion of other biological indicators such as the skeletal maturity of bones<sup>23,24</sup> and baseline of the head<sup>25,26,27</sup> could increase the precision of age estimation in the late teens.

## ACKNOWLEDGEMENT

The authors wish to thank all those who helped in the development of the data base especially the staff of Radiology Department, Khyber College of Dentistry and the department of Forensic Medicine Khyber Medical College and Western International.

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