

Maturation Of permanent teeth in Black and Latino children

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Abstract - The relationship between chronological age and the development of permanent teeth has been investigated according to the method described by Demirjian *et al*⁵. Panoramic radiographs of 1085 children (male and female) of varying ages (2 years to 15 years) were evaluated. Only healthy children with full complement of permanent teeth for their chronological age were used in this study. The degree of maturation of each of the several appropriate permanent teeth on the left side of mandible was determined, and dental maturity scores computed for each child. Evaluation of the data demonstrated that all groups in this study (Whites, Blacks and Latinos) had a more advanced maturity score for chronological age than did the French Canadian groups of Demirjian *et al*⁵. In addition, Latino boys and girls had more advanced maturity scores than did White boys and girls of the Chicago sample.

Key words: Tooth calcification; tooth eruption.

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INTRODUCTION

Several studies reported on skeletal age assessment and good tables of values are available'. However, dental age is still a topic in which much controversy exists since children of the same chronological age show great variation in the degree of dental age as well as in general maturation.

Two major criteria have been used in the assessment of dental age. Some investigators have evaluated clinical eruption or gingival emergence of teeth²; other investigators have evaluated tooth development with the help of radiographs. Since this second criterion allows for evaluation of data with accuracy and reproducibility, this method has gained acceptance by many investigators in those instances where proper material is available. Several investigators^{3,6} have described different methods of computing and assessing the developmental stages of tooth formation. These techniques have made it possible to give quite accurate dental

age estimates even for fetal material⁷. For permanent teeth, Moorrees *et al*⁴ defined 14 separate stages of tooth development, but simpler grading systems have been devised⁵.

The understanding of growth and development in normal individuals is fundamental to the understanding of variations due to systemic disturbances in children. Furthermore, the assessment of the stage of an individual's dental development can be of great importance in the evaluation of the pattern of maturity and may facilitate accuracy in predictions.

Racial composition and socioeconomic levels have been found to alter tooth emergence. Also, sex differences appear to play a role. A longitudinal study of a small sample of children in Oregon shows that tooth eruption is generally earlier in girls although there was considerable variation in the age of eruption⁹. In a comparative study of Caucasian and Black British children, Lavelle¹⁰ found that primary teeth erupted somewhat earlier in the black

group; however this difference was not statistically significant. The degree of sexual difference was also not statistically significant, although in general the teeth of girls erupted earlier. Similar results for permanent teeth were obtained by Debrot¹ for Black and White children in Curacao and for primary and permanent teeth by Freitas & Salzano² comparing White and Black Brazilian children, although in the former study only canines and first and second premolars were evaluated.

The great individual variations commonly seen in clinical practice have made it difficult to obtain systematic investigations of dental development. Only in the past few years have studies like the one of Demirjian *et al*⁵ presented reference standards for dental development of white children which are easy to use.

The aim of the present study is to analyze and compare the dental development in White, Black and Latino children in Chicago using Demirjian's method.

MATERIAL AND METHODS

The material for this study was 1085 panoramic radiographs of patients in the Department of Pediatric Dentistry of the University of Illinois, of both sexes ranging in age from 2 to 15 years (Table 1). All interpretations and evaluations were made by the same investigator to assure consistency. Care was taken to evaluate only one panoramic radiograph per child. If several radiographs were available, the earliest one was selected. Children with a history of systemic disease were not included.

The method for scoring dental age was that described by Demirjian *et al*⁵. The stages of development of each tooth are defined according to maturity. A total of 8 stages, A to H for each tooth have been described based on a tooth shape and state of calcification. Stage A in both uniradicular and multiradicular teeth shows beginning of calcification in the form of a small inverted cone at the most occlusal part of the crypt. Stage H is defined as the stage in which the apical end of the root is completed and the periodontal membrane has a uniform width around the root and its apex. The intermediate stages form a continuum.

Table 1. Age distribution of Chicago children evaluated.

| Age | MB | FB | ML | FL | MW | FW |
|----------|----|----|----|----|----|----|
| 2-2:11 | 4 | 3 | 2 | — | — | — |
| 3-3 :11 | 11 | 9 | 12 | 11 | 6 | 9 |
| 4-4 :11 | 13 | 20 | 18 | 16 | 4 | 6 |
| 5-5 :11 | 28 | 28 | 25 | 18 | 10 | 14 |
| 6-6 :11 | 19 | 27 | 35 | 20 | 11 | 12 |
| 7-7 :11 | 34 | 29 | 40 | 32 | 10 | 19 |
| 8-8 :11 | 31 | 45 | 26 | 34 | 16 | 12 |
| 9-9 :11 | 39 | 37 | 23 | 28 | 24 | 15 |
| 10-10:11 | 36 | 19 | 21 | 24 | 10 | 7 |
| 11-11:11 | 14 | 8 | 17 | 13 | 8 | 4 |
| 12-12:11 | 5 | — | 4 | 5 | 2 | — |
| 13-13:11 | — | — | 1 | — | 2 | 1 |
| 14-14:11 | — | 1 | — | — | — | — |
| 15-15:11 | 1 | — | — | — | — | — |

NIB =Male Black; FB=Female Black; NIL =Male Latino; FL=Female Latino; MW = Male White ;FW = Female White.

