

Radiological age estimation using third molars mineralization in a sample attending orthodontic clinics (A retrospective study)

Zainab Mousa Kadhom ⁽¹⁾

ABSTRACT

Background: The evaluation of the chronological age is a practical method in crime investigation field that assists in identifying individuals to treat them as underage or adult. This study aimed to assess the stages of third molars mineralization in relation to chronological age of Iraqi individuals, determine the gender differences and arches (maxillary/mandibular) differences.

Materials and Methods: A total of 300 orthopantomograms of orthodontic patients were collected according to specific criteria and evaluated visually. The developmental stages of maxillary and mandibular third molars were determined according to Demirjian method. The chronological age was recorded according to the particular mineralization stages at which it reached considering genders, sides and jaws. Comparisons were done using paired sample and independent sample t-tests.

Results: Results showed that there was no statistically significant difference ($P > 0.05$) between maxillary and mandibular third molars. The maxillary third molars reached earlier than mandibular one in stages F and G. There was no significant difference between the mean ages of males and females at each given developmental stage in the maxillary and mandibular third molars except for the stage D in the maxilla and stages D and E in the mandible. The development of third molar teeth on the right and left sides was similar except for the maxillary arch in males when there was a significant difference in stage C and D and stage E in the mandibular arch.

Conclusion: The Demirjian method is an excellent approach for age assessment using Orthopantomogram. All of the differences between the current study and other studies could be because of the difference in the populations who were chosen from different geographical areas.

Keywords: Age estimation, Demirjian method, third molar, Orthopantomogram, chronological age. (Received: 1/7/2019; Accepted: 29/8/2019)

INTRODUCTION

Over the last period of time, the forensic age estimation in living people has gained great importance.⁽¹⁾ Mostly the forensic age can be legally determined in several countries between 14 and 21 years without recognizing any documents. It is very important to use dental analysis as an approach in the medical detection of the crime because the bone and other tissues have already been destroyed whilst the most material in the individual body that can remain and resist to be analyzed is teeth.⁽²⁾ However, to determine the age of the individual, different methods have been evolved and one of these methods is the morphology of the cervical vertebrae,⁽³⁾ added to that person's general physical development.^(4,5)

An X-ray of the left hand represented an independent part participated by forensically experienced experts in age assessment of the individuals.⁽⁶⁾ Moreover, the teeth are regarded as a means for the chronological age determination in the populations. What can be seen, the radiological and the clinical examination of the apparent and morphological dental variations throughout life can become a basis in age evaluation.⁽⁷⁾

So, generally, in young adults and youths, the chronological age evaluation can use dental development as the most acceptable and reliable method.⁽⁸⁾

In-vivo, the radiological approach in the estimation of the dental development is a quick, non-invasive and simple process for investigation.^(5,9) Furthermore, the orthopantomogram (OPG) acts as a reliable method to assess the age as it is used in determining the stage of dental mineralization.^(5,10) The third molar is a tooth distinguished by the variability in the time of its formation and by its varying presence or absence in the oral cavity,⁽¹¹⁾ and the forensic important is a fundamental property of this tooth since it developed continuously over a long time.^(8,12) At the same time after about 14 years old, all the permanent dentitions would have finished their development, except the third molar; therefore, age assessments become complicated in this period.⁽¹²⁾

The eight-stage scheme (Figure 1) designed by Demirjian *et al.*⁽⁵⁾ was very simple, precise, and did not require more mediation to estimate the age.⁽¹³⁾ Also, by this method, one can compare between different ethnic groups.⁽¹⁴⁾

There are different studies^(12,13,15) that address age assessment by third molar mineralization, using Demirjian *et al.*⁽⁵⁾ approach. No previous study has assessed chronological age by using the third molar in Iraq, except one study that assessed the interrelationships among the chronological age,

(1) Assistant Lecturer, Department of Orthodontics, College of Dentistry, University of Baghdad.

dental, and skeletal maturation, conducted on all permanent teeth except third molars.⁽¹⁶⁾

This study aimed to assess the mineralization stages of third molars concerning the chronological age of Iraqi individuals and to determine the gender and arches (maxillary/mandibular) differences.

