

Original Research Article

Third molar as a diagnostic tool for age estimation in forensic odontology: An exploratory study

Dr. Ramisetty Sabitha Devi¹, Dr. M. Rajesh², Dr. B. Rajsekhar³, Dr. Madhuriya C.⁴, Dr. Atul Bhardwaj⁵,
Dr. Smitha Singh⁶

¹Reader, Department of Oral Pathology, SJDC, Eluru, Andhra Pradesh

²Associate Professor, Department of forensic medicine, Karpagam medical college, Coimbatore

³Associate Professor, Department of Pathology, P.K. Das medical college, Kerala

⁴Registrar, Fakhrudin Ali Ahmed Medical College, Assam

⁵Dept. of prosthodontics, college of dentistry, Majmaah University, KSA

⁶Pedodontics & preventive, CMC, Bharathpur, Nepal

*Corresponding author

Dr. Ramisetty Sabitha Devi

Email: drspath@gmail.com

Abstract: Age estimation is an essential part of forensic expertise. Identifying individuals in cases of natural disasters, wars, criminal cases and in terms of employment also, age estimation is an important tool. Apart from the bones, secondary sexual characters and the body proportions, teeth are a useful tool in age estimation process. Teeth have been since long a valuable tool in the hands of forensics for establishing personal identity. The various stages of the third molar development were correlated to the radiographical findings on Orthopantomogram similar to Demirjian *et al.*; (original criteria).

Keywords: Age estimation, sexual characters, radiographical findings, Orthopantomogram.

INTRODUCTION

Age estimation is an essential part of forensic expertise. Identifying individuals in cases of natural disasters, wars, criminal cases and in terms of employment also, age estimation is an important tool [1]. Apart from the bones, secondary sexual characters and the body proportions, teeth are a useful tool in age estimation process. Teeth have been since long a valuable tool in the hands of forensics for establishing personal identity. Estimating age from teeth is also carried out and they have an advantage over the bones, as they remain viable while the other tissues undergo disintegration. One more essential factor that is a proven advantage is that the teeth can be examined in both the living as well as the dead. Various methods and parameters like the eruption sequence, cemental lines, incremental lines, loss of the part of tooth structure etc have been useful in forensic odontology for age estimation. On the other hand an individual nearing adulthood can be a challenge in the estimation process, since all teeth have erupted, except for the third molars that can provide vital clues. 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 and are the only possible source of estimation among age groups below 20 years of age

with of emphasis on the various stages of the third molar development and its co relation to age estimation. Though some contradictions are present in relation to utilization of 3rd molars, the studies thus need to be interpreted with a lot of caution [4-8]. Most of the literature focuses on the presence or absence of the third molar as a criteria. Nevertheless this can be misleading in many cases. A more precise estimation would be the phases of the tooth formation that can be used as a yardstick. The present study thus tires to emulate a more detailed method of estimation of the age of the individual based upon the various stages of the third molar formation according to the radiographical findings.

MATERIAL AND METHODS

Total of 100 patients between 15 to 25 years of age, reporting to the OPD of P.K.Das medical college were enrolled in the study. All those with history of third molar extractions, any form of systemic diseases and malnutrition were excluded from the study. Written consent was taken from each of the patients/ legal guardians. Only those patients who had to get a radiographical investigation for their third molars were included, to avoid any form of unnecessary exposure to the participant during the study. The various stages of

the third molar development were correlated to the radiographical findings on Orthopantomogram similar to Demirjian et al (original criteria) [9].

1. Stage A: Cusp tips are mineralized but have not yet coalesced.
2. Stage B: Mineralized cusps are united so the mature coronal morphology is well defined.
3. Stage C: The crown is about half formed; the pulp chamber is evident and dentinal deposition is occurring.
4. Stage D: Crown formation is complete to the dentino-enamel junction. The pulp chamber has a trapezoidal form.
5. Stage E: Formation of the inter-radicular bifurcation has begun. Root length is less than the crown length.

6. Stage F: Root length is at least as great as crown length. Roots have funnel-shaped endings.
7. Stage G: Root walls are parallel, but apices remain open.
8. Stage H: Apical ends of the roots are completely closed.

