THE VARIABILITY OF MANDIBULAR THIRD MOLAR TEETH DEVELOPMENT AND ITS APPLICATION FOR AGE ESTIMATION IN PESHAWAR POPULATION

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ABSTRACT

Objective: *To determine the frequency distribution the of mandibular third molar teeth development with age and gender based on Demirjian method for forensic application*

Material and Methods: *A crossectional study was conducted from July 2015 to December 2015. Using convenient sampling technique by taking 741 subjects of Peshawar population who fulfil the inclusion criteria were selected. Out of which 356 were females, and 385 were males and their age ranged from 13 years to 25 years. The development of both left and right mandibular third molar teeth were scored using Demirjian tooth developmental stages from D to H.*

Results: *The teeth developed approximately similar in both males and females. Very less difference was found in left and right mandibular third molar teeth.*

Conclusion: *The obtained data of the current study is useful for references and determining the age of unidentified humans. However, further study is required because there is no single parameter available for age estimation.*

Keywords: *Third molar teeth development, age estimation, Demirjian tooth developmental stages*

INTRODUCTION

The identity of a person can be established by assessing one's age, gender and stature, which is a procedure adopted by anthropologists, archaeologists, and forensic experts[1]. To determine the legal age in criminal cases and human identification, the estimation of age is an essential and useful factor[2.] For legal requirements, both of these factors are associated and could be utilised to assess the age of the living as well as the dead. There are various methods for determining the age of a person from intrauterine life up to old age[3]. So age calculation is utilised in distinguishing an immature person in unlawful acts from adult class, but also for chronological age estimation about school attendance, social benefits, employment and marriage[4,5].

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Age can be assessed more precisely in children than in adults and adolescents because there are several teeth which are in their different developmental stages[6]. In 1973, Demirjian et al. developed a system that estimates the chronological age of a child from the development of multiple teeth. This method gives a valid estimate only when applied to French-Canadian children, being the population on which the system is based[7]. There are some other features of skeletal maturity that can also be useful for age estimation. While in young adults and adolescent the only teeth developing are the third molars while other factors include the union of sutures, bone epiphysis and secondary sexual characteristics achievements have already been taken place by mid-teens and early twenties; so the rest of the methods of age assessment are questionable. As a whole, for chronological age estimation, there is no satisfactory criterion available for adult and adolescent[6, 8].

According to I. Robettiet al, completion of root structure and closure of their root apices occur in all

permanent teeth at the age of 18 years except third molar teeth. If these third molar teeth are present, it provides the only opportunity to estimate the dental age from 15 years to 24 years. Dentists play an important role in age estimation from the teeth in children and young adults and adolescents[9]. Forensic literature also emphasises the usefulness of third molars for dental age estimation. All methods to estimate the chronological age of individual using the development of the teeth, it relays on the radiograph, because a single radiograph shows the degree of calcification or development of the multiple teeth[10].

No study has been conducted to determine the age of a person by observing the teeth in our population. The present study aims to assess the variability of mandibular 3rd molar teeth development (right and left) in both genders based on Demirjian method of tooth development and its applicability to age assessment for forensic application in population belonging to Peshawar KP, Pakistan.

OBJECTIVE

To determine the frequency distribution the of mandibular third molar teeth development with age and gender based on Demirjian method for forensic application

MATERIAL AND METHODS

This was a descriptive cross-sectional study in which convenient sampling technique was used.Duration of the study was from July 2015 to December 2015. A total of 741 Orthopantograms (356 females and 385 males) of the population from Peshawar Dental College were screened and their aged range between 13 to 25 years was included in the study. Radiographic artefact (Orthopantogram and Periapical X-ray), congenital disorders and abnormal form of dentition or any pathology observed on radiograph in the mandibular segment were excluded.

Informed consent was taken from the patient or the patient guardian for the study. Patient date of birth, gender, residential address and date of Orthopantogram were recorded on specially designed proforma. The date of birth was subtracted from date of Orthopantomogram to get exact age of the patient and recorded in the proforma.The developmental stage of both left and right third molar teeth were properly analysed from radiograph according to the method described Demirjian et al. using eight grade schemes where stage A to D describe the crown formation, while stage E to H describe root development. Intra and inter-observer reliability were tested by re-examining 20 OPGs after a week interval.

Kappa Agreement was used to analyse the intra-observer and inter-observer reliability. Mean ages with standard deviation at each developmental stage of third molar teeth were calculated and analysed. The data so collected were analysed by using SPSS 21version.

RESULTS

Out of total 741 patients, 356 (48%) were females, and 385 (52%) were males. Minimum age recorded in this study was 13 years, and maximum age was 22 years. Intra-observer reliability was excellent with a high value of agreement of Cohen Kappa of 0.97 for both sides. Inter-examiners reliability was also high (K= 0.91). Both were statistically significant

Demirjian's tooth developmental stage D was observed in all patients of 13 year age in both genders for a mandibular right third molar. Age 14-year patients, were also in Demirjian's tooth developmental stage D except for one female patient which was in stage E for a right third molar. Age 15 year, patients showed much larger range as they were extended from stage D to F for a mandibular right third molar. One male from age 15-year group was also in stage G. Demirjian's tooth developmental stage H was found at age 18 and above in both genders. Much variability and overlapping were noted as Demirjian's stage D extended from age 13 to 16 years. The individual frequencies and details are given in table 1.