MATERIALS AND METHODS

The study sample of this research was selected from Iraqi out patients who have attended the Department of Orthodontics at the College of Dentistry, University of Baghdad, and two private orthodontic clinics in Baghdad and Karbal'a cities between 2015 and 2018.

Out of the 600 OPGs collected and examined, only 300 patients (150 males and 150 females) with known chronologic age (10-24 years old) were selected in this study.

Gravely⁽¹¹⁾ founded that the age of nine years is the top of the formation period of the third molar, for that 10 years old was considered the age limit and an accurate radiological guide of the third molar in this study. According to Hofmann *et al.*,⁽¹⁵⁾ the exclusion criteria of this study were:

- Germectomy, agenesis and extraction of all four third molars.
- Participant age less than 10 years or more than 24 years.
- Possibility of the local, genetic exogenous or systemic factors that have effects on dental development and the facial clefts or any other craniofacial syndromes and the presence of dental pathologies like tumors or cysts as seen in the radiographs.
- OPGs with bad image quality.⁽¹⁷⁾

The OPGs which were taken as a diagnostic aid for orthodontic treatment were selected randomly and evaluated visually.⁽¹⁸⁾

Patients' chronological age at the time of OPG taking, gender, third molars germs locations and mineralization stage from A to H were recorded according to Demirjian *et al.*⁽⁵⁾ The full description of each stage was explained and illustrated in Table 1 and Figure 1. No additional subgrouping of stages C, D, E, F and H were done.⁽¹⁵⁾

Table 1: Radiological mineralization stages of permanent teeth as presented by Demirjian *et al.*⁽⁵⁾

Stage	Definition
A	The calcification begins firstly at the superior level of the crypt in the form of an inverted cone or cones, in both uniradicular and multiradicular teeth. There is no fusion of these calcified points.
B	Fusion of the calcified points forms one or many cusps, which unite to give an orderly outlined occlusal surface.
C	a. Enamel formation is finished at the occlusal surface. An extension and convergence towards the cervical region are seen. b. The dentin begins to deposit. c. At the occlusal border the outline of the pulp chamber has a curved shape.
D	a. The crown formation is accomplished down to the cemento-enamel junction. b. In uniradicular teeth, the superior border of the pulp chamber has a specific curved form, being concave towards the cervical region. The prominence of the pulp horns is present, creating an outline shaped like an umbrella top. In molars, the pulp chamber has a trapezoidal form. c. The root formation starts to begin in a form of spicule.
E	a. Uniradicular teeth: The walls of the pulp chamber now form straight lines, whose continuity is broken by the presence of the pulp horn, which is larger compared to the previous stage. Molars: Initial formation of the radicular bifurcation is seen in the form of either a calcified point or a semi-lunar shape. b. Uniradicular teeth: The crown height is more than the root length. Molars: The root length is still less than the crown height.
F	a. Uniradicular teeth: The walls of the pulp chamber now form a more or less isosceles triangle. The apex ends in a funnel shape. Molars: The calcified region of the bifurcation has developed further down to give the roots a more definite and distinct outline with funnel shaped ends. b. Uniradicular teeth: The walls of the pulp chamber are equal to or greater than the crown height. Molars: The crown height is equal to or less than the root length.
G	a. The walls of the root canal are now parallel and its apical end is still partially open (distal root in molars).
H	a. The apical end of the root canal is closed completely (distal root in molars). b. The periodontal membrane has a regular width around the root and the apex.

The stages of development determined by OPG from A to H were corresponded with a particular point of score of the gender and jaw depended on Demirjian *et al.* method.⁽⁵⁾ This score point clarified the chronological age where the appropriate stages of mineralization reached.

Statistical analyses

The collected data were analyzed with the aid of SPSS program (version 15, SPSS Inc., USA). For each stage, the means, standard deviations, minimum and maximum values were obtained.

The gender and arches differences were determined using independent sample t-test, while

side difference was detected using paired sample t-test. The probability value was set at 0.05.

