International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

AGE ESTIMATION USING DIGITAL PANORAMIC RADIOGRAPHY

AREZOU TORKIAN

E Mail: Torkian_ar@yahoo.com

ABSTRACT

One of the interesting applications of forensic deontology is age estimation by means of teeth. Age assessment proves to be a critical factor in the victim identification process. Teeth display a number of observable age related variables and they tend to remain intact under circumstances, which might alter or obliterate the rest of the skeleton. The procedures for age determination are complex. Different methods are used to estimate age. The purpose of this article is to familiarize about different techniques used to by means of teeth.

Keywords: Age Estimation, Teeth, deontology

INTRODUCTION

One of the interesting applications of Forensic Odontology is age estimation by means of teeth. Teeth may be better preserved than other parts of the body and thus give a better indication of age. It has application in establishing the identity of living or deceased persons. It also has application in living individuals whose chronologic age is under dispute. Dental age is one of the few measures of physiologic development that is uniformly applicable from infancy to late adolescence. Historically age assessment using teeth was first published by Edwin Saunders [1] in 1837, who claimed that teeth provided the most reliable guide to age compared to age estimation from height which was a standard method used during that time. Age estimation is very important in forensic medicine, not only for identification of victims, but also in crimes and accidents. It is also used for purposes other than forensic uses, such as signing up for school, recruitment, marriage and some social activities [1]. Forensic dentistry is defined as the use of dental science for legal purposes. In other words, dental records are used for the benefit of administration of justice [2]. As present, in

some cases, the judge delivers the verdict based on dental evidence and records. In cases where none of the identification methods are feasible, teeth come to the rescue [3]. In 1925, Bodeckar stated that aging causes significant changes in tooth structure; these changes can be used for age estimation. The first efficient method for the identification of the age of unknown corps was introduced by Gustafson in 1950 in Scandinavia [4]. Cameriere in 2004 measured the AR in a canine tooth on digital panoramic and periapical radiographs to assess the status of secondary dentin [13]. In previous studies, the AR was reported as the only parameter that had a significant correlation with age. Thus, the correlation of AR with age has been the subject of many investigations and the efficacy of this ratio has been evaluated in some

ethnic groups [6]. Cameriere et al, in their recent report assessed age estimation using AR of mandibular premolars on panoramic radiographs [14]. Some limitations have been described for this method in the literature such as the nature of panoramic radiography and its innate distortion [15].

Panoramic radiography has unique characteristics making it suitable for many investigations [16]. At present, digital panoramic radiography is considered a suitable alternative to conventional methods. Considering the controversies in the results of previous studies on age estimation with this technique and lack of a similar study in Iran, this preliminary study aimed to assess the efficacy of the method presented by Cameriere for age estimation from the AR in patients requiring a panoramic radiograph presenting to a maxillofacial radiology clinic.

1. Factors used for the age determination using dentition [3]

The factors are:

- The appearance of tooth germs
- Earliest detectable trace of mineralization
- Degree of completion of the unerupted tooth
- Rate of formation of enamel and formation of the neonatal line
- Clinical eruption
- Degree of completion of roots of erupted teeth
- Degree of resorption of deciduous teeth
- Attrition of the crown
- Formation of physiologic secondary dentin
- Formation of cementum
- Transparency of root dentin

- Gingival recession
- Root surface resorption
- Discolouration and staining of teeth
- Changes in the chemical composition of teeth

