

TECHNICAL NOTE

ODONTOLOGY

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Study of Chilean Children's Dental Maturation*

ABSTRACT: In forensic science, determining a person's chronological age has become a challenge for researchers. Determining age using dental calcification is becoming increasingly important. The objective of this study is to estimate the dental age of the children's population in Region VIII, Chile. The sample was randomly taken from children under the care of the Faculty of Dentistry at the Universidad de Concepción in Chile. The study encompasses 159 children between 3 and 14 years of age. The dental age was determined following the Demirjian method. The Bland-Altman method was applied to establish the correlation. It was determined that the range between chronological and dental age is similar, and the degree of correlation between both ages is nearly perfect. In conclusion, the degree of correlation between the chronological and dental ages for each gender is also very good although it is slightly higher for females.

KEYWORDS: forensic science, forensic odontology, dental age, physiological age, dental maturation, dental mineralization

Chronological age is considered an administrative criterion that does not always correspond to each individual's biological circumstances (1). Indeed, in forensic science, determining a person's chronological age has become a challenge for researchers (1–3) since reliable biological indicators and comparison patterns that contemplate geographic, racial, gender, and other variations need to be established. Additionally, although biological age is an indicator that compares an individual's organs with standard patterns for a determined age, this is also a physiological and developmental concept (4–7).

Clampton et al. (8) established the concept of physiological age using puberty development markers in children as an indicator of maturity.

The use of X-rays in medicine provided researchers with more precise instruments for growth studies in human beings. The method that is presently most used to determine age in pediatrics is the method developed by Greulich and Pyle (9) that utilizes the carpal bones on the left hand. Notwithstanding, studies that determine age using dental calcification are becoming increasingly important.

In 1973 Demirjian et al. proposed "A new system to determine dental age" (1) which was improved in 1976 when they determined dental age based on seven or four of the teeth on the lower arch (10). This study signaled a change in the studies on dental age since most of the clinical and forensic science research began to be performed following this methodology (11,12).

Almost every study conducted to research different methodologies includes the Demirjian et al. proposal (12,13). Hägg and Mattson, for instance, in a sample population of Swedish children compared the exactitude and precision of the methods of Lilliequist and Lundberg, Gustafson and Koch, and Demirjian et al. and found that the most appropriate method for assessing children's dental age was the method proposed by Demirjian because, comparatively, it presented the highest exactitude and precision (14).

Olze et al. state that when estimating dental age, the dental mineralization method employed is crucial (15). The work undertaken by the Research Committee of the American Academy of Forensic Odontology (A.B.F.O.), published by Mincer et al. in 1993, evaluated the opportunity to use third molar development to estimate the chronological age and noted that the most suitable method is the one developed by Demirjian et al. (16).

Many studies that inter-relate variables such as age and sex with dental development (17) or that analyze racial variations have been published since ethnic, racial, and social characteristics modify dental mineralization chronology (18–21).

The objective of this study is to estimate the dental age of children between ages 3 and 14 in Region VIII, Chile using the Demirjian method where the degree of correlation between their chronological age and their dental age is analyzed using the intra-class correlation coefficient.

Materials and Methodology

This is a correlation study. The sample was randomly selected from children under the care of the Pediatric Dental Clinic at the Faculty of Dentistry at the Universidad de Concepción in Chile in 2007. The sample includes 159 children ages 3–14. Parental consent was obtained from all the children's parents before their inclusion in the study. The dental age was determined by reviewing a panoramic radiography taken using the standard technique for orthopantomography in a Soredex model Cranex Tome Ceph unit (Orion Corporation, Helsinki, Finland). The Konica MG SR films were developed in an AGFA Curix 60 automatic developer processor

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(Agfa-Gevaert, Munich, Germany) with Kodak developer and fixer (Eastman-Kodak, Kodak Dental Systems, Stuttgart, Germany). Each X-ray image was analyzed using the same negatoscope under adequate lighting conditions (e.g., semi-dark room) and the development observed on the seven teeth of the lower left arch except for the third molar was recorded following the Demirjian method. The development states described by Demirjian range from the formation of the crypt to the apical closure (complete roots) (1). Each of the seven teeth was scored according to its developmental state, and the maturity score was defined as the sum of these scores. The maturity score then was used to determine the dental age using Demirjian tables for girls and boys.

Statistics

The Bland–Altman method was applied to establish the correlation. The radiographs were evaluated by only one examiner that was intracalibrated with a Kappa Index of 70.

Results

The dental age observed for the various chronological ages oscillated between 3.5 and 14.2 years. The chronological age fluctuated between 3.2 and 14.2 years. The global interclass correlation coefficient (ICC) as a measure of correspondence between the dental and chronological ages was 0.98 (IC 95%: 0.97–0.99). The ICC was 0.97 (IC 95%: 0.96–0.98) for male children and 0.98 (IC 95%: 0.97–0.99) for females (Fig. 1).

Discussion

The Demirjian study is based on a group of French Canadian children (1), while the sample of this study is focused on Chilean children.

The methodology presented has diverse applications in the dental clinic: it can improve the study of patients suffering from endocrine alterations, syndromes, etc. or it can be a useful tool in providing a better understanding of patients who present deviations from the normal eruptive pattern (17,22,23).

Numerous examples can be found in scientific literature, although it is difficult to separate the clinical aspects from the legal applications (16,24–26). Indeed, this difficulty is evident in the

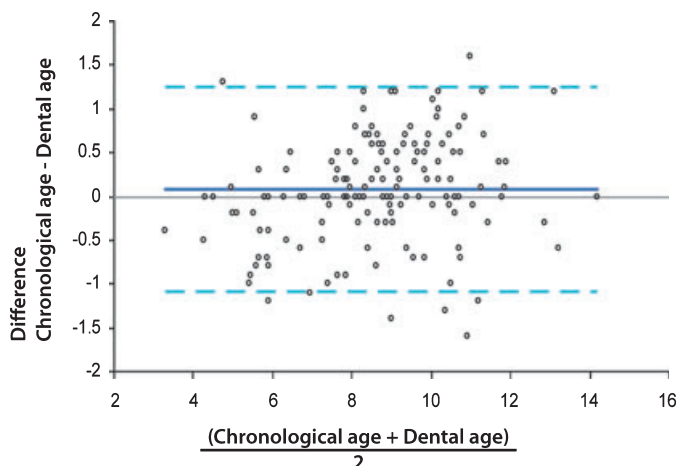


FIG. 1—The global interclass correlation coefficient (Bland–Altman method).

studies of authors who in 1981 published the application of the method to determine sexual dimorphism in the development, emergence, and agenesis of the third molars (22).

If we take into consideration that race, gender, geographical and socioeconomic factors as well as other variables influence dental formation, different ethnic groups living in other societies should be studied because they appear to behave differently (18–21,27,28). Clear developmental differences exist according to the geographic region studied, thus it is essential to establish regional dental calcification patterns to avoid the application of models obtained in other populations (29).

In conclusion, the range of chronological and dental age is similar and the degree of correlation between the chronological and dental ages is almost perfect. The degree of correlation between the chronological and dental ages for each sex is also very good, although it is slightly higher for females. Finally, the Demirjian method is applicable to the preliminary sample of Chilean children. This method could be a useful tool for forensic science and forensic odontology.

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