

ESTIMATION OF HUMAN AGE WITH THE DEVELOPMENT OF THIRD MOLARS

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ABSTRACT:

BACKGROUND: Teeth are the most durable structures in the human body. The pattern of their development has been used as a credible technique of age determination of unidentified bodies. Dental age estimation is by comparison of the dental status of an individual with published dental surveys. The third molars are the last teeth to erupt and are regarded as the most variable in the dentition. Nevertheless, radiographs depicting their growth have been used to determine the chronological age. Third molar tooth development can be reliably used to generate mean age and the estimated age range for an individual of unknown chronological age.

AIM: The Aim of this research is to estimate the human age based on the development of third molar. The objective of this study was to establish third molar morphology/development for age estimation adolescents between ages 14 and 65 years

MATERIALS AND METHODS: The orthopantograms of 280 samples (males and females), were examined and the stage of third molar development were evaluated.

RESULT: According to the present study if the third molar have reached stage A, the age of the person would be above 14 and if it has reached stage G, then the age of that particular person would be above 20. The third molars were evaluated by Demirjian method of tooth development. Stage A,B,C,D was commonly seen in individuals between 14-20 years. Stage E,F,G,H was commonly seen in individuals above 21 years.

CONCLUSION: Third molar erupts at the later stages of life and is the last teeth to erupt . Thus third molar development is a valuable tool for age estimation in late adolescence and early adulthood as there are no other indicators available for age estimation.

Keywords: Demirjian system, orthopantograms, third molars, mineralised.

INTRODUCTION:

Age estimation is one of the important duties of the medico legal officers in recent time. When one must identify a deceased individual, accurate determination of the age of the person is very important. Teeth of an individual can be a reliable means of determining age from approximately 10 weeks intrauterine up to old age (1,2). To establish the identity of an individual, age estimation is necessary not only in cases of living but also in the dead too. The accuracy of determining chronological age from tooth development (i.e., dental ageing) is not uniform from birth to adulthood. The best precision and accuracy for age estimation from tooth development is achieved when individual growth is rapid and many teeth are under development (3,4). After age 14, estimation becomes more difficult, since most of the dentition is completely developed. Only the developing third molars remain for use in age estimation (5,6).

The third molar offers a unique advantage over other teeth because its development tends to continue over a longer period and until a later age (7). Literature review shows reports on age estimation based on tooth development in various population groups (8,9,10) . There are two methods of dental age assessment, radiographically and by clinically visualization of eruption of teeth. Most studies of the third molar have been concerned with its presence or absence. Nevertheless this can be misleading in many cases. Radiographically distinguishable stages of tooth formation have been described in very few cases (11). A more precise estimation would be the phases of the tooth formation that can be used as a yardstick.

The reliability of the methodology is still under research(12, 13). By radiographic methods it is possible to follow the formation of crowns and roots of teeth and their calcification. The main objective of the study was to evaluate the reliability of chronology of stage of the tooth development in predicting the age of the south Indian population based on orthopantomograms.

MATERIALS AND METHOD:

The study was initiated by collecting 280 orthopantograms (OPG) of south Indian population with known chronological age and gender. These 280 OPGs were analysed for inclusion and exclusion criteria. Inclusion criteria included presence four permanent third molars. OPGs were excluded if any one third molar were missing, if there was obvious dental pathology, or if image deformity affected the area of interest. Thus a total of 68 OPGs were selected, which had all the 4 third molars in it. Each OPG consisted of 4

third molars counting upto a total of 272 (n=272) molars from 68 orthopantograms. The age group of study ranged from 14-65 years. Patient identification number, sex, date of birth, and eruption stages of the third molars were recorded for each individual subject. Dental development was evaluated according to the method of Demirjian system (14).

