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## DENTAL AGE ESTIMATION IN SPANISH AND VENEZUELAN CHILDREN. COMPARISON OF DEMIRJIAN'S AND CHAILLET'S SCORES

**Abstract:** Orthopantomographs taken from 308 Spanish-Caucasian and 200 Venezuelan-Amerindian children, aged between 2 and 18 years, were analysed following the Demirjian method. The applicability of this method was tested, and new predictive models for both populations were developed, using both, the original French-Canadian scores described by Demirjian (1976) and the new multi-ethnic dental scores proposed by Chaillet et al. (2005) when the ethnic origin is unknown. A high ethnic influence in dental development was found, with a clear delay in the Venezuelan-Amerindian population in relation to the Spanish-Caucasian one. New graphs were produced to convert the maturity scores to dental age for Spanish and Venezuelan children. With these graphs the Demirjian scores showed to be inadequate after the age of 12 in both populations, while Chaillet scores offered useful information until 14 years of age.

### Introduction

Some of the more accurate methods of age estimation in the juvenile and young adult have been based on the assessment of the degree of dental development. One widely used method is that of Demirjian et al., first described in 1973 and based on a large number of French-Canadian children [1,2]. The method evaluates the development of seven mandibular teeth from a panoramic radiograph and calculates dental age. Two were the aims of this study: The first one was to test the applicability of the Demirjian method to two different ethnic populations, a Spanish-Caucasian and a Venezuelan-Amerindian. The second objective was to develop age prediction models (polynomial or multiple regression models) for both populations using the original French-Canadian scores described by Demirjian [2] and the new multi-ethnic dental scores proposed by Chaillet et al. [3] when the ethnic origin is unknown, comparing the results for both scores and populations.

### Material and Methods

Orthopantomographs taken from 308 Spanish-Caucasian children (157 girls, 151 boys) aged between 4 and 17 years, and 200 Venezuelan-Amerindian children (97 girls

and 103 boys) aged between 2 and 18 years, were analysed. The Demirjian's method using standard tables (separate for boys and girls) from Demirjian et al [2], and from Chaillet et al [3] was applied. Statistical analysis of data was performed using the SPSS package, version 15.0. First, the differences between dental age and chronological age for each patient were calculated. Finally, different regression models were explored in calculations of dental age as a function of maturity score for both samples.

## Results

A high racial influence in dental development was found, with a clear delay in the Venezuelan-Amerindian population in relation to the Spanish-Caucasian one. Results showed that the Demirjian's method overestimates the age in the Spanish Caucasian sample using both scores. In the Venezuelan Amerindian sample the opposite was found: the Demirjian's method underestimates the age using both scores. Fig. 1 shows the differences between dental and chronological ages using the Demirjian method in both populations.

The Chaillet method allows the estimation of the dental age in a wider age range: Fig. 2 shows the relation between the mean maturity score, for both scales, and the mean age. As can be seen, using the Demirjian scores in the Spanish sample the 100% of maturity is achieved at the age of 12 in girls, and of 13 in boys, and in the Venezuelan sample, at the age of 14 in both, girls and boys. Using the Chaillet scores the mean 100% of maturity is achieved 2 years later.

Finally we calculated different polynomial functions between the chronological age (taken as the dependent variable) and the maturity score (taken as the independent variable), for the seven mandibular teeth. After trying the different options the statistical program offered, two models were selected: the compound and the cubic. Fig. 3 and 4 show a more stepped distribution applying the Chaillet maturity scores regarding the chronological age in both samples. So, once again Demirjian scores showed to be inadequate after the age of 12 in both populations, while Chaillet scores offered information until 14 years of age.

## Discussion

The Demirjian's method to estimate dental age has been used in different populations and, in general, most authors agree that is a useful and easy to use method, but that overestimates the age of children (overestimation of dental age ranging from 0.02 to 3.04 years, depending on the population) [4-7]. Most of them also state that specific studies should be done to adapt the method to a specific population. Therefore, our results for the Spanish population are in accordance with previously published data for other Caucasian populations. Little information is known about dental development in Amerindian populations. Cameriere et al [8] found that Demirjian dental maturity in the Peruvian sample was advanced compared to that of the original study, which shows an overestimation of age in Peruvian-Amerindian children. In our sample of Venezuelan-Amerindian children the overestimation was only found in children under

8, whilst those older than 8 were delayed in development, in both sexes. Our results are in disagreement with the general tendency, but also with the specific Camerier's results for the Peruvian population. This underestimation can be due to a small sample size, but in our opinion, in the case of the Venezuelan children, the ethnics could explain the differences with the original study because the French-Canadian population has a strong Amerindian genetic contribution but also European influence [3]. It is possible that the dental development in the French-Canadian population is in an intermediate point between the delayed Amerindian (Venezuelan) and the advanced Caucasian (Spanish).