MATERIALS AND METHODS

In this diagnostic study, 120 digital panoramic radiographs of patients over 12 years of age were selected considering the error rate of 10% of the actual value in similar studies, 5% confidence interval and 80% accuracy of results. Taking into account the regression model statistical method and considering the number of independent variables, 60 male and 60 female patients were studied. Patient's age at the time of radiography was calculated by subtracting the date of radiography from the patient's birth date (year and month). Panoramic radiographs were obtained, recorded and evaluated. The images were transferred to AutoCAD software (2011) and the area of the maxillary right canine tooth was cropped. In this study, only the maxillary right canine teeth that were fully erupted and sound were evaluated and teeth with root fillings or coronal restorations or crowns, broken teeth, carious teeth and rotated teeth were excluded. Next, for each tooth, a minimum of 20 points were marked on the tooth periphery and 10 points were marked on the pulp periphery on the image. Using the "Area" option, based on the measured values, the AR was estimated by the software (Figure 1).
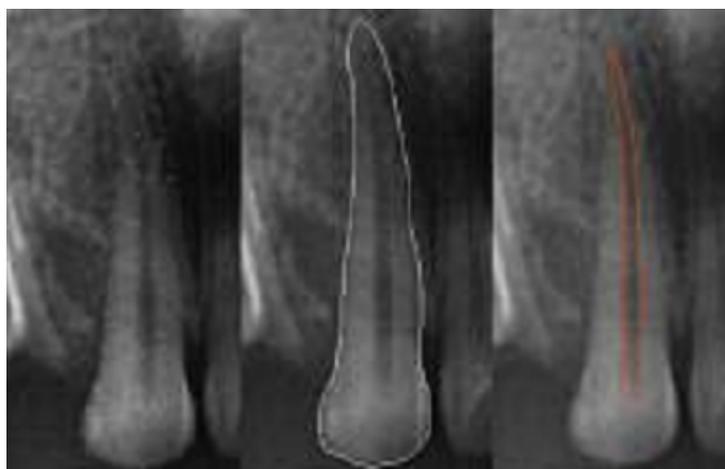

Figure 1: Steps of measurement of AR by the AutoCAD software

After data collection, patient's age was estimated based on this ratio using logistic regression analysis. A comparison was made between the estimated age and the chronological (actual) age and the role of related factors (sex) in this ratio was investigated. All measurements were made by an oral and maxillofacial radiologist. Two

weeks after the termination of assessments, 30 radiographs were randomly selected and evaluated again by the same observer to ensure the accuracy of measurements. In this study, patients were evaluated in two groups of males and females (n=60).

2. Age estimation in children and adolescents

Tooth eruption and tooth calcification are the two events that can be used to measure dental age in children and adolescents. Radio graphical evidence of formation of crown and root completion has been utilized for this age group.

Schour and Massler's chart [4] was the first attempt to study dental age estimation. This chart permits direct comparisons with radiographs. Demirjian et al developed an age estimation method [5]. that made use of a scoring system. In this method, seven mandibular teeth on the left side were divided into 8 stages and maturity score was evaluated. Age estimation can be measured using mandibular third molars [6] in which formed part of root were digitized but the precision of the age estimation was slightly inferior compared with the standard method.

RESULTS

The minimum and maximum difference between the actual age and the estimated age

in males was 0.07 and 33.28 years, respectively. The mean AR was calculated to be 0.144±0.044. In 60 male subjects, the regression formula for age estimation in each individual was calculated as follows: Age=24×AR+37.7 The correlation coefficient was found to be -0.180; statistically, the correlation between AR and age was not significant (p=0.169) (Diagram 1).

The minimum and maximum difference between the actual age and the estimated age in females was 0.36 and 17.15 years, respectively. The mean AR was calculated to be 0.143±0.023. In 60 female subjecs, the regression formula for age estimation in each individual was calculated as follows: Age=-144× AR+55 The correlation coefficient was found to be -0.336 and this correlation was statistically significant (p=0.004) (Diagram 2). The negative correlation coefficient showed that AR decreased by aging. Two weeks after the termination of assessments, 30 radiographs were randomly selected and evaluated again by the same observer. The ICC was calculated to be 0.912, which is close to one and indicates high reproducibility of results.
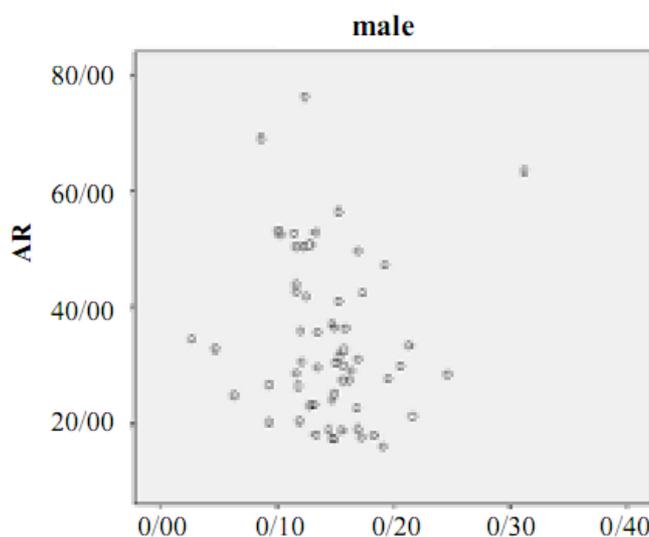
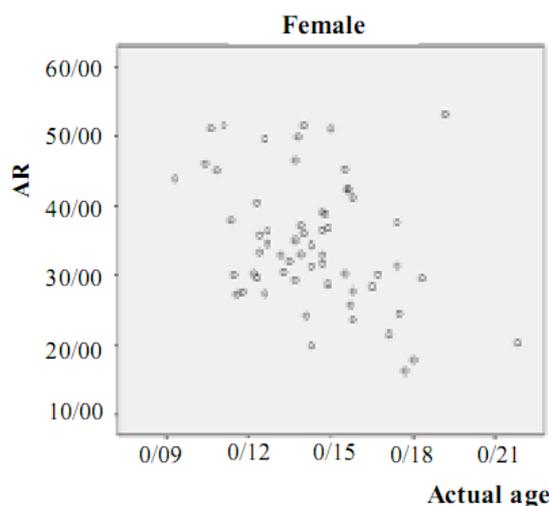**Figure 2: Distribution of actual age in comparison with AR in males**

