Estimation of crown length and root development in Iraqi primary school students using Orthopantomograph[5]

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ABSTRACT

Background: Dental development provides the orthodontist an invaluable information for providing proper timing of certain preventive & interceptive orthodontic measures. The aim of this study was to find out the normative values of crown & root lengths & developmental stage of maxillary permanent canine and first & second molars of Iraqi primary school children aged 8,10 & 12 years of age using OPG [5].

Materials & Methods: Crown length & root development was studied in 60 Iraqi primary school children aged 8 to 12 years old using Orthopantomograph [5].

Results: Crown length & root length was seen greater in females than in males and a gradual increase in root length was observed as we pass from age of 8 years toward 12 years of age indicating that root calcification was evident and pass faster in females than in males.

Coclusion: This study provide information about the normal development of maxillary dentition represented by canine, first & second molars.

Keywords: Crown length, root development, OPG. **(J Bagh Coll Dentistry 2006; 18(1) 49-53)**

INTRODUCTION

The study of dental development provides the orthodontist an invaluable information for providing proper timing of certain preventive & interceptive orthodontic measures [(1)]. The development of the dentition presents an integral part of craniofacial growth that has been a subject of investigation by many authors [(2,3)]. Different types of radiographic techniques were used in the study of this subject. Crossner &Mansfeld [(4)]; Roberts et al.[(5)] and Nystrom & Ranta, [(6)] utilized the orthopantomography in their studies. From this radiological examination the development of the entire dentition can be assessed with relatively low radiation dose and short exposure time [(7)]. Farah [(8)] introduced an objective method for the assessment of dental development in children aged 9-10 years. This method involved the use of crown & root length measurements .The crown/root ratio was determined from the analysis of the data of permanent teeth size as mentioned by Ash [(9)]. The complete root length was determined from the multiplication of crown length measurement by 1.6.

Root formation can be divided into four stages as follows:

Stage 1: From the beginning of root formation till the complete formation of the first quarter of the root.

Stage 2: From the beginning of formation of the second root quarter till the end of the first half.

Stage 3: From the beginning of formation of the third root quarter till the end of the third quarter.

Stage 4: From the beginning of the formation of the last root quarter till the end of root formation.

The present investigation is carried out to find out the normative values of crown & root lengths & developmental stage of maxillary permanent canine and first & second molars of Iraqi primary school children aged 8,10 & 12 years of age using OPG [5].

MATERIALS AND METHODS

Sixty children (30 males & 30 females) divided into 3 age groups, having normal occlusion were selected. Orthopantomograms were taken for all 60 children with anodic voltage of 75-85 kVp & anodic current of 15 mA. The exposure time was 15 second.

The state of development of the permanent maxillary canine, first & second molars has been investigated in this study.

Crown length measurement was made from cusp tip to CEJ for the canine and for the first & second molars the crown length was measured from the point of intersection of cusp line with the long axis of the tooth to CEJ.

Total tooth length was measured from the cusp tip or the point of intersection of cusp line with the long axis to the most inferior of the radiopaque tissue of the root. In multirooted teeth a line connecting the apices or the most superior part of the root was drawn & the measurement was made to the point where it intersected the longitudinal axis of the tooth.

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Root length measurements were obtained by subtracting the crown length measurements from the total tooth length measurements.

Full root length measurement was obtained by multiplying the root length value by 1.6.

The length of developmental stage of the tooth was determined by dividing the estimated full root length by four.

Crown length, root length & total tooth length were calculated & t-test was used to test the significance of difference between males & females. ANOVA test was applied for the determination of the age change in root development & total tooth length measurement in children aged 8-12 years.

RESULTS

An initial analysis was carried out for both males & females to compare between the mean values of crown length, root length & total tooth length of maxillary canine (C) , first molar(M1) & second molars (M2) on the right & left sides. Statistical non-significant differences were found between the two sides (in both genderes) by applying student t-test. For this reason the data of the right & left sides were pooled together in assessing these variables.

Males-Females difference:
1.   **Crown length**
The result indicated that the mean values for crown length of C, M1 & M2 were greater in males than in females at a high significant level (p< 0.01). This was obtained by comparing the mean values of crown length of the entire male sample to those of the entire female sample (Table 1).

2.   **Root development**:
Age group 1 (8 year): In general, females presented greater mean values of root length than males with a high level of significance for C & M1 (Table3).

Age group 2 (10 year): A highly significant increase in the mean values of root length for C, M1 &M2 in female patients when compared to mean values of male patients (Table 4).

Age group 3 (12 year): The mean values of root length for both males & females have nearly the same values for C, M1 & M2 with non-significant statistical difference. (Table 5).

Maxillary canine & second molar displayed a significant increase of their root length measurements when comparison was made between the three age groups of males using ANOVA test (Table 6) . Whereas a significant increase in root length measurements of maxillary canine & second molar was seen between female group at age 8 & 10 but not 12. (Table 7). However, the maxillary first molar in both genderes did not show significant changes between males at age 8&10 and at age 10&12 years. Non significant changes in root development of maxillary first molar were seen among all age groups of female sample.

3.   **Stage of root development**
The stage of root development was gradually increased for both males & females as we pass from age 8 years toward age 12 years for maxillary canine, first & second permanent molars as shown in (Table 8-10). However, the root development was faster in females than in males.

