

Mean Eruption Ages and Emergence Sequences of Permanent Mandibular first Molar and Central Incisor in local population of Lahore, Pakistan

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ABSTRACT

Objective: To find out the mean eruption age and emergence sequence of permanent Mandibular first molar and central incisor in local population of Lahore, Pakistan.

Background: Mandibular first molar and central incisors are the first permanent teeth that erupt in mouth. The timing of these teeth is useful to determine early or delayed eruption. It also helps in prophylactic measures, as water fluoridation. Useful in pediatric dentistry e.g. as one of the milestone, orthodontic dentistry, for diagnosis of certain growth disturbances. Useful in forensic dentistry for estimation of age, developmental differences and similarities among populations. This study standard may ensure international comparability to assist clinicians.

Study Design: Cross-sectional

Place and Duration of Study: This study was conducted at the Department of Oral Biology, KEMU, Lahore from 1st March 2010 to 15 January 2011

Materials and methods: Four thousand primary school children of both genders aging between 5-9 years were examined. Ethical permission was obtained. Consent was obtained. Emergence of teeth was noted in three anatomical stages. Teeth were noted by two-digit system of FDI (Federation Dentaire Internationale), on Performa. Statistical analysis was done by SPSS version 13.

Results: In male mean eruption age of Lower Central Incisor was 7.29 years with emergence range of 6.75- 8.14 years. Whereas Lower First Molar was 6.93 years, with range of 6.46–7.93 years. In female mean eruption age of Lower Central Incisor was 6.84 years, with emergence range of 6.08- 7.48 years. And of Lower First Molar was 6.87 years, with range of 6.75 – 7.32 years. P-value less than 0.05 was assumed significant.

Conclusion: Mandibular central incisor & first molar eruption ages are later in both genders compared to Western standards used in our clinical and basic sciences.

Key words: eruption age, permanent central incisor, first molar.

INTRODUCTION

Eruption is derived from Latin word ‘erumpere’ means to break out. Dentition begins to form at approximately 13-16 weeks in utero and continues up to late adolescence, when the development of permanent third molar gets completed¹⁻² It is genetically regulated process involving the cells of tooth organ and surrounding alveolus²⁻⁴ This physiological phenomenon starts with eruption of primary teeth followed by permanent dentition. Eruption of deciduous teeth, their shedding and subsequent eruption of the permanent dentition are orderly, sequential and age specific events.²⁻⁵

In literature emergence or eruption of tooth is in fact described as the moment tooth pierces the gingiva or keratinized mucosa and becomes clinically visible.³⁻⁶ There was no information available for the deciduous or permanent dentition eruption ages of local population. This cross-sectional multistage random sampling study in Lahore (Punjab) was the first investigation carried out in Pakistan for the mean eruption ages, range and sequence of mandibular permanent first molar and

central incisor in both genders. This study provided the standards of eruption norms for comparison and use in basic and clinical sciences as reference data in addition to Western standards.

MATERIALS AND METHODS

Cross sectional multistage random sampling technique was used. A total number of 4000 primary school children of both genders were examined, during study period from 1st March 2010 to 15 January 2011. All clinically healthy participants were included. Children under weight or with any congenital disease were excluded. Their ages were between 5-9 years. King Edward Medical University Ethical Review Committee permitted for research, and higher study board approved the study. Consent was obtained from heads of schools. Visual examination with manual palpation was performed in good light using disposable gloves and mouth mirror. Findings were recorded on Performa, by two-digit system of FDI (Federation Dentaire Internationale), adopted by World Health Organization (WHO). Emergence of teeth was noted in three stages depending clinical emergence of crown in oral cavity,

distributed as; eruptive stage 1; occlusal/upper one third of tooth crown pierced gingiva, eruptive stage 2; occlusal and middle (upper two thirds) of crown visible in oral cavity, eruptive stage 3: entire crown visible/tooth in occlusion. Data was entered in SPSS version 13, and quantitative statistics was applied to all three eruptive stages. Mean eruption age, standard deviation, emergence range and sequence were determined at each stage in both genders. Normality of data was checked by One Sample Kolmogorov-Smirnov test. P value less than 0.05 was assumed as significant. Independent sample t-test was applied for comparison between two genders.

RESULTS

In this study total participants were 4000, their ages were between 5-9 years. The mean age of children was 7.14 years, with SD $\pm$ 1.29. (Table 1) Among them male were 1616 (40.40%) and females were 2384 (59.60%). The male to female ratio was 0.68:1.