Both the left and right third molars were examined to denote the symmetry. The data was tabulated and subjected to statistical analysis using SPSS 20.0 (USA, Chicago). All p values below 0.05 were considered to be statistically significant.

RESULTS-

There were 47 males and 53 females in the study. Table 01 shows the mean and standard deviation of age of the study population.

Table 1: Distribution of the study population based upon the mean values and standard deviation of their age based upon the maxillary third molar development:

Stage of development	Male		Female	
	Mean	Standard deviation	Mean	Standard deviation
C	0.02		-	-
D	16.86	0.65	16.89	0.59
E	16.99	0.89	17.01	1.23
F	18.0	1.2	18.01	0.67
G	20.34	1.73	21.0	1.3
H	21.87	2.66	21.95	1.9

No statistically significant difference was observed among the two groups and the p value was <0.05, based upon the t test.

Table 02 shows the distribution of the population based upon their gender and its correlation to the stages of development of the mandibular teeth.

Table 02: Distribution of the study population based upon the mean values and standard deviation of their age based upon the mandibular third molar development:

Stage of development	Male		Female	
	Mean	Standard deviation	Mean	Standard deviation
D	15.91	1.45	15.89	2.33
E	16.71	0.23	16.91	1.04
F	17.69	1.24	17.63	1.27
G	21.38	2.43	20.19	1.76
H	21.45	1.66	21.87	1.40

No statistically significant difference was observed among the two groups and the p value was <0.05, based upon the t test. Table 03 shows the mean

ages at attainment of stage of third molars (right and left) in both the genders in the maxilla.

Table 3: The mean ages at attainment of stage of third molars (right and left) in both the genders in the maxilla

	Mean age and standard deviation				
	D	E	F	G	H
Male	16.1(0.75)	16.4 (0.99)	18.0(1.3)	19.1(1.83)	21.4 (1.66)
Female	16.0 (0.69)	16.2(1.33)	17.9 (0.77)	18.9(1.4)	21.1(2.9)

Table 04 shows the mean ages at attainment of stage of third molars (right and left) in both the genders in the mandible.

Table 4: The mean ages at attainment of stage of third molars (right and left) in both the genders in the mandible

	Mean age and standard deviation				
	D	E	F	G	H
Male	15.9(0.55)	16.8 (0.23)	17.0(1.84)	19.9(0.92)	20.2 (1.96)
Female	15.4 (0.69)	16.0 (0.67)	17.9 (0.77)	18.4(2.3)	19.0 (0.14)

Table 5: Regression analysis predicting chronological age from stages of III molar development:

	Maxilla		Mandible	
	Right	Left	Right	Left
Regression coefficient	1.50	1.50	1.38	1.37
r ²	0.39	0.39	0.37	0.37
F	51.87	39.59	41.25	38.72
p	0.00	0.00	0.00	0.00

There was a statistical significance obtained based upon the regression correlation (Table 05). But the data shows that the mean of the age increased along with that of the stage of tooth formation. At least radiographically there is a correlation between the age and the stage of the third molar formation.

DISCUSSION

According to Kullman, third molar development could serve as an accurate measurement of the chronological age of the patient, since it seems to be independent of a variety of exogenous factors [14]. It is perhaps one of the few tools to determine the age when an individual is nearing complete maturity. The single compelling reason to rely on third molar formation to estimate chronological age is that there are very few alternative methods during the interval roughly between the middle teens and early 20s. All of the hand- wrist bones have achieved their adult morphologies and their epiphyses have fused and the onset of secondary sex characteristics has occurred [1]. An important indicator for development that serves as a parameter is tooth development that can be determined both clinically as well as radiographically [10]. Rantanen *et al.*; [11] observed that the median age of upper and lower third molar eruption in the male subjects was 21.7 and 21.8 years, respectively, compared to 23.3 and 23.0 years in females, more than the findings of our study. In another study by Olze and associates, the third molars emerged earlier in males than in the females [12]. This was not similar to the present study findings. The study by Olze *et al.*; compared the populations across three different nations and found that South African men and women reached the mean target age earlier than those from Germany and Japan and this difference was statistically significant. Also in the same study all the women had a lower age for eruption of third molars compared to the men [13].

