

Chronological age estimation in adolescent and young adult subjects in relation to mandibular third molar development using digital panoramic image

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ABSTRACT

Background: Predicting chronological age in adolescents and young adults can be crucial in Medico legal contexts and the third molar is the only developing tooth during this period that used to determine chronological age. The purpose of this study was to estimate the chronological age based on the stages of mandibular third-molar development following the eight stages (A-H) method of Demirjian et al

Materials and methods: The sample consisted of 436 Iraqi adolescents and young adults subjects have been chosen with known chronologic age (range, 14–24 years) and sex (162 males and 274 female), digital panoramic radiograph had been taken for each examined subject, Demirjian's grading has been used to assess third molar development

Results: Statistically significant differences ($P < 0.05$) in third-molar development between males and females were revealed regarding the development stages D,E and F. Third-molar genesis was attained earlier in males than in females. Statistical analysis showed a strong correlation between age and third-molar development for males ($r = 0.91$) and for females ($r = 0.87$).

Conclusion: It was concluded that the use of mandibular third molar development stages using Demirjian method can be considered as good valuable chronological age indicators in adolescents and young adults

Keywords: Third molar; Chronological age; Age estimation. (J Bagh Coll Dentistry 2012;24(2):47-50).

INTRODUCTION

In the past decade the number of unidentified cadavers and human remains as well as the number of remains lacking age documentation and therefore requiring age determination has increased. This requires age calculation, not only for differentiating the juvenile from the adult status in criminal law cases, but especially when determining the age of a crime victim and also for estimating chronologic age in relation to school attendance, social benefits, employment, and marriage ^(1,2).

Method of chronological age estimation in adolescents and young adults may be including radiographical examination of the hand and wrist, the medial clavicular epiphyseal cartilage, and finally 3rd molar development observations ^(3,4,5).

But compared to bone development, 3rd molar development are less affected by variation in endocrine and nutritional status, and in hand and wrist development it is completed around the age of 18 while 3rd molar development continues until the early twenties when the development of almost permanent teeth may be completed, and regressive changes in teeth with increasing age may not yet appear at that age.

Therefore developing 3rd molar is the only reliable biological dental indicators variable and readily assessable from dental radiographs during adolescence and the transitional period to adulthood, Indeed a great variation in position, morphology, and time of formation ^(6,7,8). Up to now several studies have been undertaken in different populations these studies show that 3rd molar development varies slightly between different populations, making population-specific studies necessary. Recently, for different ethnic groups, numerous reports have been published on the evaluation of third-molar development ^(9,10).

Panoramic radiography is a radiological technique for producing a single image of the facial structures that include both the maxillary and mandibular dental arches and their supporting structures. Digital radiography is considered to be a great enhancement to the diagnostic radiography due to its radiation dose reduction, improved image properties, improved storage and transportability of the

Image and reduce equipment and time needed to produce a superior image ⁽¹¹⁾.

The aim of this study was to estimate chronological age and gender in adolescent and young adult subjects based on stages of mandibular third molar according to Demirjian method using digital panoramic image.

MATERIALS AND METHODS

Samples selection:

In this cross-sectional study, dental panoramic image of 450 Iraqi subjects with known chronologic age and sex were selected.

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(2) Assistant Professor, oral diagnosis Department, College of Dentistry, Baghdad University.

Selection criteria included the following:

- Adolescent and young adult Subjects;
- Well nourished and free of any known serious illness;
- Normal growth and development and dental conditions, for example, no impactions, congenital absence, or transposition of teeth.

Exclusion criteria excluded the following:

- Image deformity affecting third molars; and
- Panoramic image showing obvious dental pathology.

Fourteen films were excluded for poor radiographic quality, and for agenesis of the third molars. The final sample consisted of 436

Panoramic image from Iraqi individuals of known chronologic age and sex. Mean age range of the 436 patients for both genders was (14- 24 years). All assessments were performed by digital panoramic image in computer to ensure contrast enhancement of the tooth images.

Examination and classification covered the development phase of the left mandibular molar third and, when not present, the Contra lateral molar was considered.

Tooth calcification was rated according to the method described by Demirjian et al 12 in which one of eight stages of calcification, A to H, was assigned to the third-molar tooth (Figure 1).



Figure1: panoramic image shows third molar development.

