

Evaluation of the age and pattern of the eruption of permanent teeth in school-age children in Peshawar, aged 5 to 15 years

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Abstract

Introduction: Dental crowns and roots can be examined using radiographic techniques for calcification, growth, and development. However, a clinical examination of the oral cavity is preferred for determining dental age due to its low cost, lack of requirement for specific tools or knowledge, and is less time consuming. The objective of this research was to relationship of age ranges with dental eruption sequence and impact of gender on the timing of eruption in school children of Peshawar.

Material and Methods: A cross-sectional descriptive study was conducted in ten public schools for boys and girls that were randomly chosen from Peshawar. Using a multi-stage sample technique, 935 students between the ages of 5 and 15 who appeared to be in good physical and mental health were screened. The dental examinations were performed in both daylight and using a torch, by a trained dental professional, with the emergence of teeth through the gingiva considered as the criterion for eruption.

Results: Mandibular teeth emerged earlier than their counterpart in maxillary dentition besides premolars in both genders. Dental eruption in girls was comparatively earlier than in boys. The mandibular permanent 1st molar was the first tooth that erupts in boys, while the mandibular central incisor was the first one in girls. Maxillary Permanent Second Molar erupts last in both genders.

Conclusions: The research manifest that the dental eruption timings of school children resident of Peshawar were un-matched in a few aspects and accord in others when compared with the statistics detailed in the published literature.

Keywords: Dental age; eruption pattern; eruption sequence

Introduction

Teeth are biological maturity indicators and their eruption tags a significant landmark in somebody's life.¹ Eruption of the tooth may be defined as its movement from the loci of budding within the jaws to the functional position in the oral cavity.² It is

a complex process consisting of intra-osseous and supra-osseous events. The understanding of the age related dental eruption in ethnical groups is important from preventive and management aspects especially in the disciplines of pedodontics and orthodontics.³ The knowledge of the order of eruption is of equal importance.⁴ Dental age estimation is one of the trusted methods of age assessment as the timings of eruption of deciduous and permanent teeth are fairly persistent and this fact can be used in determining the mean dental age.⁵

Dental age assessment methods include radiographic and clinical inspection of tooth

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eruption. It is practicable to observe calcification and dental crown and root shaping radiographically. However, clinical examination of the oral cavity for dental age assessment is more appropriate since it does not require any specific equipment or dexterity and is more economizing.

Many people in Pakistan exhibit basic literacy skills and are unaware of their date of birth, which is a mandatory legal requirement in situations involving legal obligations, identification, employment, admittance to schools, etc. Every country has its own standards and norms for dental emergence and eruption sequence, thus it has been advocated that norms for dental emergence should be ascertained from the community in which they are to be practiced.⁶

Since the author was unable to locate any studies that had been conducted in the province on this subject, this study aimed to establish norms regarding mean eruption timings, gender influences, and the order in which permanent teeth erupted for Peshawar children. The study's main objectives were to evaluate any predominance in maxillary and mandibular dental eruption timings, as well as to assess the mean eruption age of permanent teeth in school children of Peshawar in relation to their chronological ages, as well as to identify the range of variation in each tooth's eruption time with respect to gender and residential area.

Materials and Methods

This cross-sectional descriptive study was carried out at ten schools, five for boys and five for girls between October 2021 and January 2022, which were randomly selected from Peshawar's urban areas (Hayatabad, University Town, and Warsak Road). The names of the schools have been omitted to maintain confidentiality and as requested during consent; they are now referred to as schools. A multi-stage sampling technique was employed in the study. A total of 1000 children were screened; 55 of them were not included in the analysis because of missing

data or their foreign nationality. Thus, the study comprised 935 school children from Peshawar's urban and rural areas, 461 males and 474 females between the specified ages, who appeared to be in good physical and mental condition. The study excluded children who had a history of a chronic localized oral infection, nutritional or endocrinal imbalance, syndromes, and developmental disorders such as cleft lip and palate. With one-year intervals, the respondents were divided into 10 age groups ranging from 5 to 15 years old. A minimum of 50 boys and 50 girls from each age group were examined. Students were selected at random from classes 1 through 9 using an application that generates random numbers.