Figure 3: Distribution of actual age in comparison with AR in females

CONCLUSION

Age estimation presents a complex problem and requires considerable experience in recognizing significant changes and allowing for their variability with in any particular population. Teeth are particularly useful in age evaluation because they display a number of observable age related variables and they tend to remain intact under circumstances which might alter or obliterate the rest of the skeleton. In males, the regression equation underestimated or overestimated the actual age. In females, this equation accurately estimated the age in 16% of cases. AR as a single index cannot be used for age estimation of an individual; however

it can be used in combination with other indexes for this purpose.

REFERENCES

1. Willems G. A review of the most commonly used dental age estimation techniques.J Forensic Odontostomatol. 2001 June;19(1):9-17.

2. Shahidi P. Dentist And Law. 1st ed. Tehran: Moalef Co; 1371 [Persian].

3. Kashyap V, Koteswara Rao N.A modified Gustafson method of age estimation from teeth. Forensic Sci Int. 1990 Oct; 47(3):237-47.

4. Xiaohu X, Philipsen H, Jablonski N,Pang K, Jiazhen Z. Age estimation from the structure of adult human teeth: Review of the literature. Forensic Sci Int. 1992 Apr; 54(1):23-8.

5. Kvaal SI, Kolltveit KM, Thomsen IO, Solheim T. Age estimation of adults from dental radiographs. Forensic Sci Int. 1995Apr;74(3):175-85.

6. Zaher JF, Fawzy IA, Habib SR, Ali MM. Age estimation from pulp/tooth area ratio in maxillary incisors among Egyptians using dental radiographic images. J Forensic Leg Med. 2011 Jan; 18(2):62-5.

7. Soomer H, Ranta H, Lincoln MJ, Penttila A, Leibur E. Reliability and validity of eight dental age estimation methods for adults. J Forensic Sci. 2003 Jan;48(1):149-52.

8. Kvaal S, Solheim T.A non-destructive dental method for age estimation.J Forensic Odonto stomatol. 1994 June; 12(1):6-11.

9. Singaraju S, Sharada P. Age estimation using pulp/tooth area ratio: A digital image analysis. J Forensic Dent Sci. 2009, May; 1(1): 37-41.

10. Lamendin H, Baccino E, Humbert J, Tavernier J, Nossintchouk R, Zerilli A. A simple technique for age estimation in adult corpses: the two criteria dental method. J Forensic Sci. 1992 Sept; 37(5):1373-9.

11. Paewinsky E, Pfeiffer H, Brinkmann B. Quantification of secondary dentine formation from orthopantomograms-a contribution to forensic age estimation methods in adults. Int J legal Med. 2005 Nov; 119(1):27-30.

12.Bosmans N, Ann P, Aly M, Willems G.The application of Kvaal's dental age calculation technique on panoramic dental radiographs. Forensic Sci Int. 2005 Nov; 153(2):208-12.

13. Cameriere R, Ferrante L, Cingolani M. Variations in pulp/tooth area ratio as an indicator of age: A preliminary study. J Forensic Sci. 2004 Mar;49(2):317-319.

14. Cameriere R, De Luca S, Alemán I, Ferrante L, Cingolani M. Age estimation by pulp/tooth ratio in lower premolars by orthopantomography. Forensic Sci Int. 2012 Aug; 214(1):105-12.