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RESEARCH ARTICLE
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Estimation of Chronological Age Based on third Molar Development in Basra Population

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ABSTRACT

Age determination for both living and non-living things is crucial, hence the goal of this study was to assess the validity of the Demirjian and Gat technique for age determination based on the growth of the third molar. To determine chronological age using stages from (A-H) Demerjian's approach and stages (1-6) Gat's method, a cross-sectional study was conducted. In the city of Basra, we looked into the third molar development of Iraqis. The T-test, Kappa test, and descriptive statistics were assessed Findings shows there were no significant differences found in our study between mineralization of right and left lower third molar P=0.05, faster third molar development in females than male.

Conclusion: third molar maturity is earlier in female than male and there's perfect agreement between the two methods in age detection.

Keywords: *Third molar, Demergian method, Gat's method, Panoramic Radiographs*

INTRODUCTION

In humans, age detection has taken an important role in today's modern society. It is of great importance in several areas: age detection of living persons and the identification process of unknown deceased persons. For the living persons, it is of significance when the birth certificate is not available to estimate the age of the person to know whether he reaches the age of criminal responsibility or not in cases like kidnapping, rape, work, marriage, adoption, and illegal migration. (1-5)

As regards unknown deceased persons, it is of significance to distinguish the victims of mass disasters, fires, accidents crashes, and murder. In western countries, today there is an increasing number of immigrants due to wars, conflicts, economic globalization, and disasters in different countries [6]. Many of them are without proper identification papers. The authorities in many countries are doubtful regarding their vague age due to legal consequences (1,2,4,6). according to the UN Child Convention, kids with age under 18 years old have special rights and cannot be sent back to their countries of origin [7], this increased the chance for them of being granted asylum. While the skeletal and somatic developments are influenced by the environment, nutrition, hormonal imbalance, and diseases, teeth seem to be less affected 8. Teeth are highly resistant to chemicals, and temperature fluctuation (9,10,11),

Therefore different methods of dental age estimation have been defined 12.

several age estimation modalities are present, which required lengthy processing times, use of costy, advanced tools or services of an experienced pathologist when using histological methods. (13,14,15)

Radiological evaluation of the development of the teeth is a simple, fast and non-invasive investigation method used in-vivo. Teeth are useful predictors, especially duringthe early years when many teeth are developing up until the age of 14-15 years [16,17]. Wisdom tooth is less used for dental age detection because of differences in time of development and time of emergence in the oral cavity (5]. The only teeth that are still developing after the ages of 14 to 15 are the third molars. Forensic sciences use radiographic examination of third molar formation as a key technique because of this. (18)

Therefore, it was crucial to establish third molar developmental phases in the Iraqi sample population in order to establish a baseline for estimating chronological age. This had useful uses such as age detection for those whose birth dates are unknown and body identification.

MATERIAL AND METHODS

The study sample of this research was selected from patients attended college of dentistry University of Basrah between 2018-2020. 400 O.P.G were collected and examined. Out of these patients, 90 had a missing lower third molar whether due to congenital missing or extraction. 14 had pathology on Both sides, 41 distorted O.P.G , 56 patients have only one side molar, and 32 patients with age out of the detected age range of this study. after removal of these O.P.Gs a total sample of 233 patients (67 Male, 166 female) were included in this study.

All radiographs had been taken previously for diagnosis and treatment purposes by (VAT Tec. digital panoramic x-ray system PAX400) 233 O.P.G with known chronological age between (10 to 25) years old wear selected an evaluation page including age and gender. coding done so age and gender couldn't be determined by Observer during examination . the chronological age calculated by subtracting the patient's date of birth from the date of taking O.P.G followed by rounding the nominal age was rounded up to the next whole number. Otherwise, the patient's nominal age was recorded. For example, the recorded age for a patient aged 12 years and 4 months would have been 12 years. The recorded age of another patient, aged 12 years and 7 months would have been 13 years.

