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"ASCERTAINING AGE IN INDIAN FEMALES BY RADIOGRAPHIC STUDY OF MANDIBULAR THIRD MOLAR"

Forensic Medicine

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ABSTRACT

Age estimation is one of the consequential factors which improve identification. The assessment of biological age is generally more precise in the early phases of development and extremely based on the state of conservation diagnostic features in the remnants. The present study consisted of 387 health looking females from age group 15 – 20 years. Radiographic evaluation of mandibular third molar was done to analyze the fact that the calcification of root, closure of apex and size of crown and root of third molars are reasonably constant and can be used in ascertaining age of an individual.

KEYWORDS

Age determination, Mandibular third molar, Indian females, radiological examination

Introduction:

Age estimation is one of the consequential factors which improve identification. The assessment of biological age is generally more precise in the early phases of development and extremely based on the state of conservation diagnostic features in the remnants1. Determinati on 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. The Indian penal code states that majority or adulthood is attended at 18 years of age. While this age imposes upon the individual, the responsibility it brings in its wake, it also equally well imposes upon the society the heavy onus when he/ she proclaiming the attainment of majority. Only then law can be implemented and it can stretch out its long arms to do Justice. There are ample of examples set out in Indian penal code, that the determination of age 15 to 18 years is mandatary to implement the law e.g. Marriage contract, sexual offences, abetment of suicide, employment, judicial punishment etc.

The third molar popularly known as wisdom tooth, is superstar of this drama of age detection where the attainment of majority is concerned. Though its eruption covers a variable range, the calcification of its root and closure of its apex and size of crown and root are reasonably constant factor. Hence to evaluate this, the study has been undertaken for ascertaining the age from developmental status and size of crown and root of mandibular third molar.

Materials and Methods:

The present study was conducted at Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur, India from July 1995 to April 1998. Institutional ethics committee approval was obtained. The study group comprised of 387 healthy looking females from age group 15 – 20 years who had third molar developed in the jaw devoid of any any systemic disorder such as developmental defects, nutritional deficiencies, endocrinal diseases present in the selected individuals. 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. Written consent of the parents or guardians also in cases were school records were accessed the consent of the Headmasters and Principals of the schools was obtained.

The oral cavity was examined for number of teeth, condition of teeth, and occlusion. In clinical examination much stress was not given to any irrelevant facts, but the third molar was scrutinized. Also the degree and level of occlusion was not recorded on clinical examination, it was left for radiological examination as the impacted or embedded tooth will not reveal any information about the age in clinical examination.

The radiograph of mandible of each individual was taken for the study of mandibular third molar. 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.

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)

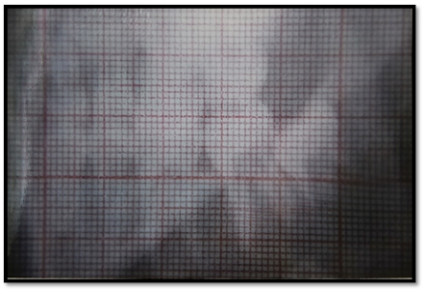
While determining the age from above staging, where the root development was just midway between two stages, the age was recorded as 6 months between the two stages. While 3 months were recorded in the cases where the development has distinctly crossed a certain stage but has not reached midway. Whereas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

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



Statistically in relation to above mentioned groups 'mean', 'standard deviation' and 'P' value have been found out for size of crown and root of third mandibular molar.

Results:

Table No. 1 shows the distribution of cases in five groups along with impacted third molar in each group. Out of total 387 cases, 26 cases (6.74 %) had impacted third molar (Image 2). As the development of third molar was delayed in impacted tooth, these cases were excluded and remaining 361 cases were included in the study group.

Table 1: Age group wise distribution of cases

Group	Age Group (years)	Number of cases	Cases with impacted third molar	Total number of cases studied in each group
Group I	15 – 16	67	Nil	67
Group II	16 – 17	78	04 (5/12%)	74
Group III	17 – 18	114	08 (7.01%)	106
Group IV	18 – 19	100	12 (12%)	88
Group V	19 – 20	28	02 (7.14%)	26
Total		387	26 (6.74%)	361

Image 2: Impacted mandibular third molar



Table 2: Correlation of assessed age from developmental status of mandibular third molar with chronological age for Group I (15 to 16 years)

Developmental stage of third molar	Number of cases	Correlation of age		
		A	B	C
		Within ± 6 months	Within ± 1 year	More than ± 1 year
Stage 3	27	26 (96.30%)	01 (3.7%)	00
Stage 4	31	13 (41.94%)	13 (41.94%)	05 (16.12%)
Stage 5	09	00	00	09 (100%)
Stage 6	00	--	--	--
Stage 7	00	--	--	--
Total	67	39 (58.20%)	14 (20.90%)	14 (20.90%)

Table 2 depicts the detailed break up of 67 cases studied at the chronological age 15 to 16 years, (Group I). Of them 39 cases (58.20 %) were correctly assessed within the margin of ± 6 months, 14 cases (20.90 %) were assessed within the margin of ±1 year and 14 cases (20.90 %) were crossing the margin of ±1 year (Image 3).