Eruption age of mandibular left & right central incisor and 1st molar is given respectively, at each emergence stage. Mean of left and right side of jaw at each stage is shown. Mean of all stages is determined as mean eruption age. Emergence range is time period from first emergence stage to third stage.

In male mean eruption age of central incisor is 7.29 years, SD $\pm$ 0.83 and SE 0.13. While emergence range is 6.75-8.14 years. The lower first molar mean age is 6.93 years, SD $\pm$ 0.76, and SE 0.12, with range of 6.46-7.93

years. P value = 0.000, showing highly significant results. (Table 2)

In female it was observed that left and right side central incisor erupted with statistically insignificant differences at eruptive stages. In contrast molar showed slight earlier eruption at all stages on right side. The mean eruption age of central incisor is 6.84 years, SD $\pm$ 1.06 and SE 0.18. And the lower first molar mean eruption age is 6.87 years, SD $\pm$ 0.84, and SE 0.17. The p value is 0.000, showing highly significant results. (Table 3)

In male lower first molar shows earlier emergence sequence than incisor. Whereas emergence range of both the teeth shows no statistically significant difference.

In female lower central incisor emergence sequence is earlier than molar, but the difference is statistically insignificant. Central incisor showed increased emergence range compared to molar. Both genders showed the t-test value -4.722 with p value 0.000, highly significant results. (Table 4)

Table No.1: Mean age of the school children n = 4000

Age of participants is between 5-9 years

Mean Age of Participants in years	7.14
Standard Error (SE)	0.02
Standard Deviation (SD)	$\pm$ 1.29

n = Total number of participants

Table No.2: Mandibular central incisor and first molar eruption age on left & right side of jaw at each emergence stage with mean of all eruptive stages in male

Lower Central Incisor Eruptive Stage 1					Lower First Molar Eruptive Stage 1			
Side of jaw	n	Eruption age in years	SD	SE	n	Eruption age in years	SD	SE
Left	28	6.79	$\pm$ 0.74	0.14	13	6.08	$\pm$ 0.34	0.09
Right	31	6.72	$\pm$ 0.62	0.11	20	6.85	$\pm$ 0.91	0.20
Mean of sides	29.5	6.75	$\pm$ 0.68	0.12	16.5	6.46	$\pm$ 0.62	0.14
Eruptive Stage 2					Eruptive Stage 2			
Left	14	7.05	$\pm$ 0.90	0.24	6	6.26	$\pm$ 0.48	0.19
Right	8	6.92	$\pm$ 0.85	0.30	10	6.58	$\pm$ 0.69	0.22
Mean of sides	11	6.98	$\pm$ 0.87	0.27	8	6.42	$\pm$ 0.58	0.20
Eruptive Stage 3					Eruptive Stage 3			
Left	1155	8.14	$\pm$ 0.95	0.02	1324	7.94	$\pm$ 1.08	0.02
Right	1152	8.14	$\pm$ 0.96	0.02	1326	7.93	$\pm$ 1.09	0.02
Mean of sides	1153.5	8.14	$\pm$ 0.95	0.02	1325	7.93	$\pm$ 1.08	0.02
Mean of all stages	1194	7.29	$\pm$ 0.83	0.13	1349.5	6.93	$\pm$ 0.76	0.12

p value = 0.000

Key words: n = Number of participants, SE = Standard error, SD = Standard deviation

DISCUSSION

In this study four thousand primary school children between ages of 5-9 years were examined. The mean age of sample was 7.14 years, SD $\pm$ 1.29 and SE 0.02. (Table1) Among them male participants were 1616

(40.40%) and female were 2384 (59.60%) respectively. The male female ratio was 0.68:1. (Graph1) Coincides with data by Gupta and others.³⁻⁷ It has been recommended that standards of teeth eruption norms should be established of the population in which applied. Mean eruption age standards of Saudi Arabia,

Iran, Turkey, Malaysia, India and other populations of world showed some deviation of eruption age and sequences from European standards used in our

practice.⁸⁻¹¹ Mandibular first molar and central incisors are the first permanent teeth erupting in oral cavity.