The panoramic radiographs were evaluated to determine the development stage of each subject's third molars, These were selected randomly and evaluated visually, dental maturation of the third molar on OPGs was scored according to modified gat's (fig.1)19 and modified Demirjian's method (fig.2)20

All O.P.Gs evaluated by 3 observers viewed the O.P.Gs twice with a two weeks interval between each session.

They were trained and their scoring calibrated by means of practice scoring sessions so there were no significant differences among the observers, if differences arose in the scoring of an O.P.G then a discussion followed to produce a consensus score. modified Gat's scoring system with the development of third molars categorized as follows Score0: no development of third molar follicle, Score1: radiolucent area of the third molar seen , but without calcification. Score2: calcification of third molar up to half of the crown , Score3: calcification of the third molar from more than half of the crown to complete crown formation, but without root formation, Score 4:root formation begun, but less than half of the root length formed, Score 5: root formation ,more than half and up to full root length formed, but the apex remain open, Score 6:completion of root apex closure.

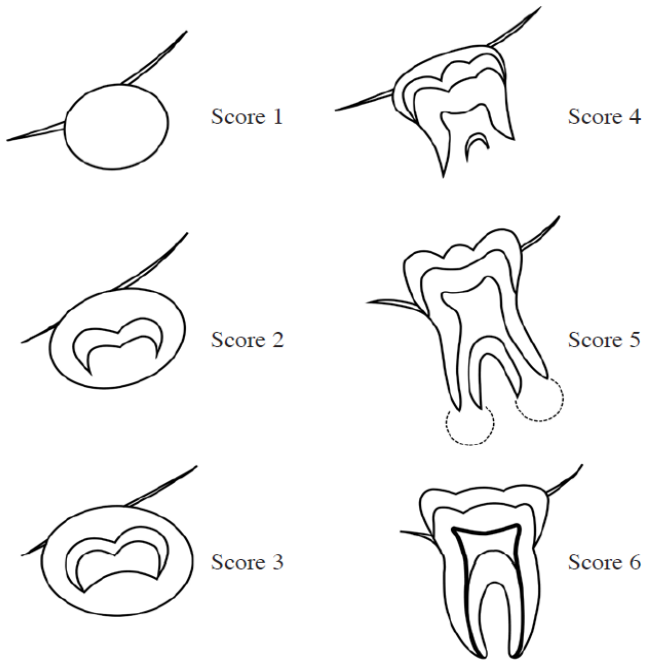

FIG. 1: modified Gat's scoring system Karune Verochana12016

According to Demirjian's scoring system(fig.2)
A; Cusp tips are mineralized but have not yet coalesced.
B; Mineralized cusps are united so the mature coronal morphology is well defined
C; The crown is about half formed ; the pulp chamber is evident and dental deposition is occurring.
D: Crown formation is complete to the dentino-enamle junction . the pulp chamber has a trapezoidal form.
E: Formation of the inter-radicular bifurcation has begun . root length is less than the crown length
F: root length is at least great as crown length. Root have funnel _shaped endings.
G: root walls are parallel, but apices remain open.
H: Apical ends of the root are completely closed, and the periodontal membrane has a uniform width around the root.