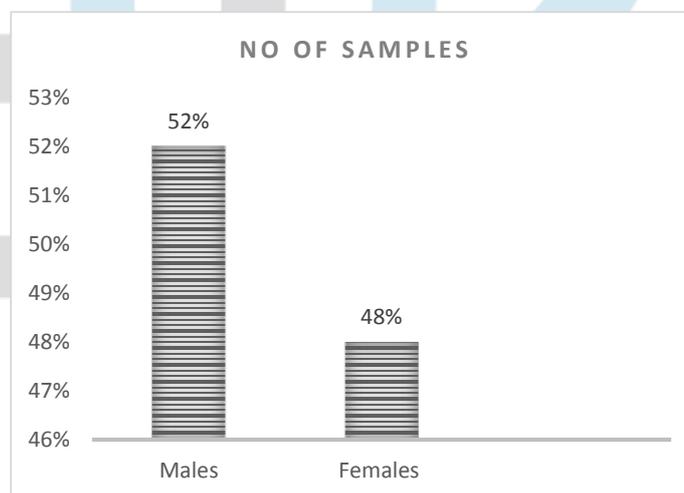
Each of these orthopantogram was studied for eight different stages of development of the third molars by methods adapted by Demirjian as follows (15):

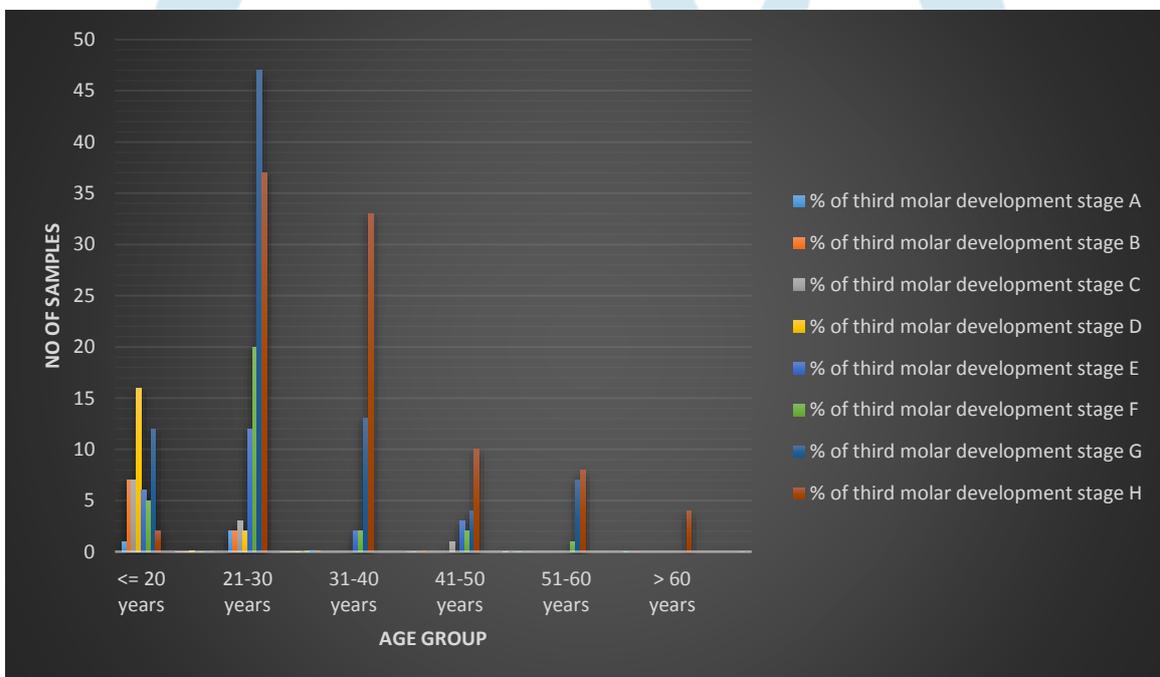
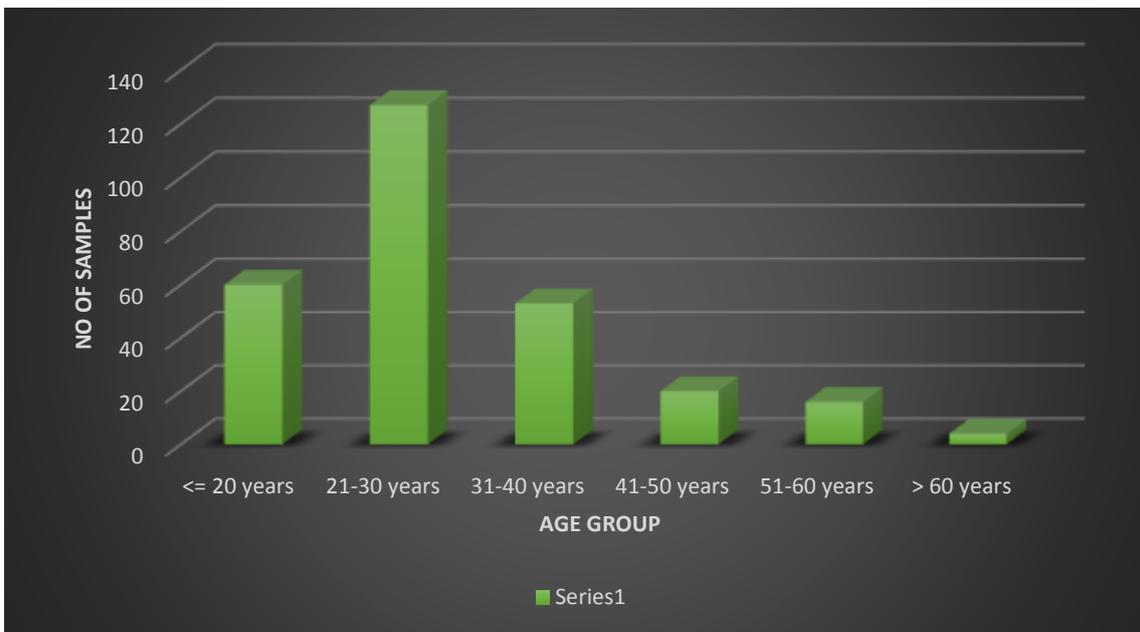
- **Stage A:** Cusp tips are mineralised but have not yet coalesced.
- **Stage B:** Mineralised cusps are united so the mature coronal morphology is well defined.
- **Stage C:** The crown is about half formed; the pulp chamber is evident and dential deposition is occurring.
- **Stage D:** Crown formation is complete to the dentino-enamel junction. The pulp chamber has a trapezoidal form.
- **Stage E:** Formation of the inter-radicular bifurcation has begun. Root length is less than the crown length.
- **Stage F:** Root length is at least as great as crown length. Roots have funnel-shaped endings.
- **Stage G:** Root walls are parallel, but apices remain open.
- **Stage H:** Apical ends of the roots are completely closed.

RESULTS:

The study information was recorded by plotting the actual age of the study participant as per the chronological stage of third molar development found on the OPG, as described by Demirjian et.al⁽¹⁵⁾. The study population was divided into six groups such as 14-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, > 60 years. Male 52% and female 48%.

The study population in between 14-20 years had majority of stage D followed by G, B and C,E,F,H,A. Population between 21-30 years had majority of stage G followed by H,F,E,C,A,B and D. Population between 31-40 years had majority of stage H followed by G,E,F. Population between 41-50 years had majority of stage H followed by G,E,F and C. Population between 51-60 had stage H followed by G, and F. Population above 60 had stage of H. Numbers of samples of various age groups and the developmental stage of the third molars have been tabulated. (Table 1).





DISCUSSION:

When estimating chronological age from tooth development, greater accuracy and precision is attained when many teeth are under development (2,4). Among children, dental age is less affected by variation in nutritional and endocrine status compared to other methods of age estimation. Estimating chronological age from third molar formation stages is suggested because of the absence of other reliable biological markers during late adolescence (4). During this period all permanent teeth, except the third molars, have completed their formation (16).