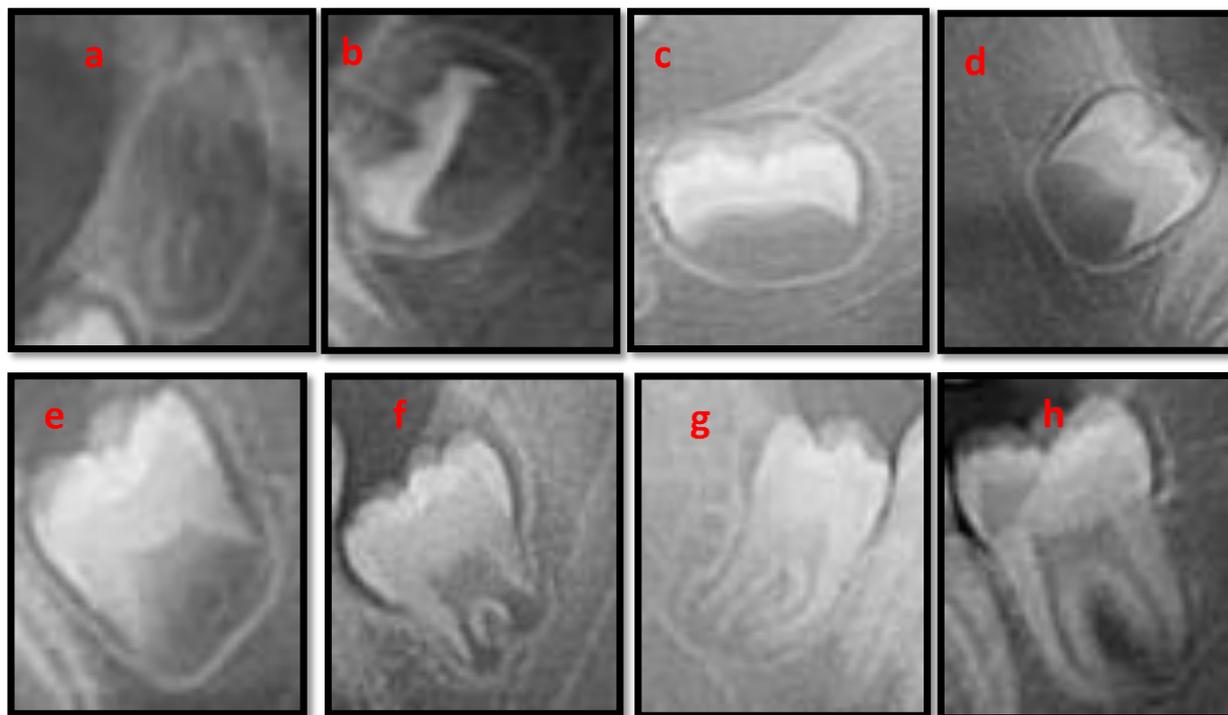


Figure 1: Third molars' mineralization stages.⁽⁵⁾

RESULTS

About 600 OPGs images have been collected for this study between 2015 and 2018. Many of these OPGs contained congenitally missing third molar germs or all four third molars or these teeth may have been influenced by many exogenous and genetic factors during development. Some of the OPGs were not clear. Too, some of these images were for the patients with age less or more than the age range of this study; therefore, about 300 OPGs had to be excluded and only 300 OPGs were selected pertinent to 150 males and 150 females with known chronologic age ranged from 10-24 years.

The landmarks of tooth formation expressed as: initial calcification (stage A), the completion of the crown (stage D), and formation of inter-radicular bifurcation (stage E), root-length completion (stage G), and close of the apex (stage H).

Descriptive statistics and comparison of age between the maxilla and mandible were shown in Table (2). The results statistically showed no significant difference ($P>0.05$) between maxillary and mandibular third molars. The mean age of stage D was 14.272 years and stage F was 16.794 years in the maxilla and in the mandible was 13.833 years for stage D and 17.128 years for F stage.

Initial calcification, the first stage of the developmental level (stage A) according to Demirjian's method, was seen at the age between

10 and 16 years. Also, in both arches, minimal age for appearance of both stages B and C was 10 years and for stages E and G was 12 years.

Moreover, from the mean ages in both arches, the maxillary third molars reached earlier than lower third molars in stages F and G only. The apex of the maxillary third molars closed (stage H) at the mean age of 21.127 years and the mandibular third molars at 21.049 years.

Descriptive statistics and gender difference of the age in all developmental stages (A to H) for the maxillary and mandibular third molars were showed in Tables (3 & 4). Stage B was first appeared at 12.080 years in the maxillary arch of females and at 10.857 years in the mandible, while in males, the appearance of this stage was at 11.800 years in the maxillary arch and 11.400 years in the mandibular jaw.