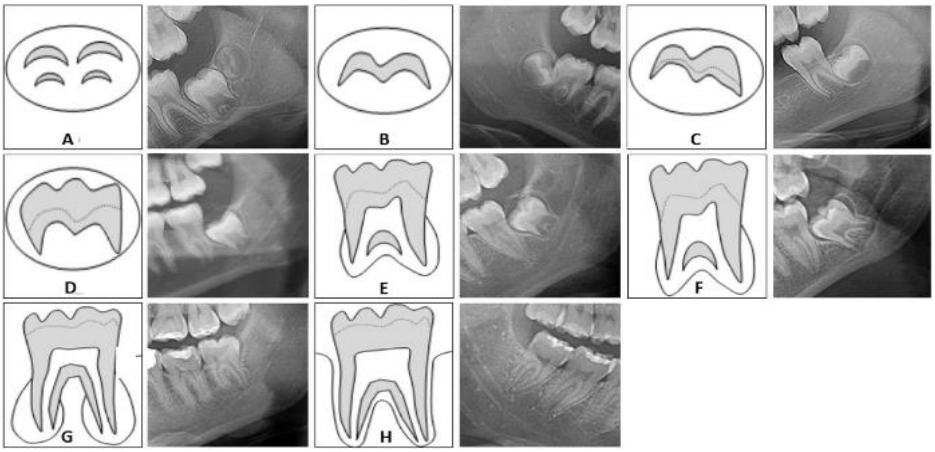

FIG 2: modified Demirjian's method 20

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According to Hofmann et al(21) the exclusion criteria of this study were; OPGs with age less than 10 years old, missing third molars, Possibility of the local, genetic exogenous or systemic factors that have effect on dental development and the facial cleft or any other craniofacial syndromes, the presence of pathology in the third mandibular area in the radiographs (for example cysts) and distorted OPG.

RESULT

Inter-observer agreement was excellent: correlation coefficient (r) was 0.9 Very good agreement was also indicated by the intraobserver result, correlation coefficient (r) was 0.91.

The initial calcification in Demrjian stage A=8-11 male and 8-13 female, in Gat's 8-14 male and 8-16 female. Minimal age for B=10 male, 9 female. In stage C is 9 male and female. In stage D =13 male and 10 female, in stage E is 12 for both male and female .in stage F 14 in male and 13-15 female, in stage G 18 in male 16 female and In stage H 19 male 17-19 female

According to Gat's method in stage 3 represent the age 10 years male and 9 years female, stage 5 / 16 male and 13-15 female in 6th stage / 19 male and 17-19 female. The calcification time of Demrjian shows that females precede males with (1-2) years as a range in stage D,E,F,G and H, the same differences is observed in Gat's methods.

Complete closure of the root apex according to Demrijian (stage H)= 17 female ,19 male

According to Gat's method (score 6)=19 male, 17 female, that means the maturation in female occur earlier.

The mean age of males and females were not significant differences at each given development stage of the right and left except (stage C) in Demirjian's where males were significantly earlier to reach these stages than females. In Gat's no significant differences between males and females.

Side differences in each gender were presented in table (1)

the development of 3rd molar teeth on the right and left were similar in both genders in both Gat's and Demirjian's methods.

TABLE 1

Females/Demerjian								Males/Demerjian							
Stage	N	Right		Left		Side difference		Stage	N	Right		Left		Side difference	
		Mean	S.D.	Mean	S.D.	t-test	p-value			Mean	S.D.	Mean	S.D.	t-test	p-value
A	18	10	1.237	9.778	1.166	0.592	0.562	A	9	9.778	1.093	9.778	1.093		
B	7	12	2	10.571	1.718	1.400	0.211	B	10	11.200	1.229	11.300	1.160	-0.190	0.853
C	36	12.889	1.526	13	1.656	-0.391	0.698	C	20	11.800	1.436	11.750	1.209	0.123	0.904
D	19	14.421	1.953	13.737	1.851	0.965	0.348	D	4	13.750	0.957	14.250	0.957	-0.775	0.495
E	20	15.850	2.477	15.250	2.381	0.745	0.466	E	10	15.100	3.213	15	2.789	0.133	0.897
F	12	16.750	2.221	17.083	1.832	-0.538	0.601	F	2	18	2.828	17	4.243	0.200	0.874
G	9	19.444	2.698	19.222	2.635	0.211	0.838	G	2	19	1.414	19	1.414		
H	33	22.061	2.318	21.818	2.417	0.386	0.702	H	3	20.667	2.082	20.333	1.528	0.180	0.874