Table No.3: Mandibular central incisor and first molar eruption age on left & right side of jaw at each emergence stage and mean of all eruptive stages in female

Lower Central Incisor Eruptive Stage 1					Lower First Molar Eruption Stage 1			
Side of jaw	n	Mean eruption age in years	SD	SE	n	Mean eruption age in	SD	SE
Left	12	6.06	± 1.16	0.33	11	6.84	± 0.64	0.19
Right	10	6.10	± 0.94	0.29	16	6.66	± 0.59	0.14
Mean of sides	11	6.08	± 1.05	0.31	13.5	6.75	± 0.61	0.16
Eruptive Stage 2					Eruption Stage 2			
Left (31)	17	6.99	± 0.96	0.23	5	6.58	± 0.62	0.27
Right (41)	18	6.96	± 0.94	0.22	4	6.54	± 0.81	0.40
Mean of sides (31+41)	17.5	6.97	± 0.95	0.22	4.5	6.56	± 0.71	0.33
Eruptive Stage 3					Eruption Stage 3			
Left (31)	1704	7.54	± 1.21	0.02	2062	7.34	± 1.22	0.02
Right (41)	1913	7.42	± 1.20	0.02	2092	7.31	± 1.23	0.02
Mean of sides (31+41)	1808.5	7.48	± 1.20	0.02	2077	7.32	± 1.22	0.02
Mean of all stages (1 – 3)	1837	6.84	± 1.06	0.18	2095	6.87	± 0.84	0.17

p value = 0.000 Key words: n=Number of participants

SE=Standard error

SD=Standard deviation

Table No. 4: Comparison of mandibular central incisor and first molar mean eruption age, sequence and emergence range in both genders

	Central incisor		First molar	
	Mean eruption age in years	Eruption range in years	Mean eruption age in years	Eruption range in years
Male	7.29 years	6.75-8.14 years	6.93 years	6.46-7.93 years
Female	6.84 years	6.08-7.48 years	6.87 years	6.75-7.32 years

Independent t-test showed p value = 0.000 significant result

In male mean eruption age of Lower Central Incisor = 7.29 years

Emergence range of Lower Central Incisor = 6.75- 8.14 years

Mean eruption age of Lower First Molar = 6.93 years

Emergence range of Lower First Molar = 6.46 – 7.93 years

In female mean eruption age of Lower Central Incisor = 6.84 years

Emergence range of Lower Central Incisor = 6.08- 7.48 years

Mean eruption age of Lower First Molar = 6.87 years

Emergence range of Lower First Molar = 6.75 – 7.32 years

In females mean eruption age is earlier than males

Therefore Uysal and colleagues correlated first molar eruption with skeletal maturity.¹² Likewise sequence differences of central incisor and first molar are also investigated at large in literature.^{3-8, 13,14} Eruption age differences of teeth on left and right side of jaw were not observed in literature. A few studies showed the eruption differences on sides of jaw, the difference is statistically insignificant.¹¹ The same has been observed in my study. Therefore age on both sides calculated as mean age for the respective emergence stage.

Mean eruption age of lower central incisor in both genders:

Mean eruption age of lower central incisor in female at stage 1; was 6.08 years, SD±1.05 years. In male age was 6.75 years, with SD±0.68 years, shown in (Table 2&3). This result showed earlier eruption in female as compared to male. Increase in mean age observed in our study is consistent with Indian population results, as sharing same demographic characteristics. However the eruption ages of Westerns, as taught in our medical

practices are not in lieu with the results shown in my study and in Indian literature.^{3,7-8}

The age of lower central incisor eruption at stage 2, in female was 6.97 years with $SD \pm 0.95$, while in male was 6.98 years with $SD \pm 0.87$ (Table 2&3). Age is directly proportional to eruption of teeth. In literature increase in age has been seen to increase eruption frequency.^{3, 15-17} The eruption age of incisor at stage 3, in female was 7.48 years with $SD \pm 1.20$. Whereas in male was 8.14 years with $SD \pm 0.95$ (Table 2&3). Earlier eruption of permanent teeth among females is in accordance with literature.^{3, 7-8}