The mean ages of males and females were not significantly different at each given developmental stage of the maxillary and mandibular third molar except for stage D in the maxillary arch and stages D and E in the mandible when males were significantly earlier to reach these stages than females.

The side differences in each gender were presented in Tables (5 & 6). The development of third molar teeth on the right and left sides was similar in both genders except for the maxillary arch in males; there was a significant difference in stage C and D and stage E in the mandibular arch.

Table 2: Descriptive statistics and arch difference of the age (in years) in whole sample.

Stages	Maxilla				Mandible				Comparison	
	Mean	Min	Max	S.D.	Mean	S.D.	Min	Max	t-test	P-value
A	11.600	10	16	2.503	11.167	1.899	10	16	0.308	0.766
B	11.956	10	16	1.941	11.259	1.631	10	16	0.673	0.516
C	12.976	10	17	1.801	12.921	1.826	10	18	0.101	0.920
D	14.272	10	20	2.201	13.833	2.034	11	20	1.086	0.279
E	15.982	12	23	2.240	15.779	2.002	12	23	0.309	0.758
F	16.794	14	23	1.705	17.128	1.957	13	23	-0.705	0.484
G	19.027	12	24	2.477	19.486	2.263	12	24	-0.684	0.497
H	21.127	17	24	1.777	21.049	1.931	12	24	0.325	0.745

Table 3: Descriptive statistics and gender difference of age (in years) for different developmental stages of maxillary third molars

Stages	Male				Female				Gender difference	
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	t-test	P-value
A	10.500	1.225	10	13	13.250	3.202	10	16	-1.948	0.184
B	11.800	1.473	10	14	12.080	2.272	10	16	-0.476	0.620
C	12.806	1.754	10	17	13.476	1.887	10	16	-1.484	0.142
D	13.030	1.858	10	20	15.147	2	12	20	-6.832	0.000
E	16.143	2.265	12	20	15.889	2.252	13	23	0.41	0.684
F	17.152	1.679	14	20	16.400	1.673	14	23	1.777	0.081
G	18.583	2.827	12	23	19.240	2.291	14	24	-1.069	0.289
H	21.058	1.773	17	24	21.244	1.800	18	24	-0.529	0.598

Table 4: Descriptive statistics and gender difference of age (in years) for different developmental stages of mandibular third molars

Stages	Male				Female				Gender difference	
	Mean	S.D.	Min.	Max.	Mean	S.D.	Min.	Max.	t-test	P-value
A	10.889	1.269	10	13	12	3.464	10	16	-0.544	0.637
B	11.400	1.392	10	14	10.857	2.268	10	16	0.751	0.459
C	12.607	1.592	10	17	13.311	2.032	10	18	-1.902	0.061
D	13.140	1.995	11	20	14.460	1.874	12	20	-3.737	0.000
E	15.200	1.883	12	18	16.089	2.012	13	23	-1.997	0.049
F	17.184	1.722	14	20	17.083	2.142	13	23	0.236	0.814
G	18.931	2.389	12	23	19.878	2.112	16	24	-1.75	0.085
H	21.127	2.012	12	24	20.923	1.812	17	24	0.516	0.607

Table 5: Descriptive statistics and side difference of the age (in years) for each developmental stages of maxillary and mandibular third molar in males

Jaw	Stages	Descriptive statistics				Side difference	
		Right		Left		t-test	P-value
		Mean	S.D.	Mean	S.D.		
Maxilla	A	10.750	1.500	13.250	3.202	-1.213	0.312
	B	11.889	1.453	11.778	1.563	0.164	0.873
	C	12.238	1.513	13.476	1.887	-2.540	0.020
	D	12.836	1.619	15.491	2.098	-6.480	0.000
	E	16.143	2.265	16.095	2.567	0.059	0.953
	F	16.967	1.629	16.400	1.673	1.505	0.143
	G	18.583	2.827	19.667	2.239	-1.511	0.144
	H	20.971	1.834	21.234	1.671	-0.626	0.536
Mandible	A	10.333	0.577	12	3.464	-0.762	0.525
	B	11.286	1.254	10.857	2.268	0.372	0.723
	C	12.615	1.602	13.577	1.922	-1.932	0.065
	D	13.000	1.600	12.885	1.904	0.223	0.826
	E	15.200	1.883	16.400	2.372	-2.320	0.028
	F	17.184	1.722	16.974	2.236	0.428	0.671
	G	19.474	1.982	19.842	2.363	-0.538	0.597
	H	21.258	1.632	21.000	2.380	0.903	0.374