Table 2 shows similar results like table 1(right third molar) for the frequency of Demirjian's tooth developmental stage in a left mandibular third molar. Statistically, very fewer differences (0.992 for males and 0.996 for females) were found in results for right and left mandibular third molar($p<0.001$).

The descriptive statistics (frequency, mean and SD) for sexual dimorphism for mandibular right third molar are given in table 3. The mean age in Demirjian's tooth developmental stage for males was 14.97 (D), 15.97 (E), 17.06 (F), 18 (G) and 19.12 (H) and for females 14.52 (D), 15.68 (E), 16.93 (F), 17.84 (G) and 19.34 (H). The mean age was approx-

imately similar; the mean difference in age between males and females were smaller from 0.132 to 0.45. The 95% confident interval and p-value showed a non-significant difference of ages between genders for Demirjian's tooth developmental stage from stage D to H.

Table-1: The frequency of Demirjian's stages of right mandibular third molar

Gender of the patient	Age	Demirjian's stages					(N) Total
Female	13	5	0	0	0	0	5(1.4%)
	14	4	1	0	0	0	5(1.4%)
	15	21	36	3	0	0	60(17%)
	16	0	10	4	0	0	14(3.9%)
	17	2	20	69	13	0	104(29.2%)
	18	0	0	11	48	10	69(19.3%)
	19	0	0	0	22	49	71(19.3%)
	20	0	0	0	7	10	17(4.8%)
	21	0	0	0	0	9	9(2.5%)
	22	0	0	0	0	2	2(0.6%)
	Total	32	67	87	90	80	356(100%)
Male	14	3	0	0	0	0	3(0.78%)
	15	39	53	3	1	0	96(25%)
	16	3	42	6	0	0	51(13.2%)
	17	0	8	84	6	0	98(25.4%)
	18	0	0	24	45	2	71(18.4%)
	19	0	0	0	13	37	50(13%)
	20	0	0	0	2	12	14(3.6%)
	21	0	0	0	0	2	2(0.5%)
	Total	45	103	117	67	53	385(100%)

DISCUSSION

The intra-observers and inter-observer reliability were high in the present study, which shows the perfection of the researchers and quality of the study, so it is unlikely that they biased the results and interpretation of our study. In this study, we have a Kappa test for inter and intra-observers reliability[11, 12]. The present study based only on mandibular third molar teeth. Maxillary third molar teeth were not included in this study because floor or posterior wall of maxillary sinus, zygomatic arch superimpose the maxillary teeth.

In the current study, stage D ranges from 13 to 17 years, stage E from 14 to 17 years, stage F from 15 to 18 years, stage G 15 to 19 years and stage H from 18 to 22 years with few exceptions. Ajmal M et al[13] reported similar results and stated that " We could conclude that tooth development stage at "H" will say that the individual is a major having completed 18 years of age. We could predict the age with the average standard deviation of 1.47 years. The descriptive statistical analysis revealed a minimum standard deviation of 0.76 years and a maximum of 2 years for the third molar development stages."

In a study by Priyadharshini KI et al[14], the third molar development between male and female subjects revealed statistically significant differences in calcification stage F and stage G in maxillary third molars and stage F in mandibular third molars ($P < 0.05$). These differences indicate that maxillary and mandibular third molar eruption reached these Demirjian's formation stages earlier in males than in females. This observation was not consistent with previous studies, which reported that the mean age at some of the developmental stages was lower for males than for females[15, 16]. In this study difference between gender were found insignificant.

Table-2: The frequency of Demirjian'stages of left mandibular third molar

Gender of the patient	Age	Demirjian's stages					(N) Total
Female	13	4	1	0	0	0	5(1.4%)
	14	3	2	0	0	0	5(1.4%)
	15	20	42	3	0	0	65(18.2%)
	16	0	20	4	0	0	24(6.7%)
	17	3	7	71	14	0	95(26.7%)
	18	0	0	4	53	13	70(19.7%)
	19	0	0	0	7	52	59(16.6%)
	20	0	0	0	0	22	22(6.2%)
	21	0	0	0	0	9	9(2.5%)
	22	0	0	0	0	2	2(0.6%)
	Total	30	72	82	74	98	356(100%)
Male	14	3	0	0	0	0	4(1%)
	15	38	50	7	1	0	35(9.1%)
	16	1	53	7	0	0	73(19%)
	17	0	2	92	4	0	73(19%)
	18	0	0	15	54	2	49(12.7%)
	19	0	0	0	13	37	36(9.4%)
	20	0	0	0	0	5	3(0.8%)
	22	0	0	0	0	1	1(0.3%)
	Total	42	105	121	72	45	385(100%)

In the present study mean age in each Demirjian's stage show very less variation as having smaller standard deviation. It denotes that age can be accurately estimated from third molar Demirjian's stages to a large extent. Similar results were reported by Johan NA et al[17]for Malaysian population.

CONCLUSION

Variation is present in the development of the third molar in the mandible. Correlation between right and left mandibular third molar teeth development is strong. Third molar root develops almost at the same times in both genders.

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