Several authors have calculated new scores [9,10]. In 2005, Chaillet et al. [3] calculated an international weighed score in order to give new dental maturity curves for children when the ethnic origin is unknown, using the Demirjian's method. Since our sample was composed of two different ethnic population groups, we decided to test the Chaillet's scores. Most of the previous studies elaborated the polynomial functions considering the "age" as the independent variable and the score as the dependent one [11-14]. Nevertheless, according to Muñoz et al. [15] when a perfect lineal fit is not possible between both variables, the unknown variable (age, in forensic cases) must be considered the dependent one. After calculating the polynomial functions for both populations, we found that the distribution of maturity scores related to chronological age was much better with the Chaillet scores, as can be seen graphically (Fig.3 a-b, Fig.3 and Fig.4).

## Conclusion

We found *ethnic influence* in dental development, with a clear delay in the Venezuelan-Amerindian population in relation to the Spanish-Caucasian one. Even with specific polynomial functions, those calculated using the Demirjian's scores showed to be inadequate after the age of 12 in both populations. On the contrary, those calculated using the Chaillet scores offered information until 14 years of age. Demirjian's method is simple, fast and easy to apply, but the *use of Chaillet International scores is more appropriate* than the curves originally proposed by Demirjian.

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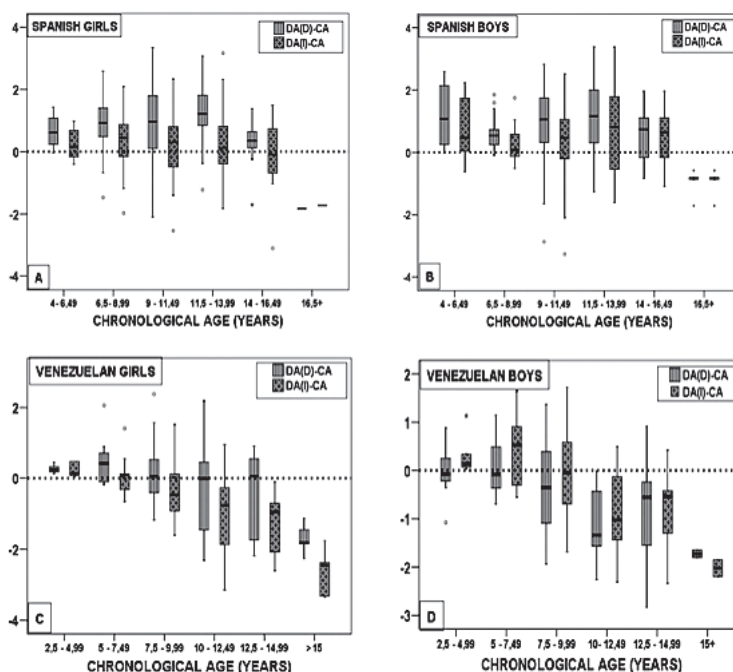


Figure 1 – Boxplots of differences between dental and chronological ages using the Demirjian method

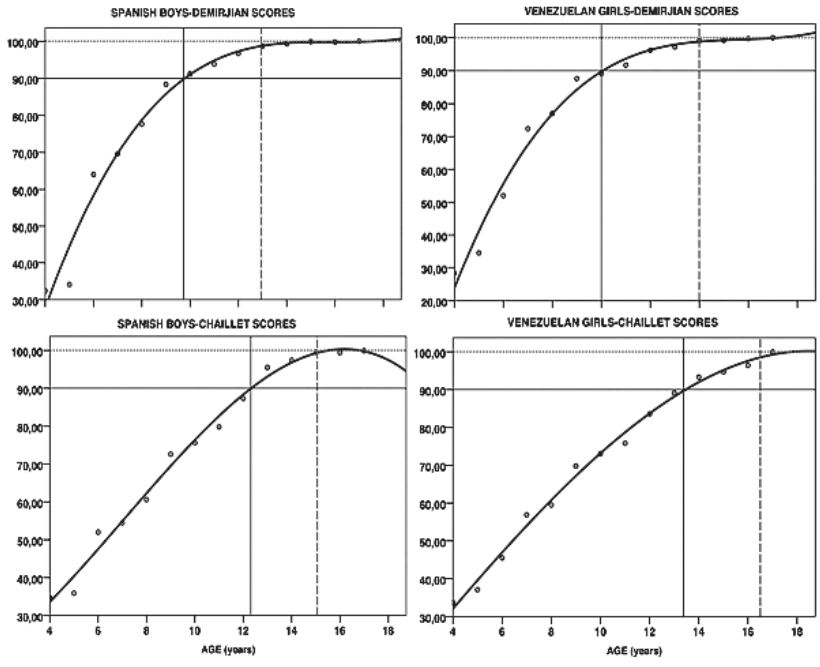


Figure 2 – Relation between the mean maturity score and the mean age, for both scores and populations

