

Chronological Age Estimation Based on Mandibular Third Molar Development from Digital Panoramic Radiograph in a South Kerala Population

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Abstract

Introduction: Tooth development is the best method in estimating the chronological age of young adults. Demirjian's method has high value of correlation and observer agreement between chronological age and estimated age.

Aim of the study: To assess the chronological age based on developmental stages of mandibular third molar using Demirjian's method.

Materials and methods: A retrospective study of 160 radiographs, among subjects in the age group of 9-25 years who underwent digital panoramic radiographic examination during the last 6 months in the Department of Oral Medicine and Radiology, Pushpagiri College of Dental Sciences, Thiruvalla, Kerala, South India. Ten males and ten females were selected for each stage of third molar development (n=160). Developmental stage of the mandibular third molar was assessed using Demirjian's method.

Results: The root formation of mandibular third molars is completed (stage H) at the mean age of 21.4 ± 2.5 years and 21.2 ± 3.2 years in females and males respectively. At the mean age of 14.6 ± 1.5 and 13.6 ± 1.9 years, the formation of inter-radicular bifurcation (Stage E) had started in males and in females. The data showed that males reached the stages at indicated ages earlier than females.

Conclusion: Radiological development of the third molar may be a useful biological variable for estimating the age of a person between teens and early 20s.

Keywords: Chronological age; Mandibular third molar; Panoramic radiograph; Demirjian method

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Citation: Mathew AL, Cherian SA, Mathew R (2017) Chronological Age Estimation Based on Mandibular Third Molar Development from Digital Panoramic Radiograph in a South Kerala Population. J Ora Med Vol.1 No.1:12

Received: December 05, 2017; **Accepted:** December 20, 2017; **Published:** December 29, 2017

Introduction

Age helps in the identification of a person. The most reliable method in estimating the chronological age of young people is with radiographics [1]. The degree of third molar formation assessed radiographically plays major role in estimation of age [2]. Teeth seem to be less affected by environment, nutrition, hormonal imbalance and diseases [3]. The normal age of eruption of third molar is 17-21 years. The assessment of human being following 14 years of age, third molar development from

initiation to its complete development can be implemented in the age estimation.

Several methods are available to estimate dental development [4-6]. Demirjian's eight-stage scheme provides high value in terms of correlation and observer agreement between the estimated and chronological age [7-9]. Many studies have evaluated the advantages of development of third molar as a reliable indicator of age assessment in different population, the influence of geographic origin on the development rate has not been sufficiently analyzed [8-11].

The main aim of the study was to assess the chronological age based on developmental stages of mandibular third molars in South Kerala population using Demirjian's method.

Materials and Methods

A retrospective panoramic study was done of 160 radiographs between the age group of 9-25 years who had undergone radiographic examination during the last six months in the Department of Oral Medicine and Radiology. All panoramic radiographs were digitally generated on a Kodak 9000c Digital Panoramic and Cephalometric System. Uncontrolled quota sampling method was used. Inclusion criteria were the availability of radiograph of adequate quality, and no history of medical or surgical disease that will affect the development of mandibular third molar. Exclusion criteria included distorted images or any pathology in mandibular third molar region.

The developmental age of third molar was assessed using Demirjian's classification system. Eight stages (A-H) of crown and root development are there in this method [9]. Crown formation from the appearance of cusp to crown completion represented by stages A-D. Root formation from radicular bifurcation to apical closing was represented by stages E-H. Demirjian's stages of 3rd molar development are represented as [9]:

A=Cusp tips are mineralized but have not yet coalesced.

B=Mineralization cusp are united, so the mature coronal morphology is well defined.

C=Crown is about half formed, the pulp chamber is evident, and the dentinal deposition is occurring.

D=Crown formation is complete to the dentino-enamel 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. Roots have funnel shaped endings.

G=Root walls are parallel, but the apices remain open.

H=Apical ends of the roots are completely closed, and the periodontal membrane has a uniform width around the roots.

Only the evaluation of mandibular third molars were done as the assessment of the maxillary third molars are often difficult as the upper third molars are often superimposed by the anatomical structures. It has also been found that the reproducibility is higher for mandibular third molars than maxillary third molars [12].

All the radiographs were viewed on an LCD monitor (12 inches), with resolution of 1600 x 1200 pixels. The assessment was performed by the investigator without the knowledge of the subject's age and gender.

Statistical data including mean age, standard deviation, minimum, maximum, 95% confidence interval and percentiles (25%, 50% and 75%) were obtained for each stage of mineralization of both genders.

