

TECHNICAL NOTE**ODONTOLOGY; ANTHROPOLOGY**

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Dental Age Assessment: The Applicability of Demirjian Method in Eastern Turkish Children

ABSTRACT: In the literature, little is known about the applicability of this method in Turkish children. The aim of this study was, therefore, to evaluate the reliability of Demirjian method of age estimation when used for eastern Turkish children. A retrospective study was performed on a sample of panoramic radiographs taken from 807 healthy eastern Turkish children. The stages of dental maturity of the mandibular left seven permanent teeth for each subject using the eight radiographic dental maturity stages demonstrated by Demirjian were evaluated. A paired *t*-test was used for statistical analysis. The mean difference between the chronological and dental ages ranged from 0.2 to 1.9 years in girls and from 0.4 to 1.3 years in boys. The differences between the chronological and dental ages were statistically significant in all age groups. The applicability of Demirjian method is not suitable for eastern Turkish population.

KEYWORDS: forensic science, dental age, age estimation, Demirjian method, Turkish children, radiographs

In dental and medical practices, age estimation is considered to be of great importance. Dental maturity, expressed as a dental age, is one of the age estimation methods (1). For both the pediatric dentistry and the orthodontist, to be able to know a child's growth and developmental status is especially important in diagnosis and treatment planning (2,3). Besides, the estimate of dental development is one of the most reliable indicators of chronological age and most widely used in forensic and legal dentistry (4). Age estimation aids the identification of age at death of a deceased child and also provides information about the physiological age when birth data are lacking or doubted (3).

Several methods have been used to determine the dental age according to the degree of the calcification observed in radiographic examinations in permanent teeth (5–9). The Demirjian method, widely used, is based on the observation of seven left-side mandibular teeth in children of French–Canadian origin. Various investigators have demonstrated differences between several ethnic groups (1–3,10), as well as between geographical areas or cities within the same country (1).

In the literature, little is known about the applicability of this method in Turkish children. To date, it was only tested in a group of 900 northern (1) and 419 northwestern (11) Turkish children. The aim of this study was, therefore, to evaluate the reliability of Demirjian method of age estimation when used for eastern Turkish children.

Material and Methods

A retrospective study was performed on a sample of panoramic radiographs taken from 807 healthy eastern Turkish children (441

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girls and 366 boys) aged between 7.00 and 15.00 years. The radiographs of the children were randomly selected from the subjects attending to the Department of Orthodontics, the Faculty of Dentistry of the University of Ataturk (Turkey). All radiographs were performed by an X-ray technician who had a minimum working experience of 5 years as of 1996, using an orthopantomography device (Planmeca Proline CC 2002, 60–80 kVp, 8–10 mA, 12.8 sec exposure time; Helsinki, Finland) with a magnification factor of 1.2. Approval from the ethics committee was not required for this retrospective study. Children were excluded from the study including the followings: agenesis of teeth, systemic diseases affecting the growth and development of the teeth, poor quality of panoramic radiographs, or image deformity effecting mandibular permanent teeth.

Chronological age was calculated by subtracting the date of the panoramic radiograph from the date of birth after having converted both to a decimal age. The stages of dental maturity of the mandibular left seven permanent teeth for each subject using the eight radiographic dental maturity stages demonstrated by Demirjian et al. (6) were evaluated by the same investigator without prior knowledge of age or gender of the children. Each stage of the seven mandibular teeth was allocated a biologically weighted score, and the sum of the scores provided an estimate of the dental maturity, measured on a scale from 0 to 100. The overall maturity score was then converted to a dental age by using available tables and/or percentile curves (5,6).

Statistical Analysis

For each age and gender group, the mean differences between the dental and chronological ages of the subject were calculated. A paired *t*-test was used for statistical analysis. To assess the reproducibility, 80 randomly selected panoramic radiographs were re-evaluated 1 month after the first examination by the same investigator. The percentage agreement of the two readings was calculated by examining of the 80 radiographs of 560 teeth.

The difference between the two readings was tested for significance with Kappa test (0.87).

Results

Table 1 shows the distribution of the girls and boys into different age groups: 441 (54.6%) were girls and 366 (45.4%) boys. Differences between the mean chronological ages and estimated dental ages according to the Demirjian method are presented in Table 2. Both genders were advanced in dental maturity when compared with the reference samples. The mean difference between the chronological and dental ages ranged from 0.2 to 1.9 years in girls and from 0.4 to 1.3 years in boys. The differences between the chronological and dental ages were statistically significant in all groups. The least differences between the chronological and estimated dental ages were observed in the 8- to 11-year age groups in boys and 7- to 7.9- and 9- to 9.9-year age groups in girls.