Table 6: Descriptive statistics and side difference of the age (in years) for each developmental stages of maxillary and mandibular third molar in females

Jaw	Stages	Descriptive statistics				Side difference	
		Right		Left		t-test	P-value
		Mean	S.D.	Mean	S.D.		
Maxilla	A	10	0	10.500	0.707	-1	0.5
	B	12.900	3.479	12.800	3.553	0.061	0.953
	C	12.839	1.899	12.774	1.627	0.193	0.848
	D	12.818	1.509	13.152	2.123	-1.146	0.260
	E	16.400	2.171	15.800	2.530	0.874	0.405
	F	17.250	1.807	17.063	1.652	1.379	0.188
	G	18.727	3.036	18.273	2.760	0.612	0.554
	H	20.939	1.853	21.182	1.740	-0.928	0.360
Mandible	A	11	1.414	11	1.414	-	-
	B	11.333	1.323	11.333	1.323	-	-
	C	12.654	1.548	12.654	1.548	-	-
	D	13.222	2.082	13.222	2.082	-	-
	E	14.923	2.019	14.923	2.019	-	-
	F	17.278	1.708	17.278	1.708	-	-
	G	18.571	2.821	18.571	2.821	-	-
	H	21.3	1.601	21.3	1.601	-	-

DISCUSSION

The use of tooth developmental stages is considered as an accurate method of chronological age determination adopted over a long time independent of disease or malnutrition and other exogenic factors.⁽⁹⁾

The author depended on the third molar formation to assess the chronological age of the subjects due to the lack of different processes through the duration between the teenagers and early 20s.⁽¹⁹⁾ It is very useful to use third molar mineralization stages in chronological age evaluation especially for the legal purposes of unknown victims.⁽²⁰⁾

All selected OPGs belong to Iraqi outpatients attended the Department of Orthodontics at the College of Dentistry and two private orthodontic clinics. The age ranged between 10-24 years since many patients at this age attend orthodontic clinics seeking orthodontic treatment.

Stage A in the current research is initiated at 10 years old. This is near to that reported in the Thai population⁽²¹⁾ (9.75 years old) and later than Jung and Cho⁽²²⁾ (7 years of age).

The results of the present study showed that stage D (crown completion) reached at age of 14.27 years in the maxilla and 13.83 years in the mandible. This result was somewhat close to that reported in Iranian population⁽²³⁾ (13.62 years) and earlier than Thai population⁽¹⁹⁾ (15.47 years) and later than Turkish population⁽²⁴⁾ (12.90 years). This could be attributed to the difference in ethnic groups.

In the present study, the root formation (stage H) was completed at a mean age of 21.12 years in the maxilla and of 21.04 years in the mandible. These

results were almost close to that of Caucasian Central Europa,⁽¹⁵⁾ while earlier than the Turkish subjects reached this stage at 22 years.⁽²⁴⁾

Regarding gender differences in this stage, the mandibular third molars in females began stage H at 20.9 years which was earlier than males in contrast to Sujatha *et al.*⁽¹⁷⁾ who reported that males reached this stage earlier than females. Khosronejad *et al.*⁽¹⁸⁾ and Hassan and Abo Hamilla⁽²⁵⁾ supported the findings of the current study when the Iranian females reached certain third molar mineralization stages (only the H stage) sooner than males and in Egyptian females, all third molars reached H stage earlier than males.