The implementation of the research received consent from Gandhara University's Ethical Review Board. Additionally, the relevant educational authorities' explicit verbal consent was sought before the study could be conducted in those schools. Each child who met the inclusion criteria was given a questionnaire following a pilot trial. Before completing the questionnaire and having their teeth examined, children were briefed about the process. Following confirmation of each child's birth certificate's availability in school records, the precise date of each child's birth was documented. Using MS Excel, the chronological age was computed in years, months, and days, and then converted to decimal numbers. The children were checked by a dental surgeon using a mouth mirror and disposable spatula under appropriate natural light or, as necessary, with the aid of a well-focused torch. By soaking the mouth mirrors in Cidex solution for 30 minutes before use, they were chemically disinfected. With the aid of a spatula and a separate set of mirrors, every student was examined. Emerged permanent teeth were documented in one's Performa. Any tooth component that

was visible through the gingiva was considered to have erupted. Radiographic assessment was not possible to manage in the school campuses due to non-availability of radiographic armamentarium. Congenitally missing teeth were documented as unerupted teeth, whereas teeth that were reported by parents / guardians as extracted were judged to have been erupted. The teeth were noted on a chart known as Palmer's Notation Chart, which employs the ratio of "8

to 1" for permanent teeth for each jaw's halves, as shown below. Third molar tooth No. 8 was not considered.

Mean dental emergence age for each individual tooth for each child was calculated. Data was processed using SPSS 19.0 software. Student t-tests and one-way ANOVA were employed to compare different variables and a p-value <0.05 was taken as significant.

Table I: Palmer's notation chart for permanent teeth

Right	Upper jaw								Upper jaw								Left
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
	Lower jaw								Lower jaw								

Results

In total, 935 children (461 males and 474 girls) participated in the study. 117 boys and 106 girls were from rural areas, while 344 boys and 368 girls were from urban zones. Table II illustrates the distribution of their ages, from 5 to 15, with a one-year gap between each group.

erupt. Permanent 1st molars erupted first (Mean age 7.14+0.48 years) in boys while upper 2nd molar erupted the last (13.75+0.74 years). Similar results were observed for girls, where permanent 1st molars erupted first (Mean age 7.02+0.53 years) and upper 2nd molar erupted last (14.11+0.62 years).

Table III displays the mean age at which boys' and girls' permanent teeth begin to

Emergence sequence for both boys and girls in both arches was 6123457.

Table II: Age Dependent Children Distribution

Age (Years)	Boys	Percentage	Girls	Percentage	Total	% of Total
5.1-6	48	10.41%	51	10.76%	99	10.59%
6.1-7	53	11.50%	55	11.60%	108	11.55%
7.1-8	54	11.71%	47	9.92%	101	10.80%
8.1-9	43	9.33%	45	9.49%	88	9.41%
9.1-10	47	10.19%	42	8.86%	89	9.52%
10.1-11	40	8.68%	46	9.70%	86	8.20%
11.1-12	46	9.98%	42	8.86%	88	9.41%
12.1-13	41	8.89%	45	9.49%	86	9.20%
13.1-14	44	9.54%	48	10.13%	92	9.84%
14.1-15	45	9.76%	53	11.18%	98	10.48%
Total	461	49.3%	474	50.7%	935	100%

Table III: Mean eruption age of permanent teeth (Boys & Girls)

Mean eruption age			Mean eruption age	
Tooth	Boys		Girls	
	Mean (Years)	SD	Mean (Years)	SD
Central Incisor Upper	7.66	0.41	7.44	0.66
Central Incisor Lower	7.65	0.39	7.45	0.62
Lateral Incisor Upper	8.88	0.66	9.14	0.57
Lateral Incisor Lower	8.72	0.71	9.02	0.66
Canine Upper	10.05	1.03	9.58	0.79
Canine Lower	9.84	0.88	9.51	0.60
1 st Premolar Upper	10.65	0.44	10.61	0.36
1 st Premolar Lower	10.65	0.44	10.61	0.36
2 nd Premolar Upper	11.30	0.60	11.65	0.46
2 nd Premolar Lower	11.30	0.58	11.65	0.46
1 st Molar Upper	7.14	0.48	7.02	0.53
1 st Molar Lower	7.14	0.48	7.02	0.53
2 nd Molar Upper	13.75	0.74	14.11	0.62
2 nd Molar Lower	13.54	0.76	13.58	0.73

It is evident from Table IV that males showed earlier eruption in upper and lower lateral incisors (3.19 and 3.67 months respectively), upper and lower 2nd premolars (4.19 and 4.35 months) and upper and lower 2nd molars (4.43 and 0.50 months), while females showed

earlier eruption in upper and lower central incisors (2.72 and 2.45 months), upper and lower canines (5.71 and 3.98 months) upper and lower 1st premolars (0.42 and 0.43 months) and upper and lower 1st molars (1.46 months).