After each tooth has been evaluated and given a letter score depending on degree of calcification and root formation, these letters are translated into numerical scores derived from standard tables that take sex into consideration⁵. The numerical score for the quadrant is the sum of the scores of evaluated teeth. This number is converted into a dental age score using the appropriate table of standards, girls and boys being evaluated separately. For uniformity, all the teeth of the lower left quadrant with exception of the 3rd molars are the ones used in this study.

Demirjian *et al*⁵ plotted the scores of each patient in their study on a graph with the chronological age as abscissa and the quadrant score as ordinate. Separate graphs were plotted for girls and boys. The data obtained from the Chicago children in the present study were analyzed using a chi square goodness of fit test¹³. The observed numbers of subjects in each group who fell into the Montreal percentile classes of Demirjian *et al*⁵ were compared

Table 2. Comparison of distribution of Montreal and Chicago females.

| Percentile | Black (226) | | Latino (198) | | White (99) | |
|------------|-------------------------------|----------|-------------------------------|----------|------------------------------|----------|
| | Observed | Expected | Observed | Expected | Observed | Expected |
| < 3 | 7 | 6.78 | 7 | 5.94 | 4 | 2.97 |
| 3-10 | 17 | 15.82 | 17 | 13.86 | 8 | 6.93 |
| 10-50 | 48 | 90.40 | 47 | 79.20 | 29 | 39.60 |
| 50-90 | 66 | 90.40 | 52 | 79.20 | 28 | 39.60 |
| 90-97 | 44 | 15.82 | 37 | 13.86 | 19 | 6.93 |
| > 97 | 44 | 6.78 | 38 | 5.94 | 11 | 2.97 |
| | Chi square =281.09 p<0.001 | | Chi square =235.00 p<0.001 | | Chi square =49.49 p<0.001 | |

with the numbers expected if the group had had the same distribution as the Montreal group of the appropriate sex.

RESULTS

The results are summarized in Tables 2, 3 and 4. The data show our Latino and Black groups as compared to the distribution in the Montreal study. The expected values are the percentile intervals multiplied by the total number of subjects. Computing the goodness of fit test, it can be noticed that the chi square values are very large and in each case $p < 0.001$. Therefore, each of our distributions is significantly different from the Montreal distribution for the same sex. A group of White children of both sexes was also evaluated. According to the goodness of fit test, in our sample of white males the chi square statistic is 55.95, $p < 0.001$ and in our female sample the chi square statistic is 49.49, $p < 0.001$.

The distributions of each of our Black and Latino groups were compared with our White groups of the same sex again using the chi square goodness of fit test. The expected values are proportional to the distribution of the White groups of the same sex (Table 4).

In the case of the Latino males, chi square was 8.53, $p < 0.1$; therefore the distribution was not significantly different from that of the White males. In the case of the Black males, chi square was 11.26, $p < 0.05$; therefore the distribution was just significantly different from the White males.

In case of the Latino females, chi square was 14.22 with $p < 0.025$. In the case of the Black females, chi square was 19.87 with $p < 0.001$. Thus, there was a significant difference between the distribution of White females and the distribution of the other two groups.

In order to determine if the ages of the subjects were randomly scattered in the percentile classes in each group, a Kruskal-Wallis test was used. The results showed

Table 3. Comparison of distribution of Montreal and Chicago males.

| Percentile | Black (233) | | Latino (226) | | White (103) | |
|------------|-------------------------------|----------|-------------------------------|----------|------------------------------|----------|
| | Observed | Expected | Observed | Expected | Observed | Expected |
| <.3 | 2 | 6.99 | 6 | 6.78 | 4 | 3.09 |
| 3-10 | 21 | 16.31 | 18 | 15.82 | 11 | 7.21 |
| 10-50 | 62 | 93.20 | 60 | 90.40 | 31 | 41.20 |
| 50-90 | 73 | 93.20 | 64 | 90.40 | 28 | 41.20 |
| 90-97 | 34 | 16.31 | 35 | 15.82 | 15 | 7.21 |
| > 97 | 41 | 6.99 | 43 | 6.78 | 14 | 3.09 |
| | Chi square =204.40 p<0.001 | | Chi square =235.07 p<0.001 | | Chi square =55.95 p<0.001 | |

