Estimation of Age for Sudanese Adults using Orthopantomographs

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Abstract

Background: Radiology plays an important role in human age determination. Radiological images are utilized in the process of age estimation.Objectives: The aim of this study was to determine the usefulness of Orthopantomgraphs (OPGs) in the assessment of the Sudanese adult age compared to chronological age.Materials and Methods: The study was obtained in Mursi Medical Center from the period of January to August 2011. The OPGs of 99 Sudanese individuals of both gender (49male and50 female) with known chronological age, ranging from 15 to 30 years, were selected .The pulp -root length ,root length, pulp/root ratio , total tooth length ,crown length of the mandibular canine were measured in mm and the estimated age was recorded using the mandibuler canine measurements .Patients were classified into three groups ,A was of age <20 years old ,B was of 20 to 27 and C was of age >27.Results: the estimated age in A and C groups were well correlated with the chronological age in both genders and no significant difference was detected, but in B group there is a significant difference between the estimated and chronological age and between males and females measurements.

Index terms— age estimation, sudanese, orthopantomography.

1 Introduction

PG is one of the imaging modalities that produce a complete view of both dental arches and their adjacent structures with minimal geometric distortion and with minimal overlap of anatomic details from the contra lateral side. ??Allan E, 2010] Age estimation, is necessary especially in a multicultural society [Nathalie Bosmansa, 2005], different methods for dental age calculation were used including morphological and radiological techniques. The morphology technique required extraction, which cannot be used in living individuals where it is not acceptable to extract teeth for ethical reasons. In such circumstances, a radiographic approach, offers a relatively nondestructive method and eliminates the need for extraction of teeth.[Ridhima ??harma and Anurag Srivastava,2010] The dental pulp development and regressive changes can be related to chronological age. ?? Reppien K., Sejrsen B., Lynnerup N.,2006] The size of the pulp decreases with age due to the deposition of the secondary dentin, and this is a continuous process that occurs throughout life [Nanci A.,2008],dental pulp can be used as a parameter to assess the age of an individual during later periods of life.

Kvaal et al. reported a new method for estimating the chronological age of adults based on the relationship between age and the pulp size on periapical dental radiographs ??Kvaal SI,et al1995] as well as on orthopantomographs (OPGs) for estimating the age of an individual. [Smans N.,2005] Therefore the Objectives of this study are to assess the dental age for Sudanese population using OPG as one of the radiological methods as well as to determine the usefulness of OPG in dental morphology assessment for the age compared to chronological age using Kvaal's method and to evaluate the applicability of dental age in forensic sciences for Sudanese II.

2   Materials and Methods

The study was done at Mursi Medical Center during the period from March 2011 to August 2011.OPG machine GENDEX was used by applying 47 Kv, 10 mAs. 99 subjects with known chronological ages between (15-30 years old), from panoramic x-ray department were involved in this study, the best presented mandible canine on the orthopantomograph and suited for measurement were chosen. The subjects with impacted teeth, opaque fillings, crowns, pathological processes in the apical bone visible on the radiograph and extracted canine and ages more than 30 were not selected. Orthopantomograms showing badly positioned teeth or teeth with large areas of enamel overlap between neighboring teeth were also excluded. The ethics and research committee approved the study and consent was obtained from all patients prior to the examination.All subjects were examined in sitting position; and in proper manner to ensure that the teeth and jaws are within the image. All foreign objects, including dental appliances, spectacles and earrings were removed. The patient's head was positioned O correctly; the patient rested the tongue against the palate to prevent a radiolucent band appearing above the maxillary teeth .Dental panoramic tomography was carried out with intensifying screens to limit the radiation dose. The Study chooses the mandible canine in both genders to apply the measurements. The variables were defined as: P= the length of the pulp, T= the length of the root from cervical area to the apical end, C= the length of the crown from the cervical area to the incisal edge, Total length of the tooth.The four variables were measured in (mm) and the pulp/tooth area ratio of the canine was calculated. Age was calculated using the Indian formula derived: (Age=64.413-(195.265 x PTR).where PTR is the pulp/tooth area ratio. The Indian specific equations [Babshet M.,et al2010] were applied for Sudanese subjects and examined its use in age prediction; the suspected age was compared to the known chronological age.

III.

3   Statistical Analysis

The data were analyzed by using SPSS, version 16.0.The data are expressed using mean, standard deviations and percentages and p value at 0.05 to test the degree of significances.

IV.

4   Results

The 99 Sudanese subjects studied consist of 50 (50.5%) female and 49(49.5%) male The total sample is divided into three groups ??) ,(P) stands for the length pulp, (T)for the length of the root from cervical area to the apical end, (C)for the length of the crown from the cervical area to the incisal edge, Total length of the tooth. And (PTR) is the pulp/tooth area ratio

5   Number of Subjects are 47 for both gender (Age <= 20 or age > 26 years),(P) stands for the length of the pulp, (T)for the length of the root from cervical area to the apical end, (C)for the length of the crown from the cervical area to the incisal edge, Total length of the tooth. And (PTR) is the pulp/tooth area

6   Discussion

Age estimation plays an important role in forensic medicine and dentistry. ??Maber M,2006] Radiology plays an indispensable role in human age determination. Radiological age estimation in adults would be challenging as the development of dentition is completed.