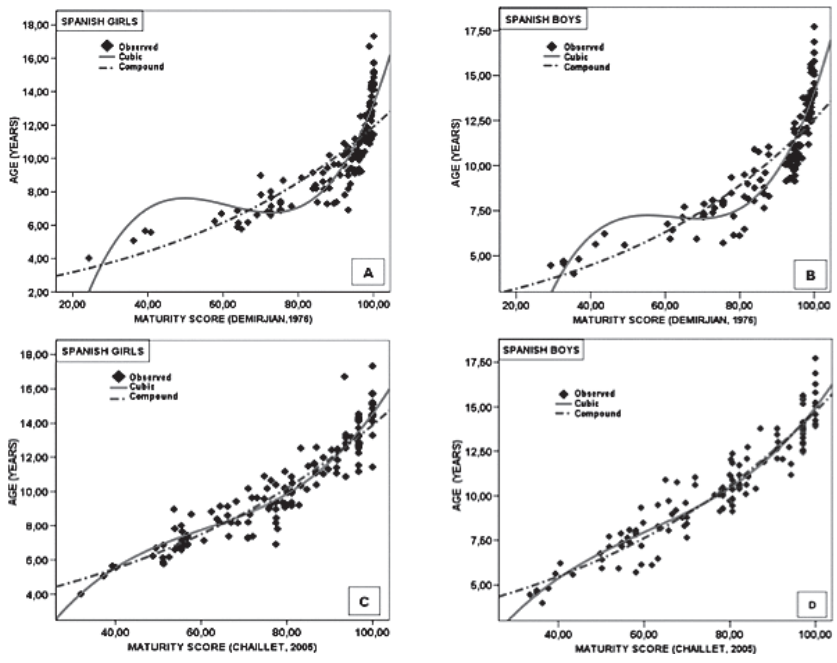


Figure 3 – Scatterplots of Maturity Score against Chronological Age in Spanish Children. Lines represent mean regression prediction in both function models

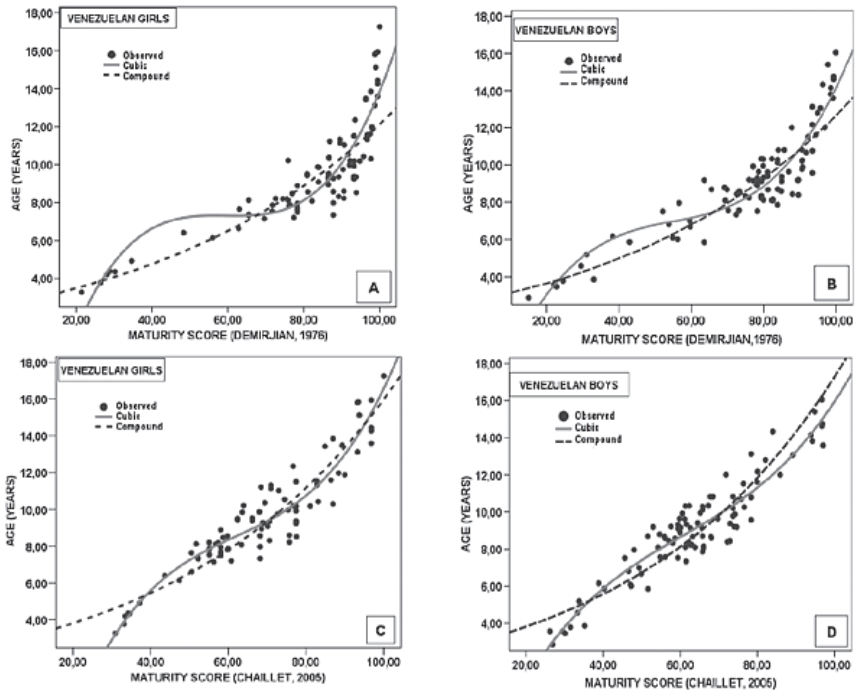


Figure 4 – Scatterplots of Maturity Score against Chronological Age in Venezuelan Children. Lines represent mean regression prediction in both function models.