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"COMPARISON OF CHRONOLOGICAL AGE WITH RADIOLOGICAL AGE FROM RADIOGRAPHIC EVALUATION OF MANDIBULAR THIRD MOLAR IN INDIAN FEMALES"

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ABSTRACT 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. An attempt to compare chronological age with radiological age from radiographic evaluation of mandibular third in Indian Females has been made in the present study. It was observed that a good correlation exists between the chronological age and assessed age from the developmental status of mandibular third molar.

KEYWORDS : Chronological age, Radiological age, Age determination, Mandibular third molar, Indian females.

Introduction:

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]. Determination of age of an individual is one of the most important aspect in medicolegal work especially in relation to females in the age group of 15 to 18 years owing to various provisions of Indian penal code pertinent to the age of female like kidnapping, rape, abduction, marriage, prostitution etc.

Of the parameters used for determination of age viz. general physical development, secondary sexual characters, ossification of bones and dental status, ossification of bones is considered to be most reliable but what is actually observed are the events of appearance and fusion of particular ossification center only which gives a very wide range. More so it is a guess work without any scientific basis for determining the age of person precisely. However from the various literature available, it has been observed that the human dentition stands out to be unique as probably the most reliable mean in assessment more so at young age. From the developmental status of teeth such as calcification, eruption and closure of its root apex, and size of crown and root, one can definitely pin point the age of the individual concerned.

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[2]. Importantly, it is increasingly being utilized in forensic sciences and in medicolegal implications to determine the age of undocumented youths plus in differentiating the juvenile from the adult status in criminal law cases.[3]

This study aims to evaluate the development of third molar in relation to chronological age in Indian Females.

Materials and Methods:

The present study was conducted at Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur, India. Institutional ethics committee approval was obtained.

a) Study Group:

The study group consisted of 76 young females from age group 15 – 20 years who had third molar developed in the jaw, to arrive at a meaningful conclusion, brought for age determination at Department of Forensic Medicine and Toxicology by the investigating authorities. As the basic aim of the study was to compare actual age with radiological age from radiographic evaluation of mandibular third molar, other parameters of age determination like physical development, secondary sexual characters and ossification of bones were not considered.

Also, it has been seen that the authentic age document was produced by the individuals such as date of birth recorded in municipal birth certificate or school leaving certificate before selecting the individual for the study. Being medicolegal cases, investigation was done by police authority and the age was confirmed by proof of birth date.

b) Technique for the exposure:

The individuals were taken to the department of radiology, Indira Gandhi Medical College, Nagpur, for the radiographic study. The radiograph of mandible of each individual was taken for the study of mandibular third molar. The X-ray machine used for the exposure was 'Seimens Klinoscope 300 with fluoroscope' of department of radiology, Indira Gandhi Medical College, Nagpur. The output of 60 KVP and MAS ranging from 12 to 16 was used for every exposure, with 36" target film distance.

The right lateral oblique exposure of mandible was taken to study the developmental status of mandibular third molar under the Gardener's View. The advantage of Gardener's view was that the overlapping of teeth from other side was totally avoided. For the purpose of identification, the numbering was done on the cassette before the exposure.

To remove bias, interpretation of all cases was undertaken without referring any clinical data. The degree of calcification of crown and root of third molar was minutely studied and staging of the same was done according to the norms laid down in standard text books. The stages were as follows:

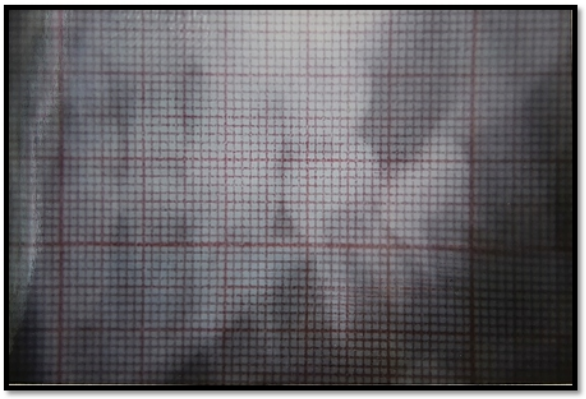
Stage number	Observation
Stage 0	Initial calcification of third molar seen
Stage 1	1/3rd crown formation completed but less than 2/3
Stage 2	2/3rd crown completed
Stage 3	Crown formation completed - Age assessed as 15 years
Stage 4	1/3rd root completed - Age assessed as 16 years
Stage 5	2/3rd root completed - Age assessed as 17 years
Stage 6	Root formation completed but the apical foramen still opened (Age assessed as 18 years)
Stage 7	Root formation completed and apical foramen also closed (Age assessed as 19)

While determining the age from above staging, where the root development was just midway between two stages, the age was recorded as 6 months between the two stages. While 3 months were recorded in the cases where the development has distinctly crossed a certain stage but has not reached midway. Whereas 9 months were recorded where development has crossed midway but had yet to reach the next stage.

The developmental status of third molar was measured by a transparent graph paper which was super-imposed on radiographic picture of second and third molar (Image 1) and the length of root or crown of second and third molar was measured in square millimeters. The measurement of crown was done in only those cases where the

development of root was not observed whereas in cases where the development of root was observed, the measurement of only root was done.

Image 1: Technique of determination of developmental status of mandibular third molar by superimposing graph paper over radiographic picture



While measuring less than half square was not counted and if it was more than half square, it was counted as one square. If there were two half squares in complete measurement, it was counted as one square. The developmental status of mandibular third molar and assessed age from it along with the size of crown and root of third molar was recorded in the proforma taking into consideration that determination of age in females in age group of 15 to 18 years is highly significant due to related provisions in the Indian Penal Code. We have grouped the sample in the present study as under –

Group number	Age
Group I	15 – 16 years
Group II	16 – 17 years
Group II	17 – 18 years
Group IV	18 – 19 years
Group V	19 – 20 years

Observations and results:

Table 1 shows correlation of chronological age with radiological age from developmental status of mandibular third molar in chronological age groups under the study. The table also shows the degree of accuracy in assessing the exact age within the margin of ±6 months (A) and in case this margin has crossed, the assessment within ±1 year margin (B) was also reflected in the table.

Table 1: Correlation of chronological age with assessed age from developmental status of mandibular third molar

Group	Age Group	Total number of cases	Developmental Stage	Number of cases	Correlation of radiological age with chronological age		
					A	B	C
Group I	15 – 16 years	19	Stage 3	10 (52.63%)	10	00	00
			Stage 4	09 (47.37%)	7 (77.77%)	02 (22.22%)	00
			Stage 5	0	--	--	--
			Stage 6	0	--	--	--
			Stage 7	0	--	--	--
Total		19		19	17 (89.47%)	02 (10.53%)	00
Group II	16 – 17 years	09	Stage 3	00	--	--	--
			Stage 4	09	09	00	00
			Stage 5	00	--	--	--
			Stage 6	00	--	--	--
			Stage 7	00	--	--	--
Total		09		09	09	00	00
Group III	17 – 18 years	33	Stage 3	00	--	--	--
			Stage 4	01 (3.03%)	1	00	00
			Stage 5	32 (96.97%)	31 (97.88%)	01 (3.12%)	--
			Stage 6	00	--	--	--
			Stage 7	00	--	--	--
Total		33		33	32 (96.97%)	01 (3.03%)	00
Group IV	18 – 19 years	07	Stage 3	00	--	--	--
			Stage 4	00	--	--	--
			Stage 5	04 (57.14%)	01 (25%)	03 (75%)	00
			Stage 6	03 (42.86%)	03	00	00
			Stage 7	00	--	--	--
Total		07		07	04 (57.14%)	03 (42.86%)	00
Group V	19 – 20	08	Stage 3	00	--	--	
			Stage 4	00	--	--	
			Stage 5	00	--	--	
			Stage 6	01 (12.50%)	00	00	01
			Stage 7	07 (87.50%)	06 (85.71%)	01 (14.29%)	00
Total		08		08	06 (75%)	01 (12.50%)	01 (12.50%)

Table 2 shows the correlation of radiological age from developmental status of mandibular third molar with chronological age in different stages. This table also shows the degree of accuracy in assessing the exact age within the margin of ±6 months (A) and in case this margin has crossed, the assessment within ±1 year margin (B) was also shown in the table.