In adulthood, teeth undergo time-related changes representing biological aging, and many studies have shown that several features of aging can be used for age determination ??Paewinsky E.2005] including volume of pulp cavity and the third molar development as well as the morphology of the teeth.

The main objective of this study was to assess the dental age using OPG as a routine method used in dentistry. The study used five variables including: The pulp -root length, root length, pulp/root ratio, total tooth length, crown length of the mandibular canine in both genders using mean values and standard deviation.

The sample was divided into 3 groups, group A was of ages <20, [??able 1,2] shows that the mean age and standard deviation were found to be For PRL (P) and TRL (T), CIL(C) it was found to be 14.6±2.9, 17.7±2.7, 10.9±.9, and the total length of the mandible canine was found to be 28.3±3.9 where the PTR ratio was found to be 82.3±6. 4.

The Indian equation mentioned by [Babshet M. 2010] was applied using the PTR to calculate the subjects suspected age, the mean age and standard deviation were found to be 15.9±1.24, 16.0±1.30 for Chronological age and estimated age respectively. The correlation between the chronological and estimated age of this group was found to be 0.000 at p-value of 0.005. ??Table3] Results of Group B (Age > 19 and age < 27) were found to

be: for PRL (P), TRL (T), CIL(C), were found to be 18.4±3.5, 15.5±3.1 and 11.2±.8 and the total length were found to be 26.7±3.1 and the PTRratio was 118.9±8.1.

The mean age and standard deviation were found to be 22.9±1. Results of Group C (Age > 26) the results shows that the mean PRL-Pwas19.4±0.8 and TRL -T was 12.5±1.124 and CILC was10.7±0.6 where the total length was found to be 23.2±1.3, and PTR ratio was 155.7±9.9.the mean age and standard deviation were found to be 30.3±1.7, 30.4±1.9 for Chronological age and estimated age respectively, The result showed that there were significant relationships detected when calculating the estimated age in group (A and C) with the chronological age in both genders, but there is a significant difference between the estimated and chronological age in group (B).[Table7, 8,9] On similar grounds, a study was carried out to examine the application of the pulp/tooth area ratio by digital periapical images of upper and lower canines as an indicator of age. It was concluded that canines can serve to predict the age of an individual [Cameriere et al, 2007] Results of the Groups A and C (Age <= 20 or age > 26 years) showed a significant relation between the chronological age and estimated age [tables 10,11,12] The relation between the chronological age and PTR Ratio was studied, it was increased by 0.19±0.02,R2 was 0.98 this ;because of that with advancing age, secondary dentine is deposited along the wall of the dental pulp chamber, leading to a reduction in the size of the pulp cavity. **??** Prapanpoch S,1994] this ratio is good indicator for ages less than 20 and more than 26 it consigned with the estimated age gained by the Indian equation but in ages of twenties the exact age was not estimated significantly when using PTR ratio. [Figures **??**,2].The relation between the chronological age and Total Length was also been evaluated, it was found that the total tooth (canine) length was decreased by increasing the age, and TRL was also decreased with age as it appears in [Figures **??**,4 To conclude ;this study is an attempt to assess the age using OPG in Sudanese population in both gender using mandibuler canine for PTR, the result suggested that The Indian formula for mandibular canine measurements can be applied to estimate the dental age for Sudanese significantly with the chronological age in ages less than 20and more than 27 in both male and female, but in the ages between 20 to 27 there is a significant difference between chronological and estimated age as well as between males and females measurements.

Also it gives a scope for future studies on larger sample size, and measuring the molars and premolars as an age indicator. [1]

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Figure 1: Fig. 1 :Fig. 2 :Fig. 3 :Fig. 4 :

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4

A-B-C)

[Note: Number of Subjects are 52 for both gender (Age > 19 and age < 27) The ages are measured in years and the variables measurements are taken in (mm) Tab le 5 : The average mean and STDV of the variables collected from both genders]

Figure 2: Table 4 :

6

	Number	Correlation	Significant
Chronological & Estimated age	52	.955	.182

Number of Subjects are 52, (Age > 19 and age < 27), P-value is significant at 0.000

c) Results Of Group C (Age > 26)

Figure 3: Table 6 :

7

	Gender	Number	Mean	Std. Deviation
Chronological age	Male	14	30.229	1.6790
	Female	5	30.320	1.8130
Estimated age	Male	14	30.736	2.0167
	Female	5	29.620	1.3424
PRL(P)	Male	14	19.29	.726
	Female	5	19.60	1.140

Figure 4: Table 7 :

8

	Chronological age	Estimated age	PRL (P)	TRL (T)	CIL (C)	Total length	PTR ratio
Number	19	19	19	19	19	19	19
Mean	30.253	30.442	19.37	12.47	10.68	23.16	155.7316
Std. Deviation	1.6638	1.8954	.831	1.124	.582	1.259	9.93518