It becomes clear from the mean ages in both arches that at stages A-F, the subjects were probably below 18 and at stage G and H, the individuals were above 18 years; this comes in agreement with Jung and Cho⁽²²⁾ who reported that Korean population exhibited stage G at age of 18 years or older, and Khosronejad *et al.*⁽¹⁸⁾ who found that both G and H stages could indicate that the person might be above 18 years old. Other studies^(26,27) showed that at stage A-D, persons were probably below 18 years and at stage H and they were above 18 years. This may be due to differences in the third molars development.⁽²⁸⁾

A study by Hofmann *et al.*⁽¹⁵⁾ showed that girls seem to achieve the mineralization stage C at a slightly earlier age than boys. Sujatha *et al.*⁽¹⁷⁾ also reported that stage D was early in males and stage G in females while in the Turkish population, both D and G stages were earlier in males than females.⁽²⁴⁾ In the present study, the development of third molars in all stages was earlier in males

than females except the maxillary third molars in stages E and F and in stage B, F and H in the mandibular third molar where females were earlier than males. This is supported by the findings of Darji *et al.* (29) who found that teeth in males were calcified earlier than in females. This is unrivaled detection for the third molar as all other permanent teeth development is earlier in females as compared to males.

The results in terms of gender differences showed no significant difference in the developmental stages of the third molar between males and females except in stage D in the maxilla and stages D and E in the mandible since the females reached these three stages later than males. The highest difference was seen at stage D in the maxilla when males were 2.117 years ahead of females.

These results come in agreement with many studies as in Thai populations (21) where the mandibular third molar in stage E was significantly higher in female, also both of Sisman *et al.* (24) and Rai *et al.* (30) reported that the significant differences regarding D and G stages only occurred between males and females.

Finally, Simonsson *et al.* (31) showed that males significantly reached stages C, D and E earlier than females. Although each study has no gender differences, it has certain differences in one or more developmental stages of the third molar in both genders as in Khosronejad *et al.* (18) and Kaomongkolgit and Tantanapornkul; (21) there were no statistically significant differences in mineralization stage of third molars between maxilla and mandible.

Regarding the left and right side symmetry, there was no significant side difference at various developmental stages in both arches like in many studies (13,18,21,29,31), but males in this study showed that their right maxillary molars reached stage C and D significantly earlier than the left one and the right mandibular third molars reached stage E earlier than the left one. This is very prevalent for the third molar to asymmetrically erupted on the left or right side. (10) This agrees with Satio (32) who reported that the third molars on the right side of the mouth calcified and erupted earlier when compared with those on the left.

The mineralization stages asymmetry of the antimere tooth was found in many studies, as in Mincer *et al.* (26) who found that the symmetry of the third molar formation of both sides in the maxilla was more than in the mandible. Also, Demisch and Wartmann (33) established that the symmetry in the development of the mandibular left and right third molars occurred in about 71% of both sexes, so it is practically a helpful approach in which the dental age could be obtained from left

and right side when they are both asymmetrical but scorable. (26)

Sample size, age, the biological variation of individuals, statistical approach and experience of the observer in age assessment and other factors are attributed to the presence of differences between Iraqi sample and that of other studies.

The present study was limited by: first, the subjects in this study were randomly selected from two areas in Iraq, Baghdad and Karbala; additionally, those patients were only the patients who referred to the orthodontic clinics.

Second, ethnicity was not controlled in this study. Because of successive waves in Iraq, many populations migrated from western and northern Iraq to Baghdad and Karbala, so there is a mix of ethnicity that happened and individuals may be not all pure Arabs; they maybe Turkman or Kurdish subjects.

The conclusions that could be drawn from this study were:

1. Demirjian's method is an excellent approach for age assessment using OPG.
2. All the differences between the present study and other studies in many countries could be due to the difference in the populations chosen from different geographical areas.
3. In this regard, the third molars of males were prior to females in attaining most of Demirjian's stages in both arches.
4. In the mandibular arch, the third molars reached all Demirjian's stages earlier than the maxillary arch except in the stages F and G, and subjects will probably be below 18 in both arches at stages A-F while the individuals will be above 18 years at stages G and H.
5. There was no significant gender difference at each given developmental stage of the maxillary and mandibular third molar except stage D in the maxillary arch and stages D and E in the mandibular arch.
6. The third molars are developed symmetrically in both sides (right and left) except the significantly earlier arrival of the maxillary right third molar in some developmental stages than the left one in males.

ACKNOWLEDGMENT

The author would like to thank Dr. Mohammad Nahidh for the invaluable assistance in this study and Dr. Raouf Rasheed and all colleagues for kindly providing part of radiographs used in this study.