TABLE 2

Males/Gat's								Females/Gat's							
Stage	N	Right		Left		Side difference		Stage	N	Right		Left		Side difference	
		Mean	S.D.	Mean	S.D.	t-test	p-value			Mean	S.D.	Mean	S.D.	t-test	p-value
1	0							1	1	13	.	9			
2	35	11.114	1.430	11.114	1.430			2	48	11.542	2.143	11.708	2.212	-0.759	0.451
3	12	12.417	1.564	12.750	1.658	-0.715	0.489	3	36	13.333	1.867	13.278	1.907	0.274	0.786
4	11	14.909	3.081	14.727	2.649	1	0.341	4	25	15.720	2.337	15.560	2.382	0.244	0.809
5	4	18.500	1.915	18.500	1.915	0	1	5	19	17.368	2.314	18	2.449	-0.959	0.350
6	3	20.667	2.082	20.333	1.528	0.180	0.874	6	33	22.061	2.318	21.818	2.417	0.378	0.708

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Table 3 show the reliability of the two methods Demirjian's and Gat's in the detection of 3rd molar development, there's perfect agreement between the two methods

TABLE 3

Method	Right side	Left side
Gats	0.836	0.807
Demerjian	0.938	0.936

DISCUSSION

Chronological Age detection depending on tooth development stage is considered as an accurate method independing on malnutrition or disease and other exogenous factors 16. There are many studies used for age detection depending on third molar development (5,16,22-25). Modified Demirjian's method was used in many studies and detected as a simple, practical and an objective method (5,16, 23,24,26-28). Others used Gat's as a simple scoring method (27).

In our research, we want to evaluate the accuracy of the modified Demirjian's and Gat's methods for age detection. Many studies have been done and found that mandibular third molar calcification began at around age 7 or 8, hence the age range chosen for this study was (8- 25). According to some writers, third molar development can be used to estimate age without the use of other biological indicators. (30-33).

There were no significant differences found in our study between mineralization of the right and left lower third molar this finding is consistent with other studies as well (5, 34-37) and disagree with Satio (38) who stated that the third molar on the right side of the mouth erupted and calcified earlier than left side.

Regarding gender differences statistically there is no significant differences in the mean age for males and females in Gat's method while in Demirjian's method differences were seen between Male and female in stage C male reached earlier than female this agree with Simonsson et al(5) , in which male significantly reach stage C,D and E earlier than female.

This disagree with other studies in which there's significant differences in other stages D, E and G.(19,34,35,37). in this study a subject is graded from A to E according to the Demirjian stages of mineralization or score 0-4 according to Gat's method there is a little likelihood that the individual is above the age of 18 years old as seen in other studies as well 5, 36,39.

Yet in our study, the minimal age for apex closure (stage H, score 6) was 19 years old for men and 17 years old for women. this indicates that if a subject had a Demirjian's grade of H or a gat score of 6, one can assume that the subject is at least 17 years old or older.Stage D or the initiation of root formation after completion crown start at 12 years old for male and female this is far from the result of Kullman et al (40) in which 15 years old and disagree with Sisman et al(37)and Simonsson et al(5).

Results show faster development in females than male that is third molar maturity is earlier in female than male this agree with Zainab M (25), Khosronejad et al(41) , and Hassan et al(42) ,but disagree with (5,32, 35,42 ,43,44)

Modified The estimation of ages greater than 20 using Gat's method is unsatisfactory. Subjects 20 years old and older showed complete root formation, hence they were all given a Gat's technique score of 6. According to the stage of third molar production, people in stages A through E are most likely to be 18 years old or older, but people in stages H are more likely to be younger. This finding suggests that the technology developed by Gat and Demirjian is appropriate for use in age detection and legal investigations.

Limitation of our study

1- Due to population movements caused by the several Iraqi Wars, we were unable to manage Basra's ethnic makeup. As a result, there is a mix

of ethnic groups, and some residents may not be pure Arabs but rather Kurdish or Turkman subjects.

2- The size of the sample, age, biological variance of the person, statistical technique, and experience of the Observer in evaluating ages are the main causes of variations between the Iraqi sample and other research.

The O.P.G for this study was difficult to gather due to the narrow age range and the fact that the Center was already seeing patients of various ages who were seeking dental or orthodontic treatment.

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