Age Estimation in Children from dental Radiograph: A Regression Equation

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Citation

B Rai, S Anand. *Age Estimation in Children from dental Radiograph: A Regression Equation*. The Internet Journal of Biological Anthropology. 2007 Volume 1 Number 2.

Abstract

Age estimation in children is not only important in clinically dentistry but also in forensic dentistry. The orthopantomograph samples of 435 healthy children (218 boys: 217 girls) aged between 4-16 years was selected. The purpose of present study for estimation chronological age based on the relationship between chronological age and measurement of the open apices in teeth and derived regression equations. The correlation coefficient between open apices and chronological age were highly significant. Also, number of tooth closed with apical and age showed significantly correlation.

INTRODUCTION

Tooth formation is widely used to assess maturity and predict age. In clinical dentistry, this information aids in diagnosis and treatment planning.[1] The continuous patterns of tooth development can be observed on a longitudinal series of radiographs and various mineralization stages.[2,3,4,5,6] A number of methods have been proposed to determine dental age,[7,8,9] but, the system developed by Demirijian has gained wide acceptance.[9]

During developmental stages particularly in root formation, a notable difference between sexes arises with females being advanced when compared with males.[10,11] The aim of this study was to determine age from open and closed apices of teeth, and derived a standard regression equation from them.

MATERIAL AND METHODS

Sample: The orthopantomographs sample of 435 healthy children (218 boys: 217 girls) aged between 4-16 years (table 1) was selected. Panoramic radiographs that were unclear or that showed hypodentia, gross pathology and previous orthodontic treatment were excluded. The chronological age for each subject was calculated by subtracting the data of the radiograph from the date of birth.

Study Design: This was a retrospective cross-sectional study. Good quality digital panoramic radiographs taken for this study during the course of diagnosis and treatment.

DENTAL AGE ESTIMATION

Orthopantomographs were digitized using a scanner (HP), and images were recorded computer files by computer aided drafting program (Adobe Photoshop 7). The seven left and right permanent mandibular teeth were recorded. The number of teeth with root development complete apical ends of the roots completely closed (N0), was calculated as by Cameriere et al.[11] but measured by vernier caliper (0.01).For incomplete root development i.e. in open apices teeth with one root, distance Ai, i: i,……5 while in two roots teeth (Ai, I=6,7) between the inner side of the open apex was measured. The possible differences in magnification and angulation among X-rays, measurements were normalized by dividing by tooth length (Li,i,1……7). Finally, dental maturity was evaluated using the normalized measurements of seven permanent [mean mandibular incisor i = ((Left + Right) / 2) mandibular teeth (xi=Ai/Li, i=1,……7), sum of the normalized open apices (S) and the number (N0) of teeth with completed root development .

Correlation coefficients were evaluated between chronological age and variables. For obtaining an estimated age as a function of the morphological variables and gender, a multiple linear regression equation with first order interactions was developed. Statistical analysis was performed with SPSS version 11.0 statistical program.

RESULTS

The ANOVA results (table II) show that gender and the variables x3 (Canine), S, N0 and first order interaction between S and N0 contributed significantly to the fit and fielding the following regression equation:

Age = 7.083+0.493G+0.931x3-0.854S+0.693N0-0.185S N0 Equation (1)

G variable is 1 for boys and 0 for girls. Correlation coefficients between age and morphological variables were statistically significant and negative.

Figure 1

Table 1: Different groups of age and gender in the study

Age (years)	Girls	Boys
4-6	23	18
6.1-8	33	53
8.1-10	48	33
10.1-12	39	40
12.1-14	38	35
14.1-16	34	37

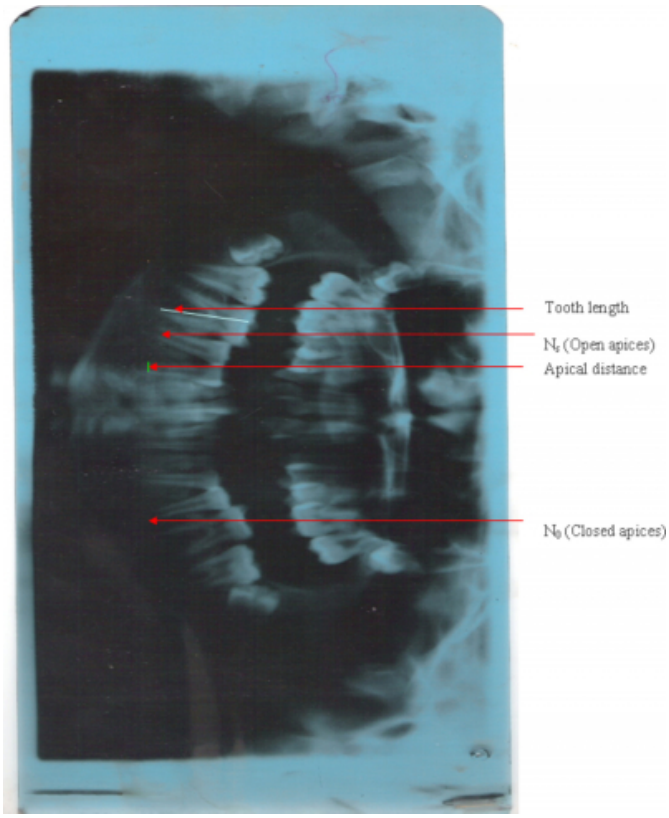
Figure 2

Table 2: Regression analysis predicting chronological age from the predictors

	Value	SD	p
Intercept	7.083	4.539	< 0.01
G	0.493	1.661	< 0.01
x3	0.931	6.9012	< 0.01
No	0.693	3.059	< 0.01
S	-0.854	2.087	< 0.01
SNo	-0.185	1.121	< 0.01

Figure 3

Figure 1: Parameters of Study



DISCUSSION AND CONCLUSION

Chronological age, as recorded by registration of birth date, is referred to throughout an individual's life. This information is relevant in medical and dental practice for evaluating developmental progress, for educational purposes and in legal maters, particularly in application of criminal law.[9,10] Various studies have reported that morphological measurements can be reliably made in orthopentomographs provided that some corrections are made to take into account the individual variability of tooth size and the differences in magnification of radiographs and angulation between x-ray beam and film.[12] In this study, to obtain an estimated age in north Indian children aged between 4 to 16 years old was obtained used measurements of the open apices of the (mean) of the seven permanent mandibular teeth. While one study have taken into account only left seven permanent mandibular teeth. The open apices in the present study showed a significant correlation with age, but only x3 contributed significantly to fit, while the other teeth entered the model equation while this consistent with previous study except x5 (Second premolar) contributed significantly to fit.[9,10] This may be due to different genetic factor, environmental factors, nutritional factors and geographical factors.[10,11] The present regression equation I is derived for

age estimation from children. This equation may be used as a diagnostic tool for age estimateion in children, where in medicolegal cases and clinical dentistry.

ACKNOWLEDGEMENT

We are thankful to Dr. Simmi Kharb, Dr. Vinod Kangra, DR.S C Anand, Mr Kashmir Verma, Suresh Kumar (B. Tech) for valuable help and critical reviewing of our manuscript.

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