Table 4. Comparison of distribution of Chicago White group with Latino and Black groups.

| Percentile | Males | | | | | | Females | | | | | |
|------------|----------|--------------|----------|----------|----------|----------|----------------|----------|-----------------|----------|----------|----------|
| | White | | Latino | | Black | | White | | Latino | | Black | |
| | Observed | Expected | Observed | Expected | Observed | Expected | Observed | Expected | Observed | Expected | Observed | Expected |
| <.3 | 4 | 6 | 8.78 | 7 | 9.05 | 4 | 7 | 8.00 | 7 | 9.13 | 7 | 9.13 |
| 3-10 | 11 | 18 | 24.14 | 21 | 24.88 | 8 | 17 | 16.00 | 17 | 18.26 | 17 | 18.26 |
| 10-50 | 31 | 60 | 68.02 | 62 | 70.13 | 29 | 47 | 58.00 | 48 | 66.20 | 48 | 66.20 |
| 50-90 | 28 | 64 | 61.44 | 73 | 63.34 | 28 | 52 | 56.00 | 66 | 63.92 | 66 | 63.92 |
| 90-97 | 15 | 35 | 32.91 | 34 | 33.93 | 19 | 37 | 38.00 | 44 | 43.37 | 44 | 43.37 |
| >97 | 14 | 43 | 30.72 | 41 | 31.37 | 11 | 38 | 22.00 | 44 | 25.11 | 44 | 25.11 |
| Total | 103 | 226 | | 233 | | 99 | 198 | | 226 | | 226 | |
| Chi square | | 8.53 | | 11.26 | | | 14.22 | | 19.87 | | | |
| | | .25 > p > .1 | | p < .05 | | | .025 > p > .01 | | .005 > p > .001 | | | |

that ages were random in the White males and females and in the Latino isiales and females. The ages were not random in the Black males and females; in both groups the subjects falling into the percentile classes over the 90th percentile tended to be older.

DISCUSSION

The time of eruption of primary and permanent teeth has been investigated in many groups of children of different nationalities, races and socioeconomic backgrounds. The aim of these studies was twofold: first, the evaluation and comparison of chronological and physiological development of the child and the understanding of the factors involved in tooth eruption, and second, the need for assessment of the stages of individual dental development as a means of determining patterns of maturity and facilitating accuracy in predictions.

In her studies of tooth eruption, Gron¹⁴ concluded that there was a closer association between the stage of root formation and tooth emergence than between chronological and skeletal ages of the child and tooth emergence. The development of tables of tooth maturation has greatly facilitated the evaluation of dental age in certain populations. Further studies are of interest in order to establish how these tables can best be used in clinical dentistry for the assessment of tooth development in normal and handicapped children. The evaluation of dental age with the aid of radiographs provides a standardized technique that can be very useful, although rating of the stages of formation is somewhat subjective. Calibration of technique plays a rule and must take place to insure proper results.

Our results agree with those of Sapoka & Demijjian' indicating that there is some variation between the dental development in different populations. These investigators also observed that French Canadian children show a slower maturation pattern than children in other parts of North America. This type of difference is also noticeable in the present study. The possibility that different norms for different groups will be necessary for high degree of accuracy must be considered. However, since these norms will require large samples, not always easy to obtain, the present availability of norms for French Canadian children is of great value. Further studies of larger populations with evaluation of ethnic and socioeconomic factors will also be valuable.

RESUMEN

Maduración de los dientes permanentes en niños negro y latinos

La relación entre edad cronológica y el desarrollo de los dientes permanentes ha sido investigada de acuerdo con el método descrito por Demitjian *et al.* Radiografías panorámicas de 1085 niños (masculinos y femeninos) de diferentes edades (2-15 años) fueron evaluadas. Solo fueron utilizados en el estudio los niños sanos con todos los dientes permanentes erupcionados para su edad cronológica. Se determinó el grado de maduración de cada uno de los dientes permanentes del lado izquierdo de la mandíbula

y el valor de madurez dental fue calculado para cada niño. La evaluación de los datos demostró que todos los grupos del estudio (blancos, negros y latinos) tuvieron un valor de madurez dental más avanzado en la edad cronológica que la observada por Demijjian *et al.*⁵ en grupos franco-canadienses. Además, los varones y hembras latinos tuvieron valores de madurez dental más avanzadas que los varones y hembras blancos de la muestra de Chicago.

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