Table IV: Comparison of Mean Eruption Age in Boys and Girls

Tooth	Boys*		Girls*		Difference of means (Months)	Sig.
	Mean (Years)	SD	Mean (Years)	SD		
Central Incisor UR	7.66	0.41	7.44	0.66	+2.72	0.051
Central Incisor LR	7.65	0.39	7.45	0.62	+2.45	0.045
Lateral Incisor UR	8.88	0.66	9.14	0.57	-3.19	0.015
Lateral Incisor LR	8.72	0.71	9.02	0.66	-3.67	0.003
Canine UR	10.05	1.03	9.58	0.79	+5.71	0.071
Canine LR	9.84	0.88	9.51	0.60	+3.98	0.024
1 st Premolar UR	10.65	0.44	10.61	0.36	+0.42	0.586
1 st Premolar LR	10.65	0.44	10.61	0.36	+0.43	0.569
2 nd Premolar UR	11.30	0.60	11.65	0.46	-4.19	0.025
2 nd Premolar LR	11.30	0.58	11.65	0.46	-4.35	0.019
1 st Molar UR	7.14	0.48	7.02	0.53	+1.46	0.293
1 st Molar LR	7.14	0.48	7.02	0.53	+1.46	0.293
2 nd Molar UR.	13.75	0.74	14.11	0.62	-4.43	0.017
2 nd Molar LR	13.54	0.76	13.58	0.73	-0.50	0.708
<i>p < 0.05 (Highly Significant Difference in Means)</i>						
" + " sign denotes earlier eruption age of permanent dentition in girls						
" - " sign denotes earlier eruption age of permanent dentition boys						
*All figures have been rounded off to 2 decimals.						

It is evident from Table V that all the mandibular teeth, except the first premolar, erupted earlier than the maxillary teeth. Moreover, there was statistically insignificant

difference in the mean eruption time of any of the contralateral teeth both maxillary and mandibular.

Table V: Comparison of Mean Eruption Age (Upper and Lower Jaw)

Tooth	Maxillary		Mandibular		Diff
	Mean*	Std. Deviation*	Mean*	Std. Deviation*	
Central Incisor	7.54	0.57	7.53	0.53	-0.01
Lateral Incisor	9.04	0.62	8.89	0.69	+0.80
Canine	9.83	0.95	9.65	0.74	+2.30
1 st Premolar	10.63	0.40	10.63	0.40	0.00
2 nd Premolar	11.51	0.54	11.50	0.54	+0.10
1 st Molar	7.07	0.50	7.07	0.50	+0.01
2 nd Molar	13.82	0.72	13.55	0.75	+3.26

T Test = 0.47605 (p<0.05) Showing no significant difference between Maxillary and Mandibular teeth
 "+“ sign denotes earlier eruption of permanent mandibular teeth
 "-“ sign denotes earlier eruption of maxillary permanent teeth
 *All figures have been rounded off to 2 decimals.

Discussion

Studies on Pakistani children have been undertaken to assess average eruption time in various population groups.^{7, 8, 24} The current study is an attempt to present information about the timing and sequence of permanent teeth eruption in school children of Peshawar; the percentage of boys and girls being 49.30 and 60.70 respectively.

In this study, intra-oral examination of the children was done at their schools under natural light or with the help of a well-focused torch without a radiograph, so it was difficult to find out any congenitally missing or extracted teeth which may have according to a study, have some impact on a statistical analysis of mean eruption time⁹⁻¹⁰ Variance in the timing of eruption in different populations is associated with various factors, like genetics factors,⁶ gender,^{11,12} and environmental associations including socio-economic stature and nutritional quotient.^{13,14} However, as this type of study has not been carried out in Peshawar previously, only the influence of gender and residential area (rural or urban) on eruption time and pattern was studied.