Results

Comparison between the right and left side of mandibular third molars did not show any significant difference. Due to this observation, the stage of development of only 38(FDI) was considered.

Tables 1 and 2 shows the results for each tooth mineralization stage according to specific ages, presented for females and males respectively.

Table 1 Distribution of age (in years) per stages as per Demirjian's classification in females.

Stages	Mean	Minimum	Maximum	95% Confidence interval	Percentile		
					25%	50%	75%
A	10.6 ± 1.6	9	13	9.42-11.78	9	10.5	12.25
B	11.2 ± 1.3	9	13	10.26-12.14	10.5	11.5	12
C	12.0 ± 1.4	9	14	10.99-13.01	11	12	13
D	13.5 ± 1.6	12	17	12.37-14.63	12	13	14.25
E	14.6 ± 1.5	12	17	13.40-15.73	13.75	14.5	15.5
F	16.0 ± 1.9	14	19	14.73-17.47	14	16	18
G	17.5 ± 2.7	14	22	15.50-19.50	15	16.5	20.25
H	21.4 ± 2.5	17	25	19.61-23.19	19	21.5	23.25

Table 2 Distribution of age (in years) per stages as per Demirjian's classification in males.

Stages	Mean	Minimum	Maximum	95% confidence Interval	Percentile		
					25%	50%	75%
A	10.4+1.8	9	14	9.09-11.71	9	9.5	11.5
B	10.9+1.3	9	13	9.98-11.82	10	10.5	12
C	13.0+0.6	12	14	12.52-13.48	12.75	13	13.25
D	13.2+1.0	12	15	12.46-13.94	12	13	14
E	13.6+1.9	10	17	12.20-15.00	12.75	13.5	14.5
F	16.0+1.5	14	19	14.93-17.07	14.75	16	17
G	16.5+1.5	14	18	15.42-17.58	15.5	17	18
H	21.2+3.2	16	25	18.87-23.53	18.25	22	24

The root formation of mandibular molar was completed (stage H) at the mean age of 21.4 ± 2.5 and 21.2 ± 3.2 years in females and males respectively. At the mean age of 14.6 ± 0.5 and 13.6 ± 1.9 years the formation of inter-radicular bifurcation (Stage E) had started in males and in females respectively. Data showed that males reached the stages earlier than females.

Discussion

Dental age estimation using panoramic radiographs are more reliable than skeletal indicators. Third molar mineralization stage is one of the most useful tools to assess chronological age.

The present study can also add to reference data for forensic application in third molar mineralization in a South Kerala population. Even though there was a wide age-range, a clear correspondence between the mineralization stage and the age of the subject was present.

In our study, the stage A initiated at 10 years of age in both males and females. This finding is in accordance with the studies on Thai population by Kaomongit and Tantanapornkul [13]. Jung and Cho [14] observed that the third molar began to calcify at seven years of age which was much earlier than our findings. We observed that the stage D or crown completion was found in the mean age of 13.2 ± 1.0 for males and 13.5 ± 1.6 for females. This is comparable with the finding of Thai population by Duangto et al. [15] where the crown was completed at the mean age of 14 years. The stage G occurs in the mean age of 16.5 ± 1.5 in males and 17.5 ± 2.8 in females. This finding is early in males as compared to the study done in Sweden by Thorson et al; where the stage G occurs at the mean age of 18.4 and 18.7 years in males and females respectively [16].

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According to our data, earliest age of root completion (stage H) earliest age was at the age of 16 and 17 years in males and females respectively. This is around three years earlier than the study by Duangto et al. [15] in Thai population, 2 years earlier than Turkish [8] and one year earlier than Korean population [14]. Cantekin et al. analyzed cone beam computed tomography image of third molar for age estimation [8].

Considering the socioeconomic status of the population in developing countries like India, panoramic radiograph is the most reliable technique in the evaluation of teeth and associated structures and also in the age estimation by assessing the third molar development.

Conclusion

The difference in the developmental stages of the third molar in various population calls for more ethnic-specific reports to be performed in different parts of the world. This would provide an accurate view of the association between chronological age of the individuals and the developmental stages of the third molar. To conclude, radiological development of the third molar may be a useful biological variable for estimating the age of a person between teens and early 20's.

Acknowledgement

We would like to acknowledge Mrs. Nisha Kurian, Assistant Professor, Biostatistics, Department of Community Medicine, Pushpagiri College of Medical Sciences for analyzing the data.

Conflict of Interest

The authors declare no conflict of interest with this submission.