REFERENCES

1. Willems G. A review of the most commonly used dental age estimation techniques. *J Forensic Odontostomatol.* 2001; 19: 9-17.
2. Schmeling A, Olze A, Reisinger W, Geserick G. Der Einfluss der Ethnie auf die bei strafrechtlichen Altersschätzungen untersuchten Merkmale Rechtsmedizin. 2001; 11: 78-81.
3. Baccetti T, Franchi L, McNamara JA. The cervical vertebral maturation (CVM) method for the assessment of optimal treatment timing in dentofacial orthopedics. *Semin Orthod.* 2005; 11: 119-29.
4. Anderson DL, Thompson GW, Popovich F. Interrelationships of dental maturity, skeletal maturity, height and weight from age 4 to 14 years. *Growth.* 1975; 39: 453-62.
5. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. *Hum Biol.* 1973;45:211-27.
6. Schmeling A, Grundmann C, Fuhrmann A. Criteria for age estimation in living individuals. *Int J Legal Med.* 2008; 122: 457-60.
7. Gustafson G. Altersbestimmungen an Zähnen. *Dtsch Zahnärztl.* 1955; 10: 1763-8.
8. Guo YC, Yan CX, Lin XW. The influence of impaction to the third molar mineralization in northwestern Chinese population. *Int J Legal Med.* 2014;128:659-65.
9. Kullman L. Accuracy of two dental and one skeletal age estimation method in Swedish adolescents. *Forensic Sci Int.* 1995;75:255-36.
10. Willershausen B, Löffler N, Schulze R. Analysis of 1202 orthopantomograms to evaluate the potential of forensic age determination based on third molar developmental stages. *Eur J Med Res.* 2001; 6: 377-84.
11. Gravely JF. A radiographic survey of third molar development. *Br Dent J.* 1965; 119: 397-401.
12. Engstrom C, Engstrom H, Sagne S. Lower third molar development in relation to skeletal maturity and chronological age. *Angle Orthod.* 1993; 53: 97-106.
13. Orhan K, Ozer L, Orhan AI, Dogan S, Paksoy CS. Radiographic evaluation of third molar development in relation to chronological age among Turkish children and youth. *Forensic Sci Int.* 2007; 165: 46-51.
14. Eid RM, Simi R, Friggi MN, Fisberg M. Assessment of dental maturity of Brazilian children aged 6-14 years using Demirjian's method. *Int J Pediatr Dent.* 2002; 12: 423-8.
15. Hofman E, Robold M, Proff P, Krischneck C. Age assessment based on third molar mineralization. An epidemiological radiological study on a central European population. *J Orofac Orthop.* 2017;78:97-111.
16. Al-Bustani AI, Ismail AM, Al-Izzi MK. The dental maturation as an indicator for the pubertal growth estimation (A new computerized approach in clinical orthodontics). *J Coll Dent.* 2002;13:42-54.
17. Sujatha R, Goutham BS, Dhull, Indira Meda K.S, Manthapuri S, Poosar CS. Age estimation using radiographic stages of third molar in Odisha population. *J Int Oral Health.* 2015; 8: 238-42.
18. Khosronejad A, Navabi N, Sakhdari S, Rakhshan V. Correlation between chronological age and third molar developmental stages in an Iranian population (Demirjian method). *Dent Res J (Isfahan).* 2017; 14: 143-9.
19. Panchbhai AS. Dental radiographic indicators, a key to age estimation. *Dentomaxillofac Radiol.* 2011; 40: 199-212.
20. Zhai Y, Park H, Han J, Wang H, Ji F, Tao J. Dental age assessment in a Northern Chinese population. *J Forensic Leg Med.* 2016; 38: 43-9.
21. Kaomongkolgit R, Tantanapornkul W. Chronological age estimation base on third molar development from panoramic radiograph in Thai population. *J Int Dent Medical Res.* 2017; 10: 65-71.
22. Jung YH, Cho BH. Radiographic evaluation of third molar development in 6 to 24 years olds. *Imaging Sci Dent.* 2014; 44: 185-91.
23. Jafari A, Mohebbi S, Khami MR, Shahabi S, Naseh M, Elhami F, Shamshiri AR. Radiographic evaluation of third molar development in 5- to 25 year olds in Tehran, Iran. *J Dentistry Tehran Univ Medical Sci.* 2012; 9:107-15.
24. Sisman Y, Uysal T, Yagmur F, Ramoglu SI. Third-molar development in relation to chronologic age in Turkish Children and young adults. *Angle Orthod.* 2007; 77: 1040-5.
25. Hassan NA, Abo Hamila NAA. Orthopantomography and age determination using third molar mineralization in a sample of Egyptians. *Mansoura J Forensic Med Clin Toxicol.* 2007; 15: 45-59.
26. Mincer HH, Hanis EF, Berryman HE. The ABFO study of third molar development and its use as an estimator of chronological age. *J Forensic Sci.* 1993; 38: 379-90.
27. Nambiar P. Age estimation using third molar development Malaysian J Patho. 1995; 17: 31-4.
28. Priyadarshini KI, Idiculla JJ, Sivapathasundaram B, Mohanbabu V, Augustine D, Patil S. Age estimation using development of third molars in South Indian population: A radiological study. *J Int Soc Prev Community Dent.* 2015; 5: 32-8.
29. Darji JA, Govekar G, Kalele SD, Hariyani H. Age estimation from third molar development; a radiological study. *J Indian Acad Forensic Med.* 2011; 33: 971-3.
30. Rai B, Kaur J, Anand SC. Mandibular third molar development staging to chronologic age and sex in north Indian children and young adults. *J Forensic Odontostomatol.* 2009; 27: 45-9.
31. Simonsson L, Näsström K, Kullman L. Radiographic evaluation of third mandibular molar development as an age indicator in a Swedish population. *Madridge J Dent Oral Surg.* 2017; 2: 31-7.
32. Satio H. Röntgenologische Untersuchungen über die Entwicklung des dritten Molaren. *Kakubyo-Gaekai-Zasshi.* 2015; 9: 156-71, 366-77, 502-14.
33. Demisch A, Wartmann P. Calcification of the mandibular third molar and its relation to skeletal and chronological age in children. *Child Development.* 1956; 27: 459-73.