The minimum and maximum dental eruption age in this study was central incisors (6.11 – 9.19 years), lateral incisors (6.96 to 9.93 years),

canines (7.99 to 11.59 years), 1st premolars (9.63 to 11.61 years), 2nd premolars (9.82 to 12.25 years), 1st molars (5.95 to 7.96 years) and 2nd molars (12.40 to 14.81 years). In a previous study, the range was 7 to 8, 8 to 9, 11 to 12, 10 to 11, 10 to 12, 6 to 7, and 12 to 13 years respectively.¹⁵ In general, according to many studies, permanent teeth erupted earlier in girls than in boys.^{11,12} However, some difference to this general rule was found in the present study. Boys showed earlier eruption in upper and lower lateral incisors (Mean age of 8.88 and 8.72 respectively, with a mean difference of -3.19 and -3.67 months as compared to girls), upper and lower 2nd premolars (Mean age 11.30 for both), with a mean difference of -4.19 and -4.35 months as compared to girls) and upper and lower 2nd molars (Mean age of 13.75 and 13.54 respectively, with a mean difference of -4.43 and -0.50 months as compared to girls), while girls showed earlier eruption in upper and lower central incisors (Mean age of 7.44 and 7.45 respectively, with a mean difference of +2.72 and +2.45 months as compared to males), upper and lower canines (Mean age of 9.58 and 9.51 respectively, with a mean difference of +5.71 and +3.98 months as compared to boys), upper and lower 1st premolars (Mean age of 10.61 and 10.61

respectively, with a mean difference of ± 0.42 and ± 0.43 months as compared to boys) and upper and lower 1st molars (Mean age of 7.02 for both with a mean difference of ± 1.46 and ± 1.46 months as compared to boys). The mandibular mean dental eruption age varied between boys and girls from a few days to more than seven months, according to a study conducted in Pakistani children.⁸ In one of the studies, Bruna et al concluded that of permanent teeth erupts between the ages of 6.99 and 12.45 years for females and between the ages of 7.06 and 12.81 for boys. Overall, they discovered no statistically significant changes between homologous contralateral teeth in the timing of emergence; however, they did find that the mandibular dentition erupt before the maxillary dentition.¹⁶ In another study, it was discovered that teeth erupted earlier in girls as compared to boys. In both sexes, mandibular teeth erupted before maxillary teeth. The teeth in the right and left quadrants erupted simultaneously.¹⁷ In the present study, we found that the mean eruption time of the contra-lateral teeth was symmetrical with no statistically significant difference. Similarly, in this study, all the mandibular teeth showed statistically significant early eruption than maxillary teeth except for 1st premolar. The findings of this study are like those for other investigators except for the variation in 1st and 2nd premolars eruption timings.^{18,19} In this study statistically significant difference was determined between boys and girls of rural and urban areas in all the teeth except central incisors and 2nd molars. In a previous study, no significant difference was seen in the mean eruption time of residents of rural and urban areas except in 1st molars and canines. Socio-economic variables can also change the dynamics of teeth eruption whereby children from higher socio-economic groups have earlier dental eruption although the difference is statistically insignificant.¹⁸

It has been found in the literature search that there is significant difference in the meantime

and sequence of eruption in different populations.¹⁹⁻²¹ Due to this variation, values for the age of permanent tooth eruption for a particular ethnic group must be taken from the same population. This profile will be helpful in proper dental health care planning and a determinant of physiological maturity.²¹ The sequence of eruption of the mandibular teeth in both boys and girls is similar to that of maxillary teeth with a slight difference in mean eruption time: the sequence being first molar (7.07 years), central incisors (7.53 and 7.54 years), lateral incisors (8.89 and 9.04 years), canines (9.65 and 9.83 years), first premolars (10.63 years), second premolars (11.50 and 11.51 years) and second molars (13.55 and 13.82 years). The results of our study are like those of another study carried out in Pakistan with a difference in eruption time of 1st molars and central incisors.²³⁻²⁵ The eruption sequence of our study is also comparable to that of other countries especially the Iranians²⁰ and Nigerians²⁶ in general, with a difference in a few respects.

Conclusions

We conclude based on our findings that the first tooth to erupt was the first Molar in girls, whereas the last tooth to erupt was the second Molar in boys. Except for the first premolar, mandibular dentition came in before the maxillary teeth. Similarly there was a statistically insignificant difference between boys and girls from rural and urban locations in the mean eruption times of the corresponding contralateral teeth.

Limitation

The difficulty in getting accurate extraction history in the age range especially of 5 to 10 years is one potential limitation of this study. It can be difficult to determine whether teeth have ever been pulled purely based on self-reported information or parental memory.

Conflict of interest

No conflict of interest.

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