Out of 76 cases, developmental stage 3 was seen in 10 cases (13.15 %) all of them belonged to group A. The developmental stage 4 was exhibited by 19 cases (25 %), of which 17 cases (89.47 %) were seen in group A, 2 cases (10.53 %) were seen in group B, no case was seen in group C.

Table 2: Correlation of radiological age with chronological age in different developmental stages of mandibular third molar

Developmental Stage	Number of cases of a particular stage	Correlation of radiological with chronological age		
		A	B	C
Stage 3	10 (13.15)	10	0	0
Stage 4	19 (25%)	17 (89.47%)	02 (10.53%)	0
Stage 5	36 (47.37)	32 (88.89%)	04 (11.11%)	0
Stage 6	04 (5.26%)	03 (75%)	0	1 (25%)
Stage 7	07 (9.22%)	06 (85.71%)	01 (14.29%)	0
Total	76	68 (89.47%)	07 (09.21%)	01 (1.32%)

The developmental stage 5 was exhibited by 36 cases of which 32 cases (88.89 %) were seen in group A, 4 cases (11.11 %) were seen in group B and no case was seen in group C.

The developmental Stage 6 was seen in 4 cases (5.26 %), of which 3 cases (75 %) were seen in Group A and one Case (25 %) was seen in group No case was seen in group B. The developmental stage 7 was seen in 7 cases (9.22 %), out of which 6 cases (85.71 %) belong to Group A, one case (14.29 %) belongs to group B and no case was seen in group C.

In all, out of 76 cases, 68 cases (89.47%) were correctly assessed within margin of ±6 months (Group A), 7 (9.21 %) cases were correctly assessed within the margin of ±1year (group B) and only one case was crossing the margin of ±1 year (Group C) between their chronological and radiological age. These findings suggest that a good correlation between chronological and radiological age from developmental status of mandibular third molar.

Discussion:

Radiographic analysis of third molar development expands the years of age estimation to 9-23 years as crown and root development can be studied independent of eruption. After the early teens, most teeth have calcified and erupted except for the third molars. This makes the third molar development the most important choice for age assessment among young children and adolescents with greater accuracy from the late teens to the early twenties.[4,5,6]

Demisch A and Wartmann P[7] (1956) had studied the calcification of third molar in 151 American white Children. He observed that crown was completed by 11.10 to 12.10 years and the root formation began at the age Of 12.4 to 15.4 years. In our study we observed completion of crown at 15 years of age. Garn et al[8] had studied 150 healthy individuals and classified third molar development into 9 stages. The stage of follicle formation appeared at 8 years in his study which we could not come across in our study.

Moorrees, Fanning and Hunt[9] had described 14 stages of third molar development however unlike our study age pertaining to a particular stage was not specified. Similarly, respective age at that particular stage was not narrated by Margaret E Richardson[10]. Tedeschi and Tedeschi[11] described the apical closure of third molar by the age 25 years where as we came across complete root development along with closure of apical foramen by 19 years.

Our finding were in accordance with the preexisting literature. [12,13,14,15]

Conclusion:

Radiographic assessment of mandibular third molar can be effectively used for assessing age of an individual owing to the ease of examination, reliability and minimal radiation exposure to the individual. A good correlation exists between the chronological age and assessed age from the developmental status of mandibular third molar. The present study is representative of local population and can provide more validity to medico-legal opinion by reducing the margin of errors to this region, however it can be used to other region also.

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