Table 1: Crown length measurements (mm) of the entire sample

Teeth	Females	Males	t-value
Maxillary Canine	9.83 ± 0.96	10.27 ± 0.81	P < 0.05
Maxillary first molar	8. 53 ± 0.66	8.10 ± 0.71	P <0.01
Maxillary second molar	8.03 ±0.79	8.59± 0.75	P <0.01

Table 2: Root length measurements (mm) of the entire sample

Teeth	Females	Males	t-value
Maxillary Canine	16.16 ± 5.6	13.96 ± 5.04	P < 0.05
Maxillary first molar	14.38 ± 2.5	13.35 ± 2.36	P <0.05
Maxillary second molar	8.36 ±4.38	6.85± 3.7	P <0.05

Table 3: Root length measurements (mm) in 8 years old males & females

Teeth	Females	Males	t-value
Maxillary Canine	12.46 ± 6.08	8.25 ± 2.25	P < 0.05
Maxillary first molar	13.79 ± 2.17	12.5 ± 1.06	P <0.01
Maxillary second molar	4 ±2.2	3.45± 1.15	P >0.05

Table 4: Root length measurements (mm) in 10 years old males & females

Teeth	Females	Males	t-value
Maxillary Canine	17.75 ± 4.35	14.75 ± 4.3	P < 0.05
Maxillary first molar	14.75 ± 2.21	13.27 ± 2.68	P <0.05
Maxillary second molar	10.08 ±3.56	6.8± 2.75	P <0.001

Table 5: Root length measurements (mm) in 12 years old males & females

Teeth	Females	Males	t-value
Maxillary Canine	18.25 ± 4.6	18.37 ± 2.11	P >0.05
Maxillary first molar	14.75 ± 3.25	14.54 ± 2.56	P >0.05
Maxillary second molar	10.37 ±3.43	10.45± 3.9	P >0.05

Table 6: Age changes of root development in males

Teeth	8 year (group 1)	10 years (group 2)	12 years (group 3)	Significance a 0.01 level
Maxillary Canine	8.25 ± 2.25	17.75 ± 4.35	18.37 ± 2.11	1,2*,3**
Maxillary first molar	12.5 ± 1.06	14.75 ± 2.21	14.54 ± 2.56	1,2*,3*
Maxillary second molar	3.45± 1.15	10.08 ±3.56	10.45± 3.9	1,2*,3**

2*: group(2) is significantly greater than (1)
3*: group(3) is significantly greater than (1)
3** : group(3) is significantly greater than (1) & (2)

Table 7: Age changes of root development in females

Teeth	8 year (group 1)	10 years (group 2)	12 years (group 3)	Significance at 0.01 level
Maxillary Canine	12.46 ± 6.08	14.75 ± 4.3	18.25 ± 4.6	1,2*,3*
Maxillary first molar	13.79 ± 2.17	13.27 ± 2.68	14.75 ± 3.25	1,2 ,3
Maxillary second molar	4 ±2.2	6.8± 2.75	10.37 ±3.43	1,2*,3*

2*: group(2) is significantly greater than (1)
3*: group(3) is significantly greater than (1)

Table 8: Stages of root development at 8 years of age

Teeth	Gender	Stage1	Stage 2	Stage 3	Stage 4
Maxillary Canine	Male	0%	33.3%	66.7%	0%
	Female	0%	29%	29%	42%
Maxillary First molar	Male	0%	0%	58.4%	41.6%
	Female	0%	0%	14.5%	85.5%
Maxillary second molar	Male	41.6%	58.4%	0%	0%
	Female	29%	58%	14.5%	0%

Table 9: Stages of root development at 10 years of age

Teeth	Gender	Stage1	Stage 2	Stage 3	Stage 4
Maxillary Canine	Male	0%	5%	55%	40%
	Female	0%	0%	6.66%	93.33%
Maxillary First molar	Male	0%	5%	55%	40%
	Female	0%	0%	6.6%	93.4%
Maxillary second molar	Male	5%	55%	40%	0%
	Female	0%	18.75%	31.25%	50%

Table 10: Stages of root development at 12 years of age

Teeth	Gender	Stage1	Stage 2	Stage 3	Stage 4
Maxillary Canine	Male	0%	0%	8.33%	91.67%
	Female	0%	0%	25%	75%
Maxillary First molar	Male	0%	0%	25%	75%
	Female	0%	8.33%	0%	91.67%
Maxillary second molar	Male	0%	25%	41.7%	33.3%
	Female	0%	33.3%	25%	41.7%

DISCUSSION

The initial statistical analysis of the mean values of crown length & total tooth length showed non-significant difference between the right & left sides. This finding is in accordance with that of other investigators [2,8]. All children (males & females) of eight years of age have completed crown formation of all examined teeth. The same findings could be detected when tables of Damirjian & Levesque [10] were inspected. In this study, non-significant gender differences in crown length measurements at age 8 years for all examined teeth. However; a marked gender difference was reported at age 10 & 12 for maxillary canine & first molar whereas second molar of children aged 12 years did not show significant gender difference. All teeth of males exhibited greater mean values than those of females (Table1). This agrees with the finding of Abdal-Hadi [11], Al-Douri & Safer [12] & Ali [13] who measured the clinical crown length of the upper central incisors. Garn et.al.[14,15] reported that tooth size is largely gene determined & the reason for the difference between males & females is largely attributed to gender-linked inheritance.

For root length measurements, the present investigation showed that the mean values were greater in males than in females for all examined teeth. The gender difference was found to be statistically significant only in maxillary canine & first molar of children aged 8 years & all teeth in 10 years old children (Table 3-5). This is almost accepted fact that females are generally advanced over males in dental development as indicated by many investigators [16,8].

The mean values of root development demonstrated in tables (3-5) indicates a gradual increase in root length for both males & females. Damirjian & Levsque [10] indicated the same finding. This is suggestive of faster rate of root calcification, especially in female sample.

This study provides us with information about the normal development of maxillary dentition represented by canine, first & second molar.

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