Other studies have evaluated the age estimation based on the root dentin transparency (17), length of the tooth, pulp/tooth volume ration (18), tooth cementum annulations (19,20), difference between the maxillary and mandibular molars, etc.

In the past, different classifications were presented by Kohler et al, Kullman et al and others. However some of these classifications identify a large number of stages that are hard to delimit from each other. Demirjian et al (14) presented a classification distinguishing four stages of crown development (A-D) and four stages of root development (E- H).

The system of tooth development stages proposed by Demirjian et al. (14) lends itself best to forensic purposes, since stages are defined by changes in shape and proportions, and no metric estimates are needed. Recent studies found that the system of Demirjian et al. performed best not only for inter-observer agreement but also for the correlation between estimated and true age(21,22).

In the present study, the minimum age of the study population was 14 years and the maximum age was 64 years. The main objective of the study was to evaluate the chronology of stage of the tooth development in correlation with the age of study population.

In the age group between 14-20 years, crown formation were completed to dentino -enamel junction in majority of the third molars. In the age group of 21-30 years, the crown formation was completed, root formed with the root walls that were parallel but apices remained open. In the age group of 31-40 years, 41-50 years, 51-60 years and above 60 years, the tooth formation was completed in majority of third molars with apical ends of the roots completely closed.

Among the study population 30.88% have reached G stage and 34.55% have reached H stage. In this present study if the third molars have reached stage A, then the age of that person was above 14. Tuteja et al, has mentioned in his study that third molar is the only developing tooth after the age of approximately 14 years (23). Stage A,B,C,D was commonly seen in individuals between 14-20 years. Stage E,F,G,H was commonly seen in individuals above 21 years.

However, the third molar is frequently the most variable tooth in the dentition with respect to size, (4-6) time of formation and time of eruption (6).The reliability of age estimation reduced in older age groups. The possible reasons might be the reduction of the criteria and signs for the age estimation of OPGs in older persons and the variability of the oral health status of patients in older age groups.

Table 1- Stages of third molar development based on Demerijan system

Age		% of third molar development stages							
		A	B	C	D	E	F	G	H
14-20 years (n=14)	Count	1	7	7	16	6	5	12	2
	% of total	0.367%	2.57%	2.57%	5.88%	2.2%	1.88%	4.41%	0.735%
21-30 years (n=31)	Count	2	2	3	2	12	20	46	37
	% of total	0.735%	0.735%	1.10%	0.73%	4.41%	7.35%	16.91%	13.60%
31-40 years (n=13)	Count	0	0	0	0	2	2	15	33
	% of total	0.00%	0.00%	0.00%	0.00%	0.73%	0.73%	5.51%	12.13%
41-50 years (n=5)	Count	0	0	1	0	3	2	4	10
	% of total	0.00%	0.00%	0.367%	0.00%	1.10%	0.73%	1.47%	3.60%
51-60 years (n=4)	Count	0	0	0	0	0	1	7	8
	% of total	0.00%	0.00%	0.00%	0.00%	0.00%	0.367%	2.57%	2.94%
> 60 years (n=1)	Count	0	0	0	0	0	0	0	4
	% of total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.47%
Total	Count	3	9	11	18	23	30	84	94
	% of total	1.11%	3.30%	4.04%	6.61%	8.45%	11.02%	30.88%	34.55%

CONCLUSION:

Age estimation with OPGs can be used to make a significant percentage of forecasts in areas such as forensic medicine and forensic dentistry, especially in young patients. In overview the developmental stages of the third molar can be the only quantitative biologic variable available for the estimating the age of a person in his/her late teens or early 20s. Age estimation based on third molar formation need further evaluation, because it plays a vital role when the other determinants are absent.

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