Discussion

Several methods for the determination of dental development have been carried. Demirjian eight-stage method is one of the principal methods used for dental age estimation. It is one of the simplest, practical, and widely used methods (12). Numerous studies (1–4,10,12) have been carried out for other populations, showing a great variability in the dental maturation process. Several authors (1,13–15) showed that the results are less accurate if another population is computed with Demirjian standards. This shows the necessity to create representative databases for each population to reach

a better comprehension of human dental maturation. Tunc and Koyuturk (1) stated differences between geographical areas or cities within the same country. However, such research had not been taken up in East Anatolian, yet. For this reason, the aim of this study was to assess the applicability of Demirjian method in an eastern Turkish population and thus the comparing of the dental maturity with that of other populations.

The mean differences between the chronological and dental ages, in a recent study published in northern Turkish population, ranged from 0.5 to 1.4 years in girls and from 0.4 to 1.4 years in boys (1). Additionally, Menten et al. (11) found delayed dental maturity in northwestern Turkish population. In agreement with those reports (1,11) published in Turkish populations, our study showed significantly more advanced dental maturity. However, the largest mean difference found in this study was 1.9 years, compared with 1.4 (1) and 0.7 (11) years reported in different parts of our country. The difference might be because of the sample sizes examined in different regions.

A common finding in reports published in different populations is that the Demirjian method for dental age estimation does not accurately estimate the dental age of examined subjects. Although some reports (16,17) showed an underestimation of the dental age, others (2,3) reported overestimation of dental age. In the present study, the use of Demirjian method for dental age estimation led to an overestimation in the dental development in eastern Turkish children. As a group, eastern Turkish children were dentally advanced compared to French–Canadian standards by 1.0 year. The mean delay in girls was 1.1 year and in boys 0.9 year. The differences were statistically significant in all age groups for girls and boys. In agreement with our results, the mean difference was greater in the Swedish sample (18). The Swedish boys differed by 0.4–1.8 years and the girls by 0.5–1.8 years. On the other hand, the mean difference for Dutch boys was 0.4 years and for girls 0.6 years (19). In the sample of Norwegian children, the mean difference was smaller; it was 0.2 years for boys and 0.3 years for girls (20).

It was also previously stated that sex differences do exist and need to be taken into account. With most maturational events, the tempo of maturation is faster in girls (21). This is in agreement with the findings of this study where girls were dentally more advanced than boys for the dental age. Hägg and Matsson (22) suggested that Demirjian method affords a high degree of reliability and precision, particularly in younger children. This result was in agreement with our study. The least differences between the chronological and estimated dental ages, in this study, were observed in the 8- to 10.9-year age groups in boys and 7- to 7.9- and 9- to 9.9-year age groups in girls.

Conclusion

Eastern Turkish children are significantly more advanced in dental maturity compared to Demirjian French–Canadian sample. Therefore, the applicability of Demirjian method is not suitable for eastern Turkish population.

Conflict of interest: The authors have no relevant conflicts of interest to declare.

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TABLE 1—Age and gender distribution of the subjects examined.

Chronological Age	Female	Male	Total (%)
7–7.9	18	17	35 (4.3)
8–8.9	34	37	71 (8.8)
9–9.9	45	39	84 (10.4)
10–10.9	103	73	176 (21.8)
11–11.9	108	72	180 (22.4)
12–12.9	48	64	112 (13.9)
13–13.9	45	32	77 (9.5)
14–14.9	40	32	72 (8.9)
Total (%)	441 (54.6)	366 (45.4)	807 (100)

TABLE 2—Differences between chronological ages and dental ages determined by Demirjian method.

Age	Mean CA	Mean DA	Mean Difference (DA-CA)	p-Value
Female				
7–7.9	7.6	7.8	0.2	0.045
8–8.9	8.5	9.8	1.3	0.000
9–9.9	9.4	10.1	0.7	0.003
10–10.9	10.4	11.6	1.2	0.000
11–11.9	11.4	12.7	1.3	0.000
12–12.9	12.4	14.3	1.9	0.000
13–13.9	13.5	15.1	1.6	0.000
14–14.9	14.4	15.2	0.8	0.000
Male				
7–7.9	7.7	8.6	0.9	0.000
8–8.9	8.7	9.1	0.4	0.000
9–9.9	9.3	10.0	0.7	0.001
10–10.9	10.5	11.0	0.6	0.002
11–11.9	11.5	12.8	1.3	0.000
12–12.9	12.6	13.7	1.1	0.000
13–13.9	13.4	14.6	1.2	0.000
14–14.9	14.3	15.2	0.9	0.004

CA, chronological age; DA, dental age.

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