Image 3: Developmental stage 3 of mandibular third molar indicating completion of crown formation, age assessed as 15 years



The detailed observation of 74 cases studied at chronological age 16 to 17 years, (group II) of is shown in Table 3. It was seen that 48 cases (64.86 %) were correctly assessed within the margin of ± 6 months, 16 cases (21.62%) were correctly assessed within the margin of ±1 year whereas only 10 cases (13.51 %) were crossing the limit of ±1 year (Image 4).

Image 4: Development stage 4 of mandibular third molar indicating 1/3rd development of root, age assessed as 16 years



Table 3: Correlation of assessed age from developmental status of mandibular third molar with chronological age for Group II (16 to 17 years)

Developmental stage of third molar	Number of cases	Correlation of age		
		A	B	C
		Within ±6 months	Within ± 1 year	More than ±1 year
Stage 3	02	01 (50%)	01 (50%)	00
Stage 4	43	37 (86.05%)	06 (13.95%)	00
Stage 5	23	10 (43.48%)	09 (39.13%)	04 (17.39%)
Stage 6	06	00	00	06 (100%)
Stage 7	00	--	--	--
Total	74	48	16 (21.62%)	10 (13.51%)

Table 4: Correlation of assessed age from developmental status of mandibular third molar with chronological age for Group III (17 to 18 years)

Developmental stage of third molar	Number of cases	Correlation of age		
		A	B	C
		Within ± 6 months	Within ± 1 year	More than ± 1 year
Stage 3	00	--	--	--
Stage 4	15	05 (33.33%)	06 (40%)	04 (26.67%)
Stage 5	76	63 (82.89%)	12 (15.79%)	01 (1.32%)
Stage 6	15	10 (66.67%)	05 (33.33%)	00

Stage 7	00	--	--	--
Total	106	78 (73.58%)	23 (21.70%)	05 (4.72%)

Table 4 shows the calculation of 106 cases studied at chronological age 17 to 18 years (group III). Out of 106 studied cases of this group, 78 cases (73.58 %) were correctly assessed within the ± 6 months margin, 23 cases (21.70 %) were correctly assessed within the margin of ± 1 year and only 5 cases (4.72%) were crossing the margin of ± 1 (Image 5).

Image 5: Developmental stage 5 of mandibular third molar indicating 2/3rd development of root, age assessed as 17 years



Table 5: Correlation of assessed age from developmental status of mandibular third molar with chronological age for Group IV (18 to 19 years)

Developmental stage of third molar	Number of cases	Correlation of age		
		A	B	C
		Within ± 6 months	Within ± 1 year	More than ± 1 year
Stage 3	00	--	--	--
Stage 4	01	00	00	01 (100%)
Stage 5	13	03 (23.08%)	05 (38.46%)	05 (38.46%)
Stage 6	66	50 (75.76%)	15 (22.73%)	01 (1.51%)
Stage 7	08	05 (62.5%)	03 (37.5%)	00
Total	88	58 (65.91%)	23 (26.14%)	07 (7.95%)

Table 5 depicts detailed break up of 88 cases studied at the chronological age 18 to 19 years (group IV). Of them, 58 cases (65.91 %) were correctly assessed within the margin of ± 6 months, 23 cases (26.14 %) were correctly assessed within ± 1 year margin and only 7 cases (7.95%) were crossing ± 1 year (Image 6).

Image 6: Developmental stage 6 of mandibular third molar indicating complete development of root, age assessed as 18 years



Table 6: Correlation of assessed age from developmental status of mandibular third molar with chronological age for Group V (19 to 20 years)

Developmental stage of third molar	Number of cases	Correlation of age		
		A	B	C
		Within ± 6 months	Within ± 1 year	More than ± 1 year
Stage 3	00	--	--	--
Stage 4	00	--	--	--
Stage 5	00	--	--	--
Stage 6	01	00	00	01 (100%)
Stage 7	25	21 (84%)	04 (16%)	00
Total	26	21 (80.77%)	04 (15.38%)	01 (3.85%)

Out of 26 cases studied in Group V (Table 6), 21 cases (80.77 %) were correctly assessed within ± 6 months margin, 4 cases (15.38 %) were correctly assessed within ± 1 year margin and only one case (3.85 %) was crossing the margin of ± 1 (Image 7).