The mean of all three eruption stages determined as mean eruption age of central incisor in female was 6.84 years with emergence range 6.08-7.48 years and $SD \pm 1.06$. Whereas in male mean age was 7.29 years, and range was 6.75-8.14 years, $SD \pm 0.83$, (table 2-4). World wide studies presented their eruption norms in months. Therefore for the easiness of comparison, our study mean ages are also shown in months. In females 82 months (6.84 years) and in male 87 months (7.29 years). Our study results and data of Saudi Arabia both showed later eruption age compared to European standards.^{2,18} Our study eruption standards for permanent lower central incisor mean eruption age can be compared with standards of various countries established in months. These countries include South Africa 65 months, Ghana 63 months, Nigeria 75 months, USA 77 months, Australia 78 months, Iran 82 months.^{17,18} Their standards were calculated only with single stage in all age groups, whereas in this study age has been calculated at three emergence stages. Nizam showed the youngest eruption age 5 years for any permanent tooth, lower 1st molar or central incisor in girls and 4.94 years in boys. His results are different than the universal standard, which is earlier eruption of permanent teeth in girls, an established fact because of earlier development of secondary sex characters.^{2-4,7,9,19} Blankenstein showed 1 to 6 months earlier permanent teeth eruption in female compared to male as in our study.²⁰ Whereas Turk female lower central incisor eruption age 6.71 years, is in accordance to our results 6.84 years for incisor. (see table 3&4)¹⁹ Whereas in Turk male mean age was 6.56 years, compared to this study 7.29 years. These differences could be result of factors mentioned as socio-economics and height & weight.²¹ My results are in accordance to results by Gupta, stating that differences in populations are common.^{3,21}

Mean eruption age of lower first molar in both genders

Eruption age of lower 1st molar at stage 1, in female was 6.75 years, with $SD \pm 0.61$, whereas in male was 6.46 years, with $SD \pm 0.62$, (table 2&3). Earlier eruption of molar in male seen at this stage needs further research.²¹ Results of this eruptive stage are in agreement with results of Nizam, who stated earlier eruption in boys.²¹

Eruption age of lower first molar at stage 2, in female was 6.56 years, with $SD \pm 0.71$, whereas in male was 6.42 years, with $SD \pm 0.58$, (table 2&3).

Molar erupted earlier at stage 1 & 2 on right side in females. In contrast to left side in male. These results revealed affect of functional lateralities as right or left sidedness in sample seen by Heikkinen on tooth eruption.⁽²⁶⁾ Whereas stage 3, showed emergence age differences on sides of jaw, statistically insignificant.¹⁷⁻²¹

Eruption age of lower first molar at stage 3 in female was 7.32 years, with $SD \pm 1.22$, whereas in male was 7.93 years, with $SD \pm 1.08$. (Table 2&3) These results are in accordance to results by Gupta. Who showed one year later eruption of mandibular incisor and 1st molar in Indian population compared to Western standards that we use.^{3,7}

Mean of all eruptive stages determined as eruption age standard for lower first molar in female was 6.87 years, with emergence range 6.75-7.32 years, $SD \pm 0.84$, whereas in male was 6.93 years with range of 6.46-7.93 years and $SD \pm 0.76$, (table 2-4). Whereas in this study lower first molar mean eruption age in months for comparison with other international studies are: in female 82 months, while in male 83 months. Saudi population mean age of lower 1st molar was 71.7 months,¹⁸ earlier than the results of our study. This could be due to socioeconomic, genetic and increased height and weight standards. As children with standard height and weight showed earlier eruption.^{17,18-21}

Mean eruption age of lower 1st molar in male can be compared with South Africa = 62 months, Ghana = 57 months, Nigeria = 72 months, USA = 74 months, Australia = 78 months, Iran = 82, Lahore (Pakistan) 83 months.^{10,18-19} Results of our study are in accordance with results of India, Iran, Australia and Saudi Arabia as compared to data in text books of dental anatomy.^{2-4,7,21} Mean eruption ages of lower incisor and 1st molar in this study are in accordance with literature, showing insignificant differences when compared with other eruption studies.^{3,8,17,21} Chohan and colleagues showed the mean eruption age of lower first molar 6.0 years,²¹ whereas of females in Turkey age was 6.23 years with $SD \pm 1.03$. Their results showed lesser differences when compared with Westerns due to economic and racial similarities. Whereas mean age of male in Izmir was 6.03 years with $SD \pm 0.85$, while compared to our study is in partial agreement.¹⁹⁻²¹ Mean eruption age of lower central incisor and 1st molar are earlier in female compared to male^{13,11,18-21}

CONCLUSION

According to our study the mean eruption age of permanent mandibular first molar and central incisor in both genders is about one year later than the Western Standards. Therefore, the range of eruption age is also higher for both teeth in both genders. Females showed earlier eruption of both teeth than males.

Recommendations: The eruption standard of this study conducted in local population of Lahore showed increase in mean eruption age and also range i.e. about one year later in both genders as compared to Western standards. Therefore it is recommended that these standards should be applied in local population of our country for best interests of local public and specialists. This research should also be conducted in other urban and rural populations of Pakistan, not only for mandibular central incisor and first molar but also on deciduous and other Permanent teeth by public as well as private sector.

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