Age estimation using third molar teeth: A study on southern Saudi population

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Abstract

Objective: To estimate the age of an individual between 13 and 23 years, using Demirjian method in Saudi male patients in the southern region of the Kingdom of Saudi Arabia. **Materials and Methods:** A total of 360 male patient's digital panoramic radiographs were used to evaluate the morphology of mandibular 3rd molar teeth roots according to the Demirjian method. Using descriptive statistical method, age was calculated. **Results:** Result showed a strong relation of age with stages of root development of 3rd molar teeth. The standard deviation of mean of root development stages is 1.47 years of age. **Conclusion:** This study suggests that age can be predicted with a statistical significant result for ages between 13 and 23. Further studies with large population are needed for better statistical results and for female age assessment.

Key words: Age estimation from tooth, Demirjian method, dental age estimation, forensic odontology, radiographic age estimation, third molar age estimation

Introduction

Age estimation is one of the important factors in identification of individual in forensic dentistry. Age estimation has been beneficial in assisting authorities in narrowing the search possibilities of unknown victims, determining eligibility for social benefits, and aiding immigration services in the processing of undocumented immigrants. Numerous studies have demonstrated the reliability of using the human dentition as an estimator of chronologic age.[1] Dental techniques that use progressive morphologic changes have proven to be the most accurate methods of estimating the ages of infants, children, and adolescents. Toward the end of human skeletal growth and development, only a few age dependent features can be evaluated by morphological methods. The third molar is the latest tooth to initiate and complete development and therefore is the last available dental morphologic predicator of age.[2]

Age can be estimated in children and in adolescents by means of development and eruption of deciduous and permanent teeth up to 14 years. For most age estimation methods, the developing teeth are subjectively assessed on radiographs. After the age of 14, the third molar is the only remaining tooth that is still developing and consequently dental age estimation methods have to rely on the development of this tooth until the age of 23. After this period, age determination is mainly done by visual examination, radiographic methods, and structural changes in teeth and by means of chemical methods.[3]

The staging of third molar crown and root mineralization can be accomplished easily and non-invasively through evaluation of dental radiographs. Several staging systems have been developed to describe the dental maturation process. In 2004 Olze et al.[4] published a study assessing the validity of five of the common classification systems: Gleiser and Hunt (1955); Demirjian et al.[5] (1973); Gustafson and Koch (1974); Harris and Nortje (1984); and Kullman et al; (1992). Olze et al. concluded that Demirjian et al. classification achieved the highest values for both the observer agreement and for

correlation between the stages as defined by the method and true age. It can, therefore, be regarded as the best method.

Modified Demirjian staging chart has been developed by investigators including Solari and Abramovitch[6] and Kasper *et al*.[7] Solari and Abramovitch added intermediate sub-stages to the latter stages of development. Kasper's modification maintains the same letter classification system and descriptors, but adds useful radiographic examples of each stage.

The study is undertaken with the objective of estimating the ages of an individual from 13 to 23 years, using Demirjian method in Saudi male patients in the southern region of the Kingdom of Saudi Arabia.

Materials and Methods

A total of 360 panoramic dental radiographs of Saudi male patents of age 13 to 23 years were chosen for the study retrospectively. There were no sufficient number of female patients on the record, so female samples were omitted from the study. All the radiographs are of digital type, i.e. stored and seen on the computer. The software used to view these radiographs is ''Clini-view'' of Instrumentarium Company and the machine used was ''Orthopantomograph'' (OPG). Three observers are trained on how to assess the radiograph according to the Demirjian's chart modified by Kasper. All patients medical histories are cross checked on the reception file for any significant findings, and patients chosen were not having any medical problems. All three observers are assessing the stages of mandibular third molar teeth development together. Then stages are marked on the form provided according to Demirjian's chart modified by Kasper.[7] Only mandibular third molars are chosen because many did not have maxillary third molars. All the scores are then subjected to descriptive statistical analysis using SPSS (Statistical Package for Social Science) software.

Results

The descriptive statistical analysis revealed a minimum standard deviation of 0.76 years and a maximum of 2 years for the third molar development stages. For the stage ''A'' mean are 13.29 ± 0.76 years. And for stage ''H'' it is 22 ± 1.77 years. This means we can estimate age from 13 up to 23 years using Demirjian chart. Detailed descriptive analysis is given in Table 1. Anova evaluation suggests that mean ages are different significantly from each other [Table 2]. Graphical representation of relation between age and stages of tooth development is shown in Figure 1.