In the present study development of third molar in all stages was found slightly earlier in females than in males. No significant association was present between the age of eruption and the chronological age of the patient (P value >0.05). Other studies reported earlier eruption in men than women with no significant associations between age and the tooth eruption, unlike our study [1, 14-16]. Our study findings were similar to that of Kullman [17]. Unlike other study reported by Mincer [17] and Yuming *et al.*; [18]. We did not observe any statistically significant difference between the men and women. We can conveniently conclude that from stages A to D, there is lesser chances of the patient being 18 years of age and if stages of H is present, more likelihood that the person is above 18 years, similar to other studies [1, 7, 18]. The linear correlation established a significant correlation between the chronological age and the developmental stages of the third molar, as reported by Darji *et al.*; [1]. The results of this study can serve as a baseline data for further exploratory research among different ethnic people, with a larger sample size.

CONCLUSION

The present study thus shows that the third molars have different stages of teeth development that can be radiographically co related with the chronological age of the patient. Since the deviations are high, this cannot serve as the sole method to rely upon in medico legal cases. Nevertheless, under circumstances where other valid and reliable tests are absent, third molars can serve as a diagnostic tool and also as an adjunct to the other methods of age estimation.

REFERENCES

1. Darji JA, Govekar G, Kalele SD, Hariyani H. Age estimation from third molar development a radiological study.

2. Williams G. A review of the most commonly used dental age estimation techniques. *J Forensic Odontostomatol.* 2001; 19:9-17.
3. Schmeling A, Grundmann C, Fuhrmann A, Kaatsch HJ, Knell B, Ramsthaler F, Reisinger W, Riepert T, Ritz-Timme S, Rösing FW, Röttscher K. Criteria for age estimation in living individuals. *International journal of legal medicine.* 2008 Nov 1; 122(6):457.
4. Robetti I, Iorio M, Dalle Molle M. Orthopantomography and the determination of majority age. *Panminerva medica.* 1993 Sep; 35(3):170-2.
5. Kullman L, Johanson G, Akesson L. Root development of the lower third molar and its relation to chronological age. *Swedish dental journal.* 1991 Dec; 16(4):161-7.
6. THottsoN J. The accuracy and precision of the third mandibular molar as an indicator of chronological age.
7. Mincer HH, Harris EF, Berryman HE. The ABFO study of third molar development and its use as an estimator of chronological age. *Journal of Forensic Science.* 1993 Mar 1; 38(2):379-90.
8. Harris MJ, Nortje CJ. The mesial root of the third mandibular molar. A possible indicator of age. *The Journal of forensic odonto-stomatology.* 1984; 2(2):39.
9. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. *Human biology.* 1973 May 1:211-27.
10. Black SM, Scheuer JL. Developmental juvenile osteology.
11. Rantanen AV. The age of eruption of the third molar teeth: a clinical study based on Finnish university students. *Tilgmann;* 1967.
12. Olze A, Pynn BR, Kraul V, Schulz R, Heinecke A, Pfeiffer H, Schmeling A. Dental age estimation based on third molar eruption in first nations people of Canada. *J Forensic Odontostomatol.* 2010; 28(1):32-8.
13. Olze A, Van Niekerk P, Ishikawa T, Zhu BL, Schulz R, Maeda H, Schmeling A. Comparative study on the effect of ethnicity on wisdom tooth eruption. *International journal of legal medicine.* 2007 Nov 1; 121(6):445-8.
14. Bhat VJ, Kamath GP. Age estimation from root development of mandibular third molars in comparison with skeletal age of wrist joint. *The American journal of forensic medicine and pathology.* 2007 Sep 1; 28(3):238-41.
15. Engström C, Engström H, Sagne S. Lower third molar development in relation to skeletal maturity and chronological age. *The angle orthodontist.* 1983 Apr; 53(2):97-106.
16. Garn SM, Lewis AB, Bonn e B. Third molar formation and its development course. *The Angle Orthodontist.* 1962 Oct; 32(4):270-9.
17. Kullman L. Accuracy of two dental and one skeletal age estimation method in Swedish adolescents. *Forensic science international.* 1995 Oct 30; 75(2-3):225-36.
18. Bai Y, Mao J, Zhu S, Wei W. Third-molar development in relation to chronologic age in young adults of central China. *Journal of Huazhong University of Science and Technology--Medical Sciences--.* 2008 Aug 1; 28(4):487-90.