الخلاصة

الخلفية: تقدير العمر زمنياً هو طريقة عملية في مجال التقصي عن الجريمة إذ يساعد في التعرف عن الأشخاص لمعالجتهم سواء كانوا تحت سن البلوغ أو بالغين. تهدف هذه الدراسة إلى تقييم مراحل تمعدن سن العقل فيما يتعلق بالعمر الزمني للأفراد العراقيين وتحديد الاختلاف بين الجنسين والاختلاف بين الفكين العلوي والسفلي.

الأشخاص وطرق العمل: جمعت 300 أشعة بانورامية لمرضى تقويم الأسنان وفقا لمعايير خاصة وقيمت بصريا. حددت مراحل تطور سن العقل في الفك العلوي والسفلي وفقا لطريقة ديميرجيان. العمر الزمني قد سجل وفقا لمراحل تمعدن معينة والتي تم الوصول إليها وفقا للجنسين، جوانب الفكين والفكين. الفروقات حددت باستخدام العينة المزدوجة والعينة الغير معتمدة للفحوصات. النتائج: أظهرت النتائج عدم وجود فروق ذات دلالة احصائية بين اسنان العقل في الفكين العلوي والسفلي. اسنان العقل في الفك العلوي تصل مبكرا قبل اسنان العقل في الفك السفلي في المرحلتين F و G. لا توجد فروق ذات دلالة احصائية بين اسنان العقل في معدلات الاعمار بين الذكور والاناث في كل مرحلة تطور معطاة في اسنان العقل العلوية والسفلية ماعدا في مرحلة D في الفك العلوي وفي مرحلتين D و E في الفك السفلي. تطور اسنان العقل في الجانبين الايمن واليسر متشابه ماعدا في الفك العلوي للذكور اذ هناك فروق ذات دلالة احصائية في المرحلتين D و C وللمرحلة E في الفك السفلي. الاستنتاجات: ان طريقة ديميرجيان هي طريقة ممتازة في تقدير العمر باستخدام الاشعة البانورامية. كل الاختلافات بين الدراسة الحالية والدراسات الاخرى ممكن ان يكون سببها الاختلافات في السكان الذين تم اختيارهم من المناطق الجغرافية المختلفة.