The first four stages (A–D) show crown formation from the beginning of cusp calcification to completed crown, and the second four (E– H) root formations from initial radicular bifurcation to apical closing.

Descriptive statistics were obtained by calculating the means, standard deviations, and range of the chronologic ages for the eight stages of dental development.

Statistical analyses were performed using the Student's t-test between sex and age. ANOVA test was used to test the statistical significance of difference in mean between developmental stages groups of mandibular molar. Pearson's correlation coefficient to test statistical significance, direction and strength of linear correlation between 2 quantitative normally variables.

All statistical analyses were performed using SPSS version 15.0. (Statistical Package for Social Sciences)

To test the reproducibility of the assessments of dental development stage, two investigators reevaluated randomly selected panoramic radiographs from 10% of the same male and female subjects after the first evaluation. Inter- and intra observer agreements were determined using the Binominal–test (non-parametric test)

RESULTS

Repeated scorings of a subsample of 40 radiographs indicated no significant intra- or inter observer differences (P_0.05). Intra observer consistency was rated at 98%, whereas inter observer agreement was 95%.

The third-molar formation process was examined in both sexes, and the mean ages and standard deviations for the Demirjian stages are described in (Table 1).

Data for Demirjian stages A, B and C was omitted from the study because no teeth in stages A and B were noted and less than 1% was noted in stage C for the present study

In both male and female sample groups there is strong positive relation ship between the dental development stage of mandibular third molar and chronological age ($p < 0.001$, for both sexes)

Statistically significant differences (P _ 0.05) were revealed in third-molar development between males and females regarding the calcification stage D and stage E. These differences indicated that third-molar genesis attained the Demirjian formation stages earlier in males than in females.

Table 1: Descriptive statistic of both genders

Sex	Male	
Stages	Mean	SD
D	14.40	0.627
E	15.79	1.503
F	17.85	1.405
G	19.00	1.275
H	21.32	1.561
Sex	Female	
D	15.09	1.460
E	16.66	1.250
F	18.07	1.557
G	19.46	1.444
H	21.36	1.314

DISCUSSION

Chronologic age estimation by tooth development has been used over a long period. Tooth development is an accurate measure of chronologic age that seems to be independent of

exogenic factors such as malnutrition or disease (13-15).

The third-molar calcification stage is one of the few tools that can be used to assess age when development is nearing completion during adolescence when the third molar is the only remaining variable dental indicator (16).

The differences between populations, the different methodology, and the dissimilarity among observers are other important shortcomings. In the present study, to overcome some of these shortcomings, all selected subjects were evaluated by two well trained observers using eight stages according to the method of Demirjian et al.¹² a range of different classifications for evaluating tooth mineralization is available.

In the past, different classifications were presented by Gleiser and Hunt,¹⁷ Moorrees et al,¹⁸ Kohler et al.¹⁹ and Kullman et al,²⁰ However, some of these classifications identify a large number of stages that are hard to delimit from each other. Demirjian et al¹² presented a classification distinguishing four stages of crown development (stages A–D) and four stages of root development (stages E–H). The system avoids any numeric identification of stages so as not to suggest that the different stages represent processes of the same duration. The stages proposed by Demirjian et al¹² are defined by changes of shape, independent of speculative estimations of length.

Dhanjal et al²¹ investigated the reproducibility of different radiographic stage assessment of third molars and concluded that the method of stage assessment of third molars developed by Demirjian et al¹² performed best not only for intra- and inter examiner agreement, but also for the correlation between estimated and true age. Therefore, this classification seemed to be the most appropriate for our study.

In the present study examined the mean ages of each stage for male and female patients statistically significant differences (P<0.05) in third-molar development between male and female subjects were revealed regarding calcification stages D and E.

These significant differences indicated that third-molar genesis in males attained these Demirjian formation stages 6 to 8 months earlier than in females.

This observation was consistent with previous studies, which report that the mean age at some of the development stages was lower for males than for females in the following populations: Hispanics,²² Belgian whites,²³ Swedes,²⁰ or people of Spanish origin⁹.

However, other researchers have demonstrated similar mean age values and distributions for sexes (10, 24, 25).

The stage of development of the third molar has a practically linear relation to the age of the subjects, whether male or female. Statistical analysis shows a stronger correlation for male (r = 0.91) than for female (r = 0.87) subjects. These results also agree with studies on other populations⁹.

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