Discussion

The development of wisdom teeth shows remarkably small diversities among different ethnic groups. Despite of that, it

Table 1: Descriptive statistics

Stages	Mean	Age in years				
		Std. deviation	95% Confidence interval for Mean		Minimum	Maximum
1	13.29	.756	12.59	13.98	13	15
2	13.83	1.167	13.38	14.27	13	19
3	14.08	.909	13.70	14.46	13	16
4	15.50	1.694	14.78	16.22	13	19
5	16.52	1.529	16.09	16.95	13	20
6	17.96	1.942	17.37	18.54	15	22
7	19.52	2.047	19.00	20.04	15	23
8	22.02	1.769	21.69	22.34	16	24
Total	18.50	3.457	18.14	18.86	13	24

Table 2: Anova

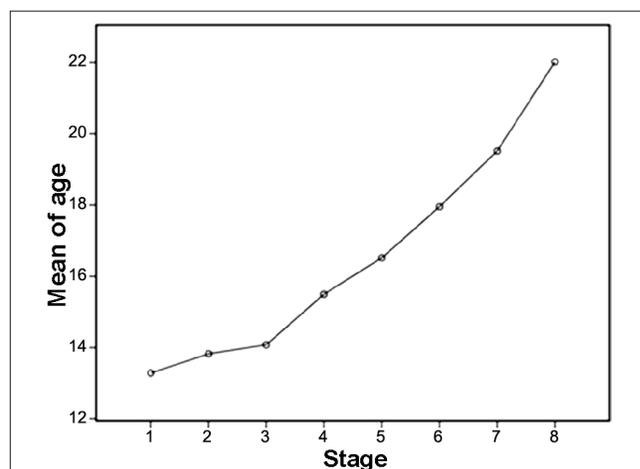|	Age in years			
	Sum of squares	Mean square	F	Sig.
Between Groups	3260.752	465.822	159.310	.000
Within Groups	1029.248	2.924		
Total	4290.000			

Figure 1: Graphical representation of relation of age and stages of tooth development

is of importance to study different ethnic groups to verify this observation or to discover differences. Interestingly, in all of the studies completed till date, an individual having third molars with Demirjian stage ''H'' development had very likely reached the chronologic age of 18, indicating that the use of this technique for determining the legal age of majority is valid.[1,8] Solari and Abramovitch in their study, stated that the mean age for stage H was 20.5 years. However, the mean age could be lower if the population sample age range was limited to an younger age less than 24 years. So, they recommend that the maximum age limit for population samples in future studies be no greater than 22 years.

Numerous reports[2] have been published on the age estimation issue concerning adolescents and young adults

in whom the assessment of third molar development was frequently investigated. Although the reliability of third molars in age estimation has been evaluated by several research groups, consensus on the usefulness of these teeth has not been reached. As concluded by Mincer *et al.*[9] in the A.B.F.O study, the examination of third molars may provide reasonable accuracy for the likelihood that a person is at least, e.g., 18 years old, instead of the estimation of exact chronological age. Therefore, we investigated the probability of Saudi male population in southern region tooth development stage and its correlation with the above finding. We could conclude that tooth development stage at "H" will definitely say that the individual is a major having completed 18 years of age. We could predict the age with the average standard deviation of 1.47 years. The descriptive statistical analysis revealed a minimum standard deviation of 0.76 years and a maximum of 2 years for the third molar development stages. These results are in accordance with the previous studies.[2,3,4,8]

Previous studies[4,8] had investigated gender differences which showed diverse results. We could not do this due to lack of sample size of females patients. Even studies had shown a significant difference between maxillary and mandibular wisdom teeth development, even though the mandibular third molar is more reliable than maxillary wisdom teeth. Here also we could not use these parameters due to less sample size of maxillary wisdom teeth.

Conclusion

We conclude that the present study can respond to the recently rising need of population based information on mandibular third molar development. The proposed data may provide Saudi reference for mandibular third molar examination for the purpose of forensic investigation. Third molar tooth development stage "H" will definitely suggest that the person is above 18 years of age. Even though, Solari and Abramovitch suggested that age limit of the sample is kept maximum at 22 years of age to get correlation for stage H and 18 years, we got this correlation even when our sample size higher limit was at age 23. Hence, the stage H finding can be used for legal prosecution to know whether the convict is a major or minor, depending upon the laws of the country. Due to the lack of adequate sample size of female patients and patients having maxillary third molars, we could not compare these parameters with the age. Since our sample size is less, limited conclusions can be drawn from this single study. Hence studies with larger population data are essential to derive at an ultimate decision and other methods of age estimation should also be tried along with Demirjian method to confirm the accuracy.

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