

Applicability of Cameriere's method of age estimation in children on Nepalese population residing in central region of Nepal

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Abstract

Introduction: Forensic sciences have been using dental age assessment as a vital part of their procedures. Age have been calculated by many other methods in the past like determination of height and its relation to age was done in early 17th century in England. One of the latest methods introduced in 2006 by Cameriere et al uses the measurement of the apical opening of the teeth and then relates it to the age of the child. The pioneer study was done in European population but it followed many other studies done in various populations.

Materials and Methods: This retrospective study was done by using the orthopantomograms of 250 children were evaluated in the age range of 5-13 year belonging to both genders. 150 belong to males and 100 to females. Dental age was estimated by using the dental equation given by Cameriere et al. It was then compared with the chronological age.

Results and conclusion: mean values of the dental age calculated by this method and the known chronological age were examined, an underestimation of 0.16 years was found. On further analysis based on gender, an underestimation of 0.23 years was found in girls and 0.12 years in boys. This study shows that the European linear equation given by Cameriere et al is applicable to the Nepalese population residing in central region of Nepal although with a little underestimation. But this can be used for practical purpose of age estimation in cases involving subjects dead or alive.

Keywords: Forensic sciences, Age estimation, Demirijian method, Cameriere's method.

Introduction

Age assessment using dental radiographs has been used readily since many years. The applicability of dental X-rays in determining the closest range of the age is useful for forensic and legal purposes.¹ Not only the forensic scientists, but the pediatric dentists benefit a lot from these age determination methods. They allow them to determine correctly the dental age of the child which can then be compared to the known chronological age.² Any disparity raises an alarm for the doctor and thus the patient is put under further systemic evaluation. Also, for orthodontic purposes, to know the growth of the child before attempting any procedure is indispensable.

On the other hand, forensic sciences have been using dental age assessment as a vital part of their procedures.³ It is not only the accuracy with which the age of the corpse can be determined but also the speed with which it can be done. In certain cases of arsonists attacks, teeth are the only structure available in the remains.⁴ So, a method of determination involving the teeth is of essence. Many cases of child abuse and trafficking need a legal confirmation of age and thus these methods are quick and helpful.

Age have been calculated by many other methods in the past like determination of height and its relation to age was done in early 17th century in England.¹ With advanced knowledge of sciences, these methods have become obsolete. Various other anthropological, skeletal and psychological methods have been used for age determination.

Skeletal methods, though used, are known to be affected by environmental changes and thus their reliability is questionable. Whereas, the dental maturation i.e. the tooth calcification is mainly guided by the genes and has minimum environmental influence. Maturation of teeth is minimally affected by hormonal imbalance, pathological insults and malnutrition as compared to skeletal features. Thus, many methods for estimation of age from dental maturity have been developed.

Demirijian method has been one of the gold mark in determination of age from teeth. It was given in 1973 and is still used for the purpose.^{5,6} Other methods include estimation from the aspartic acid values in tooth enamel, methods involving crown height determination and its relation to age assessment, root apex completion and pulp chamber size determination for the assessment of age.⁷⁻⁹

One of the latest methods introduced in 2006 by Cameriere et al uses the measurement of the apical opening of the teeth and then relates it to the age of the child.¹⁰ The pioneer study was done in European population but it followed many other studies done in various populations. ¹¹These studies have shown that this method is more accurate than many others.

So, the purpose of this study was to determine the applicability of the method in estimating age of individuals which was introduced by Cameriere et al on the Nepalese population residing in central region of Nepal.

Materials and Methods

This retrospective study was done by using the orthopantomograms from the Oral medicine and Radiology department at College of medical sciences, Nepal. Radiographs of 50 children were evaluated in the age range of 5-13 years. These OPGs belonged to both genders. All the radiographs were obtained with ethical clearance from the committee and these which were unclear due to any radiographic error, or those with hypodontia, any history of orthodontic treatment were not the part of this study.

The evaluation of the lengths and widths were done after digitizing the files in Adobe Photoshop 7. The detailed methodology of this procedure involved stepwise evaluations as below:

1. All seven permanent mandibular left teeth were evaluated in this study.
2. N_0 –was the term given to those teeth with complete root apices. So, all the teeth with N_0 were noted down.
3. Now, began the examination of teeth with incomplete root formation and thus open apices.
4. A_i - In cases of teeth with one rooth, it is the distance between the inner sides of the open apices. (A_i , where $i= 1, 2, 3...5$) Fig. 1.
5. In case of teeth with two roots, it is the sum of the distance between the two open apices and the values then range from ($A_i= 6, 7$)
6. $L_i=$ The total length of the tooth was used to put into consideration the possible effects of magnification and angulation on the above values. So, the values were normalized by dividing them with tooth length ($L_i= 1, 2, 3...7$).
7. To determine the dental maturity, normalized measurements if all the seven permanent left mandibular teeth ($X_i=A_i/L_i$, where $i=1, 2....7$), the sum of the open apices and N_0 .
8. All the above determination of values were done by a single observer and to eliminate the bias, random sample of 25 OPGs was again evaluated by another observer again after an interval of three weeks.
9. The values were finally used for age determination through the equation originally formulated by Cameriere et all:

10. Dental Age = $8.971 + 0.375g + 1.631x5 + 0.674N0 - 1.034s - 0.176s.N0$
11. Where, $g=$ gender (1 for boys and 0 for girls), $x5 = A5 /L5$, $s=$ sum of normalized open apices, $N0=$ number of teeth with completed root development.
12. After the determination of dental age by the above method, chronological age was determined by substracting date on which the radiograph was taken from the date of birth. Statistics were done using SPSS software.

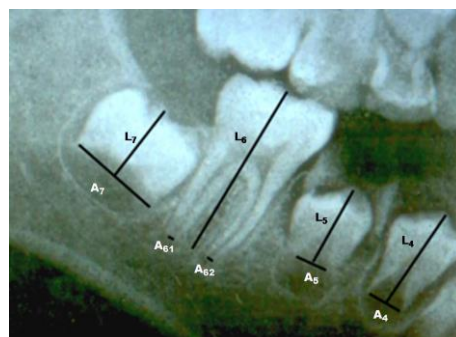


Fig. 1: A_i - In cases of teeth with one rooth, it is the distance between the inner sides of the open apices. (A_i , where $i= 1, 2, 3...5$) In case of teeth with two roots, it is the sum of the distance between the two open apices and the values then range from ($A_i= 6,7$) $L_i =$ The total length of the tooth was used to put into consideration the possible effects of magnification and angulation on the above values

Results and observations

No statistically significant difference was found on the intra examiner values of the panoramic values. When the mean values of the dental age calculated by this method and the known chronological age were examined, an underestimation of 0.16 years was found. On further analysis based on gender, an underestimation of 0.23 years was found in girls and 0.12 years in boys. Table 1.

On comparing the dental and chronologic age, the p values were insignificant showing that with this method of calculation of dental age, no significant difference of the calculated age was found as compared to the real chronological age.

Table 1: Overall assessment of the data

	Chronological age(5-7)	Chronological age (7-9)	Chronological age (10-12)	Chronological age (13-15)	Overall
Difference of Chronological age and dental age (boys)	N=50 0.13	N=30 0.14	N=40 0.10	N=30 0.11	0.12
Difference of Chronological age and dental age (girls)	N=30 0.22	N=20 0.24	N=35 0.25	N=15 0.21	0.23
p-Value					0.25

Table 2: Comparison of dental and chronological age of the children with mean age 10.34 by the use of Paired t test (p<0.5 is significant)

	Mean age (yrs)	Standard deviation	P Value
Chronological age	10.34	+/- 1.73	0.27
Dental age	10.14	+/- 1.68	

Discussion

Forensic dentistry is an evolving branch of forensic sciences.³ Role of a forensic dentist is at par with the other branches under forensics in a number of cases involving an age dispute. In mass disasters, the identification of individuals is mainly based on the dental remains.² It is quick and easily documentable. Not only in such legal cases but also in cases of child abuse and trafficking, age estimation is very important and thus many methods have been used since early 17th century to estimate the age of the child from dental methods.⁵

The age of the child can be determined both alive and dead from the dental radiographs by the estimation of the development of teeth, jaw bones, maxillofacial structures, etc.⁷⁻⁹ Tooth formation involves many steps starting from the initial appearance of tooth bud to the calcification of crown and then root.¹² This is a continuous process and all the teeth in one arch are usually under different stage of development at a particular age.¹³ A complete study in to the growth and development of the teeth has led to the development of many methods which can associate these developmental stages to the age of the child.¹⁴

Many methods like Demerijian, Nolla's etc. have been used to assess the age of the child.⁵⁻⁶ Then again, they have been found applicable on one population and in a particular age group and may be less applicable to another population or age group. Many studies have been done to see the applicability of these tests on a particular population.

In our study, we have used a rather new method which has been given by Cameriere et al in 2006 and performed on the European population. There results have shown a high predictability value of the linear equation adapted by them on the European population.^{15,16} Our evaluation of the same equation on Nepalese population residing in the central region of Nepal has given similar results. An underestimation of age through this method is evident from the chronological age but the difference has not been found to be significant.

One study done on an Indian population using same methods reported a mean over estimation of 0.04 years in girls and 0.05 years in boys.¹⁷⁻¹⁹

The differences in the values can also be attributed to the errors produced due to sample size and structure, subjectivity, nationality, observer's calculation etc.

So, with this study we can say that the European linear equation given by Cameriere et al is applicable to the Nepalese population residing in central region of Nepal although with a little underestimation. But this can be used for practical purpose of age estimation in cases involving subjects dead or alive.

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