Image 7: Developmental stage 7 of mandibular third molar indicating complete development of root with closed apical foramen, age assessed as 19 years



Table 7: Cumulative correlation of assessed age from developmental status of mandibular third molar with chronologic al age for all five groups (15 – 20 years)

Developmental stage of third molar	Number of cases	Correlation of age		
		A	B	C
		Within ± 6 months	Within ± 1 year	More than ± 1 year
Stage 3	29	27 (93.10%)	02 (6.90%)	00
Stage 4	90	55 (61.11%)	25 (27.77%)	10 (11.12%)
Stage 5	121	76 (62.81%)	26 (21.49%)	19 (15.70%)
Stage 6	88	60 (68.18%)	20 (22.73%)	08 (9.09%)
Stage 7	33	26 (78.79%)	07 (21.21%)	00
Total	361	244 (67.59%)	80 (22.16%)	37 (10.25%)

The detailed observation of 361 cases studied is shown in table 7. In all, out of 361 cases, 244 cases (67.59 %) were correctly assessed within the margin of ± 6 months, 80 cases were correctly assessed within the margin of ± 1 year between their chronological age and assessed age, whereas only 37 cases (10.25 %) were crossing the margin of ± 1 year. These findings suggest that a good correlation exists between the chronological age and assessed age from the developmental status of mandibular third molar.

Table 8: Correlation of chronological age from developmental size of crown and root of mandibular third molar

Group	Age group (years)	Total number of cases	Crown/Root of third molar measured (number of cases)	Size		
				Range (mm)	Mean (mm)	Standard Deviation (mm)
Group I	15 – 16	67	Crown 18	5 – 7	6.22	± 0.8782
			Root 49	3 – 15	6.96	± 2.36
Group II	16 – 17	74	Crown 1	6	6	--
			Root 73	5 – 20	9.06	± 3.96
Group III	17 – 18	106	Root 106	6 – 19	11.77	± 2.83
Group IV	18 – 19	88	Root 88	8 – 21	15.84	± 3.77
Group V	19 – 20	26	Root 26	15 – 22	17.03	± 1.65

Table 8 shows the correlation of chronological age with the developmental size of crown and root of mandibular third molar. The developmental size of crown and root of mandibular third molar was calculated as per the chronological age groups under the study.

Table 9: Statistical significance of size of root of mandibular third molar in chronological age group

Age group with their mean and standard deviation	P – value	Opinion about statistical significance	
15 – 16 years 6.96±2.36	16 – 17 years 9.06±3.69	P < 0.001	Highly Significant
16 – 17 years 9.06±3.69	17 – 18 years 11.77±2.83	P < 0.001	Highly Significant

17 – 18 years 11.77±2.83	18 – 19 years 15.84±3.77	P < 0.001	Highly Significant
18 – 19 years 15.84±3.77	19 – 20 years 17.03±1.65	p>0.05	Not significant

Table 9 shows the statistical significance of size of root of third molar in chronological age groups. As the crown size was not measured in Groups III, IV and V hence its statistical significance could not be studied. Groups I, II, III and IV were compared with their mean root size and standard deviation and were found to be statistically significant. However when mean root size and standard deviation of groups IV and V were compared (p>0.05) the results were statistically insignificant as development of mandibular third molar is completed by 18 years.

Discussion:

Where most of the times in various medicolegal conditions, the request from the investigating agency is submitted, it must be emphasized that the age determination in forensic context is not the same as that required in clinical situation.

Banks HV2 had studied third molar based on a sample of 1000 American children of both sexes. However in present study we could not come across the formation of crypt and we found that completion of crown calcification at the age 15 years, completion of root formation at the age 18 years and closure of apical foramen at the age 19 years. Schour and Massler3 observed that crown was completed by 12 to 16 years and root was completed by 18 to 25 years, findings being consistent with our study. Nolla CM4 had studied the permanent teeth where in observations from stage 2 to stage 10 given by Nolla and our staging of third molar i.e. from stage 0 to stage 7 were similar.

Demisch A and Wartmann P5 (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 al6 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.

Dalitz GD7 had studied the crown formation and root development of third molar. His observations were in accordance with our study.

Moorrees, Fanning and Hunt8 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[9].. Tedeschi and Tedeschi10 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.

Venta I11 studied the impaction of third molar on the basis of radiographic findings at the age of 20 years. The most important finding being impaction which he came across in 94% of the cases at the age 20 whereas in our study third molar was tilted to second molar in 26 cases means in 6.74% of the cases.

The findings in our study were in accordance with the findings of Arey LB12, J H Scott JH and Symons NBB13, Levescue et al14, Wheeler15, Johnson et al (1985).

Conclusion:

The study of third molar as a criteria for age assessment can avoid the variables in development of the individual in relation to race, diet, hereditary and biological variation as known ages are compared with unknown ages. As the size of root in group I and group II, group II and group III, group III and group IV were observed statistically highly significant, these values can be taken into consideration for giving more definite opinion about the age.

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