Number of Subjects are (Age > 26)

Figure 5: Table 8 :

9

		Number	Correlation	Significant
Chronological & Estimated age		19	.894	.000

Number of Subjects are 19 (Age > 26) P-value is significant at 0.000

d) Results of the Groups A and C (Age <= 20 or age > 26 years)

Figure 6: Table 9 :

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TRL (T)	Male	14	12.29	1.069
	Female	5	13.00	1.225

Figure 7: Table 10 :

Tab le 11 :	Chronological age	Estimated age	PRL (P)	TRL (T)	CIL (C)	Total length	PTR ratio
Number	47	47	47	47	47	47	
Mean	21.717	21.84	16.53	15.57	10.83	26.21	
Std. Deviation	7.2456	7.326	3.322	3.393	.789	3.989	

Number of Subjects are 47 (Age <= 20 or age > 26/ years),the measurements are taken in (mm) for the var

Table12 : The correlation between the chronological and estimated age

	Number	Correlation	Significant
Chronological & Estimated age	Number of Subjects are 47, Age <= 20 or age > 26 years		

ratio

Figure 8:

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123 [Estrela et al.] , Carlos Estrela , José Valladares Neto , Mike Reis Bueno , Orlando Aguirre Guedes .

124 [Porto] , Olavo Cesar Lyra Porto .

125 [Solheim ()] *A nondestructive dental method for age estimation, T.forensic odontostomatol*, T S I Solheim . 1994.
126   12 p. .

127 [Maber et al. ()] 'Accuracy of age estimation of radiographic methods using developing teeth'. M Maber , H M
128   Liversidge , M P Hector . *Forensic Sci Int* 2006. 159 p. .

129 [Cameriere et al. ()] 'Age estimation by Es pulp/tooth ratio in canines by peri-apical X-rays'. R Cameriere , L
130   Ferrante , M G Belcastro , B Bonfiglioli , E Rastelli , M Cingolani . *J Forensic Sci* 2007. 52 p. .

131 [Kvaal et al. ()] 'Age estimation of adults from dental radiographs'. S I Kvaal , K M Kolltveit , I O Thomsen , T
132   Solheim . *Forensic Sci Int* 1995. 74 p. .

133 [Landa et al. (2009)] 'Application of the method of Kvaal et al, to digital orthopantomograms'. M I Landa , P
134   M Gara Mendi , M C Botella , I Aleman . *Int J legal Med* 2009 Mar 123. (2) p. .

135 [Reppien et al. ()] 'Evaluation of post-mortem estimated dental age versus real age: A retrospective 21-year
136   survey'. K Reppien , B Sejrsen , N Lynnerup . *Forensic Sci Int* 2006. 159 p. .

137 [Jesus Djalma Pécora Linear measurements of human permanent dental development stages using Cone-Beam Computed Tomogr
138   'Jesus Djalma Pécora Linear measurements of human permanent dental development stages using Cone-Beam
139   Computed Tomography: a preliminary study'. *Dental Press J. Orthod* Maringá Sept./Oct. 2010. 15 (5) .

140 [Prapanpoch et al. ()] 'Morphometric analysis of the dental pulp chamber as a method of age determination in
141   humans'. S Prapanpoch , S B Dove , J A Cottone . *Am J Forensic Med Pathol* 1992. 13 p. .

142 [Babshet and Acharya (2010)] 'Naikmasur VG Age estimation in Indians from pulp/tooth area ratio of mandibu-
143   lar canines'. M Babshet , A B Acharya . *Forensic Sci Int* 2010 Apr 15. 197 (1-3) p. 125.

144 [Farman (2010)] *Panoramic Radiology Seminars on Maxillofacial Imaging and Interpretation. First Edition*,
145   Allan G Farman . November 2010. Berlin Heidelberg: Springer.

146 [Paewinsky et al. ()] 'Quantification of secondary dentine formation from orthopantomograms–a contribution to
147   forensic age estimation methods in adults'. E Paewinsky , H Pfeiffer , B Brinkmann . *Int J Legal Med* 2005.
148   119 p. .

149 [Sharma and Srivastava ()] 'Radiographic evaluation of dental age of adults using Kvaal's method'. Ridhima
150   Sharma , Anurag Srivastava . *J Forensic Dent Sci* 2010.

151 [Ed ()] *Tencate's Oral Histology, Development, Structure and Function*, Nanci A Ed . 2008. Elsevier Publishers.
152   p. 225.

153 [Bosmansa et al. ()] 'The application of Kvaal's dental age calculation technique on panoramic dental radio-
154   graphs'. Nathalie Bosmansa , Peirs Annb , Medhat Alya , Guy Willemsa . *Forensic Science International*
155   2005. 153 p. .

156 [Smans et al. ()] 'The application of Kvaal's dental age calculation technique on panoramic dental radiographs'.
157   N Smans , Ann P Aly , M Willems , G . *Forensic Sci Int* 2005. 153 p. .